



I'm green™
BIO-BASED

I'm green™
bio-based
Polyethylene

Innovation and differentiation
for your product

Braskem 



I'm green™ bio-based Polyethylene:

biopolymer that offers versatility and a favorable carbon footprint

By using Green Polyethylene, Braskem's partners can offer unique products made from renewable resources that make a significant contribution to reducing the level of greenhouse gas emissions throughout the chain. Green Polyethylene is a renewable alternative to Polyethylene, a thermoplastic resin largely used for packaging in consumer goods industries, such as food and beverage, cleaning and personal care products, as well as toys, trash containers and plastic bags. At the end of its lifespan, Green Polyethylene can be recycled in the same chains already developed for conventional Polyethylene.

The I'm green™ bio-based seal can be applied to finished packaging and products that have Green Polyethylene in their composition.

Different source, same properties

Green Polyethylene is a drop-in biopolymer. Substituting conventional Polyethylene with Green Polyethylene does not require investments in new plastics manufacturing machinery.

The Green Polyethylene portfolio features approximately 30 grades in the HDPE, LLDPE and LDPE families that cover a wide range of applications. The vast majority of these grades have renewable carbon content between 80% and 100%, based on their biogenic carbon content measured in accordance with the standard ASTM D6866.

There are a number of recognized certifiers in Europe, the USA and Asia that offer labels for the renewable content of a material or products based on ASTM D6866.

The raw material used to make Braskem's Green Polyethylene is sugarcane ethanol.



Life Cycle Analysis

To address the challenges of today's modern world and society's growing demands for more sustainable solutions, "Life Cycle Thinking" is one of the major challenges faced by industries and governments when designing their products and proposing new regulations.

To learn more about the impacts associated with the production of Green Polyethylene, Braskem conducted Life Cycle Analysis, Water Footprint and Land Use studies of the product. The latest LCA study was concluded in 2016, with the effort

drawing on the participation of specialists in the sugarcane industry, ethanol suppliers and specialized consulting firms.

The LCA was conducted in accordance with the standards NBR ISO14040:2009 and NBR ISO14044:2009 and a panel of specialists were charged with reviewing the work. Six categories of impacts were covered representing the entire process, from the cultivation of sugarcane to the product's arrival at Braskem's factory gate: The new study encompasses more categories: climate change,

ozone layer depletion, inhalable inorganics, photochemical ozone formation, acidification, water use, soil use, natural resources consumption, ecotoxicity, human toxicity, eutrophication. The data used was in large part obtained from primary sources in the production processes of both Braskem and ethanol suppliers.

To gain a better understanding of the differences in the impacts between fossil-based and bio-based plastics, the results of conventional Polyethylene and Green Polyethylene were compared for all six categories.



Responsibility in the chain

Braskem's relationship with the ethanol supply chain is guided by its Responsible Ethanol Sourcing, updated in 2017, with the support of ProForest, a UK-based sustainability management consulting firm with expertise in natural resources.

The social and environmental practices established in the code aim seek continuous improvement in sugarcane and ethanol production and, most importantly, respect for Brazilian laws and regulations. For this, the code drew on the models of good practices described in the UN Global Compact, the São Paulo State Agricultural and Environmental Protocol, Brazil's Sugarcane Agroecological Zoning and the National Commitment to Improve Labor Conditions for Sugarcane Workers.

Braskem conducts regular audits of its suppliers using third-party verification to ensure they comply with its code of conduct and works jointly with them to draft action plans to correct any gaps.



Brazil's sugarcane industry

Brazil is the world's largest sugarcane producer and second-largest ethanol producer.

Approximately 50% of the sugarcane produced is used to make sugar, with Brazil a leading player in world sugar trade, with the remaining 50% used to make ethanol. The sugarcane industry also makes an important contribution to Brazil's energy matrix: 16% of the energy consumed in Brazil comes from renewable resources derived from sugarcane, both from the use of bagasse as a fuel for sugar mills and for electricity generation exported to Brazilian grid and from ethanol used mostly as fuel for vehicles.

Land use in Brazil

Ninety percent of Brazil's sugarcane cultivation is concentrated in the country's Center-South region. The expansion in sugarcane planted area is regulated by the Sugarcane Agroecological Zoning Policy, which is a regulatory framework implemented by the federal government in 2009 that prohibits the expansion of sugarcane cultivation into high biodiversity areas, such as the Amazon Rainforest and the Pantanal Wetlands. Sugarcane cultivation currently occupies 8 million hectares of Brazil's land mass and there are still 65 million hectares identified as suitable for this

activity. Brazil currently has 358 hectares of arable land available for agricultural activities.

The Sugarcane Agroecological Zoning Policy identifies the best use of the areas available for agriculture in Brazil and for sustainable expansion, which puts into context any aspects related to improving food security and reducing the use of water and agrochemicals.

Genetically modified (GMO) sugarcane is currently not commercially cultivated in Brazil.



▶ be green be versatile

RESOURCES TO USE RESPONSIBILITY RIGID AND FLEXIBLE PACKAGING
SHELF LIFE RESPONSIBLE SOURCING
CARBON REDUCTION EASY TO USE VERSATILITY
DROPP-IN POLYETHYLENE DROPP-IN POLYETHYLENE 100% RECYCLABLE
Productivity drop-in polyethylene Biopolymer Productivity
DURABILITY SHELF LIFE PERFORMANCE
EASY TO USE 100% recyclable RIGID AND FLEXIBLE PACKAGING
POLYETHYLENE DROPP-IN POLYETHYLENE
RENEWABLE RESOURCE RESPONSIBILITY SHELF LIFE
VERSATILITY SHELF LIFE
VERSATILITY SHELF LIFE
PERFORMANCE SHELF LIFE
DROPP-IN POLYETHYLENE SHELF LIFE
Shelf life
VERSATILITY
EASY TO USE
100% recyclable
Performance



I'm
green
BIO-BASED

Product portfolio

The broad product portfolio enables Green Polyethylene to be used in rigid and flexible applications that are already well consolidated in the market as well as in growth applications.

Braskem's technical teams provide support for the development of new products and ensure shorter

approval times for Clients and the achievement of high renewable-content levels in final products.

The technical information on the grades that meet the needs of Blow Film and Cast Film Extrusion, Fiber Extrusion, Injection Molding, Blow Molding and Tubing processes can be found in this catalog.

See some of the industries where I'm green™ bio-based Polyethylene is used:



Beverages



Retailing



Home care



Agriculture and industry



Cosmetics



Food



Hygiene and beauty



be green and be a Braskem partner

Braskem is a world leader in terms of biopolymer production capacity through its Green Polyethylene, which it has marketed since 2010.

Around the world, Braskem has a dedicated team to serve, provide technical assistance and build solid relationships with its Clients.

I'm green™ bio-based seal: transparent communication and guarantee of origin

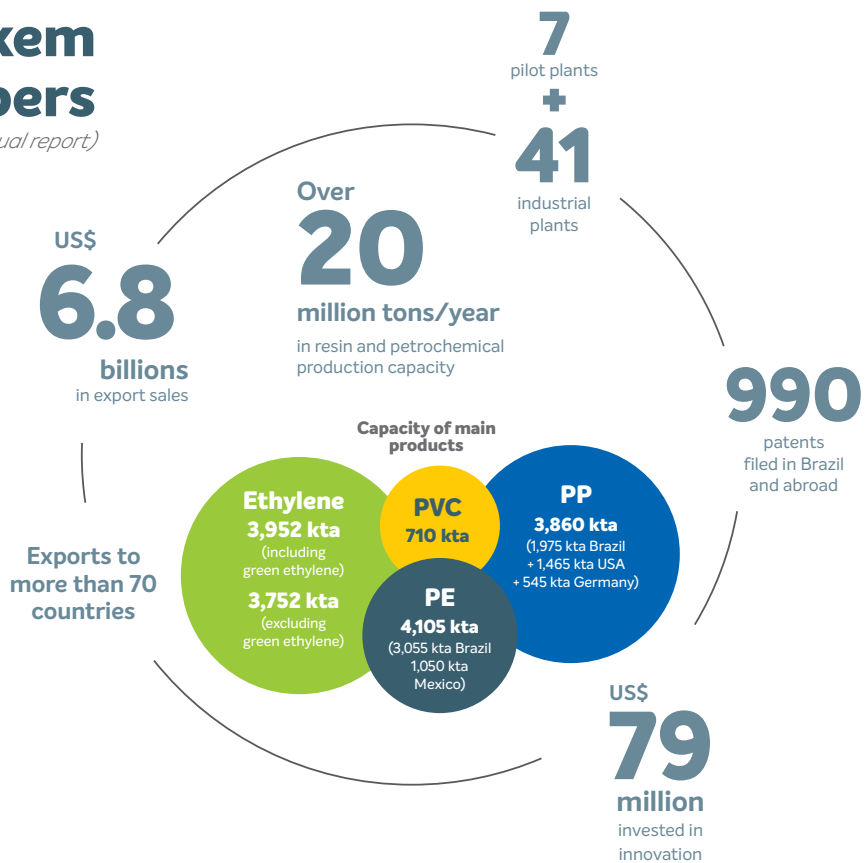
The I'm green™ bio-based seal can be applied to finished products that use Green Polyethylene in their composition.

The seal can be used by Clients at their discretion. However its use must be accompanied by communication of the renewable content of the product or packaging verified based on C14 analysis in accordance with standard ASTM D6866.



Braskem in numbers

Base year 2016 (annual report)

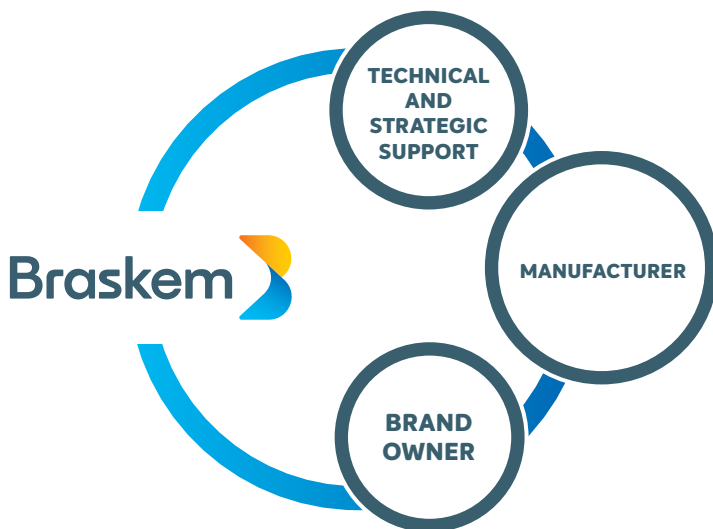


Braskem is the largest producer of thermoplastic resins in the Americas

Braskem is the largest thermoplastic resin producer in the Americas. With 41 industrial plants in Brazil, United States, Germany and Mexico, the company produces over 16 million tons of thermoplastic resins and other petrochemicals each year. Braskem is the world's leading biopolymer producer, with annual production capacity of 200 kton of polyethylene made from sugarcane ethanol.

Pillars of sustainable development

- More sustainable resources and operations
- More sustainable product portfolio
- Solutions for a more sustainable life



Braskem is a component of the Dow Jones Sustainability Index Emerging Markets, the Carbon Efficient Index (ICo2) and the Corporate Sustainability Index of the BM&FBovespa – Securities, Commodities and Futures Exchange. Braskem is a member of the United Nations' platform for more sustainable industries and its sustainability annual report is rated level A+. It also was elected one of the 50 most innovative companies in the world in 2014 by the U.S.-based magazine Fast Company for substituting some of its fossil-based feedstocks with biobased feedstocks for plastics production.

RENEWABLE
RESOURCE
shelf life
CARBON
REDUCTION

100%
recyclable
EASY
TO USE
CARBON
REDUCTION
SHELF LIFE
PERFORMA

SHELF LIFE
Productivity
Easy to use
DURABILITY
Productivity
Easy to use
DURABILITY
Productivity
Easy to use
DURABILITY

CARBON
REDUCTION

Shelf
life



100%
recyclable



shelf
life

Versatility

EASY
TO USE

BIOPOLYMER
Performance

PERFORMANCE
CARBON REDUCTION

100%
recyclable

BIOPOLYMER
Performance



I'm green
BIO-BASED

Plastic
X% Biobased Verified
by ASTM D6866

Green PE

Injection Molding

Properties Typical		Melt Flow Rate ^a (190 °C/2,16 kg)	Density	Tensile Strength at Yield ^a	Tensile Strength at Break ^a	Flexural Modulus (1% secant) ^b	Shore D Hardness ^c	Notched Izod Impact Strength ^b	Vicat Softening Temperature ^b	Deflection Temperature Under Load (0,455 MPa) ^b	Minimum C14 content
ASTM Method	D 1238	D 792	D 638	D 638	D 790	D 2240	D 256	D 1525	D 648	D 6866	
Units	g/10 min	g/cm ³	MPa	MPa	MPa	-	J/m	°C	°C	%	
HDPE	SHA7260	20	0.955	-	26	1150	63	20	122	67	94
	Pails and basins; caps and closures; toys; thin-walled parts; Housewares; rigid containers for cosmetics and pharmaceutical applications (compliant with USP37 and EUP).										
	SHC7260	7.2	0.959	30	18	1375	60	35	126	73	94
	Industrial containers and boxes for general use; safety helmets; toilet seats; housewares; toys; caps & closures; pallets; boxes for beverages bottles.; boxes for frozen food and agricultural products; rigid containers for cosmetics and pharmaceutical applications (complies with USP 37).										
	SHD7255LS-L	4.5	0.954	27	26	1150	58	40	125	66	94
	Boxes for frozen food and horticultural products; Industrial containers and boxes for general use.										
LDPE	SGE7252	2.0	0.952	26	30	1100	62	50	124	66	96
	Caps and closures.										
	SHC7260LS-L	7.2	0.959	30	18	1375	60	35	125	73	94
	Industrial containers; boxes for fish and produce; hard hats; toilet seats; housewares; toys; caps and closures; pallets.										
	SGE7252XP	2.0	0.952 ^{d)}	27	36	1200	62	65	126	65	94
	Masterbatches; injected parts with large flat area; caps and closures.										
LDPE	SPB208	22	0.923 ^{d)}	10	8	250	45	NB	87	43	95
	Masterbatches; injected parts with large flat area; caps and closures.										
LDPE	SPB608	30	0.915 ^{d)}	8	9	200	42	NB	79	42	95
	Masterbatches; injected parts with large flat area; caps and closures.										

NB = No Break. Test specimens prepared from compression molding, according to ASTM D 4703. Tests performed on samples of: a) 2 mm. b) 3 mm. c) 6 mm. d) 2 mm at 50 °C. e) 3 mm at 50 °C.

Blown Molding and Tubing

Typical Properties		Melt Flow Rate (190 °C/2,16 kg)	Melt Flow Rate (190 °C/21,6 kg)	Density	Tensile Strength at Yield ^a	Tensile Strength at Break ^a	Flexural Modulus (1% Secant) ^b	Shore D Hardness ^c	Notched Izod Impact Strength ^b	Environmental Stress Cracking Resistance (10% Igepal) ^d	Environmental Stress Cracking Resistance (10% Igepal) ^d	Vicat Softening Temperature ^b	Deflection Temperature Under Load (0,455 MPa) ^b	Minimum C14 content
ASTM Method	D 1238	D 1238	D 792	D 638	D 638	D 790	D 2240	D 256	D 1693	D 1693	D 1525	D 648	D 6866	
Units	g/10 min	g/10 min	g/cm ³	MPa	MPa	MPa	-	J/m	h /F50	h /F50	°C	°C	%	
HDPE	SGF4950	0,36	28	0,956	30	30	1350	66	150	40	70	127	70	96
	Bottles for household cleaning products and health and care products; bottles for food products; caps and closures molded by compression; rigid containers for cosmetics and pharmaceutical applications (complies with USP 33).													
	SGF4960	0,34	28	0,961	30	30	1550	65	225	-	-	132	70	96
	Bottles for food and beverages; bottles for dairy products; rigid containers for cosmetics and lubricant oils; caps and closures molded by compression; rigid bottles for pharmaceutical applications (complies with USP 33).													
LDPE	SGD4960	0,70	50	0,962	32	22	1600	64	89	19	24	128	79	96
	Bottles for food and beverages; bottles for dairy products; bottles for non-food applications such as alcohol, cosmetics and lubricant oils.													
	SGF4950HS	0,21	20	0,951	25	35	1100	62	150	150	>1000	125	70	95
Canisters from 2 to 20L for chemical products; bottles for concentrated detergent; bottles for food; tanks for wind shield and air ducts.														
LDPE	SEB853	2,70	-	0,923 ^{e)}	-	-	-	-	-	-	-	-	-	96
	Bottles and tubes.													
	STN7006	0,60	-	0,924	-	-	-	-	-	-	-	-	-	-
Bottles and tubes.														
LDPE	SBF0323HC	0,32	-	0,923 ^{e)}	10	15	260	50	NB	30 ^{e)}	-	95	45	95
	Bottles and tubes.													

NB = No Break. Test specimens prepared from compression molding, according to ASTM D 4703. Tests performed on samples of: a) 2 mm. b) 3 mm. c) 6 mm. d) 2 mm at 50 °C. e) 3 mm at 50 °C. f) Value obtained by ASTM method D1505 (gradient column)

Fiber Extrusion												
Typical Properties		Melt Flow Rate (190 °C/2.16 kg)	Melt Flow Rate (190 °C/21.6 kg)	Density	Tensile Strength at Yield ^a	Tensile Strength at Break ^a	Flexural Modulus (1% Secant) ^b	Shore D Hardness ^c	Notched Izod Impact Strength ^b	Vicat Softening Temperature ^b	Deflection Temperature Under Load (0.455 MPa) ^b	Minimum C14 content
ASTM Method		D 1238	D 1238	D 792	D 638	D 638	D 790	D 2240	D 256	D 1525	D 648	D 6866
Units		g/10 min	g/10 min	g/cm ³	MPa	MPa	MPa	-	J/m	°C	°C	%
HDPE	SHA7260	20	-	0.955	-	25	1150	63	20	122	67	94
	Bicomponent nonwoven fibers; general fibers.											
	SHE150	1.0	-	0.948	28	40	1280	62	-	128	76	94
Raschel; shading and protecting nets; ropes.												

Test specimens prepared from compression molding, according to ASTM D 4703. Tests performed on samples of: a) 2 mm. b) 3 mm. c) 6 mm.

Blown Film Extrusion and Cast Film Extrusion															
Properties Typical		Melt Flow Rate (190 °C/2.16 kg)	Melt Flow Rate (190 °C/5 kg)	Melt Flow Rate (190 °C/21.6 kg)	Density	Thickness	Tensile Strength at Break (DM/DT)	Tensile Elongation at Break (DM/DT)	Tensile Modulus 1% (DM/DT)	Dart Drop Impact	Elmendorf Tear Strength (DM/DT)	Haze	Gloss 60°	Minimum C14 content	Additives
ASTM Method		D 1238	D 1238	D 1238	D 792	-	D 882	D 882	D 882	D 1709	D 1922	D 1003	D 2457	D 6866	-
Units		g/10 min	g/10 min	g/10 min	g/cm ³	µm	MPa	%	MPa	g (F50)	gF	%	-	%	-
HDPE	SGM9450F	-	0.33	9.3	0.952	12.5	85/45	590/740	750/870	200	5/50	-	-	96	AF
	Retail bags; promotional bags; star bags; frozen food packaging.														
	SHE150	1.0	-	-	0.948	-	-	-	-	-	-	-	-	94	AF
Cereal packaging; LLDPE and LDPE blends.															
LLDPE	SLL118	1.0	-	-	0.916 ^{a)}	25	50/40	1130/1430	180/200	120	180/400	37	48	87	-
	Stretch films; liners; LDPE and HDPE blends and packages for general use. Others applications: blends for irrigation pipes; liners; flexible bottles for cosmetics and pharmaceutical applications (complies with USP 37).														
	SLL118/21	1.0	-	-	0.918 ^{a)}	38	40/30	1070/1340	210/230	130	180/400	-	-	87	AB, D
	Automatic Packaging (FFS); HDPE and LDPE blends.														
	SLL318	2.7	-	-	0.918 ^{a)}	38	30/30	1220/1440	180/200	90	120/340	-	-	87	-
	Stretch films; liners; LDPE and HDPE blends; packages for general use. Others applications: blends for irrigation pipes; insulation for low and medium tension XLPE wires and cables.														
	SLH118	1.0	-	-	0.916 ^{a)}	40	40/40	1080/1360	200/210	150	300/510	-	-	84	-
	Stretch films; liners; LDPE and HDPE blends; packages for general use. Others applications: blends for irrigation pipes; bottles for cosmetic and pharmaceutical applications (complies with USP 37).														
SLH118/21	1.0	-	-	0.918	-	40/40	1080/1360	200/210	150	300/510	-	-	84	-	
Blends with HDPE; blends with LDPE; general use packing; technical films; technical films for automatic packaging.															
SLH218	2.3	-	-	0.916 ^{a)}	38	40/40	1170/1500	210/240	110	240/520	-	-	84	-	
Stretch films; liners; LDPE and HDPE blends; packages for general use. Others applications: blends for irrigation pipes; insulation for low and medium tension XLPE wires and cables.															
SLH0820/30AF	0.80	-	-	0.92 ^{a)}	100	40/40	1190/1370	190/220	410	600/2020	24	95	84	AB, AF	
Heavy duty bags; LDPE and HDPE blends.															
LDPE	SBF0323HC	0.32	-	-	0.923 ^{a)}	70	20/20	390/930	150/160	290	-/270	10	92	95	-
	Heavy duty bags; agriculture, coextruded and shrink films; bottles for cosmetics and pharmaceutical applications (complies with USP 37).														
	STN7006	0.60	-	-	0.924	40	25/20	280/870	165/175	140	-/160	9	90	95	-
	High clarity films for coextruded food packaging, such as: cheese, meat, sausages, sliced ham, etc; Cast films for table cloth, curtains and laminated tissues; flexible bottles for solids, liquids or pasties products for hygiene and cleanliness; flexible containers for cosmetics and pharmaceutical applications (complies with USP 37).														
	STS7006	0.60	-	-	0.925	40	25/20	280/870	165/175	140	-/160	12	80	95	AB, D
	High clarity films for coextruded food packaging, such as: cheese, meat, sausages, sliced ham, etc.														
	SEB853	2.7	-	-	0.923 ^{a)}	40	25/20	350/1050	145/150	80	580/210	7	75	95	-
	Aplicações típicas de filmes soprados. entre elas filmes para fraldas e outros fins gerais. além de misturas com PEBDL e PEAD.														
SEB853/72	2.7	-	-	0.923 ^{a)}	40	25/20	350/1050	145/150	80	580/210	7	-	95	AB, D	
Lamination film; general purpose; automatic packaging of solids products (FFS); automatic packaging for several products; High clarity films.															
SPB681	3.8	-	-	0.922 ^{a)}	40	23/14	370/875	145/150	75	685/265	7	75	95	-	
LLDPE and HDPE blends; bottles for cosmetics and pharmaceutical applications (complies with USP 37).															
SPB681/59	3.8	-	-	0.922 ^{a)}	40	23/14	370/875	145/150	75	685/265	7	-	95	AB, D	
Lamination film; general purpose; automatic packaging of solids products (FFS).															

DM = Machine Direction; DT = Transverse Direction. Additives: AB = antiblocking, D = sliding, AF = flow aid. a) Value obtained by the ASTM D1505 method.

Extrusion Coating												
Properties Typical		Melt Flow Rate (190 °C/2.16 kg)	Density	Thickness	Tensile Strength at Break (DM/DT)	Tensile Elongation at Break (DM/DT)	Dart Drop Impact	Elmendorf Tear Strength (DM/DT)	Haze	Gloss 60°	Minimum C14 content	Additives
ASTM Method		D 1238	D 792	-	D 882	D 882	D 1709	D 1922	D 1003	D 2457	D 6866	-
Units		g/10 min	g/cm ³	µm	MPa	%	g /F50	gF	%	-	%	-
LDPE	SBC818	8.30	0.918	25	25/20	380/870	70	-/56	8	76	95	-
Applications with low neck-in; good stability of film and good adhesion to porous substrates; carton packaging for food application.												

DM = Machine Direction; DT = Transverse Direction.



