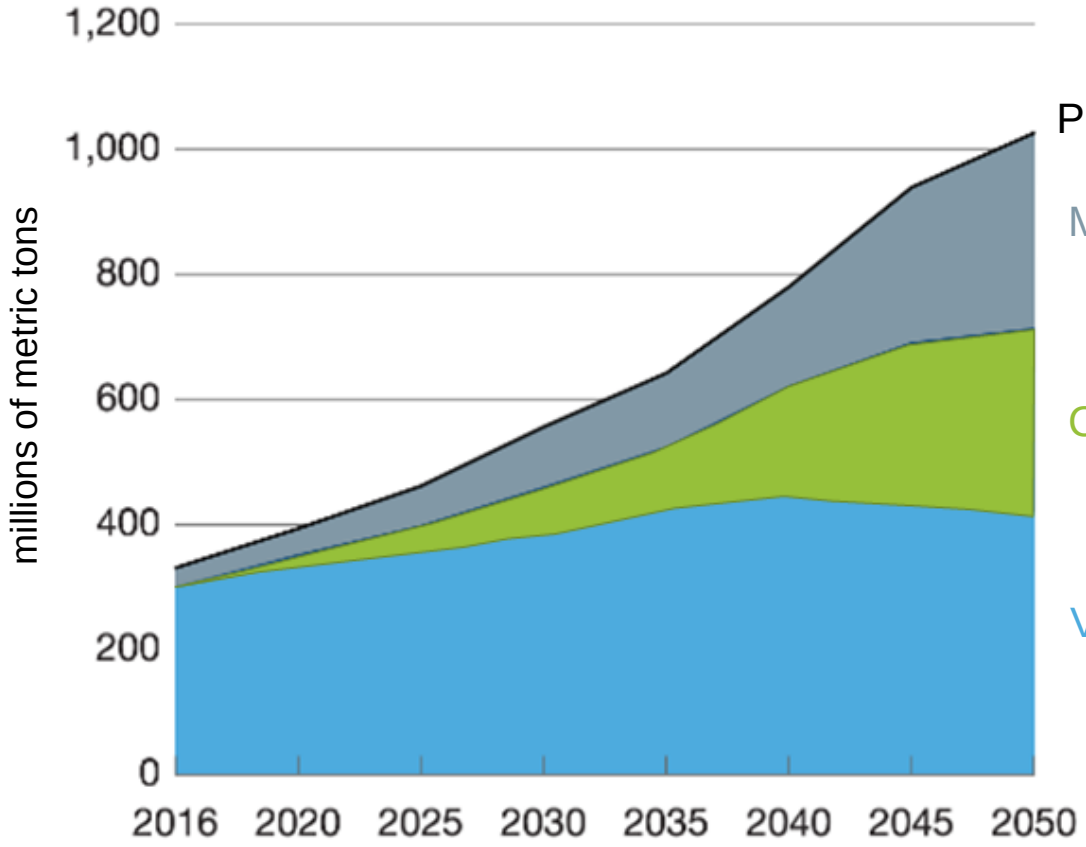
ENGEL Injection Moulding Technologies to boost Circular Economy

Global polymer future demand

How it could be converted



60% in 2050 will be from plastic reuse & recycling

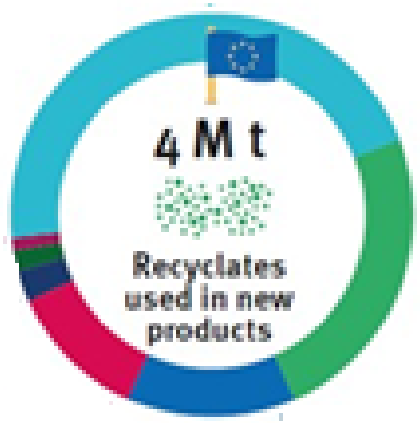
Source: McKinsey, 2020

Global polymer future demand

European Plastics

Recycled Plastics

Current area of use

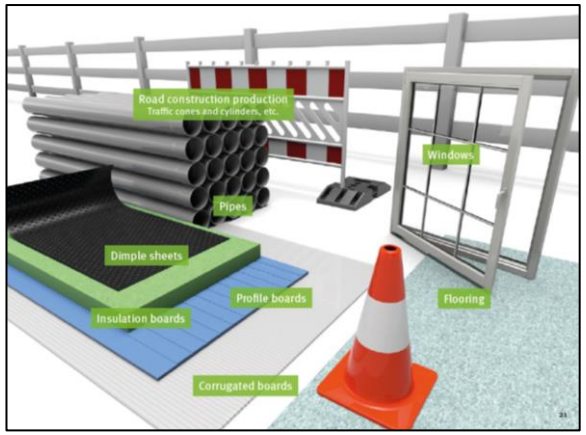


46% are used in Building & Construction

24% are used in Packaging

17% are used in Automotive, Electrical & other products

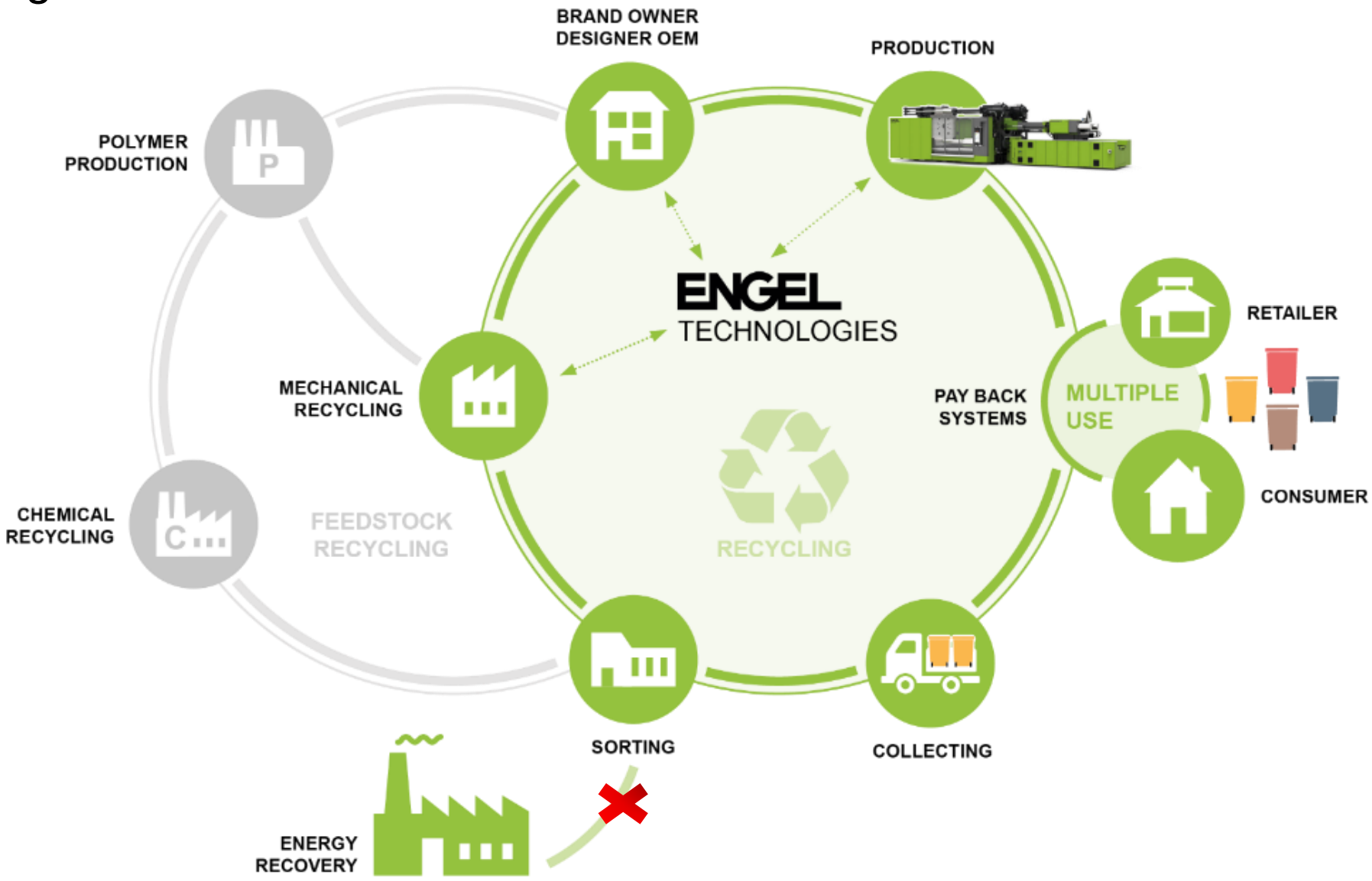
13% are used in Agriculture and Gardening Applications



Aboveata were rounded - Recyclates from post-consumer waste only

What is our role in Circular Economy?

Loops of recycling



What activities can we perform?

ENGEL Solutions for Recycling

Brand Owner
Designer
OEM

Technologies for Design for Recycling
- Multi-component injection molding on same polymer base (e.g. IML)

Technologies for increasing the amount of recycled material
e.g. skinmelt, foilmelt

Mechanical Recycling

Recyclable materials
- Coordinate standards for regrind and regranulate

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Production

Process stability
- Assistance systems, iQ-products

Long-life plasticising unit
- Screw, non-return valve, barrel

Machine concepts

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Recyclable materials

Flowable materials for injection moulding

Recyclate

Regrind

grinded/shredded particles

Regranulate Recompound

regranulated from regrind into melt process

Agglomerate

agglomerate/accumulated thin-walled foils

- **Contamination**

  Sand, glass, aluminium, paper, wood, natural fibres, foreign plastics
- **Moisture**
- **Bulk density**
- **Particle size**

useable for injection moulding?

Recycling-Requests to recycling@engel.at

Checklist




1. Enter your **request**
2. Send us a sample of **material**
3. Elaboration by **recycling team (PS, GA, TE, SALES)** in scope of an OPQ
4. **Meeting** with customers & sales about implementation of the solution

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Technology that enables design for recycling

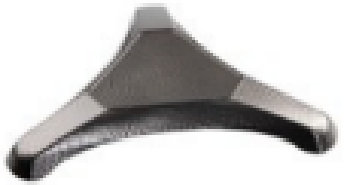
and increase the amount of recycled material

In-Mould Labelling (IML)

- Label and polymer have the same molecular structure / polymer base e.g. PP → 100% recyclable

Foilmelt

- Up to 100% recycled base material, High-quality surface



Skinmelt

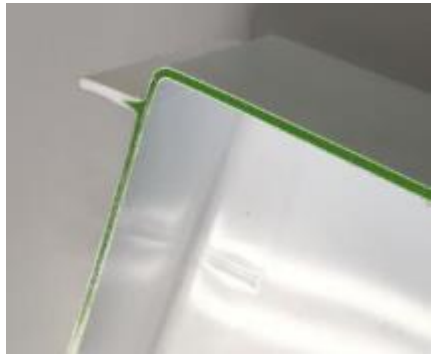
Up to 50% recycled core material, High-value skin material

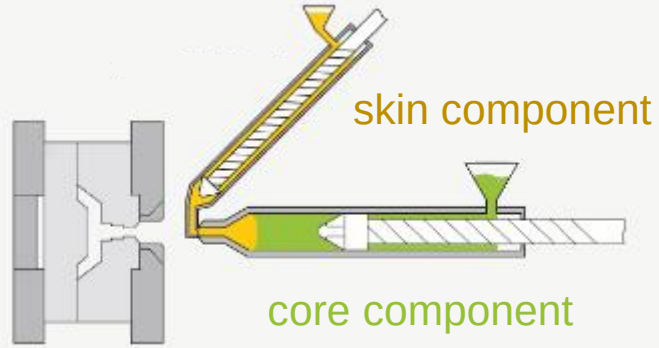
Same polymer base

Skinmelt

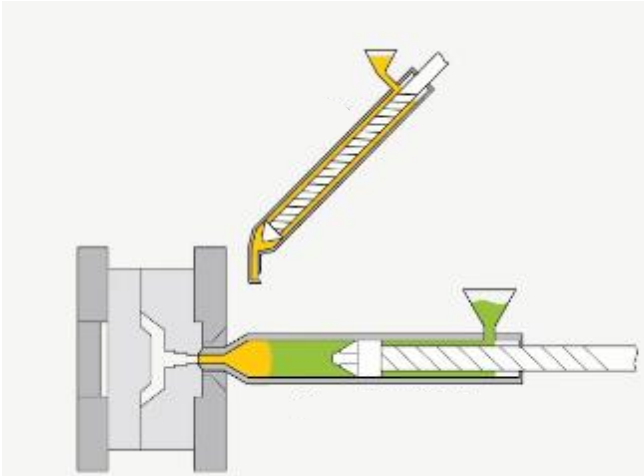
Higher amount of regranulate in sandwich parts

- Cost saving
- High value material at the surface
- Regranulate in the core

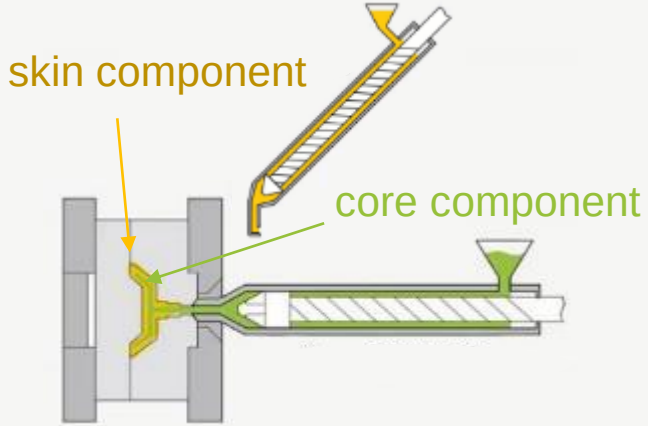




1. Loading the skin material into the main injection unit



2. Starting the injection



3. Holding the pressure

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technologies

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Machine concepts

Smart Machine

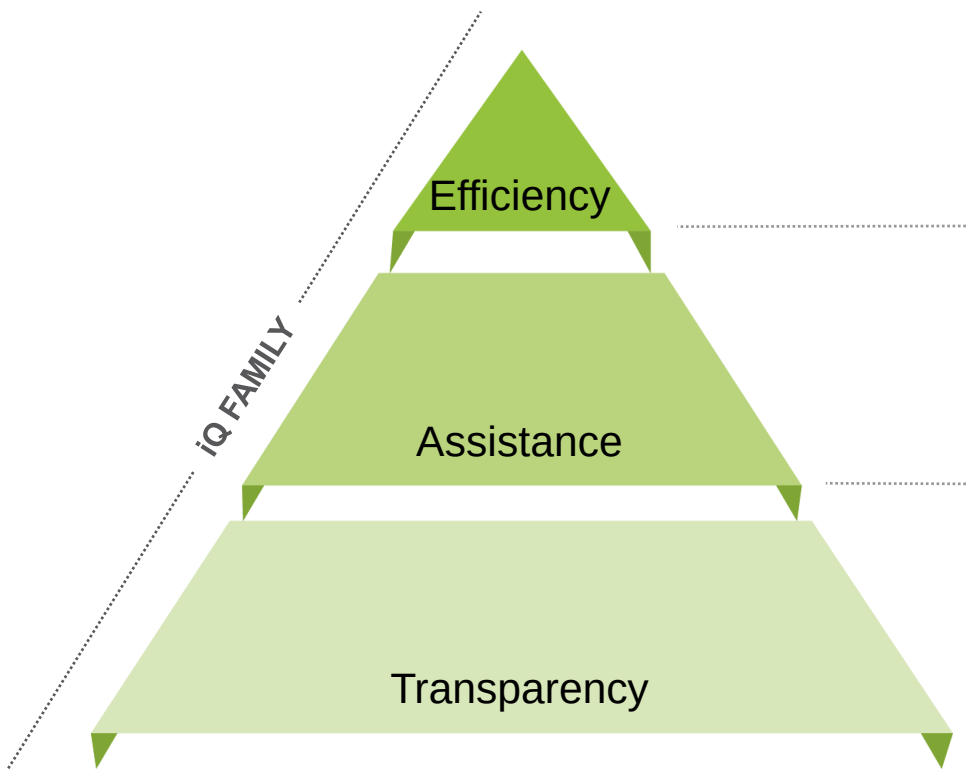
Use more recyclates thanks to higher process stability

Digitalization as an important component for the Circular Economy

Recyclates are naturally subject to greater batch fluctuations than virgin materials. Our digital solutions from the ENGEL inject 4.0 programme can help to significantly reduce influences on the process automatically

Smart Machine

more stability, better quality



Relevant with recycled material

iQ weight control

iQ flow control

CONTROL THE PROCESS

Relevant with recycled material

iQ clamp control

iQ melt control

OPTIMISE THE PROCESS

Relevant with recycled material

iQ process observer

MONITOR THE PROCESS

Smart Machine

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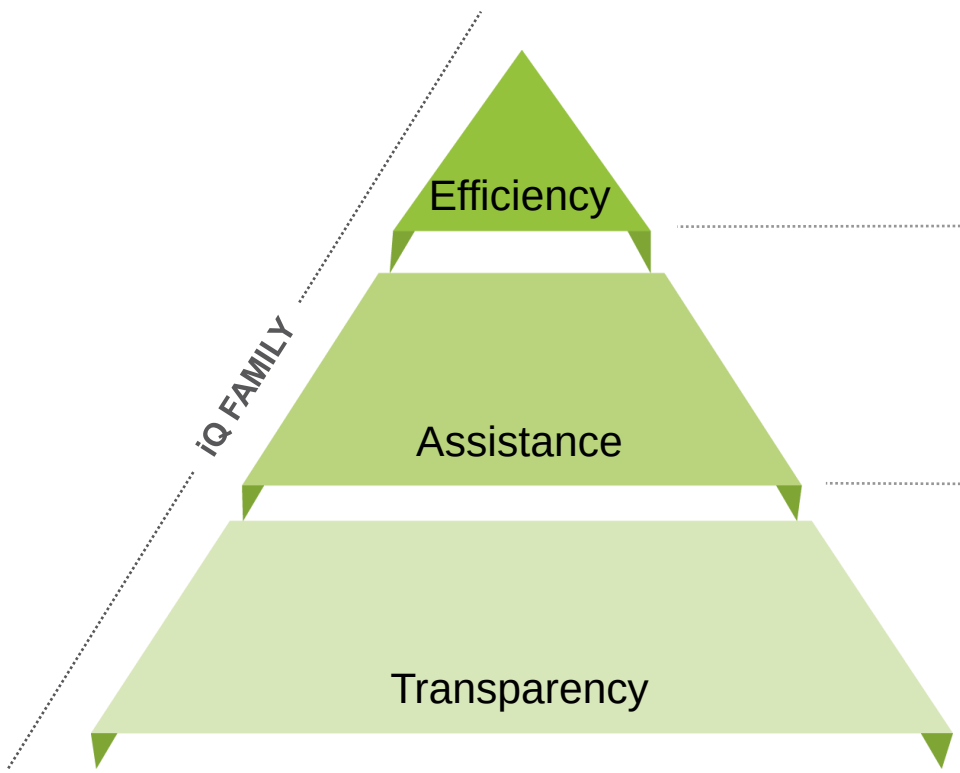

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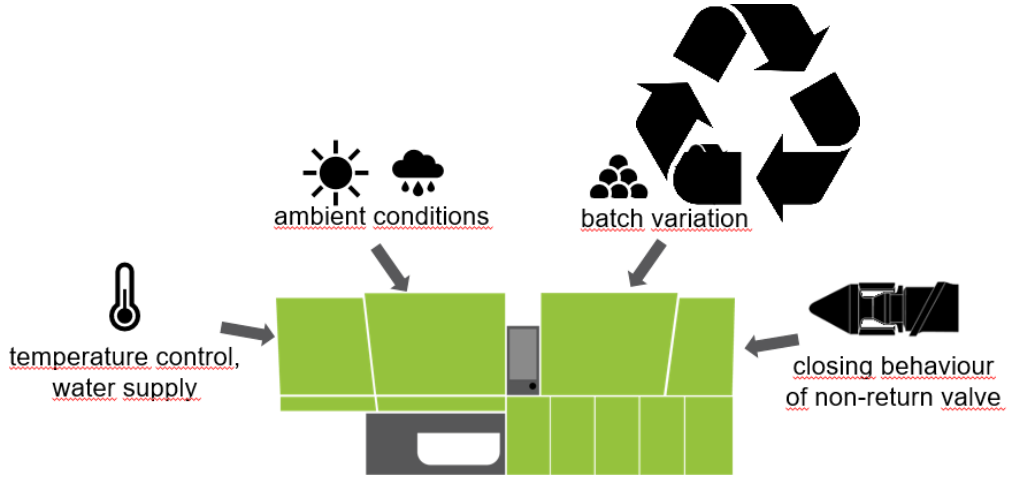
iQ Weight Control

Intelligent compensation for changes occurring during the process

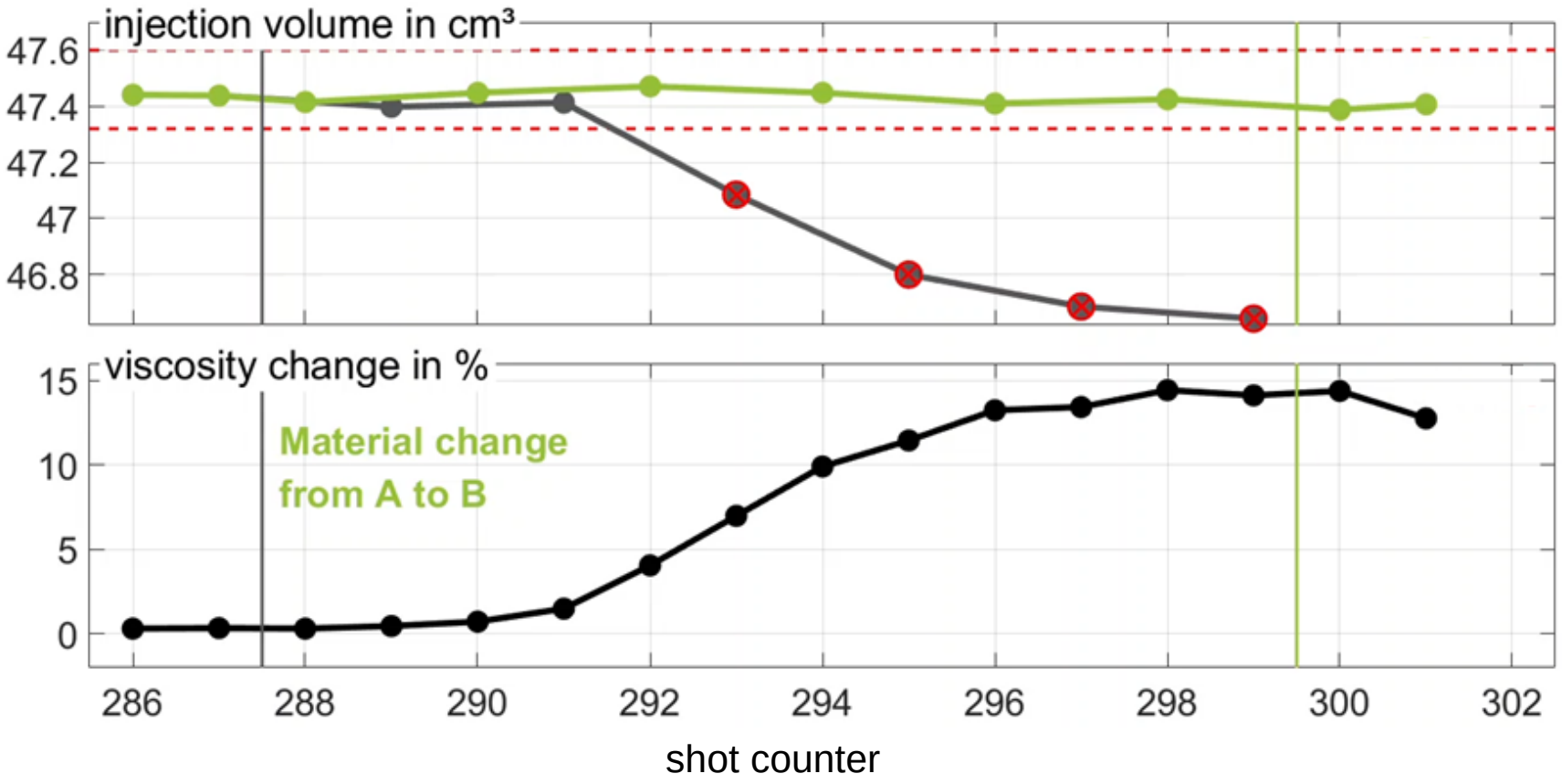


consistent component quality

compensates for environmental influences and fluctuations in materials, increasing the reproducibility of the process and molded weight

iQ weight control | MGG Polymers & BAGE Plastics

Processing 100 % recycled plastics



iQ weight control on

iQ weight control off

reject

iQ Weight Control - technical paper

Opening a broader range of applications for recyclates

The iQ weight control Assistance System Ensures Higher Process Stability

Opening up a Broader Range of Applications for Recyclates

Smart assistance systems are paving the way for self-optimizing production. Automatic correction of quality-relevant parameters is already reality for individual phases of the injection molding process. At K2019, ENGEL presented the iQ weight control with the example of a recyclate application for the first time. Extensive tests performed jointly between the injection-molding machine manufacturer and the recycling specialist EREMA confirm that the system has great potential for the circular economy.

Transport and storage boxes are predestined for the use of recycled raw materials. Several customers of ENGEL AUSTRIA GmbH, Schwertberg, Austria, already process recyclates in large quantities to produce various containers, with iQ weight control to improve the process repeatability. The software detects fluctuations in the raw material and in the ambient conditions, and adjusts the injection profile, switchover point and holding pressure, individually for each shot to suit the current production conditions. "We can process recyclates from different sources and, thanks to iQ weight control, minimize the reject rate. This makes it substantially easier to use recycled materials," commented, for example, a well-known internationally active processor.

Fluctuations in the material properties pose a significant challenge for the processing of recyclates. Even homogeneously collected and treated plastic wastes are subject to greater fluctuations than virgin material, since the recyclate properties are also influenced by circumstances such as how heavily the wastes are polluted and the process used to wash, shred and repelletize the wastes. In recyclate processing, such materials are generally sourced from different suppliers. Since recycling companies use different technologies, the variance is particularly high when a batch is changed.

ENGEL tackled this theme at K2019. With an ENGEL victory 120 machine, fully recycled ABS was processed into elongated sample parts (**Title figure**). The recyclate batches came

ENGEL be the first
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presse | technical paper

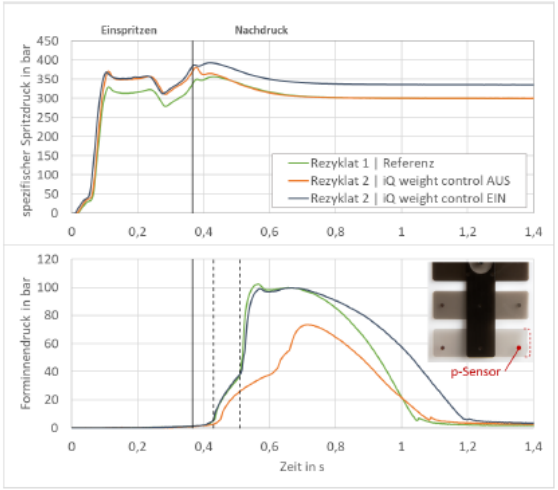

Fig. 6. Pressure curves after batch change from recyclate 1 to recyclate 2. The upper diagram presents the specific injection pressure profile. The plot of the cavity pressure curves (bottom) supports the result of the part weight measurement and also shows the more uniform fill front progress with iQ weight control. (Picture: ENGEL)

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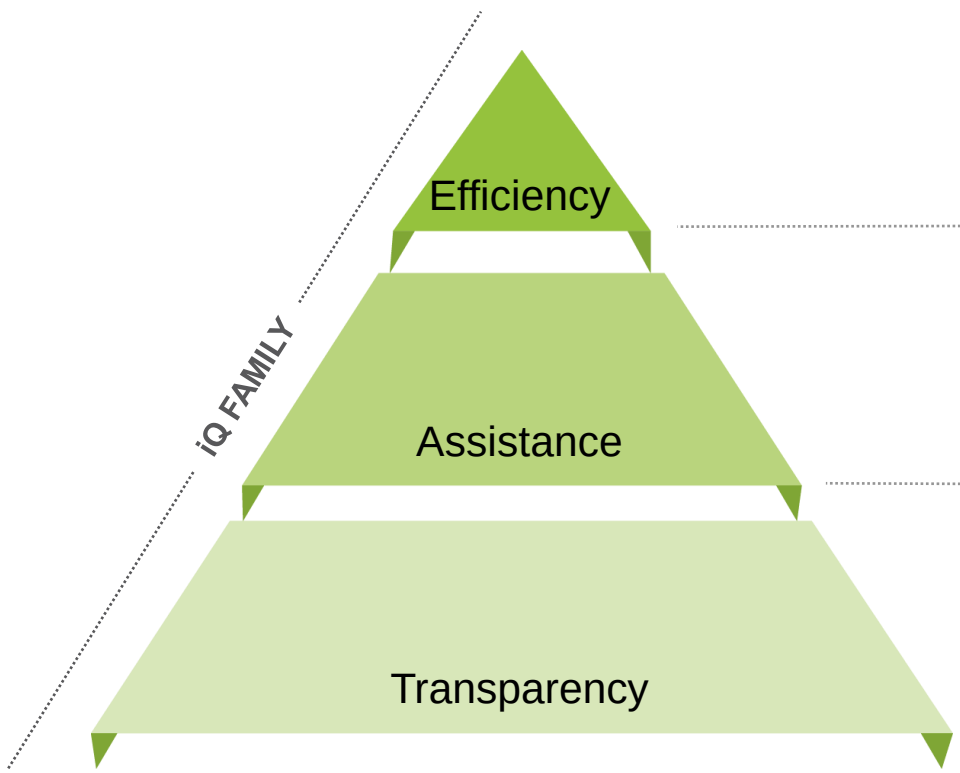
Ask for a copy

Smart Machine

more stability, better quality



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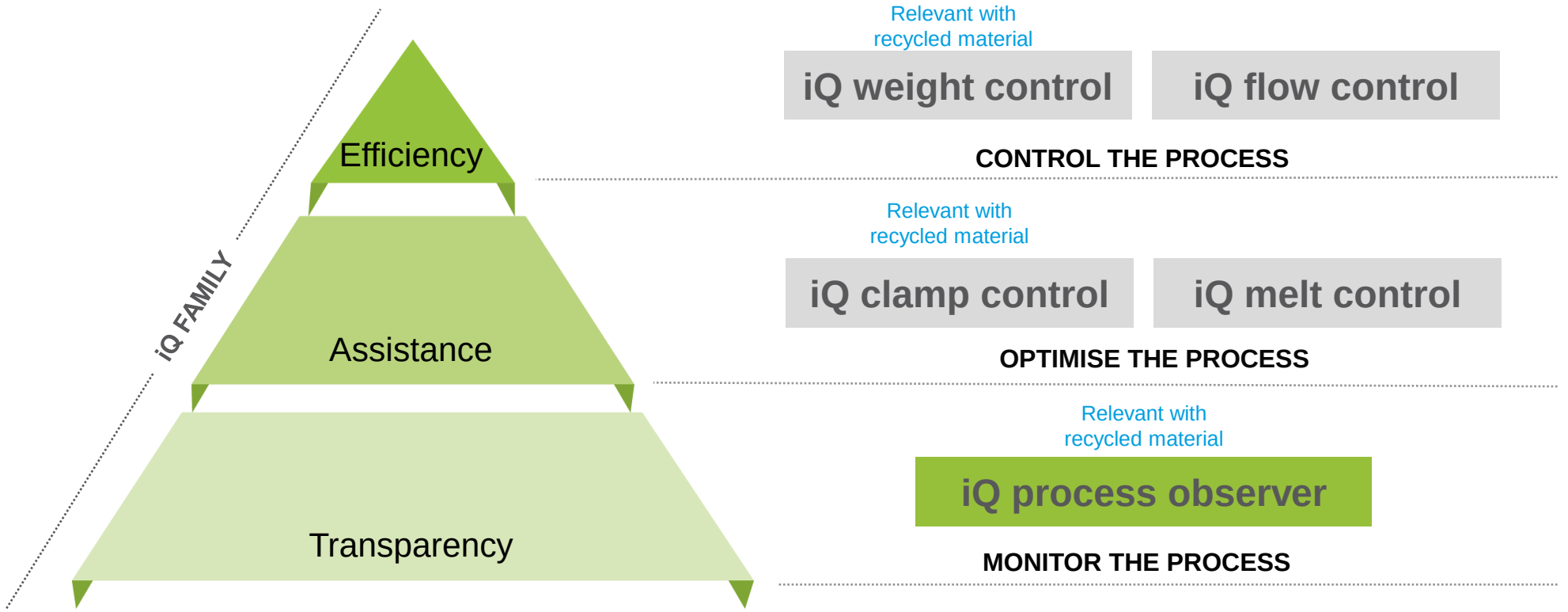
iQ Clamp Control

Intelligent clamping force optimisation

- automatically regulates the clamping force and guarantees component quality
- automatically determines the optimal clamping force
- provides quality-relevant information about each shot
- prevents rejects due to burrs or burn marks
- reduces wear on mould and clamping unit „improves energy efficiency – thanks to optimised clamping force

Smart Machine

more stability, better quality



iQ Process Observer

Hundreds of process parameters can be monitored continuously and effortlessly

Recognising process changes in time

Identify causes and reduce machine downtimes and rejects

Simple and fast handling

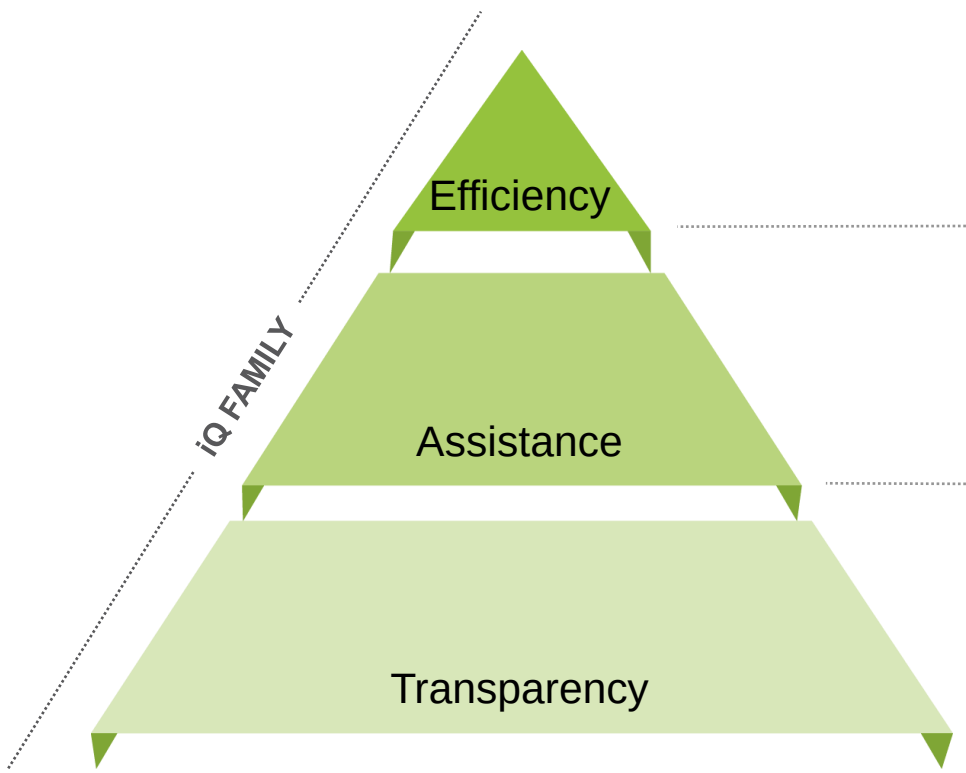
Process monitoring clearly displayed on the machine

Smart process data analysis

Intelligent interpretation of the process status

Smart Machine

more stability, better quality



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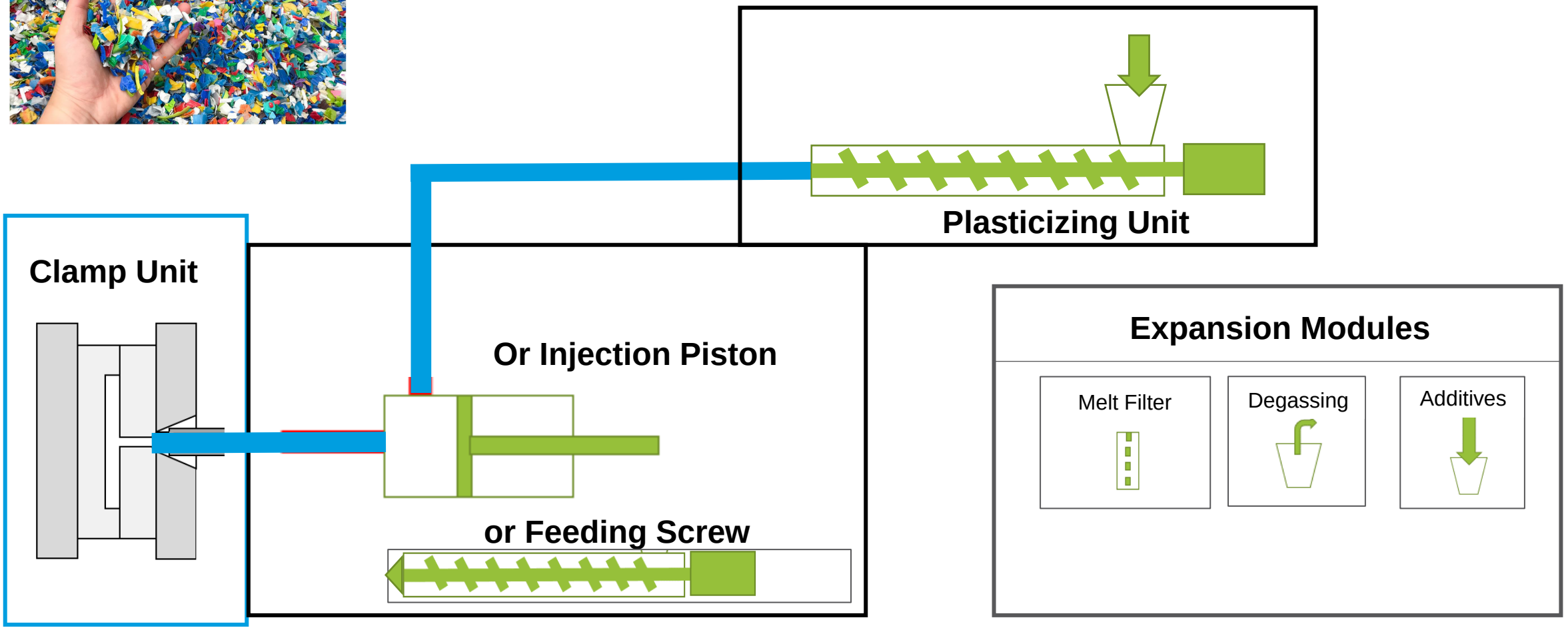
Injection moulding machines for recycling purpose

ENGEL two Stage Process

ENGEL

2-stage process in circular economy



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50 SUSTAINABILITY & CLIMATE LEADERS

A RACE WE CAN WIN

NEW PLASTICS ECONOMY Global Commitment

Member of the **Ellen MacArthur Foundation**

PLATTFORM VERPACKUNG MIT ZUKUNFT

ENGEL

Get in contact with us and we offer you the ideal solution!

We look forward to your feedback!

recycling@engel.at