Rijksdienst voor Ondernemend Nederland

Public final report
DEI+ pilot- en demoproject CO_2-reductie 2019
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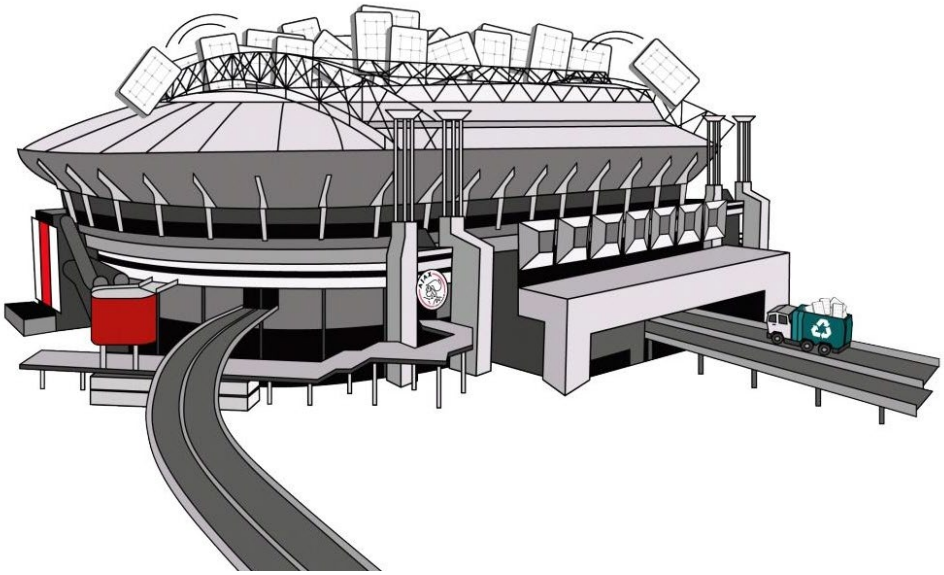

Pyrolyse Recycling Initiatief voor Matrassen
[PRIMA]

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A DEI+ pilotproject for the Topsector Energie (TSE) by:

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Public final report

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Coordinator:	Koninklijke CBM, Branchevereniging voor Interieurbouw en Meubelindustrie
Co-applicants:	Waste4Me B.V. TNO 2nd LOF B.V. / Matras Recycling Europe (MRE) Enerpy Holland B.V.
Start and end date:	1st of August 2019 – 31st of December 2020

1. Introduction and goal

1.1 Introduction

Since 2015, old mattresses have been collected as a separate 14th mono stream from the recycling centers. Every year, 90% of these mattresses are released for waste processing via this route. The other part is now collected through the retailers who offer these mattresses to the waste processors. The mattress file has been given a separate status in the transition agenda for consumer goods and has also been specifically designated as an icon project. In March 2018, the second chamber assessed the documents to introduce an extended producer responsibility, after which the State Secretary issued an ultimatum to the mattress chain in June 2018 to come up with a plan of action, otherwise a mandatory UPV from the Ministry of I&W. It is clear in the file that the NVRD, which is responsible for the 284 waste disposal sites, no longer wants to bear the bill in the future. In addition, we want to move towards a circular economy, in which raw materials reuse is leading. This means that we will no longer bandage the mattresses in the future.

According to the survey conducted in 2017 by the USI, we assume that about 37% of the old mattresses are mechanically recycled, and the rest incinerated. The gate rates for incineration are also significantly lower than for recycling. This does not stimulate the circular economy. The PRIMA project has the potential to lead to an annual reduction of 35kt of CO2 by the mattress industry in 2025 if we recycle the total waste flow of 8 million kg annually instead of incinerating it.

1.2 Goal

The mechanical recycling of mattresses is currently mainly hindered by about 60% - namely the PUR (polyurethane) and latex - as recyclate, which is not properly reusable. The objective of this pilotproject was to convert these components via pyrolysis into useful chemical building blocks and a source of energy. The aim is optimization towards the highest possible added value and the lowest possible ecological footprint.

The main objective of the project was the specific further development of the pyrolysis techniques (WER, RMO) for large-scale processing of end-of-life (EoL) mattresses on a scale of 100 - 500 kg/h via pilot on a scale of approx. 150 kg/h of the technology of Waste4Me and Enerpy as a sustainable (eco-efficient) recycling method.

2. Results

2.1 Technical results

In terms of technical feasibility, only the processing the Latex fraction is feasible by Waste4ME's pyrolysis. Aside from the uncertainty of the use of gas for chemical purpose, a lot of the values in this report point towards a rather positive future prospect. Using gas treatment technology enables the recovery of valuable components.

The PU foam is not feasible to convert by Waste4ME's pyrolysis process as the reaction products do not have any value and create severe technical issues. The ticking was properly tested as the size reduction to Waste4ME's acceptance criteria was not performed. The technical setup towards electricity is a proven route and the focus should be on recovering the valuable gases as hydrogen, ethene and propene.

In terms of technical feasibility of Enerpy's radiolysis technique, the processing of all three fractions is possible. The batch technology was able to process every fraction into suitable components, but the economics of scale of this technology have yet to be determined. It is therefore too soon to say with absolute certainty that this specific technology is suitable for all mattress volumes.

2.2 Economic results

Due to the good conversion of material to gas the economic feasibility is easy to produce electricity and the case is only improved by recovering gases although this route is less certain. Improving on gas recovery will bring the conversion route into the category C2 and C3 chemical recycling and thus be seen as recycling. This route will open the door for CO2 and circularity credits.

2.3 Conclusions

The main conclusions of this project is that a valid conversion technology has been identified and tested, which is promising for the processing of mattresses into renewable sources in the future. It is capable of producing several key components that appear interesting for further processing into (petro)chemical resources, but the oil samples still show a complex mixture, which is not directly applicable. The chemical industry will have to conduct additional research. On the other hand, the same chemical industry is also looking for alternative feedstock with regard to naptha. The route from waste to raw material and biomass to chemistry are serious tracks in this regard.

3. Effects on the Topsector Energie

3.1 Realized energy saving and CO2 reduction

The LCA study shows that pyrolysis is a significantly better option than incineration in terms of greenhouse gas (GHG) emissions and cumulative energy demand (CED) for all cases studied. Base case analysis showed that pyrolysis of waste mattresses saves approximately 526 kg CO2 eq. (IPCC 2013 GWP 100a) and approximately 5.1 GJ (= 24% savings) Cumulative Energy Demand (CED - version 1.11) per tonne of mattress waste compared to current incineration. In the Netherlands, 16.6 ktonnes are currently incinerated, and pyrolysis could deliver a CO2 reduction of 8,750 tonne CO2 eq. per year.

Finally, this study concluded that mechanical recycling can be better or worse than pyrolysis, as the environmental impact of mechanical recycling is highly dependent on the processes used and the quality of the recycled material.

4. Publications

The PRIMA project has been in the spotlight with several organizations and stakeholders, both nationally and internationally. Because the Netherlands (as well as Belgium and France) are working on a 'Uitgebreide Producentenverantwoordelijkheid' (UPV), an Extended Producers Responsibility to ensure a proper 'green' conduct, and CBM has played an active role in this, the PRIMA project also provided an in-depth knowledge boost and possible 'future-proof' vision of mattress recycling. A lot has happened the past year regarding this topic, because besides political stakes, the economic stakes also play a major role in the transition to a sustainable mattress sector. TNO has published a paper concerning the LCA study that was conducted. CBM has also been asked to present their findings at the Interzum trade fair for furniture production and interior. A copy of the presentation is available upon request at CBM.

To thoroughly explain the project, CBM has made a documentary in which all participants were interviewed. This provides the (layman) viewer with an idea of what the scale of the problem is and what challenges exists. The documentary can be viewed at https://www.youtube.com/watch?v=QcIiloh_Ejw.

For more information or a free example of the final report, you can contact Dirk van Deursen (CBM): vandeursen@cbm.nl.