Seek Together

How can packaging enable the circular economy?

FAQ | Packaging Europe Webinar | 26 May 2020

With this document, we aim to provide answers to the most frequently asked questions in our webinar **"How do we make flexible plastic packaging part of the circular economy?"** held together with Packaging Europe on 26 May 2020. This document does not include cost-related clarifications, and we prefer to address those directly with you in a commercial discussion.

The Dow Packaging & Specialty Plastics Team

FAQ

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Design for Recyclability

1. **In order to build a circular economy, which of the approaches has the best applicability and/or acceptance, light-weighting or mono-material, bio-plastics or recyclable content or ease of processing post-use?**

   All approaches can have a positive impact when designing for a circular economy. Light-weighting has been a focus for many years in the packaging industry and continues to be very important to maximize resource efficiency without negatively impacting product protection. Light-weighted packages should now also be designed for recyclability so that we cannot only benefit from an efficient packaging design but also extract the full value from the packaging in another application following a recycling step. The incorporation of recycled content is clearly critical to the circular economy.

2. **The shown examples of design for recyclability are all about pouches. Do you have any example for flow-packs like chocolate bars or roll-wrap biscuits?**

   We are working actively in flow-wrap applications particularly in cases where markets are looking to move to PE-based solutions. New technologies such as oriented PE using a suitable, high-performance seal layer have demonstrated excellent runnability at high line speeds and we continue to work with partners to further improve packaging efficiency with such solutions.

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3. **Which extrusion partner did RB and you work with on the Finish pouches, which sealing technology did you use and what is the microns of the pouch?**

   RB's recyclable Finish pouches were produced in collaboration with Dow as material science partner and Drukpol.Flexo as extrusion partner. As sealing technology, Dow's AFFINITY™ Polyolefin Plastomer is used to obtain low seal initiation temperature and a broad operating window on the packaging machine. Final thickness is about 112µm.

4. **Can you describe the package structure, barrier performance and end-of-life use of the recyclable Bear Naked granola pouch presented in the webinar?**

   This is a multilayer, surface-printed, coextruded (not laminated) film, and the majority of the structure is based on different types of polyethylene and a thin layer of EVOH resin used to obtain oxygen barrier. This layer is pre-compatibilized with the rest of the structure via the incorporation of Dow's compatibilizer resin RETAIN™ which means the recycled film could be incorporated into new PE-based packaging.

   Oxygen transmission rate (OTR) is approximately 1 cc/m2/day (23°C, 50% RH) and water vapour transmission rate (WVTR) is <0,5 g/m2/day (23°C, 100% RH). The use of RETAIN™ compatibilizer can enable higher levels of EVOH to be used without compromising on the performance of the recycled resin. Different industry working groups already accept the use of up to 5% EVOH in their guidelines for recyclability and it is possible that this percentage increases in the future as more data is generated.

   With regards to the use of the recycled pouch films, there are currently several hurdles for post-consumer, mechanically-recycled PE to be incorporated into food contact packaging due to the need for traceability and consistency to achieve regulatory approval. Currently, a more appropriate use of the mechanically-recycled PE films would be for non-food-contact film applications. Feedstock recycling may provide a more robust approach to allow the use of recycled packaging in primary food packaging.

5. **Is Dow also working on the sustainability of pigments/inks?**

   Since Dow is not a supplier of pigments and inks, we are working with partners to understand the impact of these components on the recyclability of packaging and how this can be improved.

6. **How can pigments and printing inks be handled in a recycling process?**

   There are techniques under development to substantially remove the ink from printed substrates which would increase the breadth of secondary applications where the recycled resin could be used. Clearly any colour present in the recycled resin will limit its use in transparent or light-coloured applications, but typically the colour is not significantly impacting the physical performance of the recyclate. There exist as well recycling streams for transparent and coloured films.

7. **How can laminated flexible packaging be made recyclable?**

   By following design for recyclability guidelines, laminate films can play their part in the packaging circular economy. Dow is working with partners to understand how best to optimize the design of laminate structures, including the substrates and adhesive layers, to obtain the highest quality recycled resin.

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8. **How do the design for recyclability initiatives differ for consumer and pharma applications and could you describe the differences?**

   Design for recyclability initiatives should cover all application areas to ensure that we have the maximum benefit for the circular economy. Some applications will present more challenges than others when we look to match performance requirements with recyclability, but through industry collaboration, we believe that suitable solutions will be developed for all applications.

9. **Are there are variations in what materials can be recycled at the local/regional level and how can you design to ensure recyclability in the highest number of regions?**

   Currently, there are significant variations and we expect to see important changes such as harmonization for recycling systems over the next years as different countries/regions better adapt their collection and recycling capabilities to meet the needs of the circular economy. Dow is working with the EU, the packaging industry and associations as well as local/national authorities to help ensure that design for recyclability guidelines are aligned with recycling infrastructure as much as possible.

10. **How can the value of design for recyclability initiatives be best communicated to consumers?**

    Simple, on-package communication about recyclability and recycled content will certainly help to educate consumers about their packaging choices and raise awareness. Beyond this, as an industry we must continue to communicate the benefits of a circular economy so that consumers are ever more conscious about their buying decisions and their treatment of domestic packaging waste. Eventually, one may expect on-pack communication about Design for Recyclability to disappear as this becomes the “norm” and more focus will be placed on recycled content.

Bio-based Plastics

1. **What range of materials are there from Dow in terms of bio-based plastics? And what is the potential for recyclability as mandated from the EU single-use plastics target?**

   We offer bio-based low density polyethylene resins in the DOW™ LDPE R range, bio-based linear low density polyethylene resins in the DOWLEX™ R and ELITE™ R ranges, bio-based polyolefin elastomers such as ENGAGE™ RE and AFFINITY™ GA RE and bio-based plastomers such as AFFINITY™ R. All of these are ISCC+ certified based on mass balance.

   Our bio-based resins are drop-in solutions, which means they have the same performance and characteristics compared to their fossil-derived counterparts, so they do not have an impact in final package recyclability. Some countries are considering to implement a reduced Extended Producer Responsibility (EPR) tax for packages containing a certain percentage of bio-based resins, yet this is still under discussion.

2. **Are there any commercial products of your bio-based resins used in a multilayer structure with EVOH?**

   Our bio-based low density and linear low density polyethylene resins can be used in bulk layers of barrier films and our bio-based AFFINITY™ R plastomer resins can be used as high performance sealants in the sealant

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layer for good package hermeticity. We are exploring as well options to produce bio-based tie layers complementing our large BYNEL™ portfolio to offer a broader range of bio-based resins for barrier films.

3. **Are the presented bio-based polymers of Dow 100% bio-sourced?**
   Yes, they are produced using tall oil, a paper production process residue, as bio-feedstock using the mass balance approach certified by ISCC+.

4. **Are your packaging bio-based solutions also biodegradable?**
   We should not confuse bio-based plastics with bio-degradable applications. One deals with beginning of life (bio-plastics) and the other deals with end of life. Currently, we do not support biodegradable plastics as they require a specific and separate collection and controlled decomposing infrastructure and these are not widely available. Biodegradable plastics can also be perceived by consumers as easy to throw away which could increase littering and waste management issues.

5. **How do you see the market supply of tall oil? How much of this bio-feedstock is available and what happens with it now?**
   Tall oil is currently used for bio-fuels for the automotive market and bio-naphtha for bio-plastic. As the demand for bio-plastics keeps rising at higher levels than bio-fuels it is estimated that its availability will increase for bio-plastics in the medium term.

6. **What are the benefits of switching to bio-based plastic for a flexible film application?**
   Dow's bio-based PE resins are drop-in solutions, having the same properties vs fossil-derived counterparts, and as such they do not impact in final packaging recyclability. The biggest benefits are significant lower carbon footprint vs. fossil-derived ones and a decrease in consumption of fossil resources. These are two important goals in many brand owners' and retailers' sustainability agendas and aligned to transitioning towards a plastics circular economy.

7. **Can you have bio-based plastic that also contains recycled content?**
   Yes, this could be possible to incorporate either mechanical post-consumer recyclates combined with bio-based PE resins into a non-food application or even recycled content from alternative feedstocks with bio-based resins for food contact applications.

8. **How will the future plastic tax accelerate bio-based materials?**
   Some countries are considering to implement a reduced Extended Producer Responsibility (EPR) tax for packages containing a certain percentage of bio-based resins, this is still under discussion. If this happens, clearly demand of bio-based plastics will be further increased for the regions they will be applicable.
9. **Can the bio-based materials also be recycled back to food contact material?**
   They can be mechanically recycled in the PE plastics waste stream to be used in non-food contact applications, similar to other PE films. So far mechanical recyclability for food contact applications is not a

possible solution due to migration and potentially related food safety. Only for singular applications a close loop exists, such as HDPE milk bottles in the UK. Feedstock recycling may provide a more robust approach to allow the use of recycled packaging in primary food packaging.

10. **Would an increased use of bio-resins lead to a negative impact on the environment due to feedstocks from plants that could be used for food, resulting in more agriculture surface area and the environmental impact of this - a potential net negative?**

    Our bio-based plastics do not – directly or indirectly – compete with food since the bio-feedstocks do not come from arable land resources but from tall oil, a residue from the paper industry.

Mechanical and Feedstock Recycling

1. **You talk about "Feedstock Recycling" which is not a general used term. Would it not be good to have harmonization of terms?**

   While there are various definitions of chemical and feedstock recycling, at Dow we have opted to call the process of turning plastic waste into recycled naphtha “feedstock” recycling – as to us this is the clearest description of what it is. Having said this, Dow and our industry peers are collaborating with Cefic for alignment with and towards the EU. The same is the case for important metrics like recycling rates, recycled content, recyclable, etc.

2. **What are Dow’s present and future capacities in feedstock recycling?**

   Dow has committed to deliver 100 kta of recycled materials in its product offering in 2025. We are currently rolling out the projects that should enable these volumes to become available on the market.

3. **Is feedstock recycling a project or a reality today?**

   There are numerous examples of commercial assets that turn waste plastics into an oil, while most of that oil cannot yet be used as feedstock for the production of new plastics. As an industry, we are working hard to make this possible and several announcements have been made on successful projects that allow customers to buy recycled content, albeit not a large scale right now.

4. **A lot of people claim about energy input for feedstock recycling. What is the reality?**

   Like for any chemical conversion, energy is needed to convert waste-plastics back into plastics. Although LCA data are still in development, preliminary numbers show that recycled plastics have a lower footprint than plastics that are incinerated at the end of life. In addition, there are also indications that recycled plastics have a lower CO_2 footprint than virgin plastics (from oil-refining).

5. **With regards to feedstock recycling, must the waste collected contain the same polymer or can it be mixed materials?**

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For feedstock recycling, mono-materials have to be used to maximize the output suitable for the market. The key strength of feedstock recycling is that the polymers are broken down completely, hence allowing also mixed inputs. However, not all mixtures are suitable and it depends on the applied technology what types of mixes can be applied.

6. **What economic scale makes feedstock recycling competitive with virgin polyolefin or mechanical recycling?**

   Making feedstock recycling competitive with mechanical recycling and virgin polymers depends on many factors such as the price of carbon, the price of the waste, the price of energy and the carbon efficiency of the technology. In a recent study by McKinsey et al., it was demonstrated that starting from a scale of ~50 kta, feedstock recycling can become competitive with virgin material.

7. **What is the yield of the feedstock recycling systems?**

   That depends on many factors, such as the location of the recycling facility, the ability of the technology to tune the product slate, the market conditions for products and by-products and most and for all on the technology selected. And like with any process, carbon efficiencies, energy efficiencies, and by-products need to be optimized.

   We believe that more than 50% of the plastic entering the process can actually be converted back into plastics. In order to recycle as much as possible carbon from waste plastics back into new plastics, we think that both mechanical recycling and feedstock recycling are needed. Even when this is done with 50% carbon efficiency, this is already a more favorable solution than landfill or incineration.

8. **How do you see the balance between mechanical and chemical recycling? It seems each can have a role in the circular economy. How do we drive the most eco-efficient path forward?**

   Since mechanical recycling has some limitations with consistency of product quality and use in food applications, Dow believes that mechanical recycling and feedstock recycling are complementary and that a circular economy of plastics will offer both solutions.

9. **How do mechanical recycling facilities (MRF) collect and sort flexibles in a large enough volume for chemical recycling? If there is no perceived value, wouldn't they refrain from investing in technology?**

   In order to make the circular economy work, all players in the value chain are needed to make this a success. However, costs need to be managed accordingly and in line with EPR and other societal fees for waste handling.

10. **When will feedstock recycled material commercially available through Dow?**

    At this moment, pre-marketing volumes are available. Our partnerships with for example Fuenix, will allow us to ramp-up volumes to the desirable > 100 kta in 2025.

11. **In feedstock recycling, could you also recycle polyolefins?**

Yes we can. In fact, polyolefins are the preferred feedstock for a chemical recycling facility that uses pyrolysis. Facilities that apply gasification are a bit more flexible on the input material.

12. **When is chemical recycled resin available for blown film or pharma registration?**

    When we use the feedstock recycling route (chemical recycling), the products we can make are suitable for any application that can also be served with virgin (fossil) feedstock, and including blown film applications and pharma grades.

13. **Do printed labels/sleeves reach a relevant mass to be interesting for your chemical recycling plans?**

    In principle yes. We would prefer a steady and significant input stream.

14. **How can we properly calculate the reduction of greenhouse gases by using some of the available options such as bio-based plastics, chemically recycled films etc.?**

    At this moment, several Life Cycle Assessments (LCA) are in development. As the methodology is also in development, this is a complex process that still needs further alignment in order to produce meaningful results in the right context. Please note that such LCA should go beyond the GHG effect.

15. **What will be the roadmap for developing recycling technologies (chemical and mechanical) side by side?**

    We see many developments in this space, including hybrid options where the refuse of a mechanical recycling facility becomes the feedstock for a chemical recycling facility. Joint challenges such as better sorting and stirring towards higher quality input streams are happening as well. To date, several mechanical recycling facilities are in operation and the number of chemical recycling announcements is growing.

16. **How far are we from an industrialization plan for chemical recycling and how competitive will it be considering the actual oil cost?**

    The plan is there and several companies, including Dow, have made announcements on the first units that will do chemical recycling. We must, however, realize that first-of-its kind installations are typically small and not optimized yet.

17. **What's the possibility of multi-layer plastic (MLP) waste feed for chemical recycling?**

    At this moment, MLPs are challenging for mechanical and chemical recycling, mostly due to the heteroatoms in these materials. However, two technology developments will facilitate the recyclability of MLP: several separation techniques are underway to selectively remove the layers and allow for recycling of the individual components independently. In addition, design for recyclability activities will target to develop better recyclable packaging, including mono-material packaging and multiplayer packaging.

18. **Is chemical recycling accepted for recycling content calculation?**

At this moment, the definitions of recycled content are not uniform. Therefore, Dow and other value chain partners are developing the framework for circular plastics together with the European Commission. It is our vision that both mechanical and chemical recycling should contribute to the recycling rates.

19. **What is your perspective on carbon efficiency and CO_2 footprint of chemical/feedstock recycling as compared to mechanical recycling?**

    Dow is currently developing Life Cycle Assessments (LCA) for the projects that are under development with partners such as Fuenix.

    A recent LCA study publicized by BASF demonstrated that both mechanical and chemical recycling have a lower CO_2 footprint than incineration and that the differences between mechanical and chemical recycling are rather small.

    It must be stressed that LCA data are very sensitive for the applied data and boundary conditions and that each case must be valued in a transparent and concise way, with external validation. This is a complex and time-consuming process and not all data are easily available while methodology that is broadly accepted is still under development.

20. **What is the impact of gasification and pyrolysis on the environment? What are the results of LCA compared with the current scheme?**

    In contrast to well established chemical manufacturing processes, norms comparing gasification and pyrolysis of waste do not yet exist. Boundary conditions must be taken into account, such as pretreatment of waste, location and type of energy used and avoidance of waste by using it as a resource. Everything else being the same, there is a likelihood that gasification has a higher CO_2 footprint, but also other LCA dimensions need to be considered.

Life Cycle Assessment

1. **Are LCAs of the presented products available and disclosed?**

Life cycle assessment (LCA) methodology is still under development, and the industry is currently using the ISO 14040–44 approach for appraising and quantifying the total environment impact of products or activities over their entire life cycle of the particular materials, processes, products, technologies, services or activities. LCA aims to measure the total environmental impact of a product or material, including the impact of extracting or producing the raw-material, transporting and processing it (e.g. turning it into a food package which is then filled and ends up on a consumer's kitchen table), and the impact of its use and disposal.

We usually do not publicize LCA values of our products, but details can be shared under NDA, so you will be able to calculate estimated carbon footprint of films and packages produced with our solutions.

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2. **How would the different technologies used compare in terms of LCA in relation to fossil based?**

   One of the primary drivers of LCA research has been carbon footprint and how one application's carbon footprint may compare to another. However, there are a number of emerging areas that require equal focus beyond just looking at carbon – such as land use or water impact of materials and products. Overall, LCA should measure the impact on people, the planet and prosperity.

3. **What is the timeline for scaling the chemical recycling solutions to PE, and what is the LCA result to these materials in comparison to virgin PE and other alternative materials?**

   The target for our feedstock recycled material to be available in developmental quantities is end of 2021. In terms of LCA comparison vs virgin materials, boundary conditions and location matters, as well as the process used. A commercial process operation needs to be established in order for us to be able to share further data.

4. **How do we easily deliver LCA and carbon footprint reduction values in a meaningful way?**

   We need to emphasize the material savings and mass efficiency. Use of waste to create a higher value product rather than burying it or burning it.

About Dow

The Dow Chemical Company (Dow) combines science and technology knowledge to develop premier materials science solutions that are essential to human progress. Dow has one of the strongest and broadest toolkits in the industry, with robust technology, asset integration, scale and competitive capabilities that enable it to address complex global issues. Dow's market-driven, industry-leading portfolio of advanced materials, industrial intermediates, and plastics businesses deliver a broad range of differentiated technology-based products and solutions for customers in high-growth markets such as packaging, infrastructure, and consumer care. More information can be found at www.dow.com.

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