



A View of the Future of PET Resins

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A View of the Future of PET Resins

- **M&G Technology Model.**
- **Three Key Technology Model Components:**
 - * **Core Technology;**
 - * **Flexibility Enabling Process Innovations;**
 - * **Product Innovation Technologies.**
- **Conclusions.**

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The Technology Challenge in PET



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- **Costly innovations are useless because they will not be adopted on a large enough scale to justify R&D and manufacturing investments.**
- **Pursuing low cost-price at the expense of performance kills innovation, degrades end-users' brand value, and hinders PET growth and market enlargement.**

The challenge is therefore to provide
performance & flexibility
with
simple and economically viable
technological solutions

M&G PET Strategy



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Market Rationalization

Market Enlargement (M&G)

Strategic Aim

Commodity market rationalization

New demand creation /
Market enlargement

Market Targets

Existing commodity market

New applications requiring performance enhanced PET

Target Market Requirements

- .. Low price
- .. Standard grades
- .. Customers ready to sacrifice flexibility/performance for price

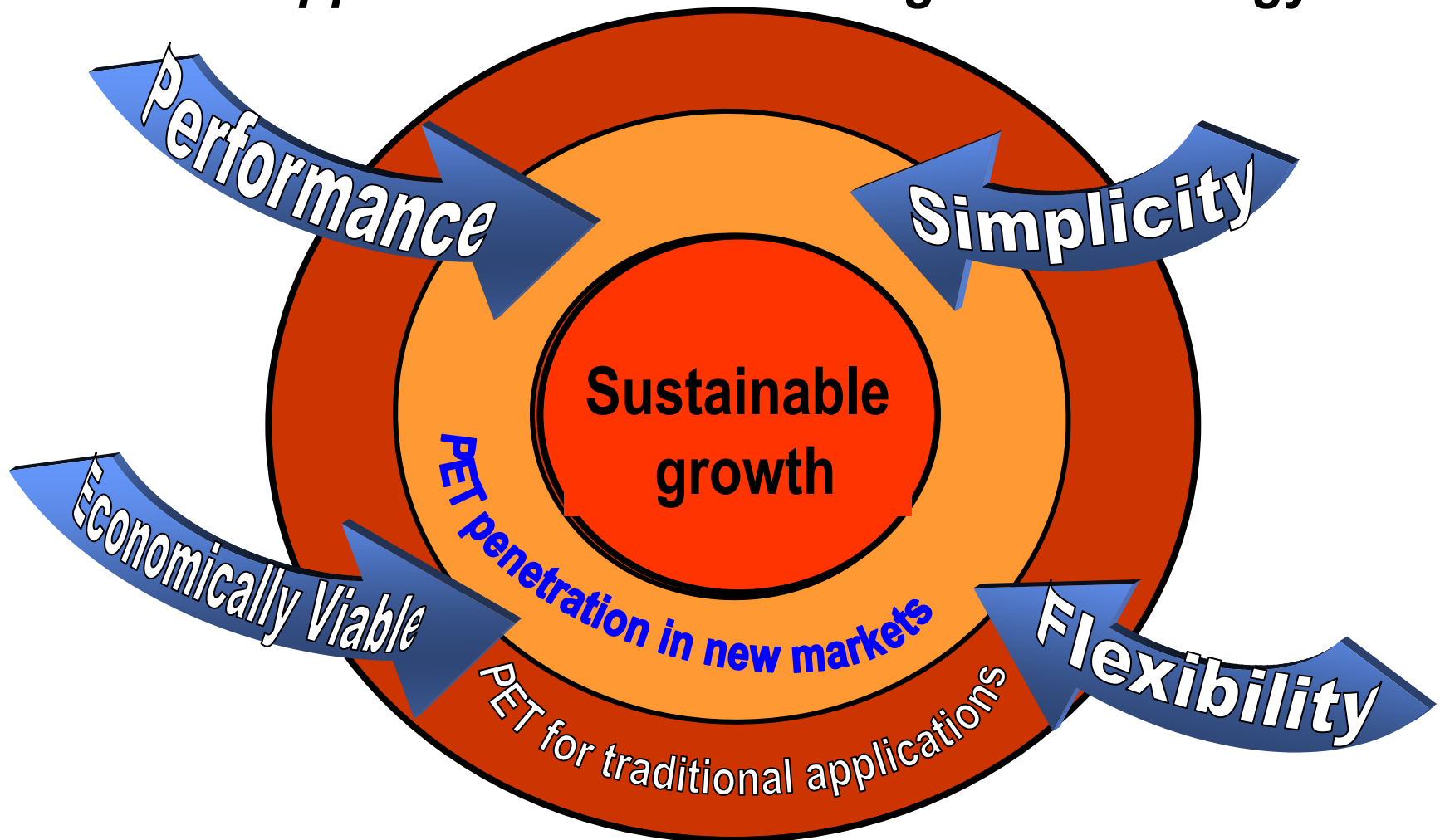
- .. Viable economics for large scale conversion to PET
- .. High performance grades
- .. Customers need performance and flexibility to convert to PET

M&G Technology Group TARGETS



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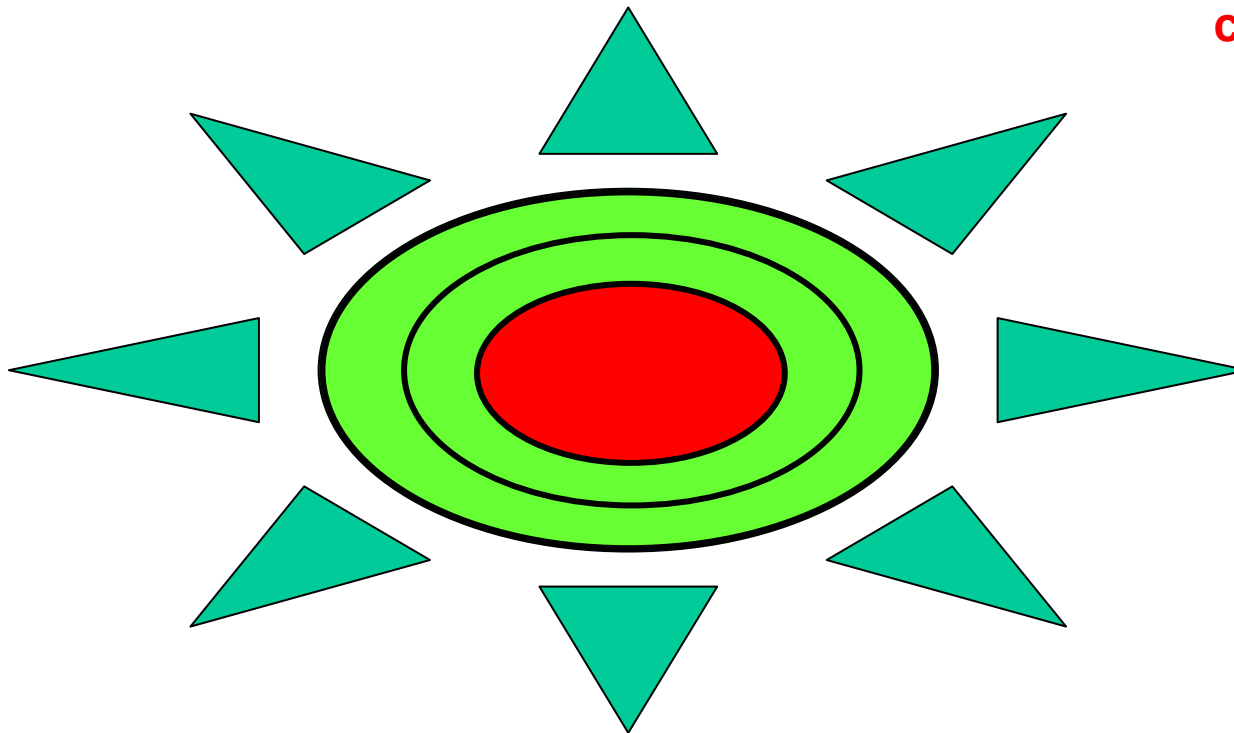
M&G Technology Group targets are set to support M&G market enlargement strategy






M&G Technology Model



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-  Core technology
-  Flexibility enabling process innovation technologies
-  Product innovation technologies

M&G's model achieves **compatibility between cost & performance** by connecting an efficiency driven **technology core** to performance driven **product innovation technologies** through **flexibility enabling process innovations**

M&G Technology Model (continues)



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Core Technology

The objective of M&G Core Technology is to minimize the capital and operation cost of producing standard PET grades for the commodity segments.

Product Innovation Technologies

The goal of M&G Product Innovation Technologies is to satisfy performance requirements of new large scale application areas without creating additional system costs to converters and end-users.

Flexibility Enabling Process Innovation Technologies

The goal of M&G Flexibility Enabling Process Technologies is to enable the adoption of product innovation technologies in the context of M&G's jumbo scale continuous process manufacturing (CP), minimizing cost addition.

A View of the Future of PET Resins



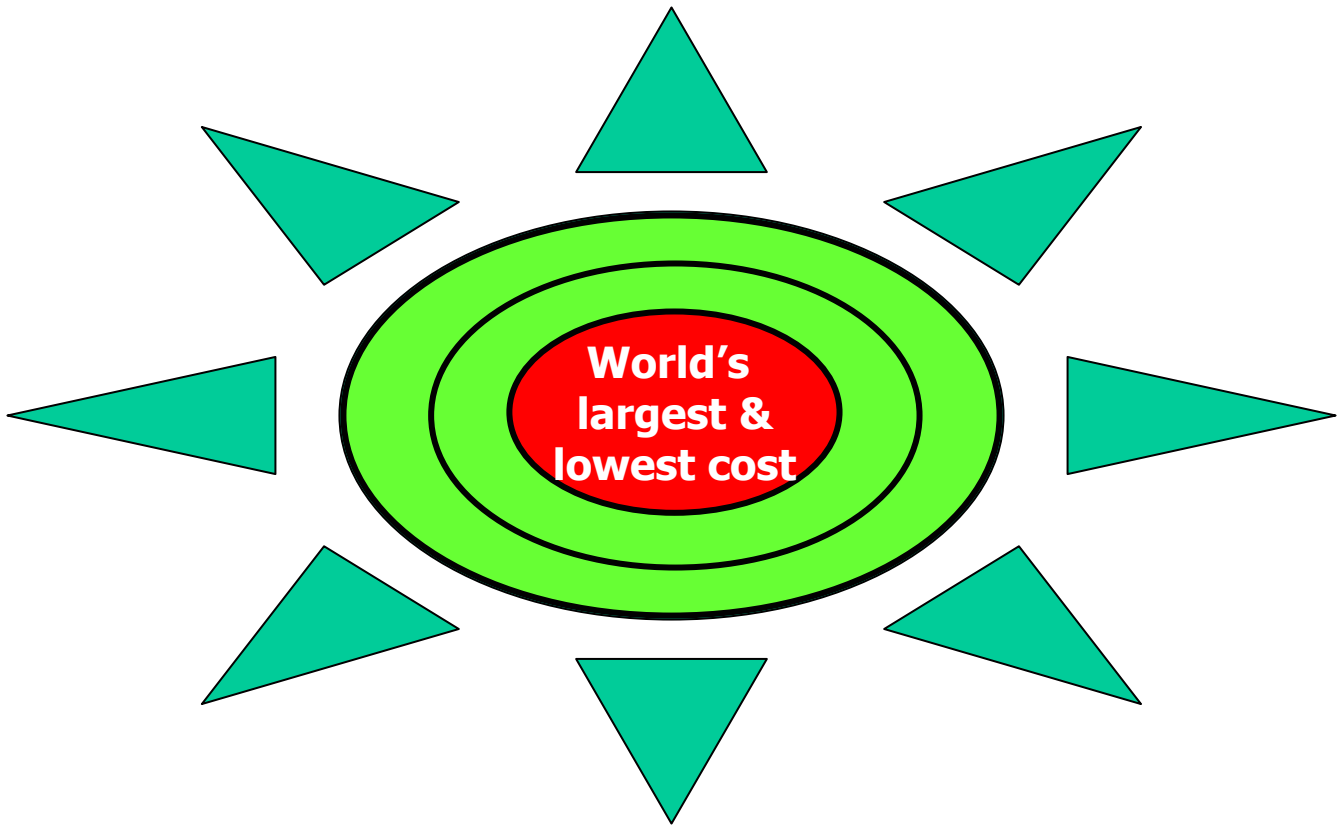
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M&G Core Technology



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M&G's Core Technology is the most advanced in the industry and allows the fastest construction of the world's largest and lowest cost PET plants:

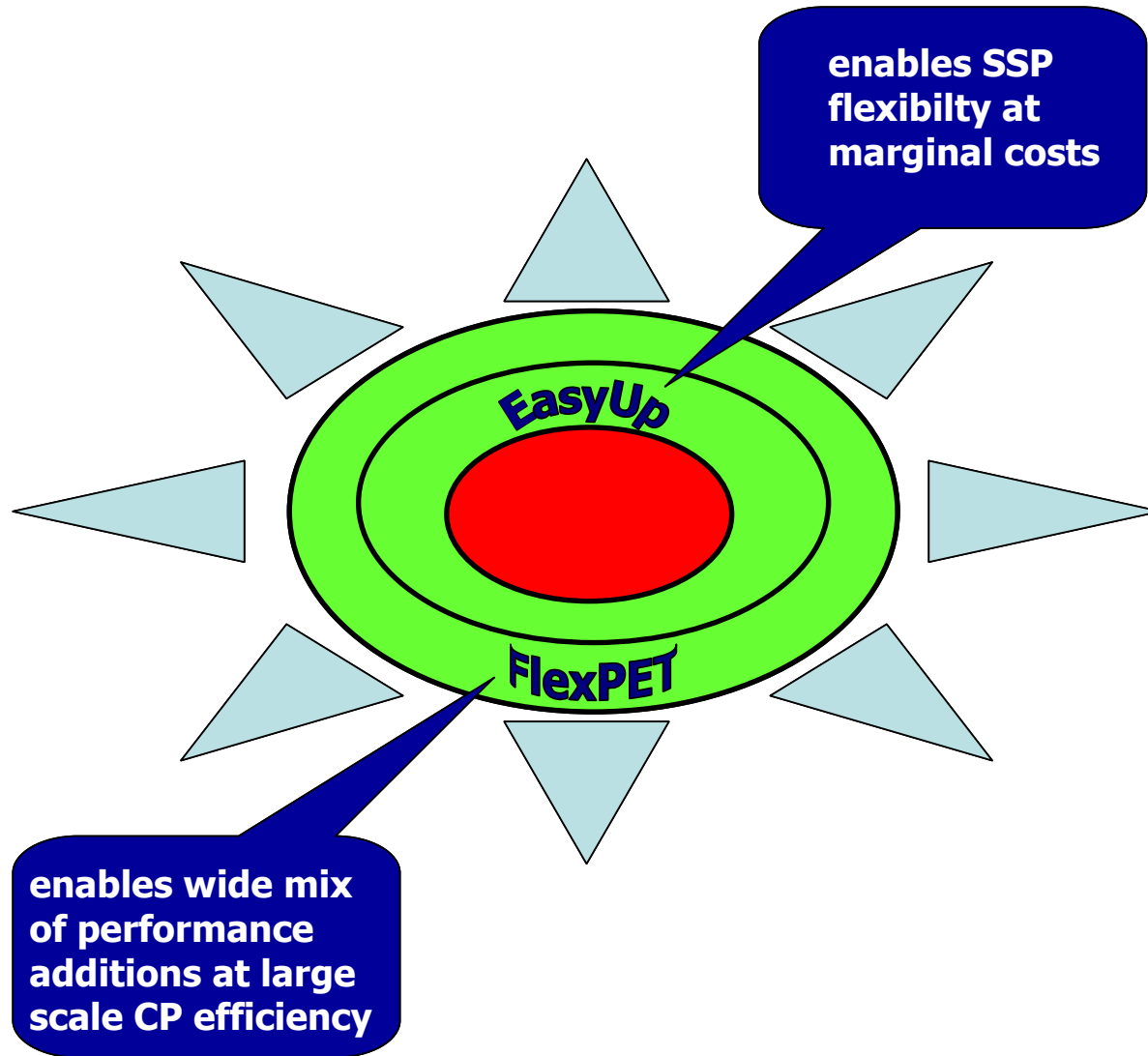
2003	→	Location:	ALTAMIRA, MEXICO
		Capacity:	400 kMT/year
		Capex:	\$ 70 million
		Announcement date:	October 17, 2001
		On stream date:	April 2003
2005	→	Location:	IPOJUCA, BRAZIL
		Capacity:	450 kMT/year
		Capex:	\$ 70 million
		Announcement date:	December 22, 2004
		On stream (est):	Late 2006

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-

Flexibility Enabling Process Innovations



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***EasyUP* is a proprietary technology which simplifies and improves the polymerization in the solid state that goes beyond the current limitations at much lower CAPEX and OPEX.**

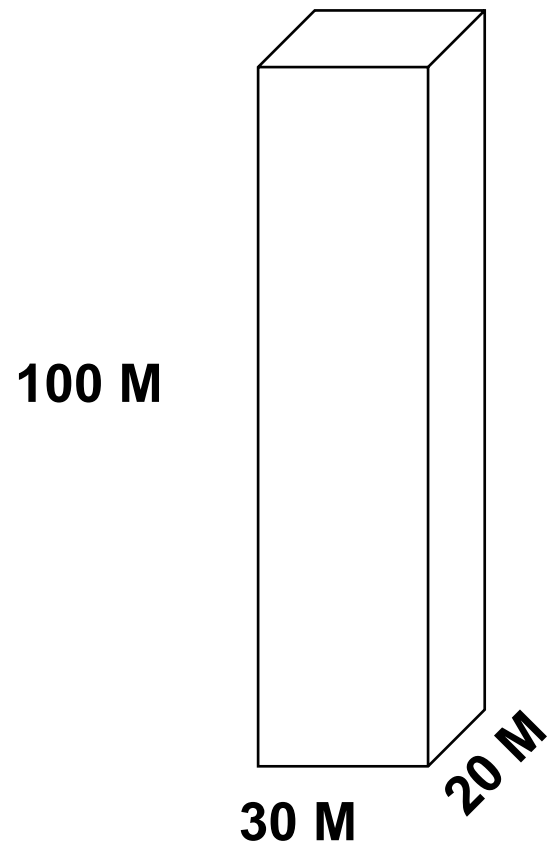
- **The new process takes place in special gas atmosphere which allows use of smaller sized equipment.**
- **The reaction takes place in a horizontal kiln type reactor which guarantees a perfect plug flow (equivalent to 500 CSTR in series vs. 10 CSTR in series of standard technology).**
- **The streamlined process requires half the equipment utilized in standard technology.**

EasyUP – Building Comparison

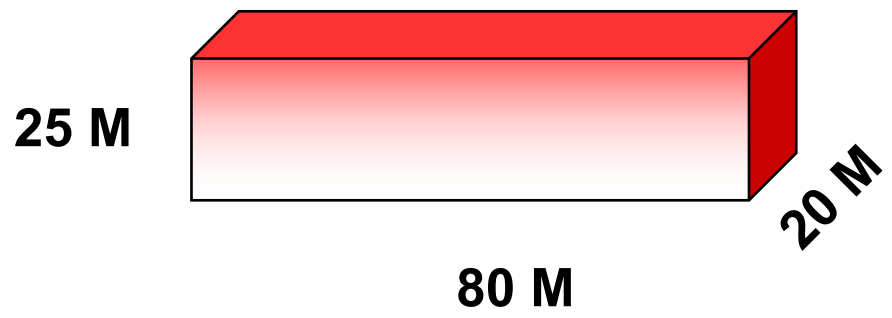


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700 t/d standard SSP plant



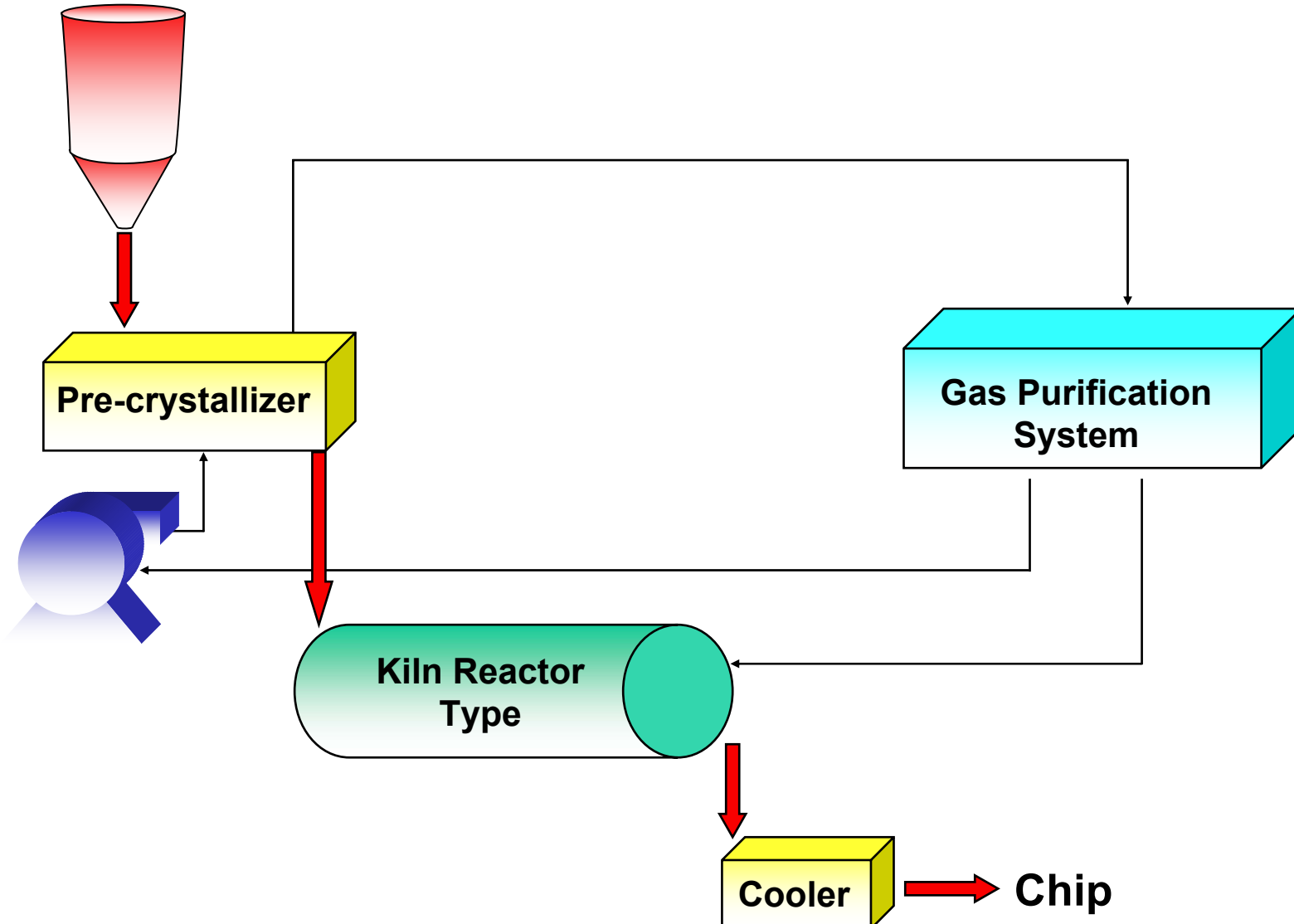
1250 t/d EasyUP plant



EasyUP – Block Diagram



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EasyUP – Technology Comparison



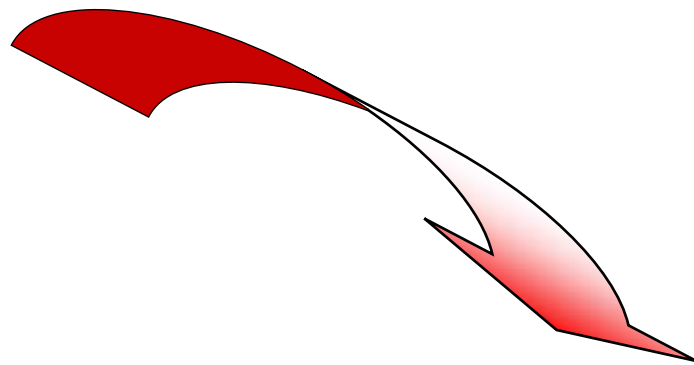
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	<u>Standard</u>	<u>EasyUP</u>
<u>CAPEX</u>	High because of building and amount of equipment	40% of standard
<u>Size</u>	Max size 700 t/d	Up to 2000 t/d
<u>Plug flow Characteristics</u>	Poor On large units due to switch pressure chip to chip	Optimal No pressure Reactor almost empty
<u>Flexibility: Off spec generation during grade change</u>	Low The lower the bigger the unit	High No intermediate material The reactor is run empty between products
<u>Variable costs</u>	Higher Long residence times (20 hrs) command higher costs	Lower Less gas and shorter residence times (<8 hr) halve the variable costs



FlexPET: “It is all in the Pellet”

FlexPET...



**...the economy of scale
of the largest plant
with the flexibility
of the specialty boutique!**



FlexPET: “It is all in the Pellet”

M&G has always believed in the simplest possible recipe with the lowest possible modification.

***FlexPET* is the exploitation of this theory where the polymer has a non-modified common base with the functional modifier added in the final pellet at the end of the process.**

FlexPET: “It is all in the Pellet”



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- ***FlexPET*** is a production technology that takes advantage of the economy of scale by modifying the product at the end of the melt line before the cutter.
- This technology allows a megaplant (1500 t/d) with the flexibility of the small specialty line, for the production of as many products as cutting lines.

FlexPET: “It is all in the Pellet”



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- **This new production technique encapsulates the modifiers in the pellet and protects them from any degradation or the resin from any discoloring.**
- **The nature of the pellet allows its handling and thermal treatment in standard PET conditions, therefore the product can be solid stated and dried conventionally.**

FlexPET: “It is all in the Pellet”



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The bulk of the pellet is made of the same base resin for all types of application, while the added part contains the modifier relevant to the specific application:

- * Mineral water;**
- * Quick Heat Uptake;**
- * Passive barrier;**
- * Active barrier;**
- * Post Consumer Recycle, etc...**



FlexPET: “It is all in the Pellet”

PERFECT DOSING

This type of pellet allows the precise, exact and intimate distribution of the functional modifier inside the resin when molten in the injection molding machine.

CONCLUSIONS

- 1. FlexPET* has commodity economics with specialty flexibility;**
- 2. FlexPET* does not require any investment by the customers or any change in their process conditions;**
- 3. FlexPET* delivers the product functionally when the customers need and exactly in the amount they need it.**

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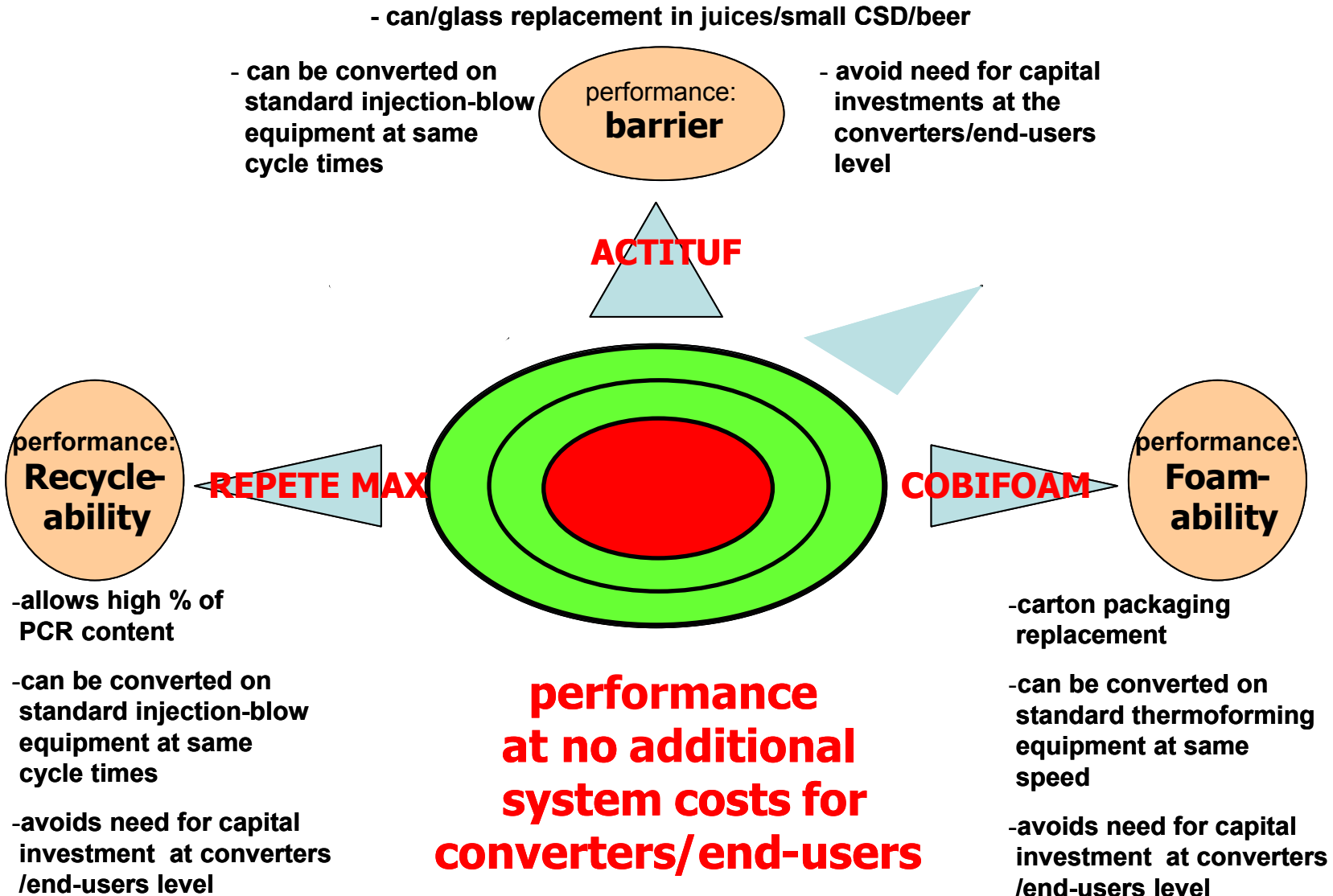
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Product Innovation Technologies



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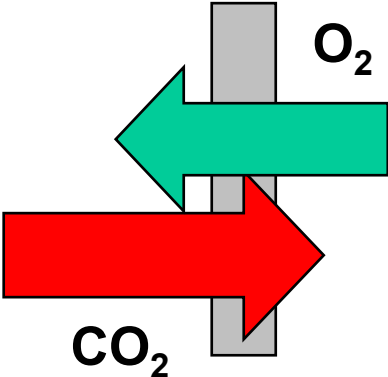


ActiTUF™ – Product Technology

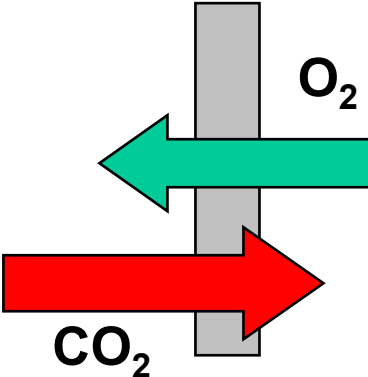


GRUPPO MOSSI & GHISOLFI

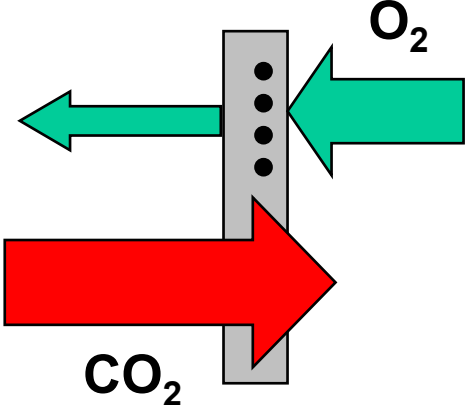
STD PET



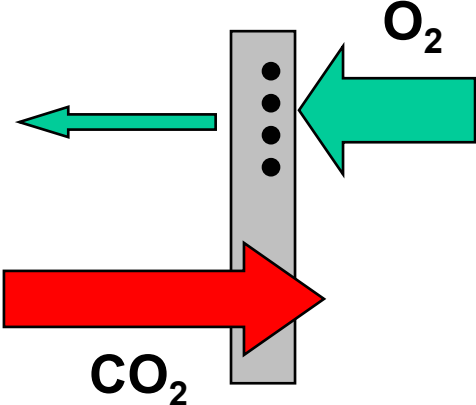
Passive Barrier



Active Barrier



Active & Passive Barrier

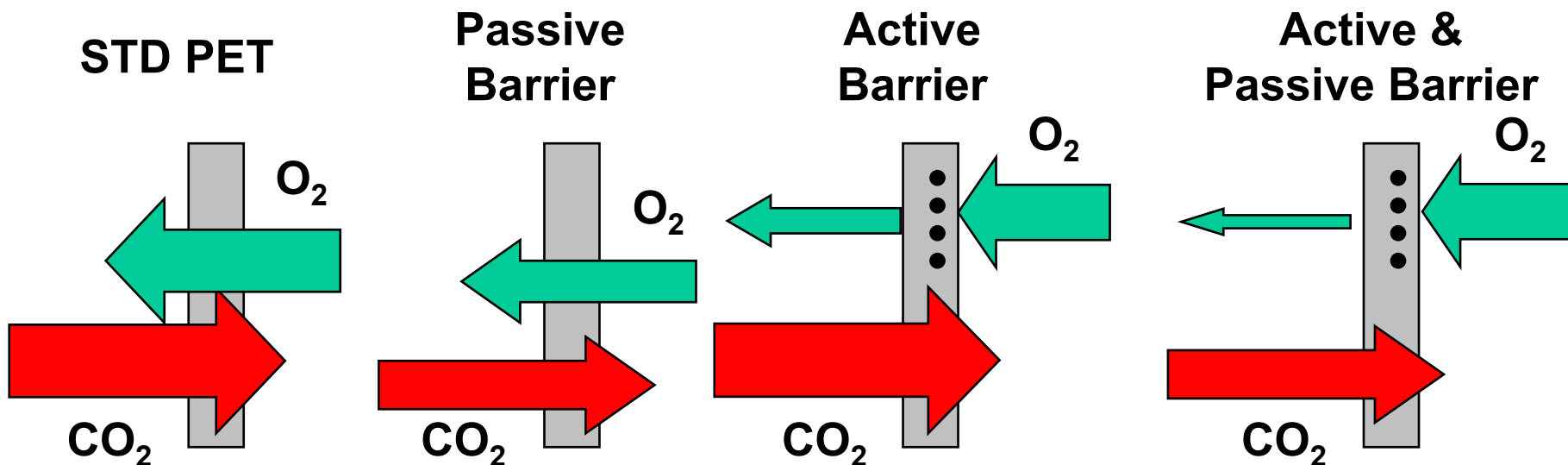


ActiTUF™ – Product Technology

M&G's ActiTUF™ is based on proprietary development on active and passive barrier:

...can be converted using standard injection technology;

- ...can match standard cycle time;
- ...can be tailored to desired barrier performances;
- ...with Oxygen scavenging triggered upon filling;
- ... and has proven enhanced barrier performances.

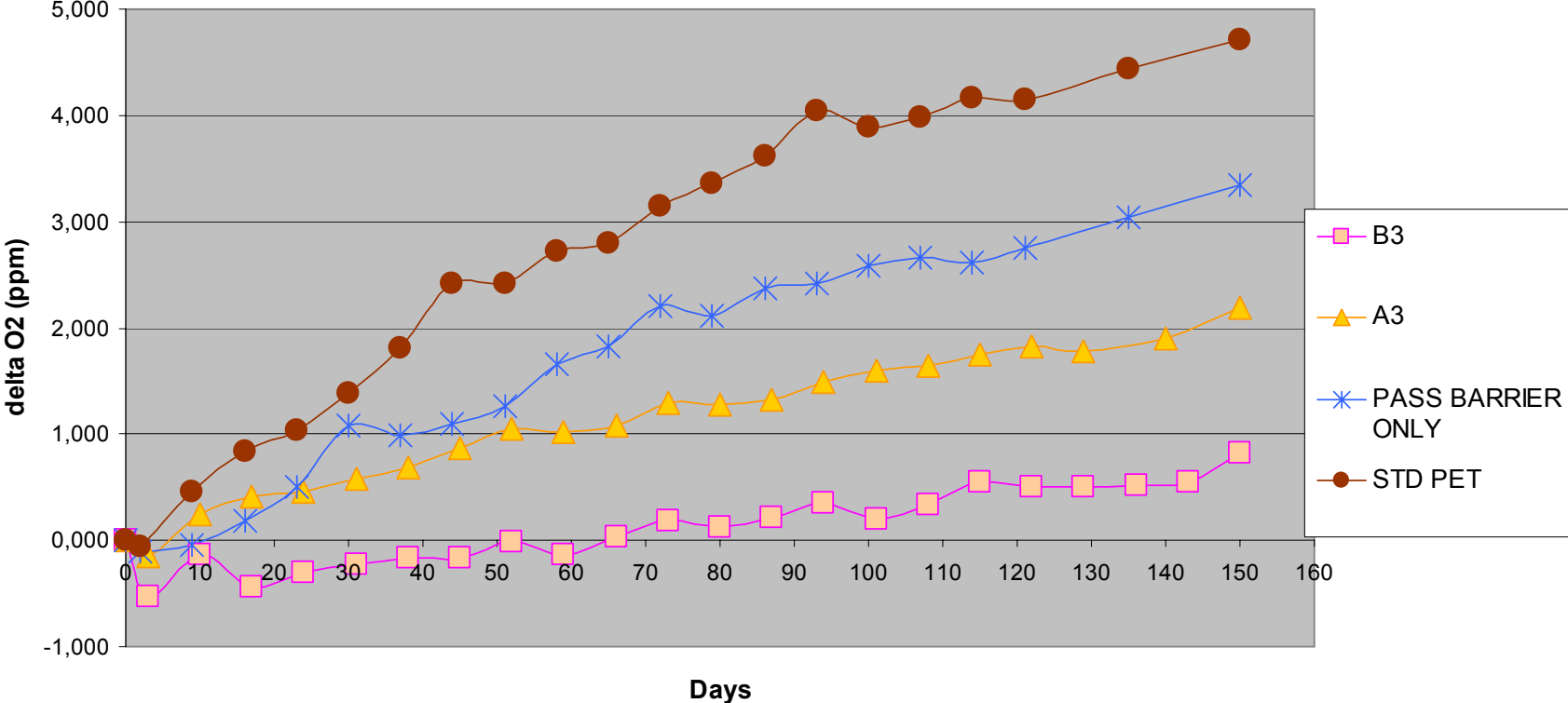


CONTRIBUTION OF PASSIVE BARRIER

- **Enhance the value of the scavenger system;**
- **Passive barrier with *FlexPET* technology:**
 - **significantly reduces visual haze;**
- **Passive barrier with *FlexPET* meets regulatory requirements.**

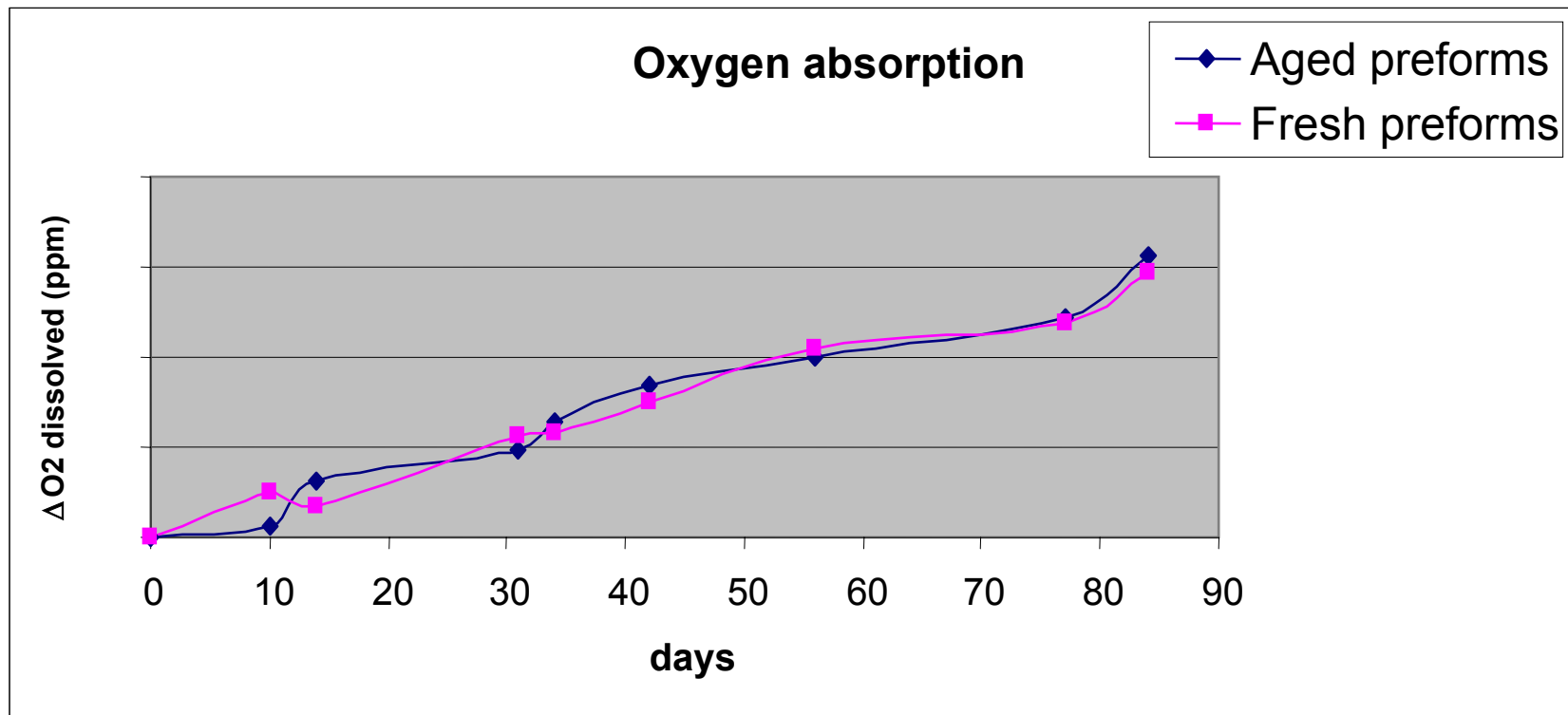
BARRIER PERFORMANCES

ACTIVE + PASSIVE BARRIER
(bottle 0,64 / 25 gr preform)



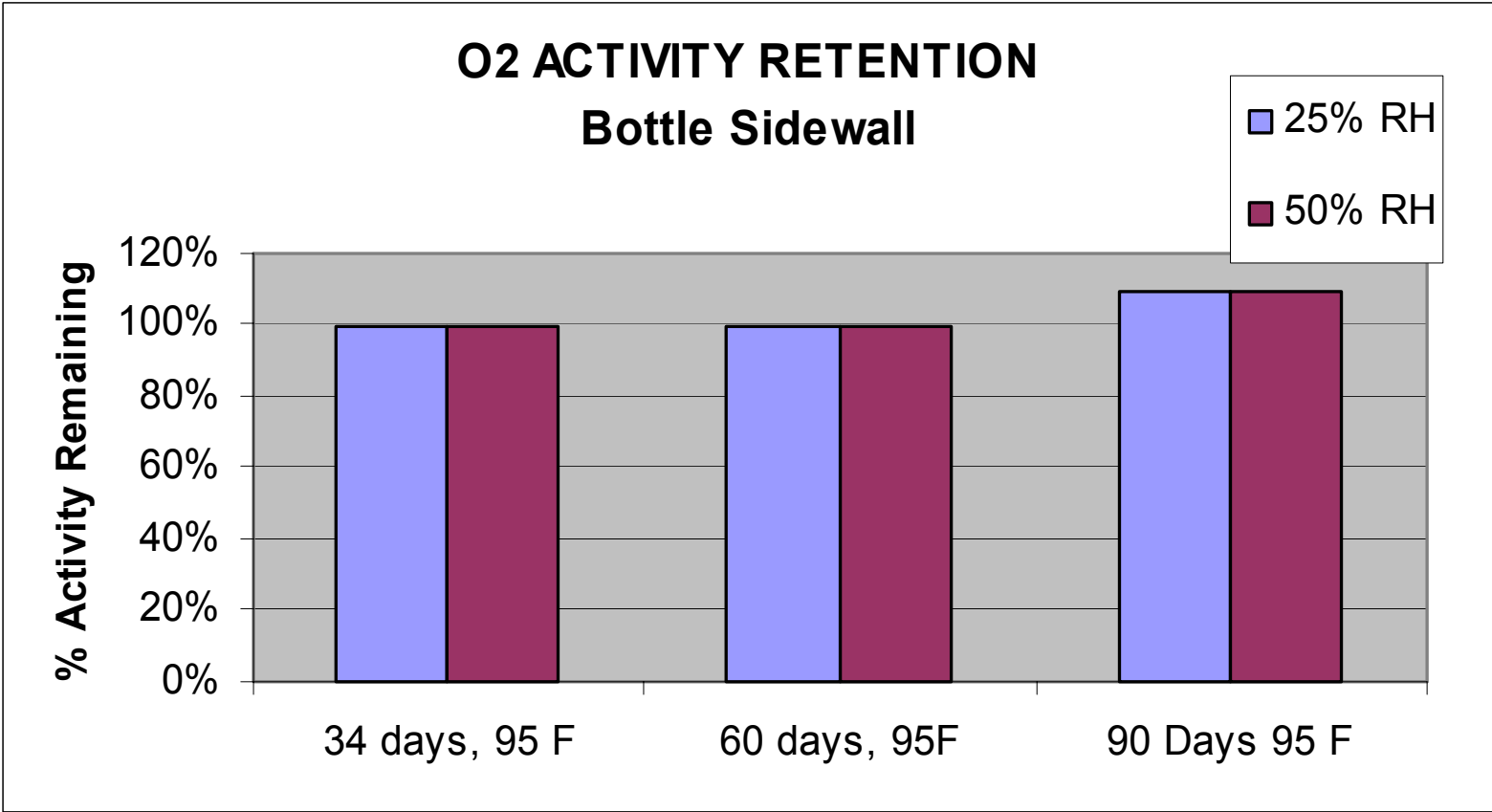
TRIGGERED UPON FILLING

Preforms totally maintain performances after a 6 month storage in an industrial warehouse.



TRIGGERED UPON FILLING

Bottles maintain performances after storage at severe conditions (95°F/ 35°C).



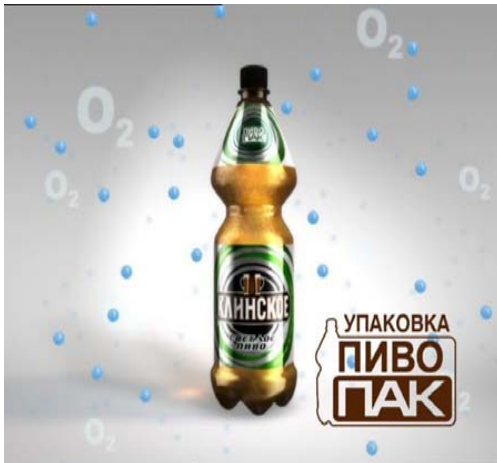
M&G – Interbrew: A Success Story

- In February 2003, Interbrew starts selling premium beers in Russia in bottles made of M&G ActiTUF™ monolayer PET.
- During 2004, Interbrew launches top brands in Eastern Europe, Korea, Belgium.
- In 2005, local production of ActiTUF™ preforms starts in Russia and Korea.



THE RESULTS

February 2003
PIVOPACK



Klinskoye
Russia

April 2003
PIVOPACK



Siberian Crown
Russia

June 2003
QPACK



Bergenbier
Romania

August 2003
QPACK



Kamenitza
Bulgaria

Klinskoye, Siberian Crown, Bergenbier, Kamenitza, OB, Ozujsko, PIVOPACK, QPACK
are INTERBREW registered trade mark.

THE RESULTS (cont'd)

September 2003

QPACK



**Ozujsko
Croatia**

Novemer 2003

QPACK



**OB
Korea**

December 2003

QPACK



**DOMMELSCH
The Netherlands**

Klinskoye, Siberian Crown, Bergenbier, Kamenitza, OB, Ozujsko, PIVOPACK, QPACK
are INTERBREW registered trade mark.

THE DEVELOPMENT IN THE YEAR 2004



JUPILER
Belgium



STELLA ARTOIS
Eastern Europe



STELLA ARTOIS
Belgium

1. Uses FDA-approved PCR pellets as feed;
2. PCR fed directly into CP unit at 10% recycle content;
3. Product meets all customer requirements;
4. Process has run commercially since 2000;
5. There are limitations on feed materials.

Bottle Data	L*	a*	b*	Haze
REPETE MAX	81	0.01	-1.18	5.63
CLEARTUF MAX	82	0.06	-1.09	5.98

- **Be capable of processing a wide variety of PCR materials (e.g. colored bottles, copolymers, additives, etc.).**
- **Produce a product that meets:**
 - ✓ **All regulatory requirements;**
 - ✓ **All performance & aesthetic requirements.**
- **Produce products at cost parity with virgin raw materials.**
- **Be robust against non-PET contaminants (e.g. PVC, PE, PP, Adhesives, etc.).**
- **Fit local and/or societal requirements.**

**M&G is the only PET producer who
has been using commercial grade
of chemical recycling product:**

REPETE[®] MAX

FOAMABLE PET TECHNOLOGY AND CONVERSION



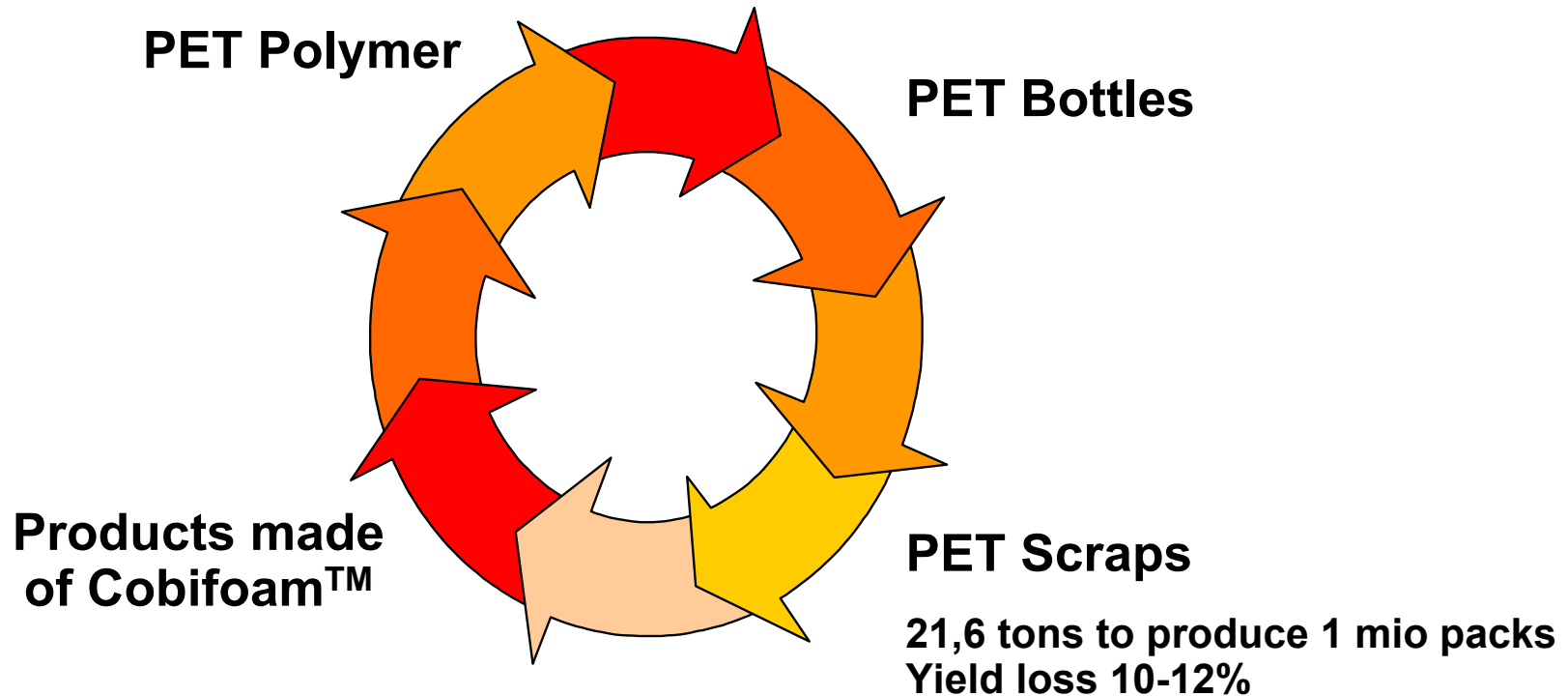
- Suitable for Food and Technical applications
- Good balance between light weight and mechanical properties
- Thermal stability up to 200°C



- Excellent chemical resistance to a wide range of chemicals
- Recyclability of foam scraps at the inlet of the extrusion foaming line



A COMPETITIVE ADVANTAGE POST CONSUMER UTILIZATION



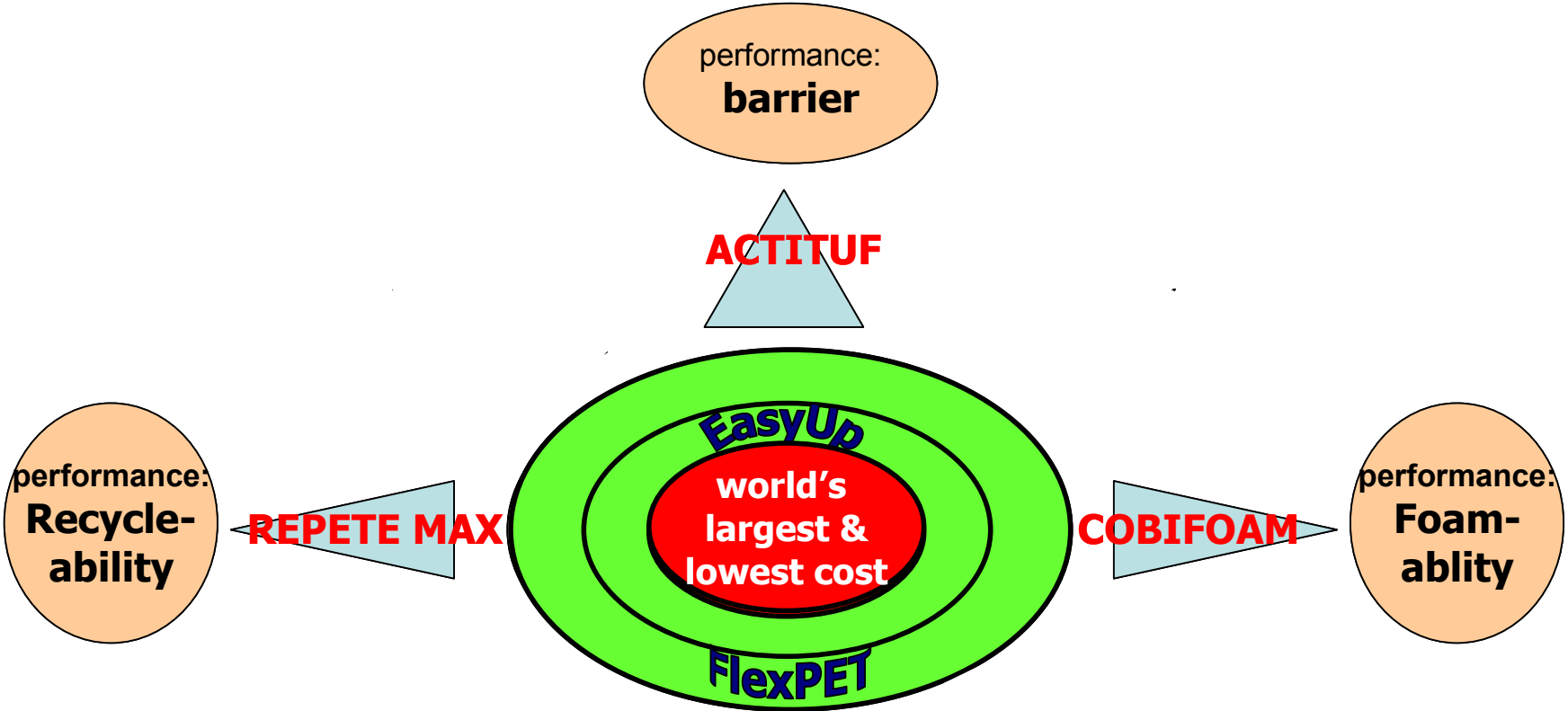
A closed loop...an unexplored efficiency!

In 2004 several extrusion foaming lines have been installed to be exclusively fed by COBIFOAM™ in:

- * Food packaging;**
 - * Trays;**
 - * Boat industries;**
 - * Thick boards.**
-

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Conclusions



**performance
at the right cost**