



Sustainability and Recycling

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The Dow Chemical Company

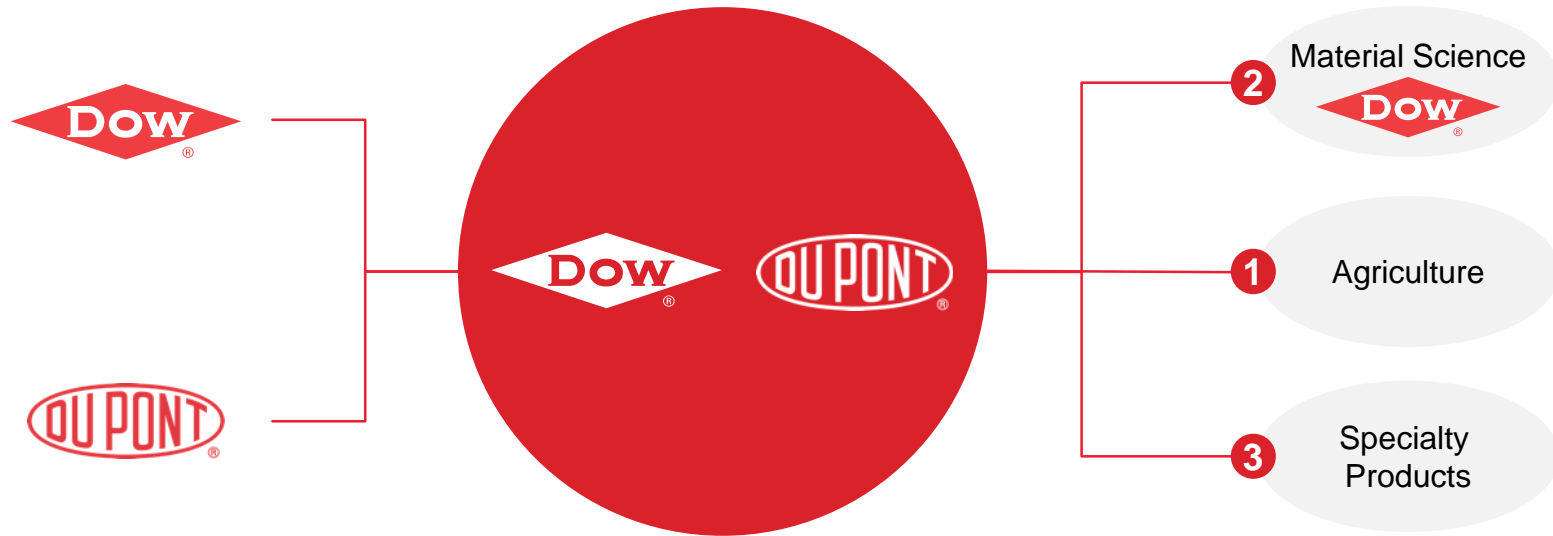
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Agenda

- **Sustainability Journey**
- **RecycleReady technology**
- **Solutions for more sustainable Packaging**
 - **Design for Recyclability**
 - **Recycling Compatibilisers**
 - **Recycling towards a circular economy**
- **Summary and Conclusions**



Dow and DuPont Combine in a Merger of Equals



Dec 2015

August 2017

-18 months post-close

A merger of equals that combines industry-leading capabilities and product portfolios from two historic companies to set the stage for the creation of three stronger and more focused spin companies.



DELIVERING SOLUTIONS UNLOCKING OPPORTUNITIES

Materials Science Division: Industry's Premier Materials Solutions Provider

2016 Net Sales: ~\$40B, >20% Op. EBITDA Margin*

TECHNOLOGY PLATFORMS

- Polyolefins
- Elastomers
- Polyurethanes
- Silicones
- Acrylics
- Ethylene oxide derivatives
- Propylene oxide derivatives
- Cellulosics



Packaging & Specialty Plastics

~\$20B Net Sales
>25% Op. EBITDA MARGIN

Industrial Intermediates & Infrastructure

~\$11B Net Sales
>15% Op. EBITDA MARGIN

Performance Materials & Coatings

~\$8B Net Sales
>15% Op. EBITDA MARGIN

WORLD-CLASS CAPABILITIES

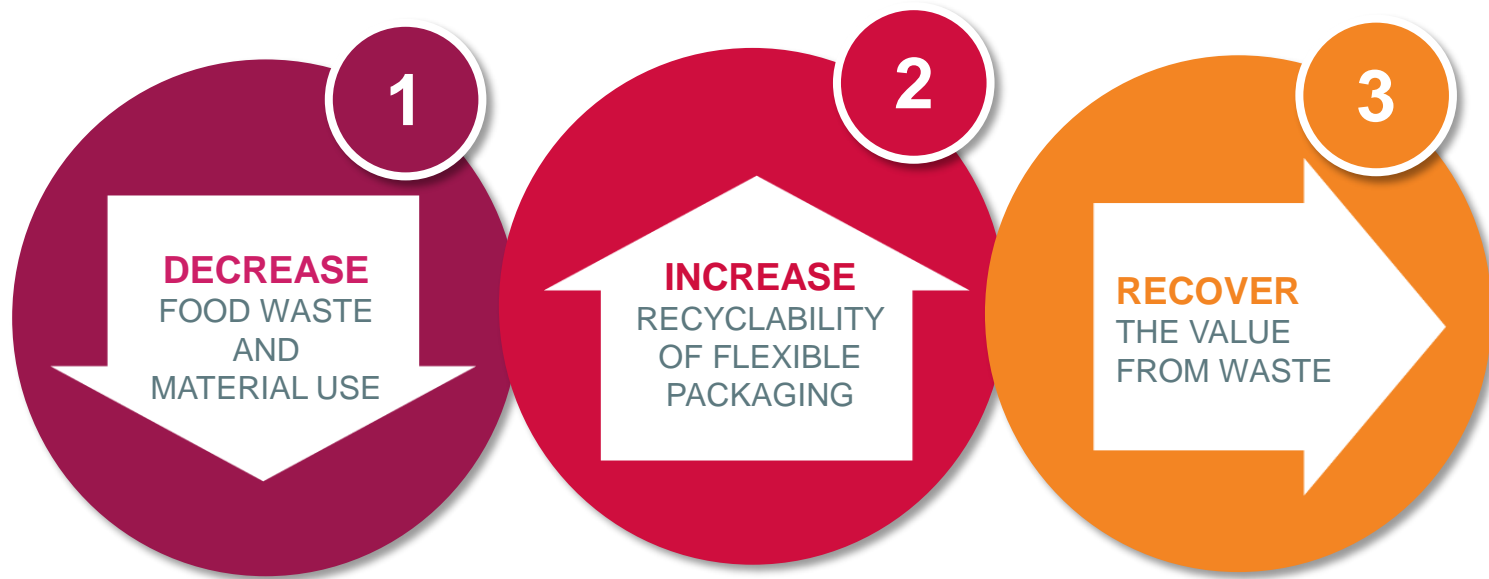
- High-throughput R&D
- Catalyst discovery
- Polymer science
- Formulation expertise
- Process engineering
- High-performance computer modeling
- Application development

Integration across assets, technologies and end-markets • Strongest and deepest chemistry toolkit in the industry, with scale
Higher asset intensity, greater vertical integration, industry-leading market verticals



DELIVERING SOLUTIONS UNLOCKING OPPORTUNITIES

Our Sustainability Priority Areas



Stemming the Tide

Over **80 PERCENT** of ocean plastic comes from land-based sources.

Only **20 PERCENT** originates from ocean-based sources like fisheries and vessels.

Among leakage from land-based sources:

75 PERCENT

Comes from waste that remains uncollected



25 PERCENT

Leaks into the ocean after it's been collected

TEN rivers may contribute up to **95 PERCENT** of plastic in the ocean



Plastic regulations/ bans

Single-use plastics items are estimated 50% of marine litter.

PWM 2018:

- EPR - Brand has to collect and ensure it is Reused, Recycled or recovered.
- PRO to facilitate at price



Better design

of plastics for less toxicity,
more durability and
easier recycling



More information

to raise awareness and
encourage responsible
behaviour



Actions

to encourage the
use of recycled
plastic



Stronger incentives

to collect, sort and
recycle all plastics



Government interventions

News > World > Asia

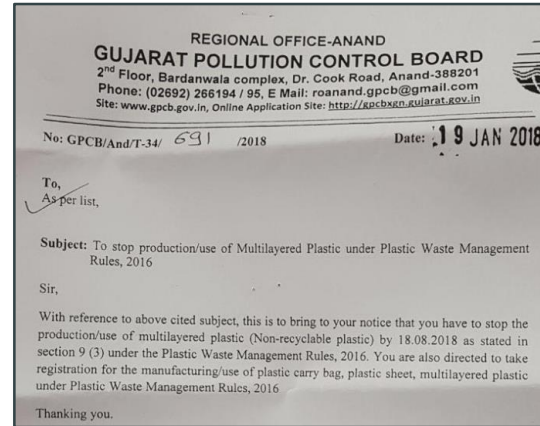
India just banned all forms of disposable plastic in its capital

National tribunal prohibits use of cutlery, bags and other plastic items amid concern over pollution of the sea and air

Ian Johnston Environment Correspondent | @montaukian | Wednesday 25 January 2017 13:32 GMT | 22 comments

TAIWAN BANNING SINGLE USE PLASTIC ITEMS

TAIPEI • Taiwan is planning a blanket ban on single-use plastic items including straws, cups and shopping bags by 2030, said authorities yesterday. Major chain restaurants must stop providing plastic straws for in-store use from next year, a requirement that will expand to all dining outlets in 2020. Consumers will have to pay extra for all straws, plastic shopping bags, disposable utensils and beverage cups from 2025, ahead of a full ban on the single-use items five years later.



NEWS | INDONESIA | 15 SEPTEMBER 2016

Indonesia: Plastic tax to curb rubbish dumped in rivers

Move aims to cut 187 million tonnes of carrier bags dumped into the country's waters, clogging up drainage channels.

By **Step Vansoren**



Ban on plastic bags off to a good start despite complaints



Maharashtra: Ban comes into force, dispose of all plastic materials in a month

TNN | Updated: Mar 24, 2018, 01:16 IST

A Not-so-Secret Burger Recipe
May 16/18th, 2018 @ 12:01: News Burgers



✉️ 🖨️ A- A+

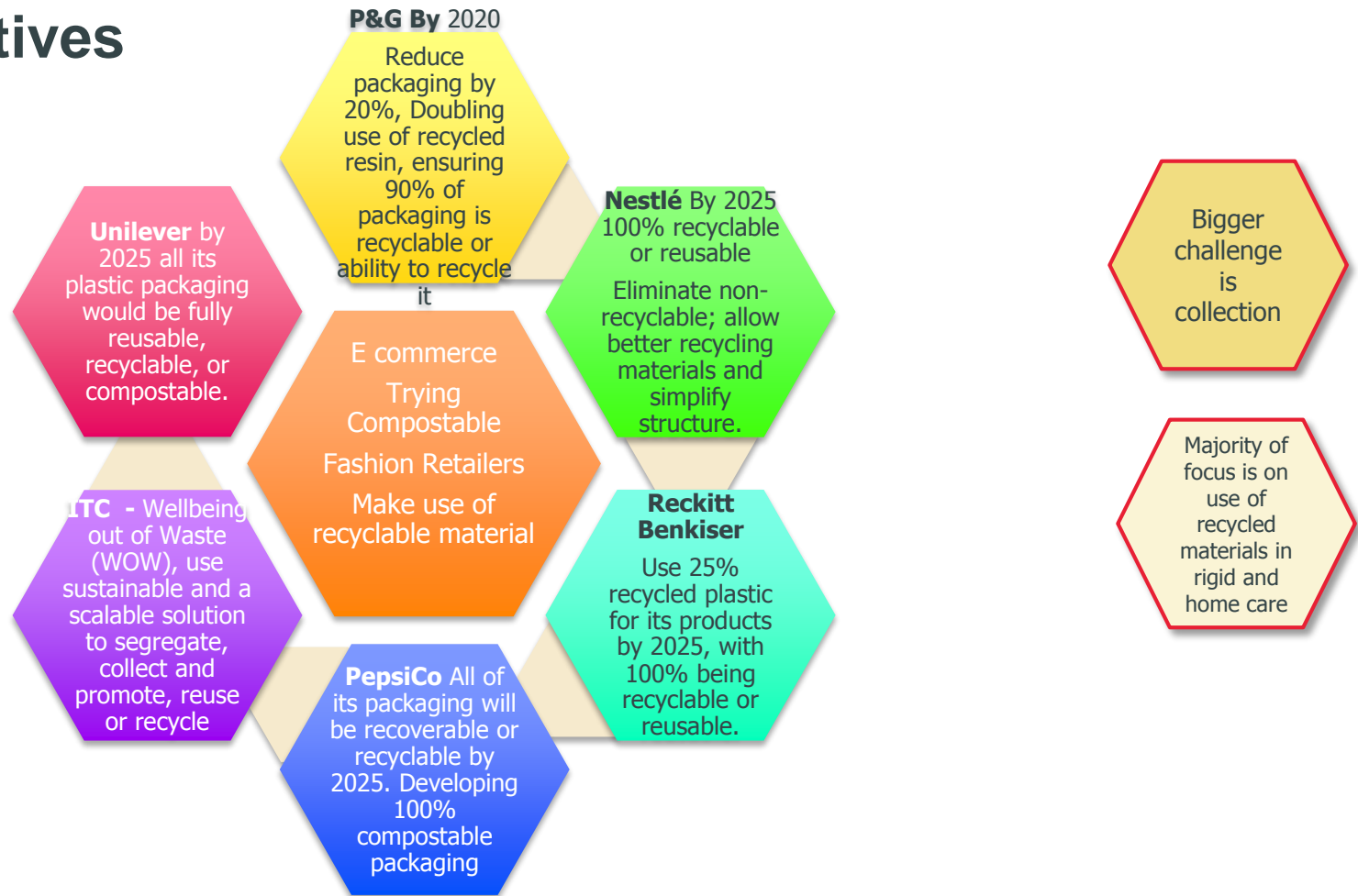


MUMBAI: You have just one month to dispose of all the plastic bags and cutlery and thermocol that you have at home as the state-wide ban on plastics came into effect on Friday.



DOW

BO Initiatives



Solutionism – Challenging status Quo

Drivers









- Focus on Technology (All PE & Barrier film) & compatibilizers
- Collaborate to give End of Life – Asphalt road, bricks
- Stricter Government regulations - Plastic waste management

Challenges

- Poor economic value of plastic waste
- Non-segregation of the plastic waste at source
- Negative perception of plastics



Drivers & Economics recyclable packaging

Parameters	Brand Owners	Consumers
Regulatory Compliance	Low  High	Low  High
Reusability	Low  High	Low  High
Cost effectiveness	Low  High	Low  High
Environmental Friendly	Low  High	Low  High

More & more countries adopting EPR

EPR Mandates BO to pay for the recycling, Reuse, Recovery process and safe disposal

Preference to Recyclable: There will be least additional expenses for handling of post consumer plastic waste

Elements	Non-recyclable	Recyclable
EPR Cost	~Rs.12/Kg	Nil, Existing Stream
Value for PCR	Zero (Cement Kiln)	Rs.60/Kg
Waste pickers livelihood	Rs 2-3/Kg	Rs. 12-15/Kg



All numbers are based on our interaction and understanding and are typical and may vary from region to region

Enabling Solutions for Recycling Plastics

RECYCLE**READY**
TECHNOLOGY

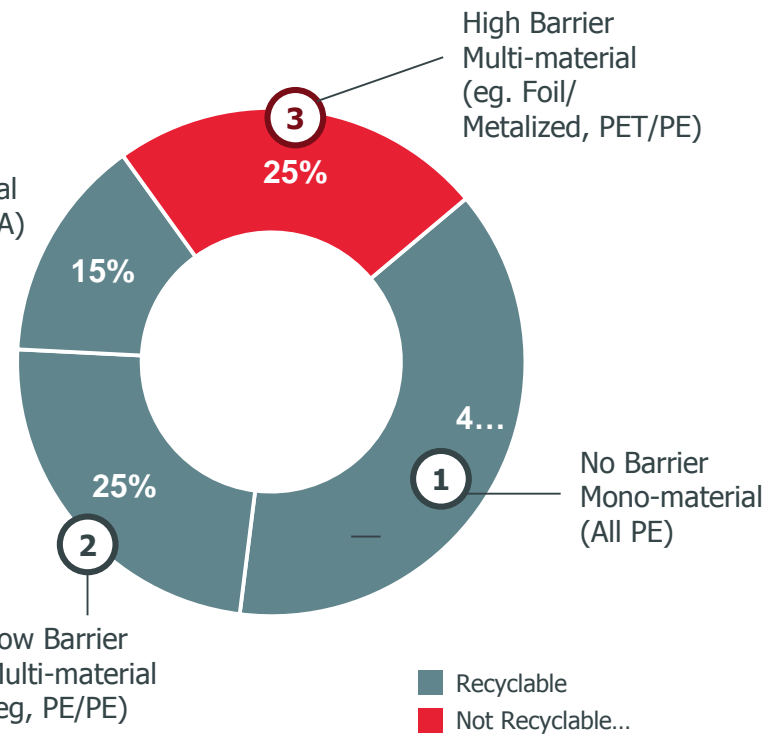
for store drop-off recycling by



Retain
polymer modifier by



Barrier
Multi-material
(EVOH/PE/PA)



* Source: Dow Internal assessment



Asia Pacific Focus

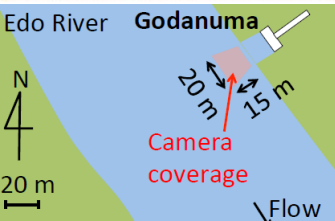
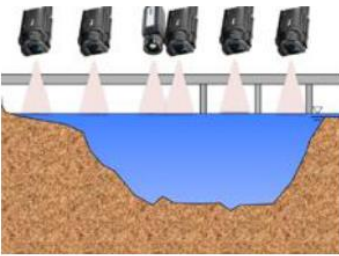
Improve Education

Drive Science

Improve Waste Management

Develop End Market

Build Collaboration



Dow Makes Moves to Reduce Marine Plastic Pollution in Japan, Indonesia

by Sustainable Brands

December 22, 2017



Image credit: Dell

Related: Waste Not, Walking the Talk, Dow.

According to the United Nations Environment Program (UNEP), up to 8 million tons of plastic waste are dumped into the world's oceans annually. In 2016, The Dow Chemical Company announced a commitment to spend \$2.8 million over the next two years to drive solutions that address global marine debris and litter. Dow is now making good on that promise with new efforts in Japan and Indonesia.



BERITA SATU

HOME SATU POLITIK SAJAJANA SAINS FOKUS TAJUK OPINI MULTIMEDIA B1.TV

Dow Perkuat Pengelolaan Limbah Plastik di Indonesia



Proses kerja pengaplikasian aspal campuran limbah plastik di Jalan Sultan Agung, Bekasi, Sabtu, 16 September 2017.

25 durable plastic mix roads planned

THE I | Updated: Feb 5, 2018, 08:00 IST



PUNE: Better use of waste plastic is on the cards. Roads in the city will be constructed using a mixture of polymer glue and tar that is made from shredded plastic waste. The Pune Municipal Corporation (PMC) has planned to construct around 25 roads in different areas of the city using this technique.

RECYCLE READY TECHNOLOGY

for store drop-off recycling by Dow



Develop end use market – Plastic waste road

Paving the Way Towards a Sustainable Future

Two
Cities



40 km of roads made
with recycled
plastic

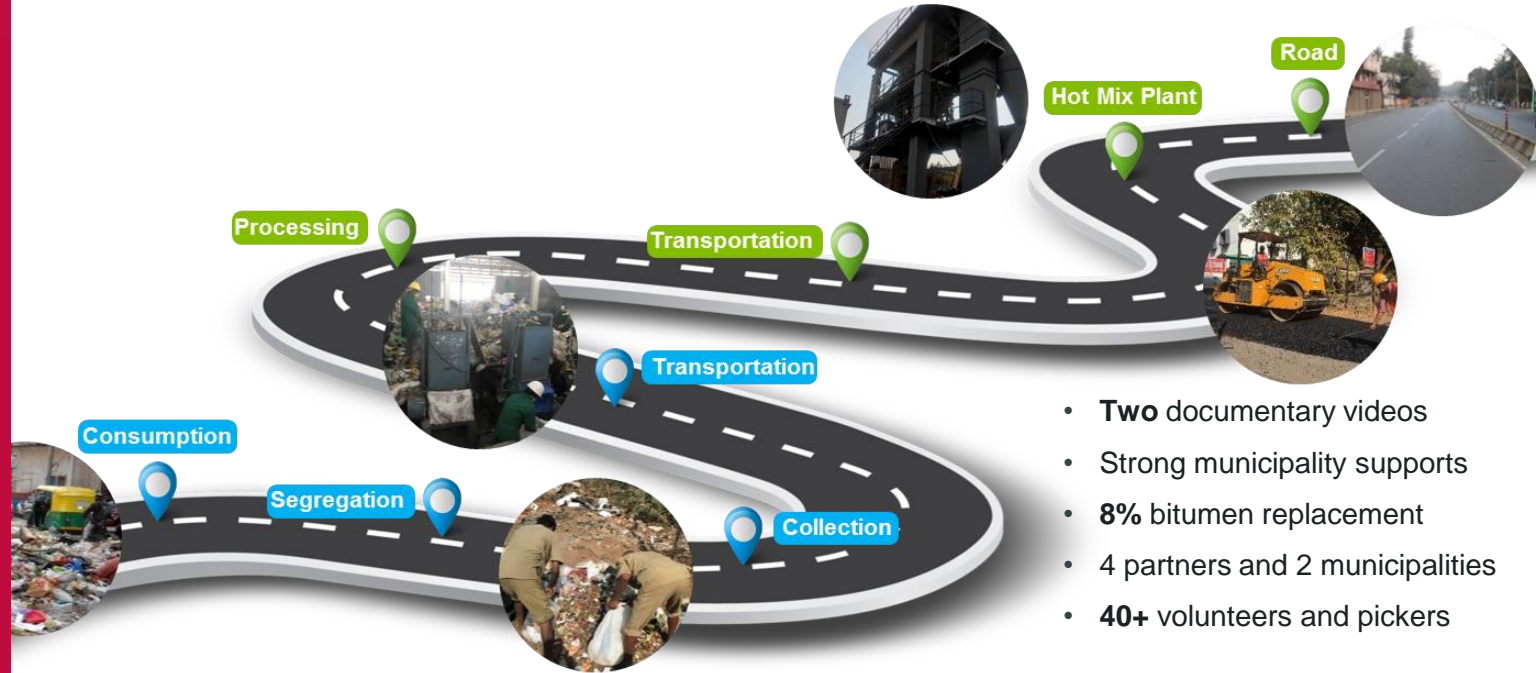
100 metric
tons of
waste
diverted

25 equivalent to
million
flexible
pouches

longer
road
life

potential reductions
in green house gas
emissions **CO₂**

Dow



- **Two** documentary videos
- Strong municipality supports
- **8%** bitumen replacement
- 4 partners and 2 municipalities
- **40+** volunteers and pickers

Our Vision: A More Circular Economy



Make sure all plastic packaging
is recovered and its value is captured instead
of ending up buried in
a landfill somewhere

Dow

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Partnering to Drive the Blueprint for a Circular Economy for Plastics



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Enhanced Recyclability of Flexible Packaging

- Packaging design cannot be considered in isolation from the packaged product and its value chain.
- Extended shelf-life of food its protection and the associated reduction in food waste and the resource efficiency is the most important factor in the sustainability equation, not the recyclability of the packaging.
- However, a lot of packaging structures can be easily be redesigned for higher recyclability.



Design Guidelines for Better Recyclability

- **Avoid black, fillers, pigments where possible**
- **Avoid paper**
- **Avoid contamination with PA, PET, lamination adhesives**
- **Avoid difficult to recycle materials like PVC**
- **Integrate compatibilisers in order to facilitate post Industrial and post consumer recycling (RecycleReady)**
- **Lightweight , wherever possible while maintaining or even improving performance**



The Dow Packaging Redesign Toolbox

- ✓ **Light-weighting with INNATE™ and SURLYN® - Thinner, but stiffer and tougher films**
- ✓ **All PE Pouch developments with and without barrier**
- ✓ **TF BOPE for All PE structures vs OPP/OPA/OPET**
- ✓ **Barrier Adhesive L86-500 to enhance barrier performance of re-designed packages**
- ✓ **RETAIN™ as integrated compatibiliser for post industrial or post consumer recycling**
- ✓ **Fusabond®, Retain™, Intune™, Engage™ and Elvaloy® Recycling Solutions**



Enhanced Recyclability of Flexible Packaging

Re-Design of Flexible Packaging

- *Design barrier and stiffness based on final application*

Unique Portfolio for Mechanical Recycling

- Solutions for post-industrial & post-consumer waste streams



Unique Portfolio for Mechanical Recycling

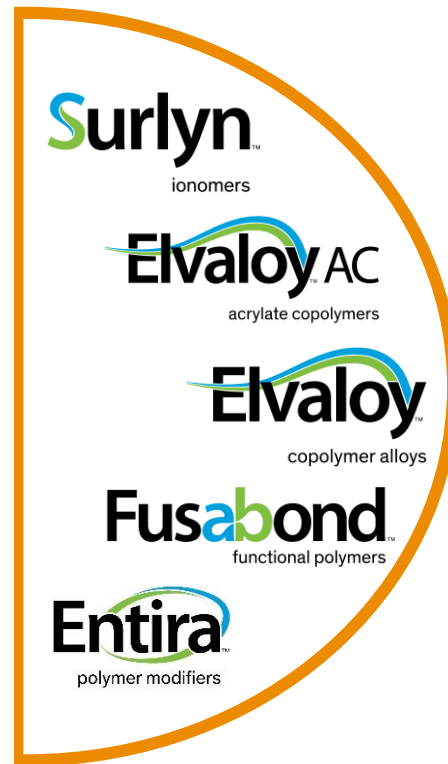


Impact Modification
Viscosity Control



Stress Crack
Resistance

Compatibilization



Applications | Offering for Packaging Recycling

Solutions for Post-Industrial and for Post-Consumer Waste

Post Industrial Waste (PIR)

PE and
EVOH & PA

Retain
polymer modifier by 

PP and
EVOH & PA

Fusabond
functional polymers

PE and PP

Infuse
olefin block
copolymers by 

Engage
polyolefin elastomers by 

Entira
polymer modifiers

Intune
olefin block copolymers by 

Post Consumer Waste (PCR)

Flexibles

Coming from
separate
collection

**RECYCLE READY
TECHNOLOGY**
for store drop-off recycling

Coming from
mixed
collection

CEFLEX
A CIRCULAR ECONOMY FOR FLEXIBLE PACKAGING

**THE
VIRTUOUS
CIRCLE**

Rigids

PET

Elvaloy
copolymer alloys

PE and PP

Infuse
olefin block
copolymers by 

Engage
polyolefin elastomers by 

Entira
polymer modifiers

Intune
olefin block copolymers by 



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Recyclable Monomaterial Laminates- Technology Approach

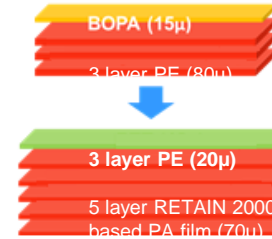
All PE Laminate
(Low Barrier)



Recyclable Barrier Films
(Moderate Barrier)



Recyclable High Barrier
Laminates



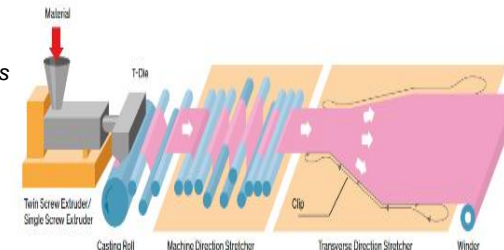
- Development for Soya Chunks
- PET//metPET//PE replacement with PE//Co-Ex PE for snack packs

Enhancing Print PE
Substrate

INNATE TF-BOPE



Good color registration during printing
by excellent dimension stability



Leveraging learning to other applications like detergent, 5 & 10kg wheat flour



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RecycleReady Technology – All PE

An Added Value

Dow's broad portfolio of technologies offer the convenience and features of typical multi-material, multi-layered pouches, flow wrappers, and barrier film with the added benefit of recyclability.

Key Features and Benefits of Recycle Ready



- **Same** end-use convenience
- **Comparable** functional performance in stiffness and barrier protection* to current SUPs in the market
- **Complete** hermetic seals to avoid leaks
- **Suitable** to be recycled in communities with existing PE film recycling streams via programs such as **the Grocery Store Drop-Off ****
- **Tested** and eligible to use the Sustainable Packaging Coalition (SPC) - **How2Recycle Label** (license required for label use by SPC) ***

* Check barrier requirements that are suitable for PE SUP applications.

** Where such recycling facilities are provided (www.plasticfilmrecycling.org).

*** The How2Recycle Label is a project of GreenBlue's Sustainable Packaging Coalition® (SPC) of which Dow is a founding member.

Pouch illustrations are for representative purposes only; Dow does not manufacture the actual pouch, nor produce these types of retail products.



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Recyclable Barrier Film

Launched numerous new technologies to support efforts to increase recycling and improve how plastics contribute to the Circular Economy

- Introduced **RecycleReady Technology** for Store Drop-off Recycling – a new collaborative technology available that allows non-barrier plastic pouches, previously made from the non-recyclable combination of PET and Polyethylene to be made from polyethylene, which allows them to be recycled with other polyethylene films and bags
- Launched **RETAIN™ Polymer Modifiers** – a compatibilizer technology that allows films and pouches containing both polyethylene and EVOH to carry the Sustainable Packaging Coalition's How2Recycle label for store drop-off, for recycling in the existing polyethylene film recycling stream

RECYCLE**READY**
TECHNOLOGY
for store drop-off recycling

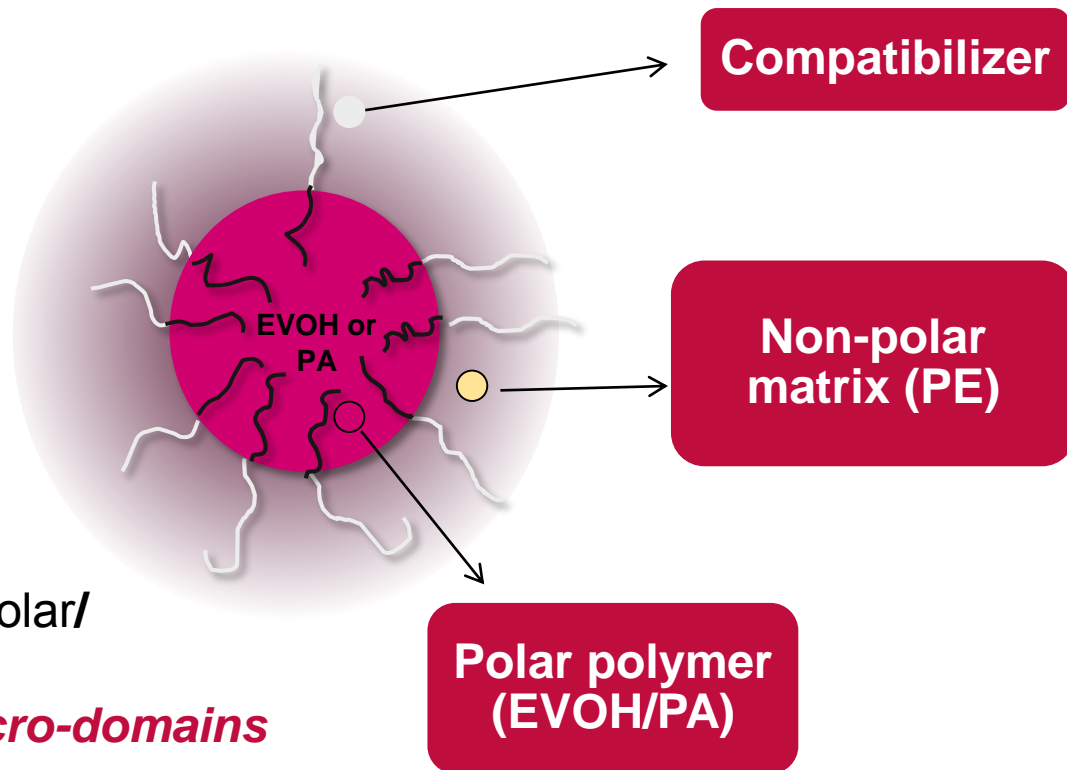
Retain
polymer modifier



RETAIN™ Polymer Modifier



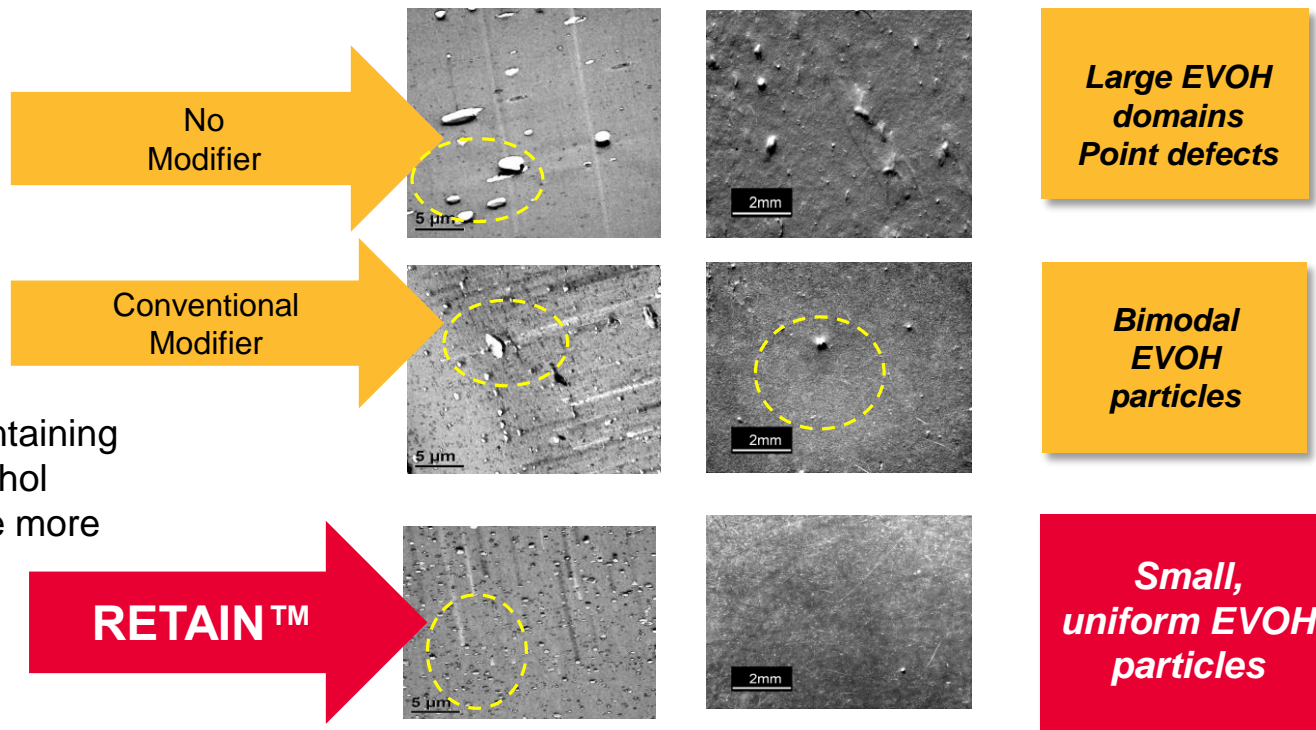
- Low viscosity = fast mixing
- Reactive groups will “coat” the polar/
*Barrier components,
encapsulate them into micro-domains*



Solutions for Post Industrial: Barrier Film

Gel Reduction / Optical Improvements

Allow pelletized barrier films, containing materials like ethylene vinyl alcohol (EVOH) or polyamide (PA), to be more **evenly dispersed into a polyolefin matrix**



ENABLING ZERO INDUSTRIAL PACKING WASTE

Unique Portfolio for Mechanical Recycling

Examples Of Recycled Streams	Dow-DuPont Compatibilizers
PE-PA or PE-EVOH	<i>RETAIN™ 3000 and 2000; FUSABOND® E226 and M603</i>
PP-PA or PP-EVOH	<i>FUSABOND® P353, N525 and N416</i>
PP-PE <i>(from rigids: bottles, flacons, tubes, food, cosmetics and household).</i>	<i>ENTIRA® EP 1754 , Infuse™, Intune™ Attane™ Engage™</i>
PC-PET	<i>ELVALOY® PTW</i>
PC-ABS	<i>Elvaloy 1224AC</i>



Conclusion

- **Sustainability is the single most important trend**
- **Product Protection and Material use Reduction are important**
- **Recycling is the key word for Material use Reduction**
- **We at Dow have the broadest and most effective portfolio for recycling compatibilisers**





**Together we can change the
packaging industry!**

Thank you!

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