LG Chem.
Sustainable materials

OUR VISION “LG Chem innovative sustainability”

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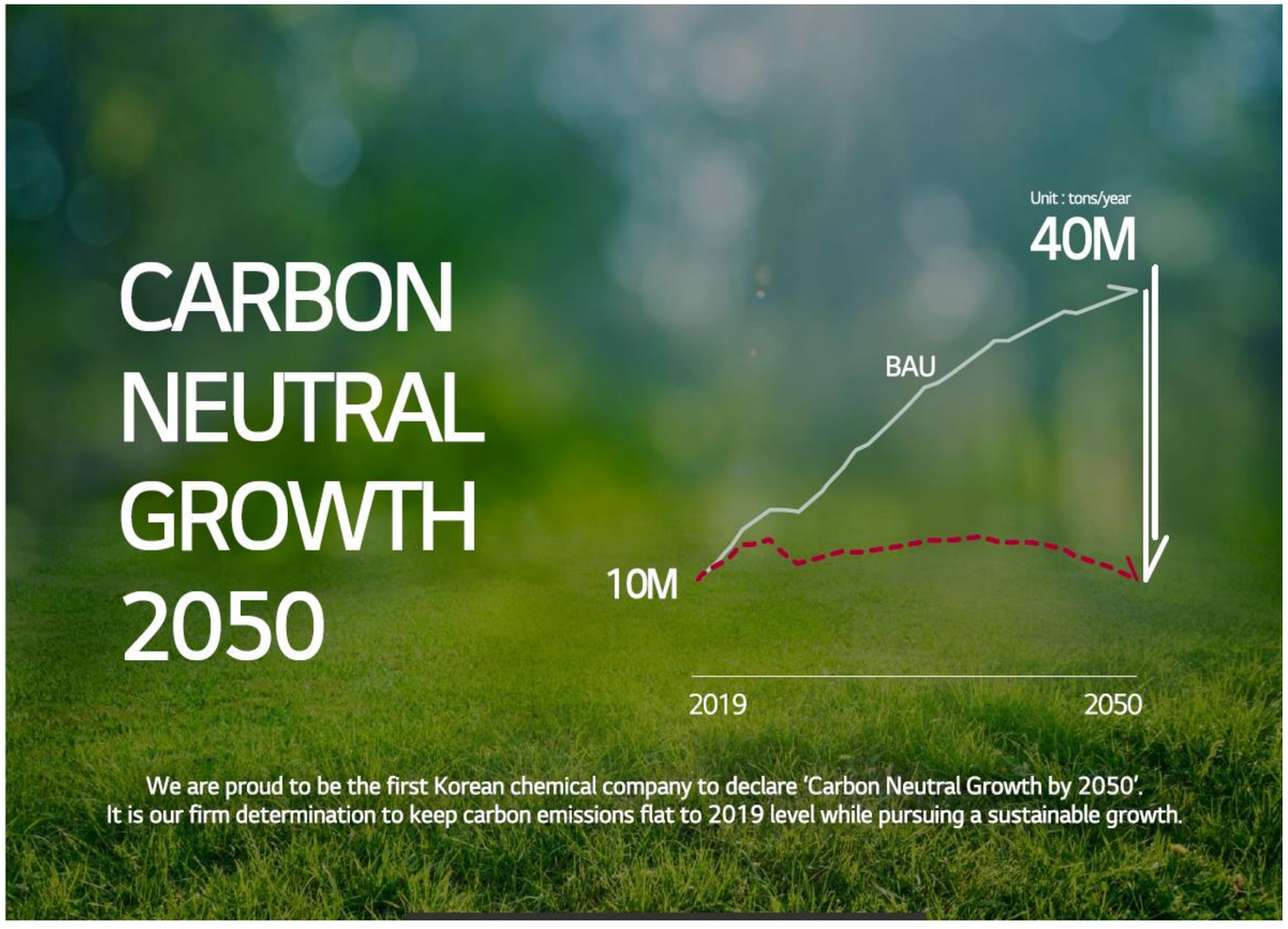
LG Chem. Sustainability

- Our vision
- Goals
- Strategy



Our Vision

"LG Chem Innovative Sustainability"

Deliever advanced innovative and sustainable solutions for our environmental and society

LG Chem. Sustainability

- Our vision
- **Goals**
- Strategy

LG Chem. Sustainability

- Our vision
- Goals
- Strategy

Strategy

“Focus on 4 Areas (Core activity) “

Leading Sustainable Innovation for customer

Managing the Impacts of Climate Change

Making a Positive Contribution to Society

Leading Sustainable Innovation for customer

Managing the Impacts of Climate Change

Making a Positive Contribution to Society

Supply Chain Responsibility

Human right / Diversity & Inclusion

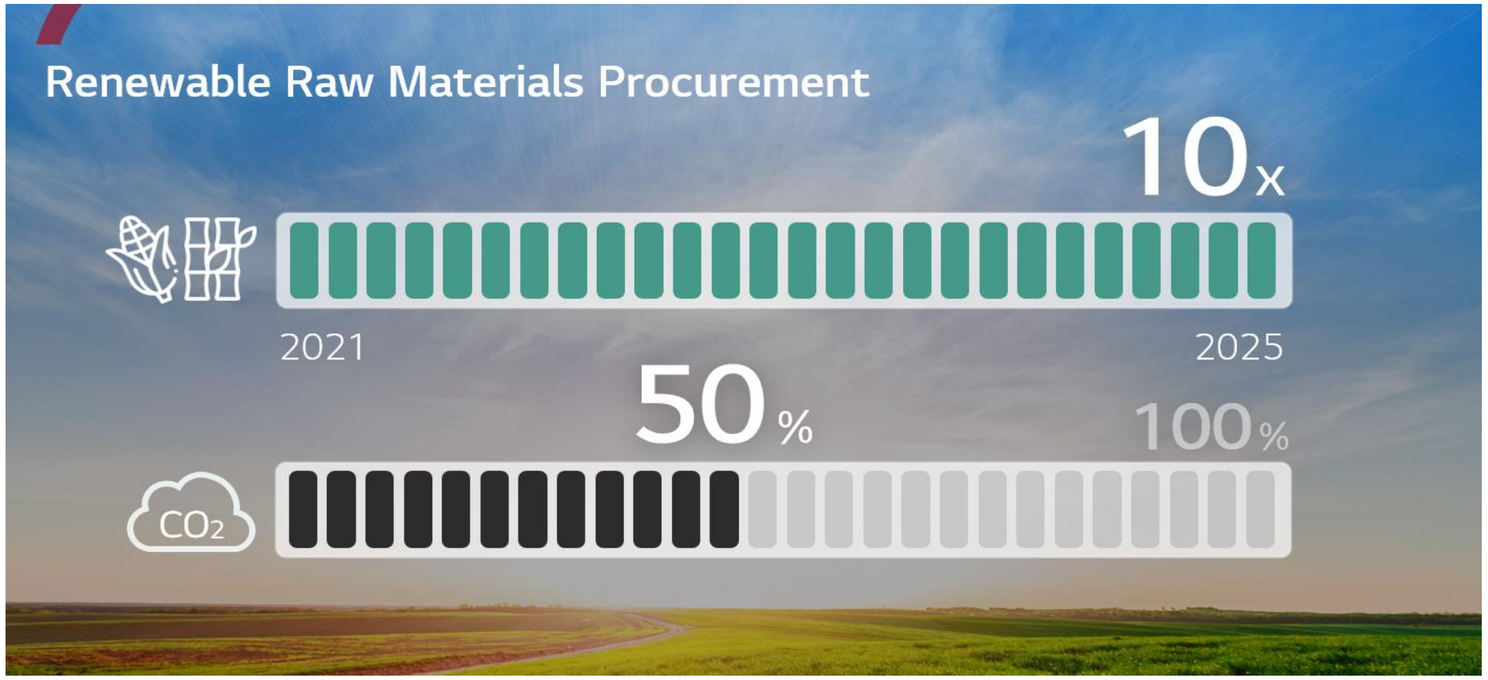
Ecosystem & Biodiversity

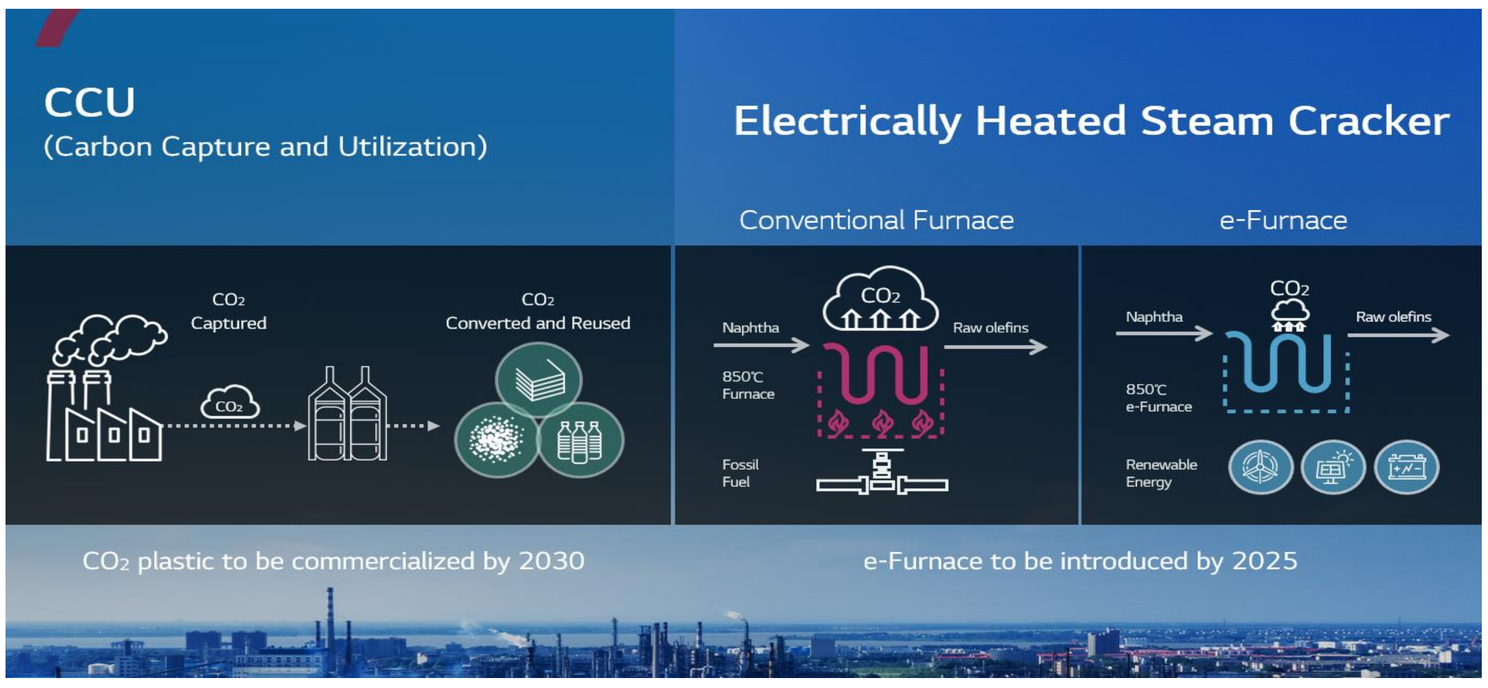
Clean Water & Sanitation

Safety & Wellness

Core Activity

- **Climate Action**
- Renewable Energy 100
- Circular Economy
- Responsible Products





Climate Action

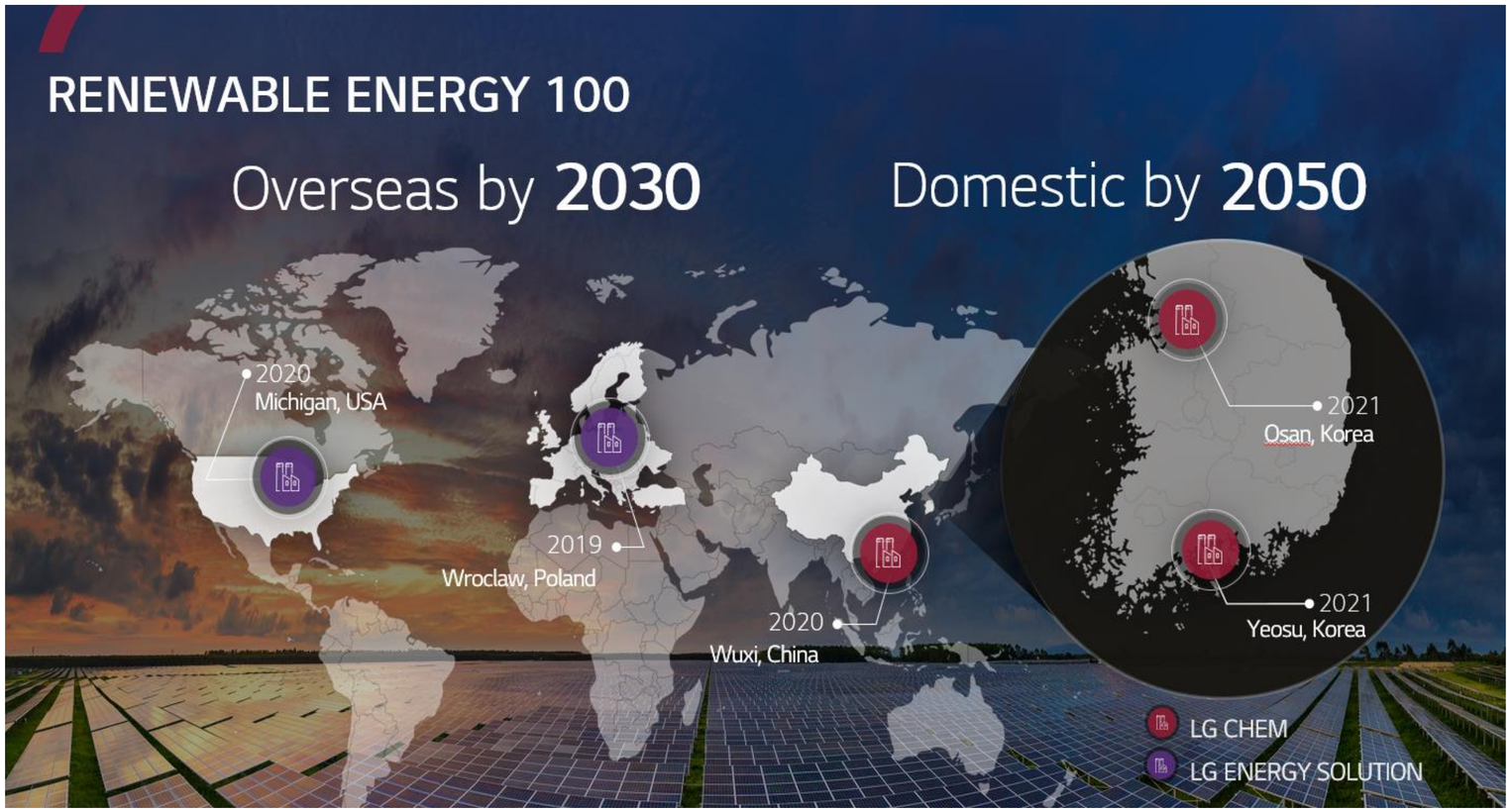
The use of renewable raw materials helps reduce the dependency of fossil resources with less carbon emissions

We aim to increase the volume of the materials up to 10 times than now by2025

We are developing the CCU technology by 2030 and adapting electrically heated steam cracker by 2025

Core Activity

- Climate Action
- Renewable Energy 100
- Circular Economy
- Responsible Products



Renewable Energy 100

We will plan to adapt renewable energy overseas by 2030 and domestic by 2050.
As of today, a total of 260 GWh per year, equal to the effect of planting 2.7million trees, has been converted to renewable energy.

Core Activity

- Climate Action
- Renewable Energy 100
- Circular Economy
- Responsible Products

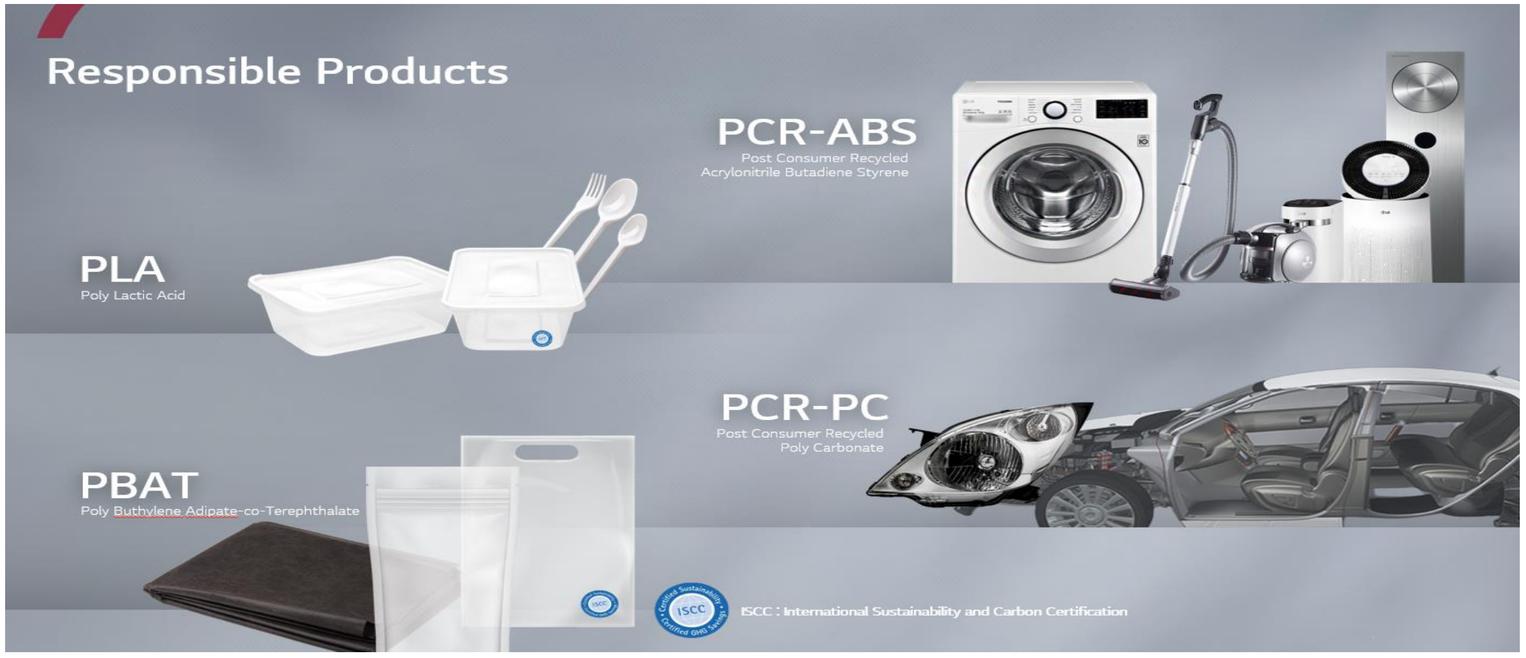
Circular Economy

We are developing the mechanical PCR ABS and expanding mechanical and chemical recycling production plant

We will plan to use heat, steam, and water to be recycled in production

Core Activity

- Climate Action
- Renewable Energy 100
- Circular Economy
- Responsible Products



Responsible Products

A holistic approach to the environmental impacts our products at every stage of their life cycle will enable us to reduce our footprint

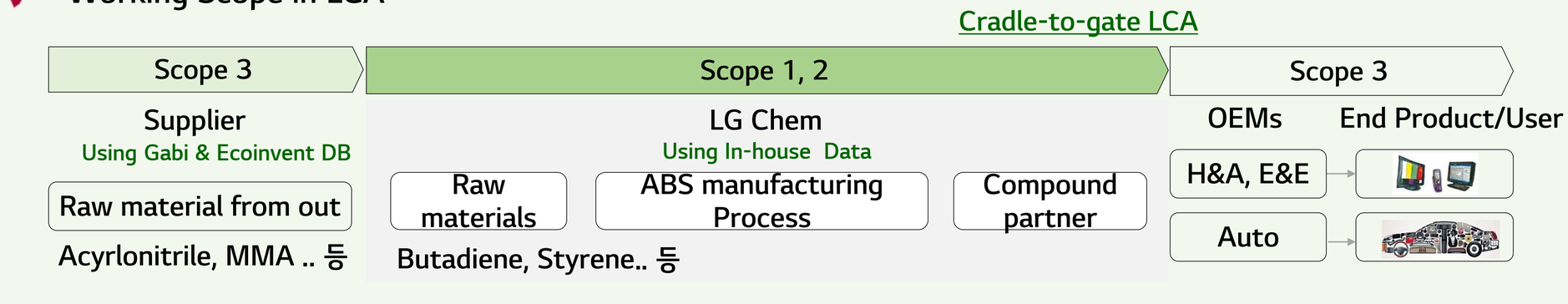
We can work on LCA according to standard Process (ISO)

Life Cycle Assessment

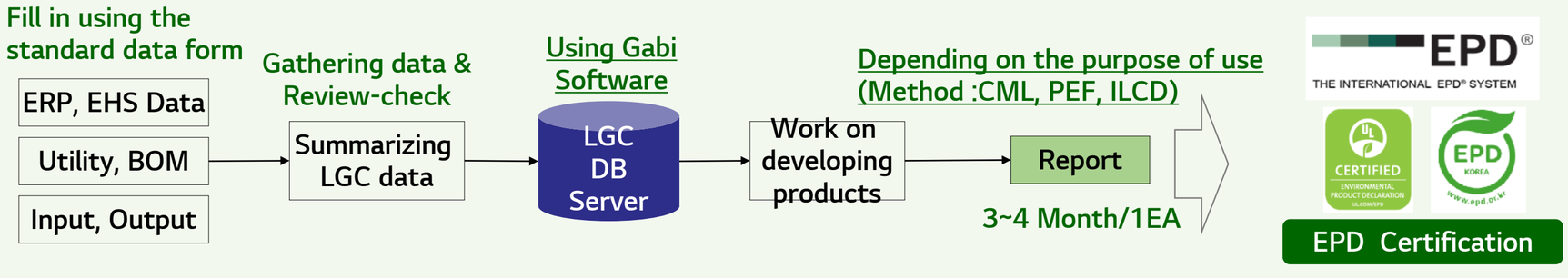
- LCA is a way to measure impact on environment by measuring carbon emission within the complete process of production, distribution and disposal

Working Scope & Process

✓ Working Scope in LCA



✓ Summarizing LCA Process



Life Cycle Assessment

- LCA is a way to measure impact on environment by measuring carbon emission within the complete process of production, distribution and disposal

Full LCA Report

System boundary

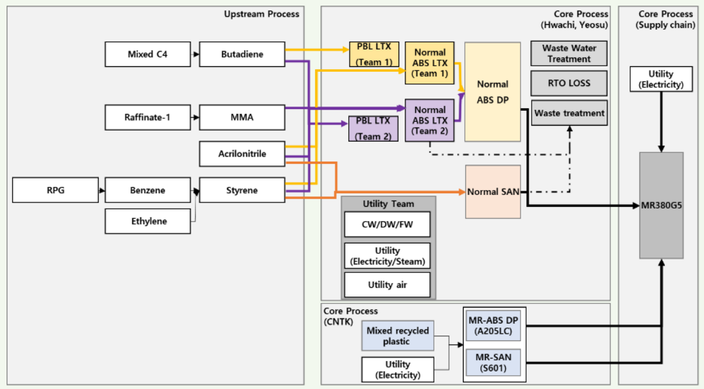
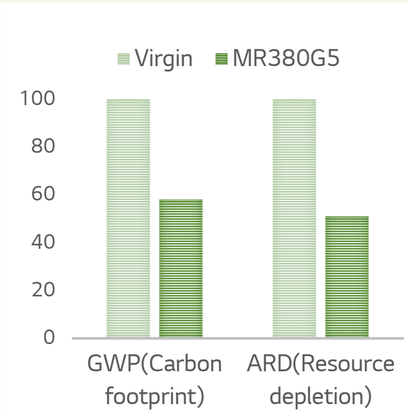


*Figure 1: General flow diagram of MR380G5 production processes

Impact Category Descriptions

Impact Categories	Units
Global Warming Potential (GWP)	g CO2 eq.
Abiotic Resource Depletion Potential (ADP)	kg Sb eq.
Photochemical Ozone Creation Potentials (POCP)	g C2H4 eq.
Acidification Potential (AP)	g SO2 eq.
Eutrophication Potential (EP)	g PO4 3- eq.
Ozone Depletion Potential (ODP)	g CFC-11 eq.
Water Footprint	m3-H2O eq
Cumulative Energy Demand	MJ-eq

Environmental improvement Effect



10,000tons usage standard

Carbon Footprint
the amount of 425 vehicles produced in Seoul for a year

Energy Demand
the amount used 22,670 households in Seoul for a year

Water Footprint
Olympic swimming pool 12.3 pieces of water

Results of Characterization (1kg of MRC380G5)

Impact Categories	Units	Quantities
Global Warming Potential (GWP)	g CO2 eq.	1.31.E+03
Abiotic Resource Depletion Potential (ADP)	kg Sb eq.	1.66.E-02
Photochemical Ozone Creation Potentials (POCP)	g C2H4 eq.	1.78.E+00
Acidification Potential (AP)	g SO2 eq.	2.25.E+00
Eutrophication Potential (EP)	g PO4 3- eq.	2.47.E+00
Ozone Depletion Potential (ODP)	g CFC-11 eq.	1.88.E-04
Water Footprint	m3-H2O eq	7.74E-03
Cumulative Energy Demand	MJ-eq	4.24E+01

Sustainable Materials

- Mechanical Post Consumer Recycle ABS
- Chemical Pre Consumer Recycle ABS
- Bio balanced ABS

Mechanical Post-CR ABS

Certi.

CO2

Strength Virgin likely Physical property

Chemical Pre-CR ABS

Certi.

CO2

Strength Virgin likely Physical property and appearance

Bio Balanced ABS

Certi.

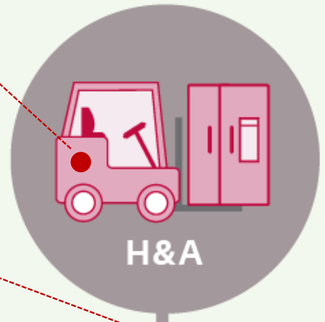
CO2

Strength Equal to virgin

Mechanical Post-CR ABS

Our M.PCR ABS products are being made using post consumer recycling materials recovered from mainly Home Appliance used and discarded.

Manufacture Process



Pre-Treatment Line

1st Pulverizer

2nd Pulverizer

Sus

Urethan

Metal

Moulded Compressor

Magnoto-Static Sorting Machine

Sus Sorting Machine

Metal Sorting Machine

NIR Sorting Machine

Light Sorting Machine

Aluminum

Copper

PP/PS

ABS Flake

100% ABS Pellet

Packing

Sorting/ Transfer

Cutting

Drying

Cooling

1st /2nd Extrusion

Transfer

Mixing

Supply to LG Chem

Mechanical Post-CR ABS (Application Case)

Air purifier

We have already applied to the exterior of home appliance

Appling to the air purifier exterior

Injection specimen image

Mechanical Post-CR ABS

- MRC380L3, MRC380L5, MRC380D3, MRC380D5

It has a similar level of physical properties or appearance quality as virgin

Properties

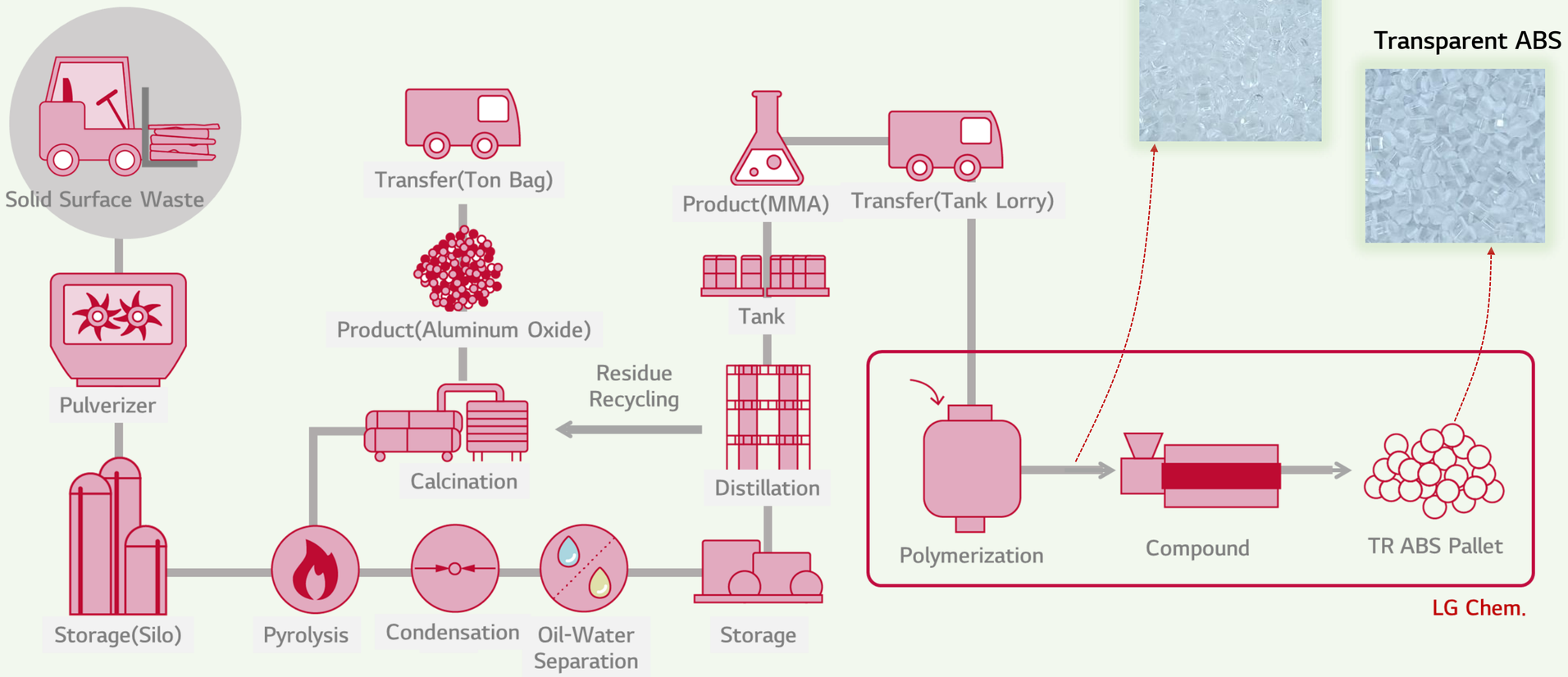
		Color	PCR Content	MI	IMP(1/8”)	TS	HDT
Unit			%	g/10min	kg·cm/cm	kg/cm^2	℃
HF380	High flow ABS	-	-	42	26	420	86
MRC380L3		Light	30	40	25	410	85
MRC380L5		Light	50	33	24	400	85
MRC380D3		Dark	30	40	27	420	85
MRC380D5		Dark	50	36	28	410	85

Chemical Pre-CR ABS

Our C.Pre-CR ABS product is being made by polymerization using chemical recycling monomer recovered from waste artificial marble material through pyrolysis

Development collaboration of new market products using recycling MMA monomer

Manufacture Process

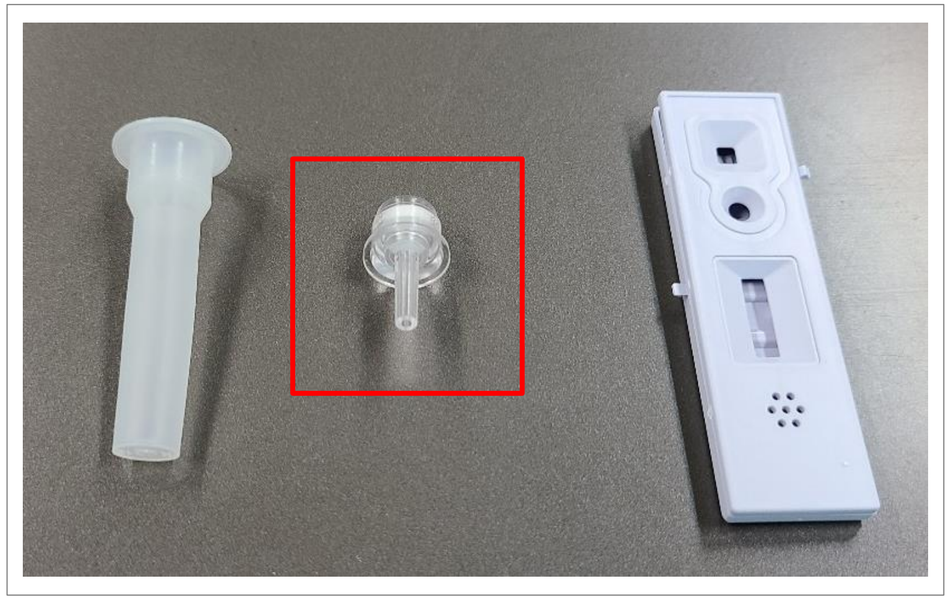


Chemical Pre-CR ABS (Application Case)

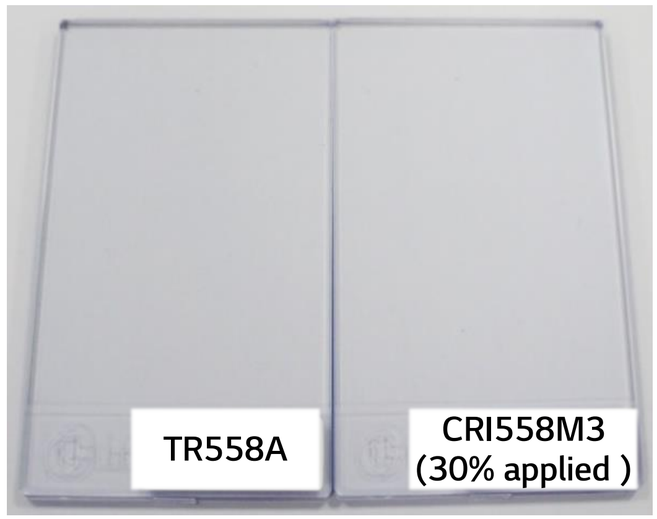
- CRI558M3

We have already applied to a variety of products

Appling to Covid-19 Tester



Injection specimen image



Tt 91 Tt 90

Chemical Pre-CR ABS (Transparent)

- CRI558M3

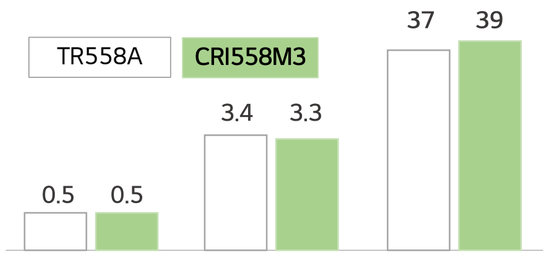
Properties

▪ Excellent physical properties as virgin level

Properties	Test Method (ASTM)	Test Condition	Unit	Natural Color	
				TR558A	CRI558M3
R-Monomer Content	-	-	-	-	30%
MI	D1238	220℃/10kg	g/10min	27	26
IMP(1/4")	D256	23℃, 6.4mm	kg·cm/cm	12	13
Tt / Hz	D1003	3mm	%	91 / 1.8	89 / 1.6
TS	D638	50mm/min	kg/cm^2	523	520
FS	D790	10mm/min, 6.4mm	kg/cm^2	815	822
HDT	D648	18.6kg	℃	86	87

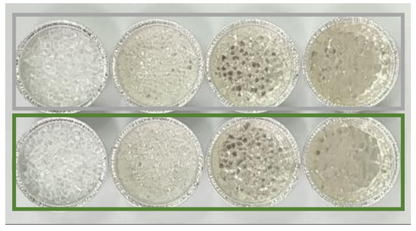
Thermal stability

• Excellent thermal stability



*** Scorch test**

- Test condition : 200℃ for 1hr

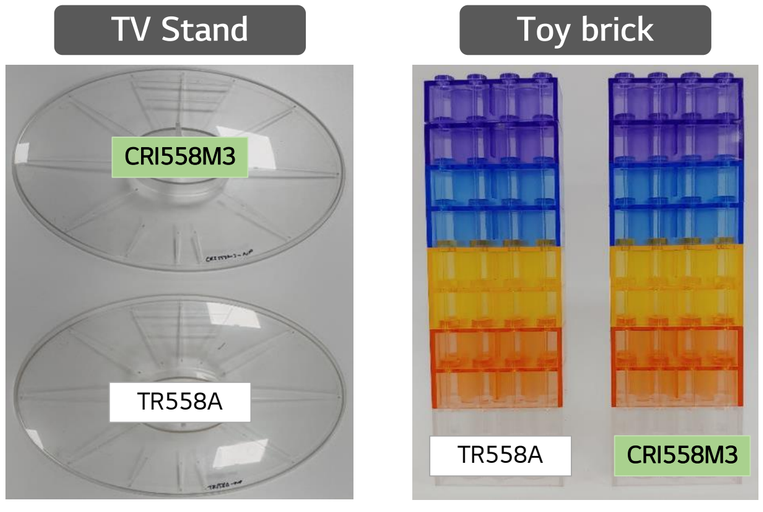


1) Test with injection molding machine 2) O.I.T. : Oxidation Induction Time

* Injection temperature : 250℃

Appearance & color

▪ Equal to virgin appearance



Chemical Resistance

▪ They have the same chemical resistance that does not break like virgin

ESCR (Environmental Stress-Cracking Resistance) Test

Fix the specimen on the jig and apply the Solvent

Ethanol 50% (Jig 0.6, 24hr)

Soybean oil (Jig 0.4, 24hr)

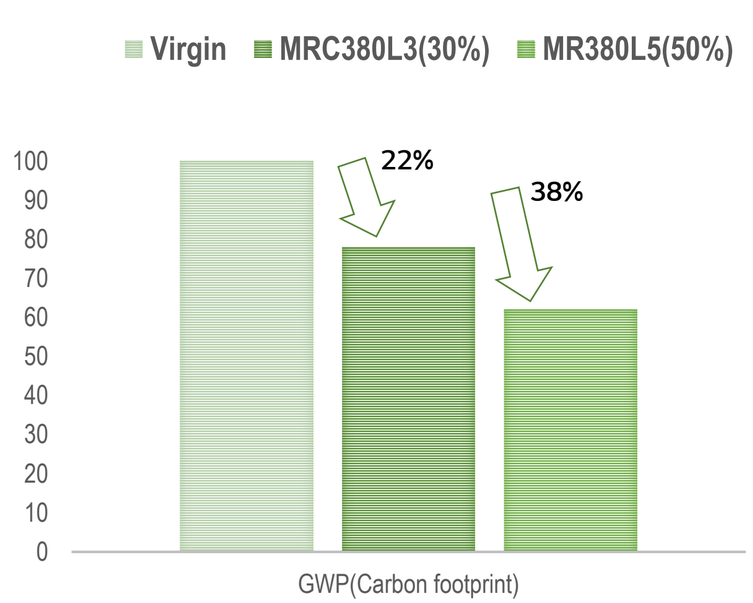
PCR-ABS Carbon footprint

- M.PCR ABS : MRC380L3, MRC380L5
- CR ABS : CRI558M3

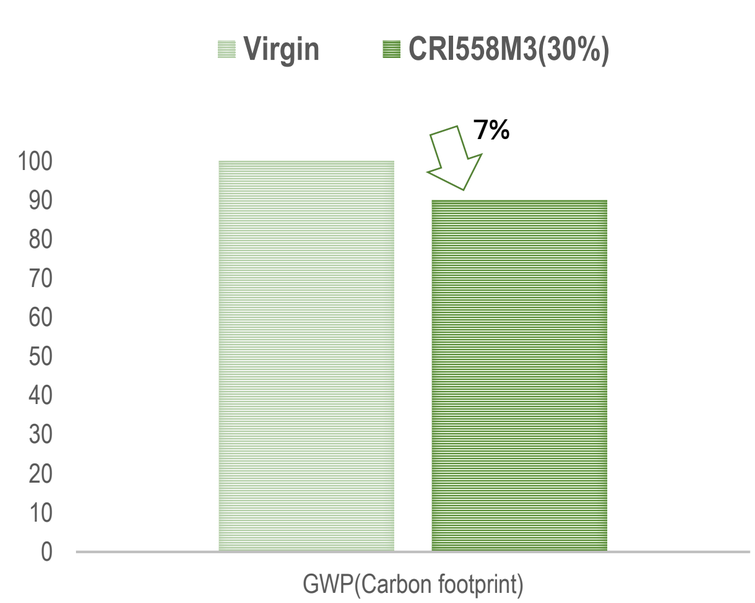
LCA Results

As a results, Carbon Footprint have improved by more than 38% compared to virgin.

✓ GWP(Carbon footprint) improvement Effect



Mechanical Post-CR ABS



Chemical Recycled ABS

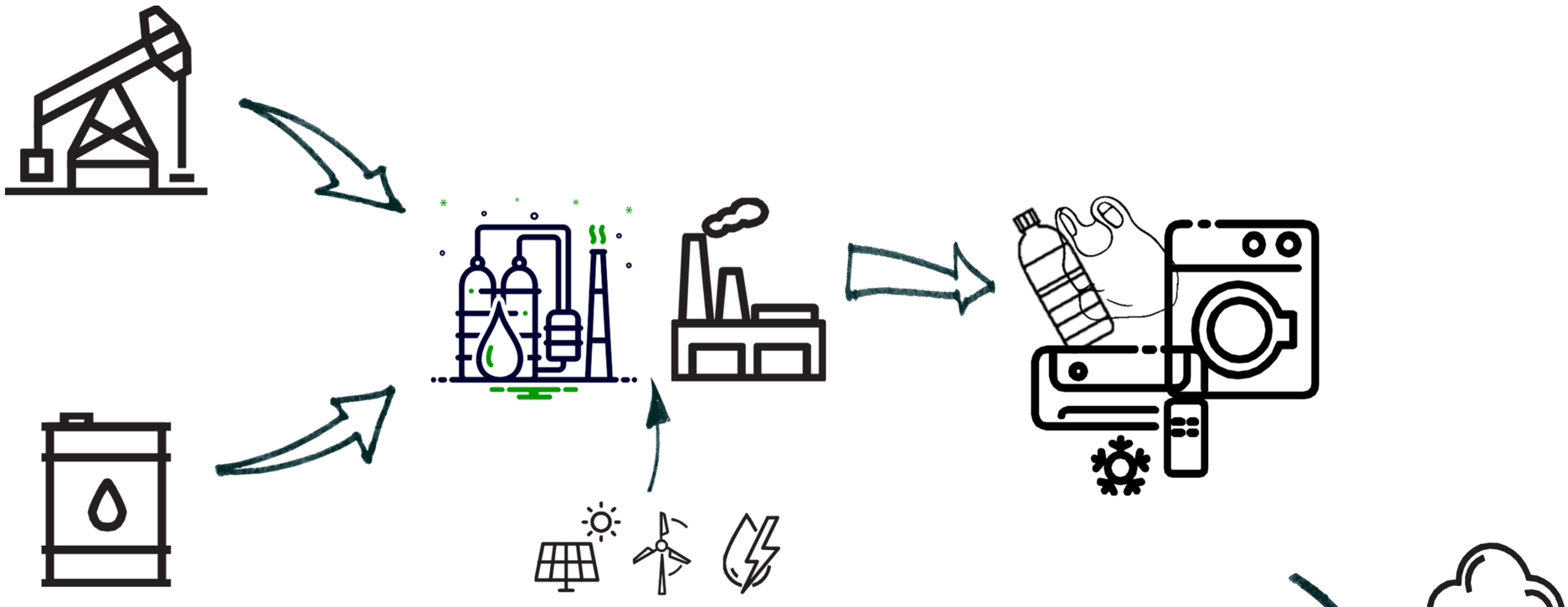
This data was calculated based on LG Chem in-house data. Data is approximate version, please request LCA report if need actual accurate data.
Full LCA report will be issued on '22.1Q.

Bio-Balanced Materials

Biomass balanced Approach

LG Chem's Biomass Balance Approach contributes to the use of renewable raw materials in conventional production system and can be applied to the majority of the products in its portfolio.

Expansion of Biomass product based on ISCC+ certification

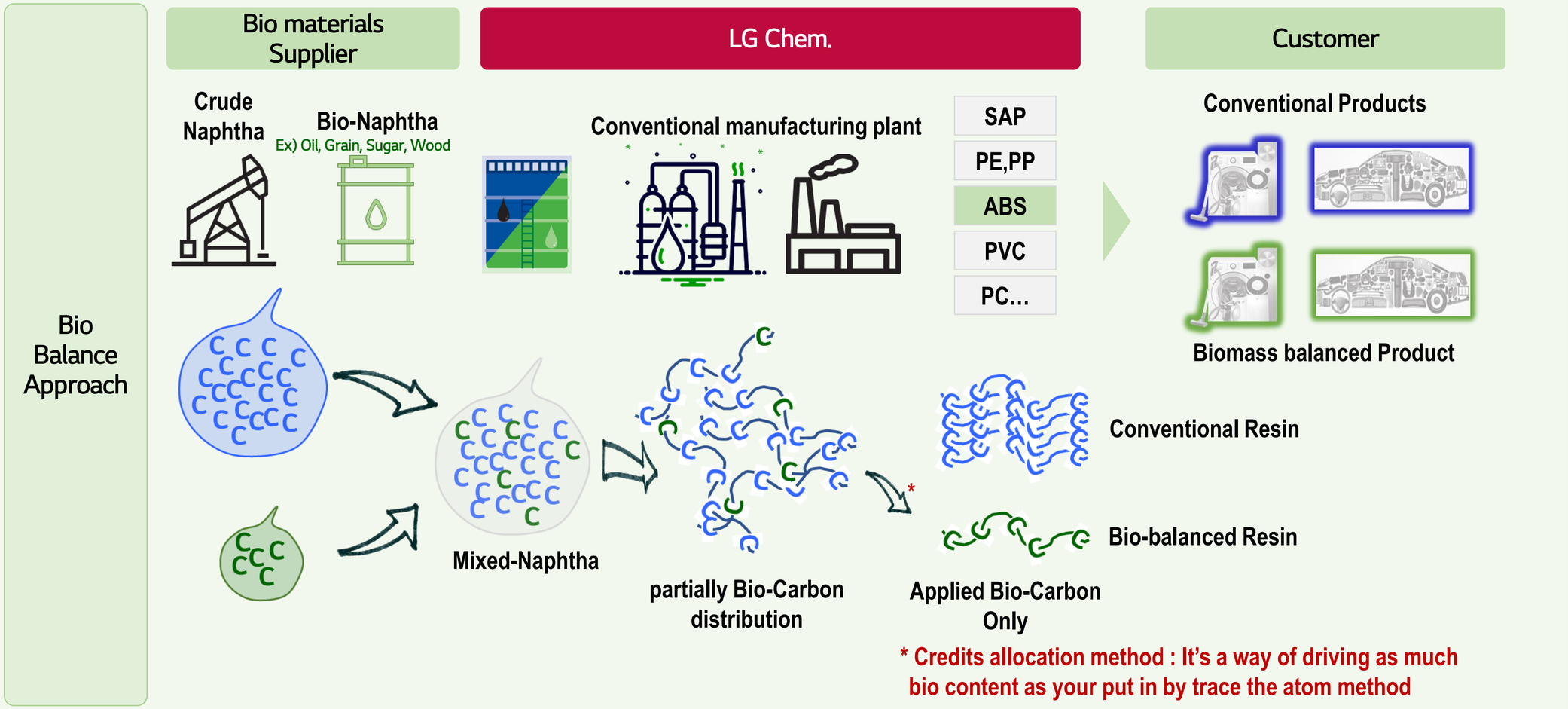


Let reduce CO2 emissions and save fossil resources

Bio-Balanced Materials

Biomass balance approach

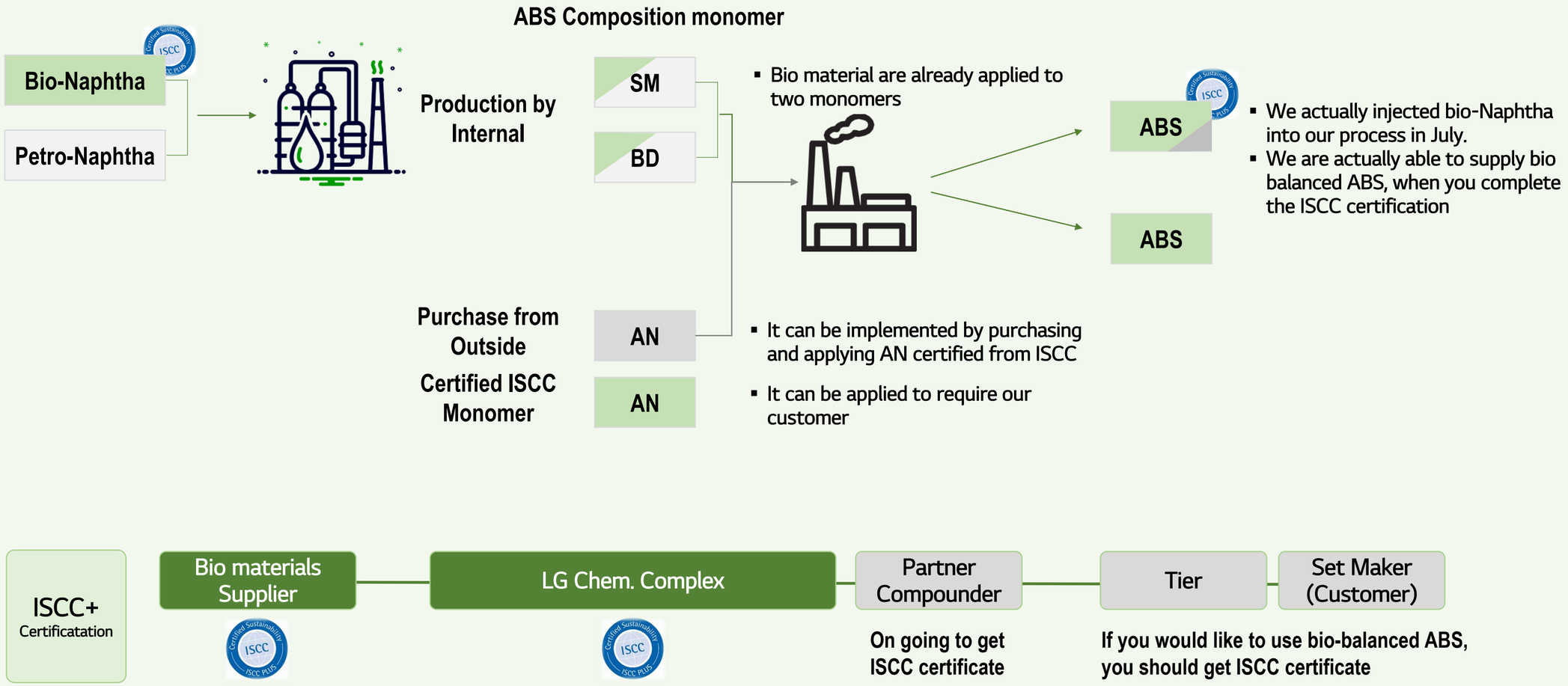
LG Chem's bio-balanced Material is applied mass balance approach that the carbon of the resin is extracted and credits are allocated in proportion.



Bio-Balanced Materials

Ensures identical product quality and properties

Detailed manufacturing Process



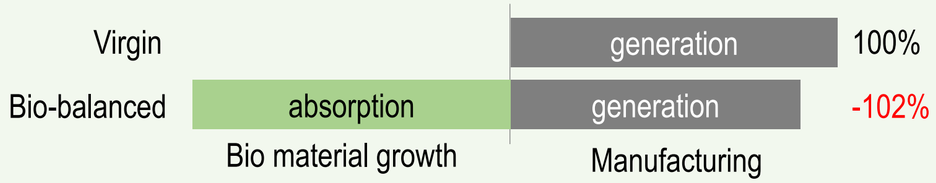
Bio-Balanced Materials

LCA Results

LG Chem's bio-balanced ABS can reduce the CO_2 eq emissions in the scope of cradle-to-gate by 102%, compared to conventional fossil-based naphtha

✓ How does CO_2 decrease so much?

The absorbed amount of CO_2 until the growth period of bio-materials is larger than the amount of CO_2 in using manufacturing process

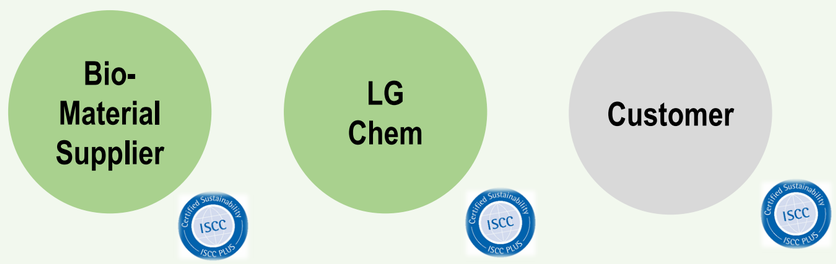


Carbon Footprint :

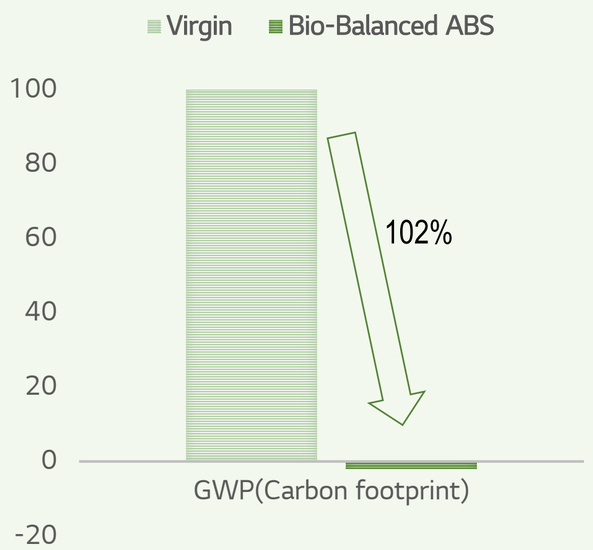
102% reduction from using virgin material

✓ What are the requirements for using this product?

Our customers need to be ISCC+ certified to use it.



✓ Environmental improvement Effect



Category	Units	Virgin	Bio balanced	Improvement Level
GWP	$kgCO_2$-eq	2.23	-0.05	102%

- Only GWP(global warming potential) result can be provided without NDA contract
- Please refer to above LCA result for polymerization plant as an example, it should be used referential only.

Thank you for your attention.