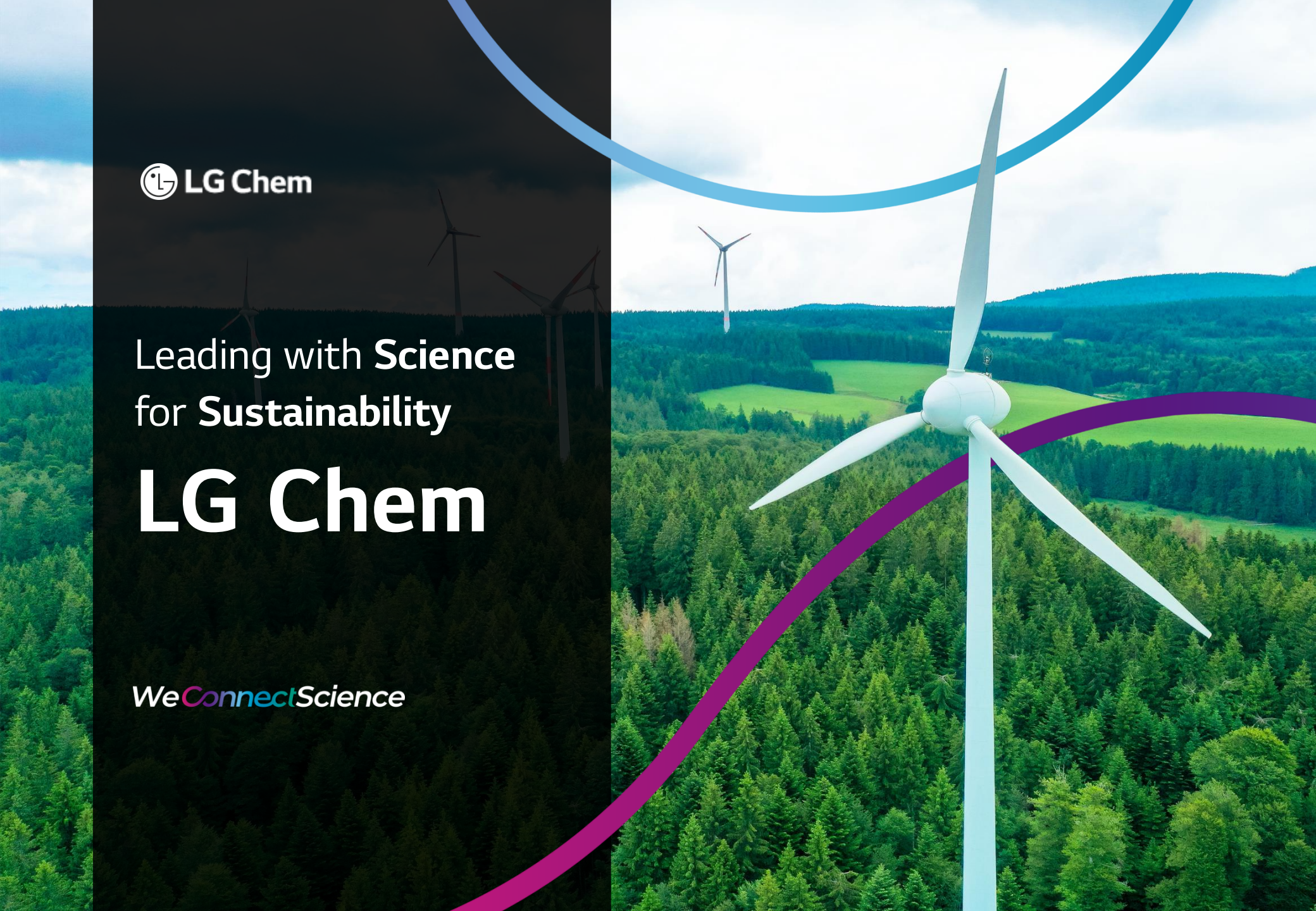




Leading with **Science**
for **Sustainability**

LG Chem

We **Connect** Science





Overview of Sustainability Strategy

01 | LG Chem Introduction

02 | Sustainable Product Portfolio

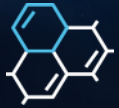
1. Mechanical Recycle
2. Chemical Recycle
3. Bio Based
4. Bio Mass Balanced

03 | Global Plant Location

04 | Wrap-Up

LG Chem | Introduction & Business Area

Business units



Advanced Materials

- Engineering Material
- Battery Material
- IT Material
- NCC
- Polyolefins
- PVC/Plasticizers
- RO Filter
- Semiconductor Materials
- Acrylates/SAP
- HPM
- Catalyst
- CNT
- ABS



Life Science

- Primary Care
- Specialty Care
- Aesthetic



Petrochemicals

Financial Result



Sales in 2021
USD **37.3bn**
(Approx)



Workforce
18,800(Person)
Domestic 13,920
Overseas 4,880
(Approx)

Sales

(Unit : Billion USD)

Operating profit

(Unit : Billion USD)





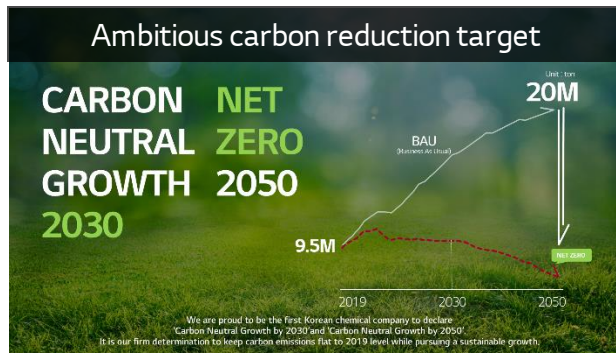
Sustainability

LG Chem's sustainable strategy

LG Chem call to action includes aggressive carbon reduction, increased green energy and circular resource system



Carbon Neutrality



Carbon neutral by 2030 and
"Net Zero by 2050"

- First Korean chemical company to establish carbon reduction target
- 30 million tons of CO₂ to be avoided, equivalent to emission from 13 million cars per annum

Detailed carbon reduction strategy

- Expand renewable energy usage and increase energy efficiency in processes/equipment
- Leverage carbon capture utilization storage technology



Renewable Energy Usage



RE100 for all business sites
at corporate level

- Reduce carbon emission by 60%+ by 2050 through RE100
- Implement mid- and long-term strategies leveraging renewable energy supply methods and national system

RE100 in all business sites
at divisional level

- Established RE100 in EU plant since Jan 2021
- Plan to meet RE100 in Korean and APAC plants by Dec 2022



Circular Economy



Sustainable portfolio and
green environment commitment

- Plan to commercialize mechanical and chemical recycling as well as leverage biomaterials
- Reduce landfill wastes to zero at current sites and mandate zero wastes in new sites

Transparency in all products
throughout value chain

- Supply carbon footprint quantification for all products using LCA*
- Analyze social impact along value chain with PSIA* initiatives

*LCA (Life Cycle Assessment)

*PSIA (Product Social Impact Assessment)



Eco-friendly Material Brand LETZero

A compound word of "Let" and "Zero," which means "to turn harmful substances to the environment and the net increase in carbon emissions into zero."

LETZero Product Line

Recycle



PCR ABS

Electrical/electronic products, automobiles, construction materials, etc.



PCR PC, PCR PC/ABS

Electrical/electronic products, automobiles, industrial materials, building materials



PCR PP

Packaging materials, medical instruments



PCR PE

Packaging materials, medical instruments

Bio materials



Bio balanced SAP

Diapers, menstrual pads



Bio balanced NPG

Paint, PET film, coating agents, adhesives, UPR



Bio IPA

Semiconductor/LCD manufacturing detergent, paint, pharmaceuticals, and cosmetics



Bio balanced Acrylates

Paints, adhesives, coating agents

⋮

Biodegradable



PLA

Packaging materials, film, 3d printing



PLH

Disposable bags and gloves



PBAT

Agricultural film, packaging materials

LETZero Certification



Royal Botanic Toothpaste by LG Household & Health Care with LETZero Certification



Bus stop built with PCR materials

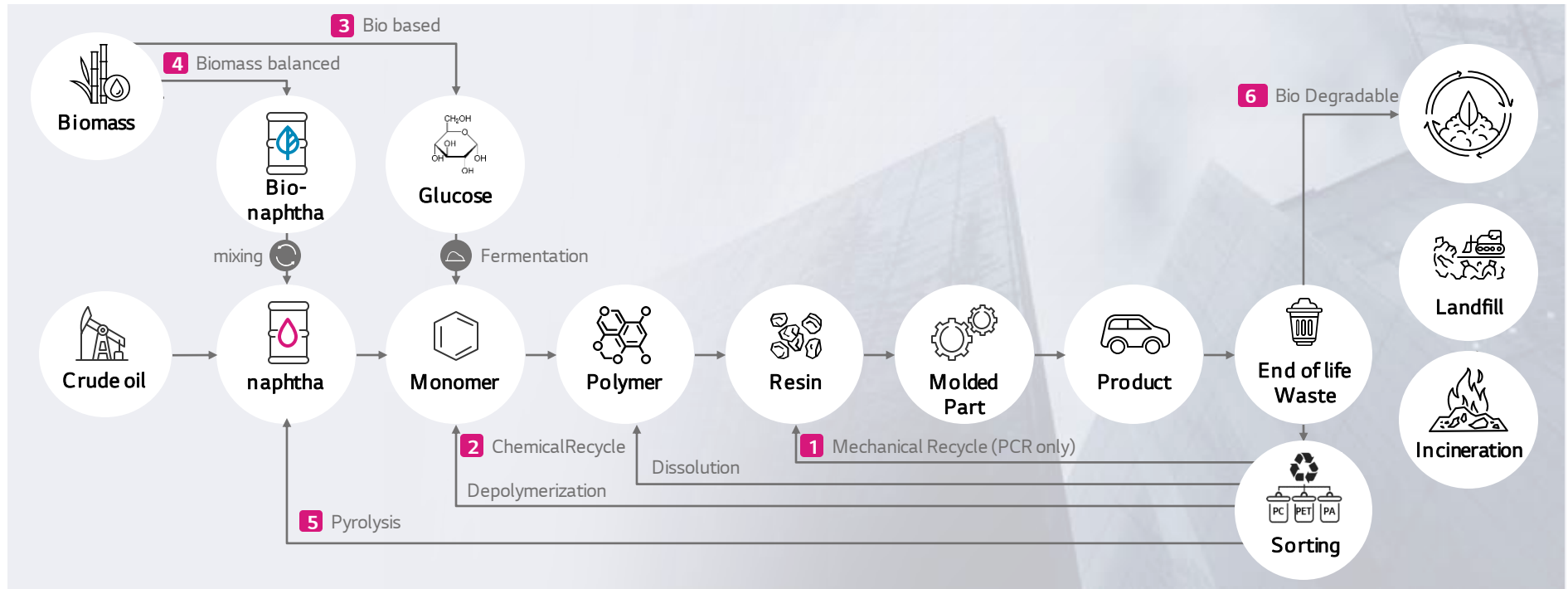


LETZero Product Package

Overview of LG Chem's Sustainable Portfolio

Engineering Materials division adopted 4 technologies as future promising technologies in sustainability perspective.

Overview

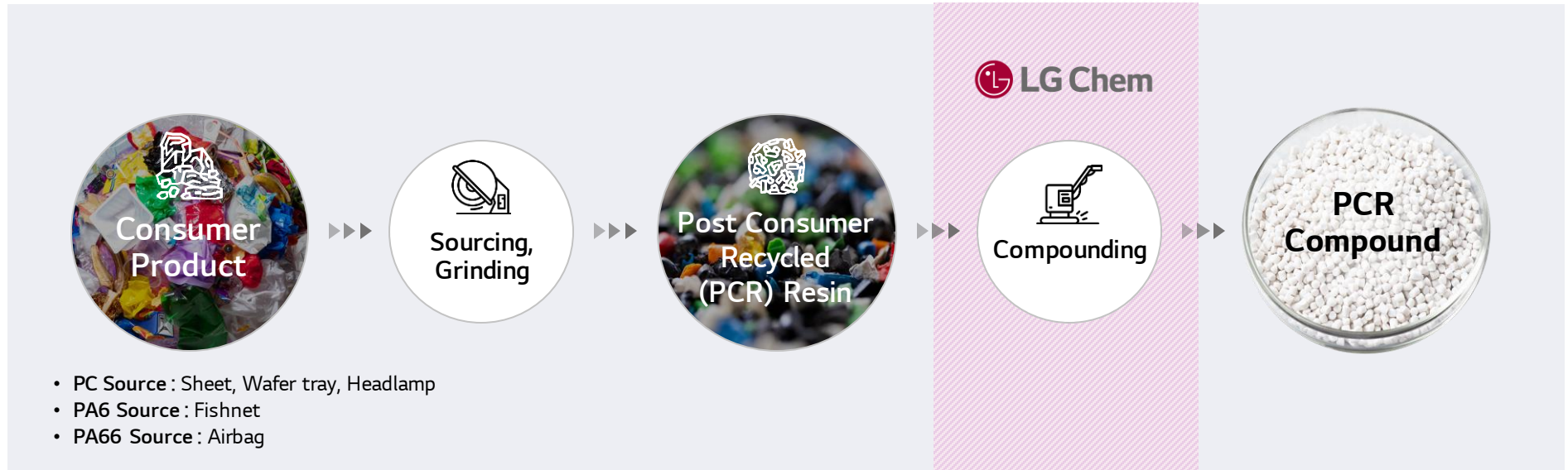


Portfolio

Mechanical Recycle	Chemical Recycle	Bio-based	Bio-mass Balanced	Bio-Degradable
<ul style="list-style-type: none"> • PC, PC/ABS, PA66 • OBP PET (Alloy with PC Compound) • OBP PA6 (Reinforced, FR) 	<ul style="list-style-type: none"> • PC, PC/ABS • PBT, TPEE • Pyrolysis (Other divisionI) - 43,000 MT/yr (~'24) 	<ul style="list-style-type: none"> • PA56 (Replaceable of PA66) • PBT, TPEE 	<ul style="list-style-type: none"> • PC, PC/ABS 	<ul style="list-style-type: none"> • PLA (Other division) - 75,000 MT/yr (~'25) • PBAT (Other division) - 100,000 MT/yr (~'25)

Mechanical Recycle

Technical Description



Transparent Traceability

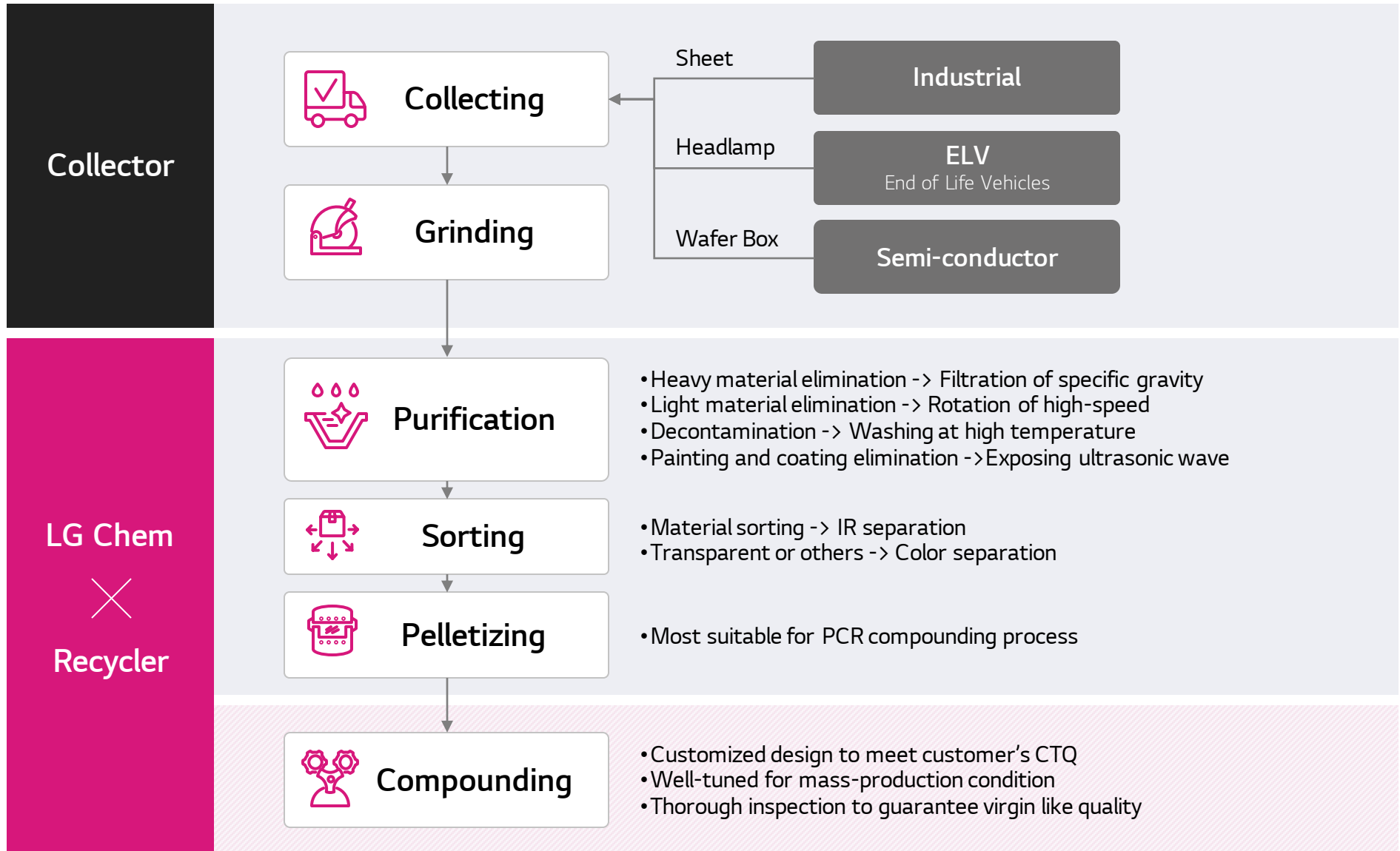


UL ECV, 746D
Environmental Claim Validation



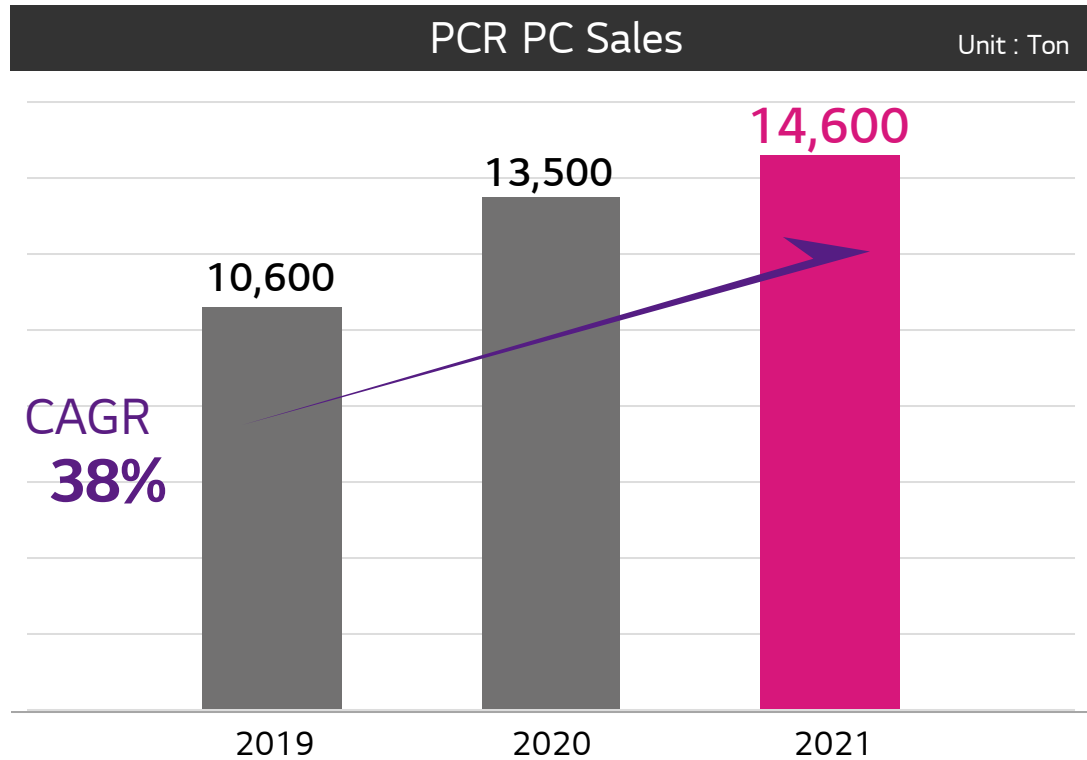
TUV
Technischer Überwachungsverein
Technical Inspection Association

Mechanical Recycle



Mechanical Recycle

Business Summary



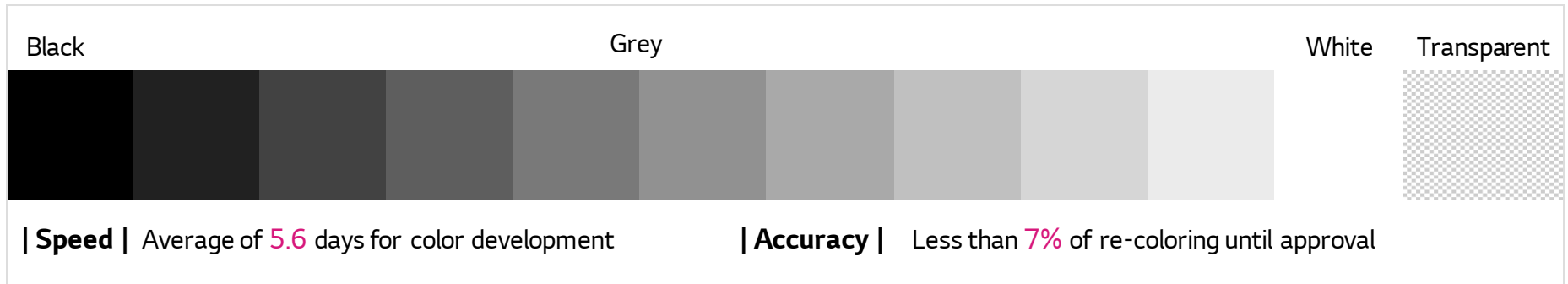
PCR MAX Content		
Virgin-Like Quality	PC 90%	PC/ABS 75%



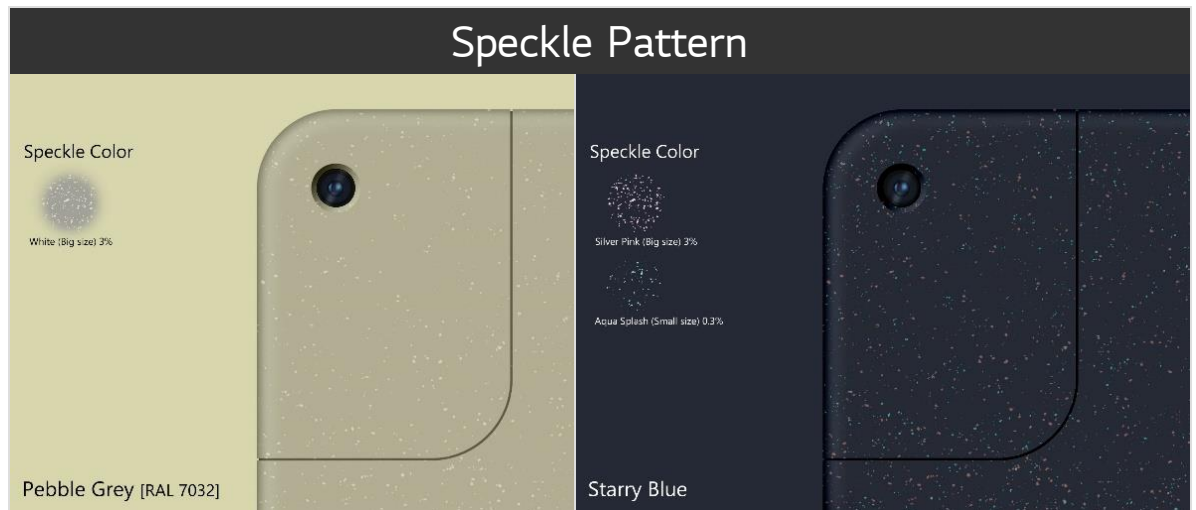
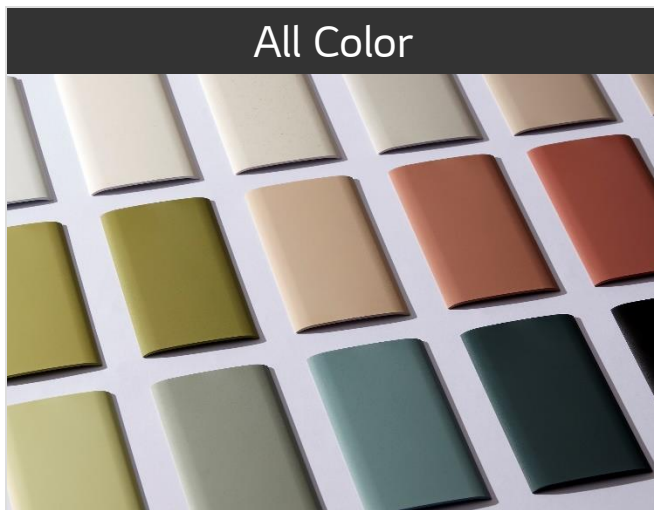
Mechanical Recycle

LG Chem's provides a new color solution experience through advanced coloring technology with rapid and accurate color development.

Color



Special color



Mechanical Recycle

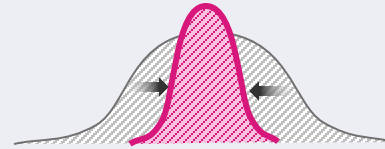
Enhanced Quality Control

Inspections for Virgin source 2

- Melt Flow Rate
- Color (Yellow Index)

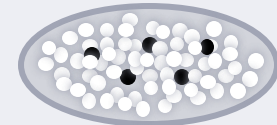


Additional Inspections for PCR source 4



- Izod Impact Strength
- HDT*

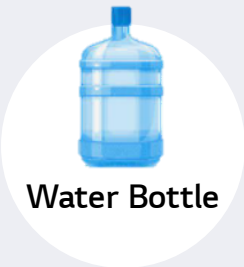
*Heat Deflection Temperature



- Foreign Material
- Halogen/Heavy metal

Control of PCR Source

Past Version



Water Bottle



CD/DVD

Very High and Low
(MFR 3~70)
Molecular Weight Source



**Broad Dispersion
+ Unstable Quality
between Lots**



Today Version



Wafer Tray



Sheet



Auto
Headlamp

Proper (MFR 15~25)
Molecular Weight Source



**Narrow Dispersion
+ Stable Quality
between Lots**

Application Examples

E&E, IT



Auto



Others



Application

Notebook

**AI
Speaker**

Set Top Box

Adaptor

**Interior
Parts**

**Trim
Parts**

AVN*
Audio Video
Navigation

**Mobile
Phone Case**

Metering

**Bus
Shelter**

Grade

LUPOY
ER2403FT

LUPOY
ER5001RFZ

LUPOY
ER1000Y

LUPOY
ER1006FNA

LUPOY
ER5006N/
6NC/7N

LUPOY
ER5100N,
5200A, 5300A

LUPOY
ER1000MU

LUPOY
ER1004A

LUPOY
ER2101F

LUPOY
ER1000MH

Description

PCR 30%
GF40%
V-0 @ 0.8 mm

PCR 60%
V-0 @ 1.2 mm

PCR 90%
IR Transmission

PCR 50%
V-0 @ 0.8 mm

PCR 50%
Painting

PCR 30 ~ 50%
GF 10 ~ 30%

PCR 50%

PCR 50%
Impact
Modified

PCR 60%
GF 10%
V-0 @ 1.2 mm

PCR 60%,
Transparent
Extrusion

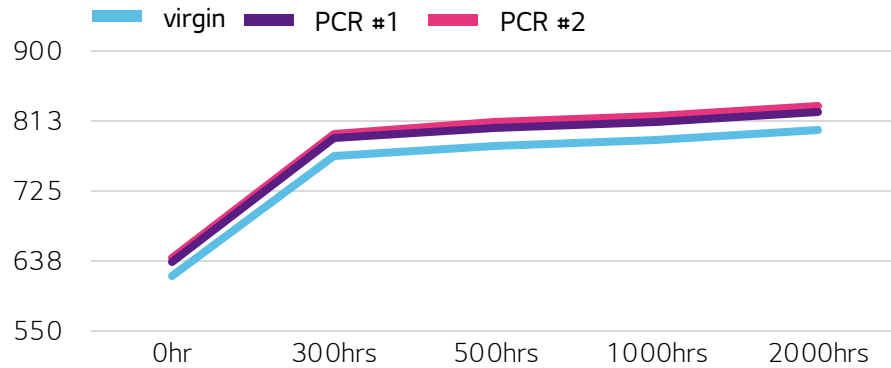
Virgin-Like Quality

Long-Term Reliability

PCR product shows similar tendency as virgin product for long-term reliability test (120°C, 2,000 hrs)

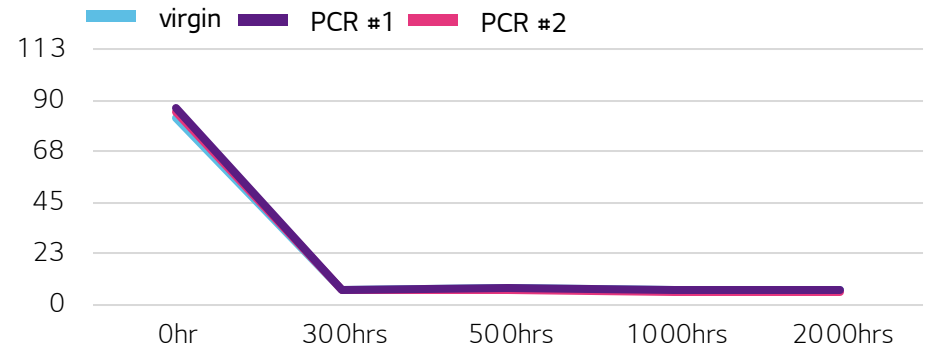
Tensile strength

(kgf/cm²)



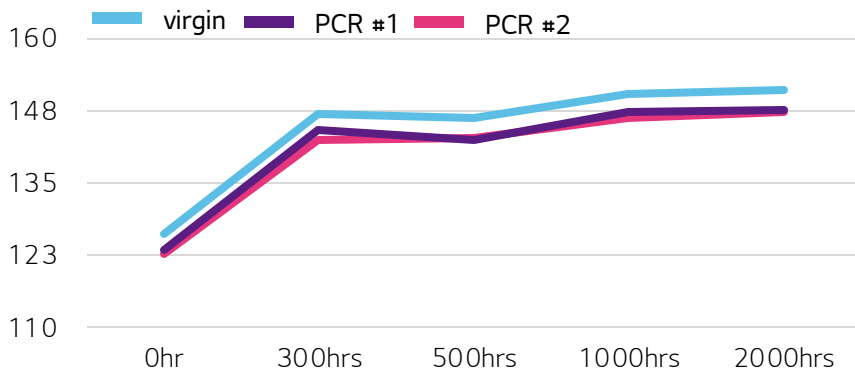
Izod Impact 1/8"

(kgf.cm/cm)



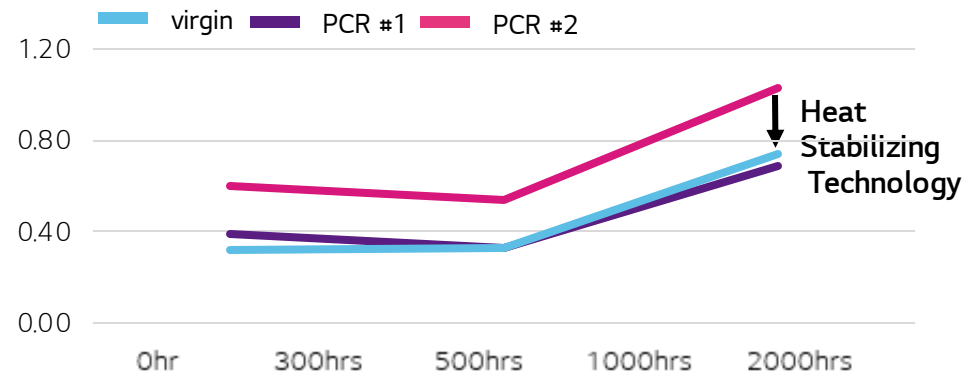
HDT

(18.6kg)



Color

(Delta B)



PCR Portfolio - PC

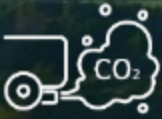
		Recycled Type	Virgin Type	Description	Application
Non-Reinforced <u>PC Comp.</u>	Non-FR	ER1000D/MA	GP1000M	PCR 50%, Transparent	<ul style="list-style-type: none"> Transparent Sheet Phone Case Keycap Remote Controller Settopbox
		ER1000MH	-	PCR 60%, Transparent, Extrusion	
		ER1000ML	-	PCR 50%, High Flow, Transparent V1 @3.0mm	
		ER1000Z	GP1000L	PCR 75%, Transparent	
		ER1000Y	-	PCR 90%, Transparent	
		ER1004A/N	SC1004A	PCR 30%/50%, IM ¹⁾	
	FR	ER1006FH/FD/FN	EF1006F	PCR 20%/30%/50%, V0 @ 1.0 mm, RTI 125 °C	<ul style="list-style-type: none"> Charger Outdoor CCTV IoT Devise Battery Case Tablet B/Cover
		ER1006FZ/FX/FY		PCR 75%/85%/90%, V0 @ 1.0 mm, RTI 125 °C	
		ER1006FU		PCR 50%, V0 @ 1.5 mm, F1(Weatherability)	
		ER1007FA/FZ	SF1007F	PCR 30%/60%, High Flow, IM, V0 @ 0.8 mm	
		ER1008RF/RFN	GN1008RF	PCR 35%/50%, IM, V0 @ 0.6 mm	
Reinforced <u>PC Comp.</u>	Non-FR	ER2102N	GP2102	GF 9% + PCR 50%	<ul style="list-style-type: none"> Action Camera Tablet Bezel Laptop Cover
		ER2101FN	-	GF 10% + PCR 60%, V0 @ 1.5mm	
		ER2103FN	-	GF 10% + PCR 55%, V0 @ 0.8 mm	
		ER2109FD	GN2109FD	GF 10% + PCR 50%, V0 @ 1.5 mm	
		ER2201F	GN2201FM	GF 20% + $\pm 0\%$, V0 @ 1.5 mm	
	FR	ER2203FN	-	GF 20% + PCR 50%, V0 @ 0.8 mm	
		ER2253F	GN2253F	GF 25% + PCR 30%, V0 @ 0.8 mm	
		ER2303F	-	GF 30% + PCR 30%, V0 @ 0.8 mm	
		ER2403FT	GN2403FT	GF 40% + PCR 30%, V0 @ 0.8 mm	
		ER2503FT	GN2503FT	GF 50% + PCR 30%, V0 @ 0.8 mm	

PCR Portfolio – PC/ABS, PC/ASA

		Recycled Type	Virgin Type	Description	Application
Non-Reinforced <u>PC/ABS</u> Comp.	Non-FR	ER5002N	HI5200A	PCR 50%, Low PC %	• Auto Interior/Trim Part
		ER5006N	HR5006A	PCR 50%, Medium PC %	
		ER5006NC	HR5007A	PCR 50%, Medium High PC %	
		ER5007N	HR5007AC	PCR 50%, High PC %	
	FR	ER5000SFC	GN5000SFC	PCR 30% , V0 @ 1.5 mm, High Flow	• TV Back Cover • Battery Cover
		ER5001RF	GN5001RF	PCR 30% , V0 @ 1.5 mm, RTI 80°C	
		ER5001RFK/RFZ		PCR 30%/60%, V0 @ 1.2 mm	
		ER5001RFA	GN5001RFA	PCR 30% , V0 @ 1.2 mm	
		ER5001RFH	GN5001RFH	PCR 60% , V0 @ 1.5 mm, RTI 80°C	
Non-Reinforced <u>PC/ASA</u> Comp.	FR	ER5000FS	EU5000FS	PCR 50%, V0 @ 1.5 mm, F1, PC/ASA	• Meter Part
Reinforced <u>PC/ABS</u> Comp.	Non-FR	ER5100N	GP5100	GF 10% + PCR 50%	• Notebook Part • Auto Interior/Trim Part
		ER5200A	GP5200	GF 20% + PCR 30%	
		ER5300A	GP5300	GF 30% + PCR 30%	
	FR	ER5101RFN	-	MF 5% + PCR 50% , V0 @ 0.75 mm	
		ER5101RFL	GN5151RFA	MF 15% + PCR 30% , V0 @ 1.2 mm	
		ER5101RFN		MF 15% + PCR 50% , V0 @ 1.2 mm	
		ER5254FW	GN5254FW	MF 25% + PCR 30% , V0 @ 1.0 mm	
		ER5254FN		MF 25% + PCR 35% , V0 @ 1.2 mm	

Environmental Benefit

PCRPC 50%
PC/ABS



CO₂Emission

-40%



Water Consumption

-30%



Cumulative
Energy Demand

-30%

LCA Report (PCR vs Virgin)



PCR PC/ABS



LCA Results report

• Target product
- LUPOY ER5007N (1 kg)

• Data collection period
- 2020.01.01 ~ 2020.12.31.
• Standard
- According to ISO 14040 & 14044

Life Cycle Assessment Results

Impat Category	Unit	Quantities
Climate Change	kg CO2 eq.	1.90E+00
Acidification	kg SO2 eq.	1.13E-02
Ozone depletion	kg CFC11 eq.	2.94E-07
H2O depletion	m3 H2O eq.	2.38E-02
Eutrophication	kg PO43- eq.	1.46E-03
Photochemical oxidation creation	kg ethylene eq.	7.97E-04
Abiotic Resource depletion	kg Sb eq.	1.68E-02

Life Cycle Assessment Background Information

1. Functional Unit

To produce 1kg of polycarbonate (PC) based compound, in Korea, in the year of 2020

2. System Boundary

Cradle to Gate (excluding environmental burden of the first cycle of recycled materials)

3. Characterization Method

CML 2001 (Climate Change, Acidification, Ozone depletion, Eutrophication, Photochemical oxidation creation, Abiotic Resource depletion)
ReCipe 1.08 Midpoint (Water depletion)

4. Data Source

- Upstream: On-site data were collected for recycled materials, secondary data being utilized for the other materials.
- Manufacturing: On-site data were collected.
- Downstream: Not applicable

5. Data quality and Sensitivity

6. Allocation

Since raw materials, utilities, energy consumptions, and wastes in the process are not separately managed between the product and by-products, an allocation according to the production weight ratio was considered. As for a by-product which reuses internally, it was considered as a close loop.



Virgin PC/ABS



LCA Results report

• Target product
- LUPOY HR5007AC (1 kg)

• Data collection period
- 2020.01.01 ~ 2020.12.31.
• Standard
- According to ISO 14040 & 14044

Life Cycle Assessment Results

Impat Category	Unit	Quantities
Climate Change	kg CO2 eq.	3.60E+00
Acidification	kg SO2 eq.	2.43E-02
Ozone depletion	kg CFC11 eq.	8.91E-07
H2O depletion	m3 H2O eq.	4.05E-02
Eutrophication	kg PO43- eq.	3.54E-03
Photochemical oxidation creation	kg ethylene eq.	1.03E-03
Abiotic Resource depletion	kg Sb eq.	3.49E-02

Life Cycle Assessment Background Information

1. Functional Unit

To produce 1kg of polycarbonate (PC) based compound, in Korea, in the year of 2020

2. System Boundary

Cradle to Gate (excluding environmental burden of the first cycle of recycled materials)

3. Characterization Method

CML 2001 (Climate Change, Acidification, Ozone depletion, Eutrophication, Photochemical oxidation creation, Abiotic Resource depletion)
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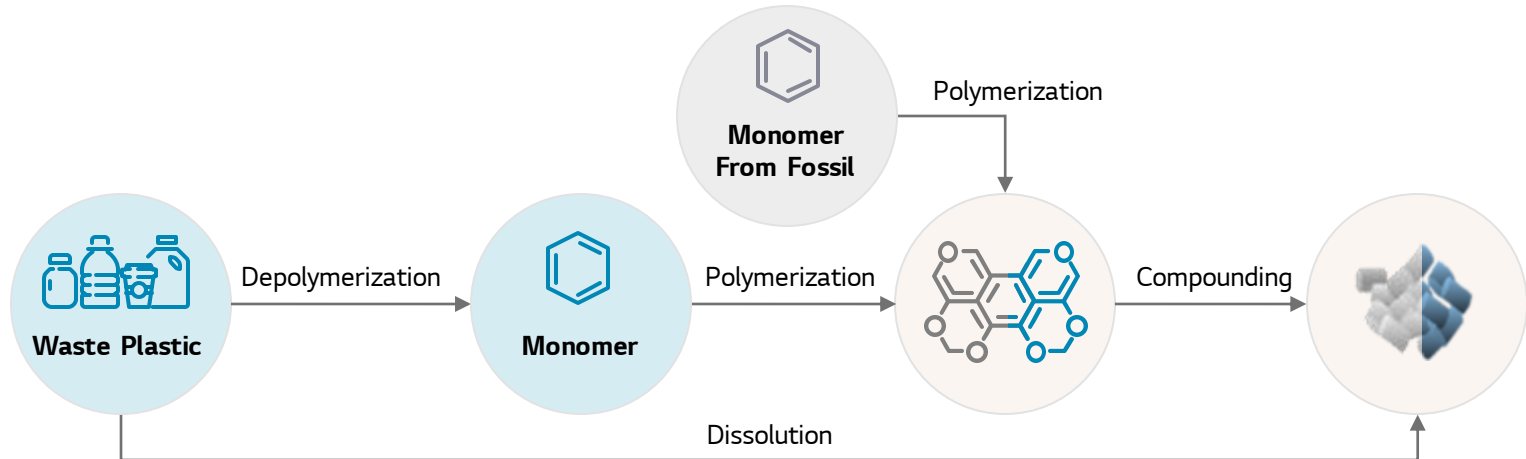
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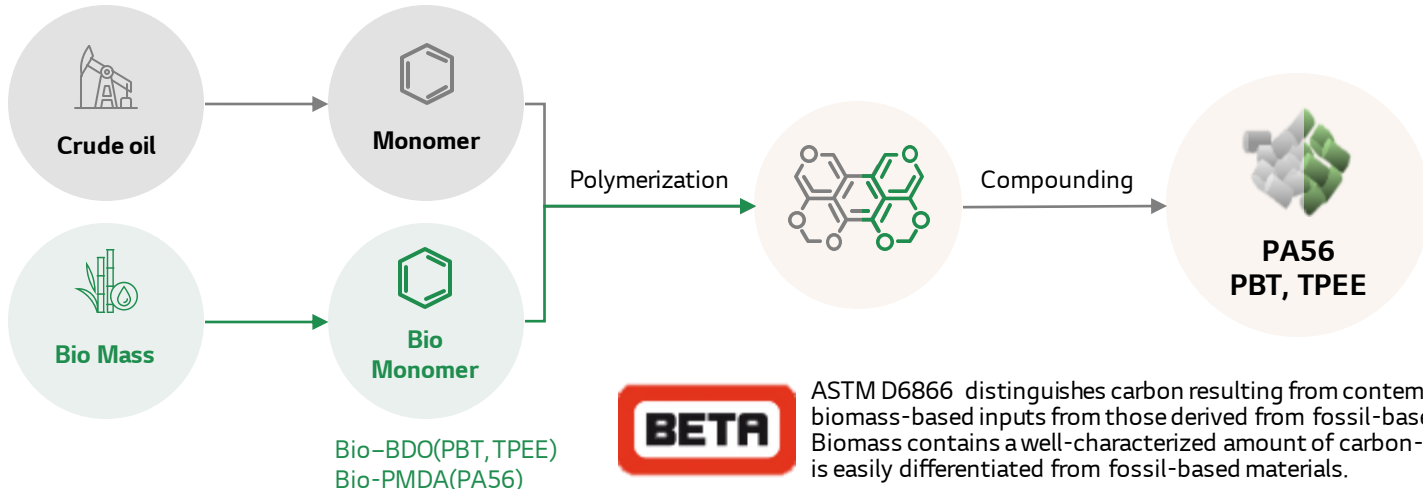
Chemical Recycle

It is an upcycle process which aims to convert heavily contaminated plastic waste into its monomer stage(pre-cursor) through depolymerization technology

Source	Waste PET		Waste PC	
				
Technical Description				
Milestone <small>*Timeline may change during development</small>		Jun. 2021	Dec. 2022	Dec. 2024
	PC (Dissolution)	Pilot Construction	Sample Release	Mass Production
	PC (Depolymerization)	Pilot Construction	Sample Release	Mass Production
	PBT/TPEE	Pilot Scale-up	Feasibility Test	Mass Production

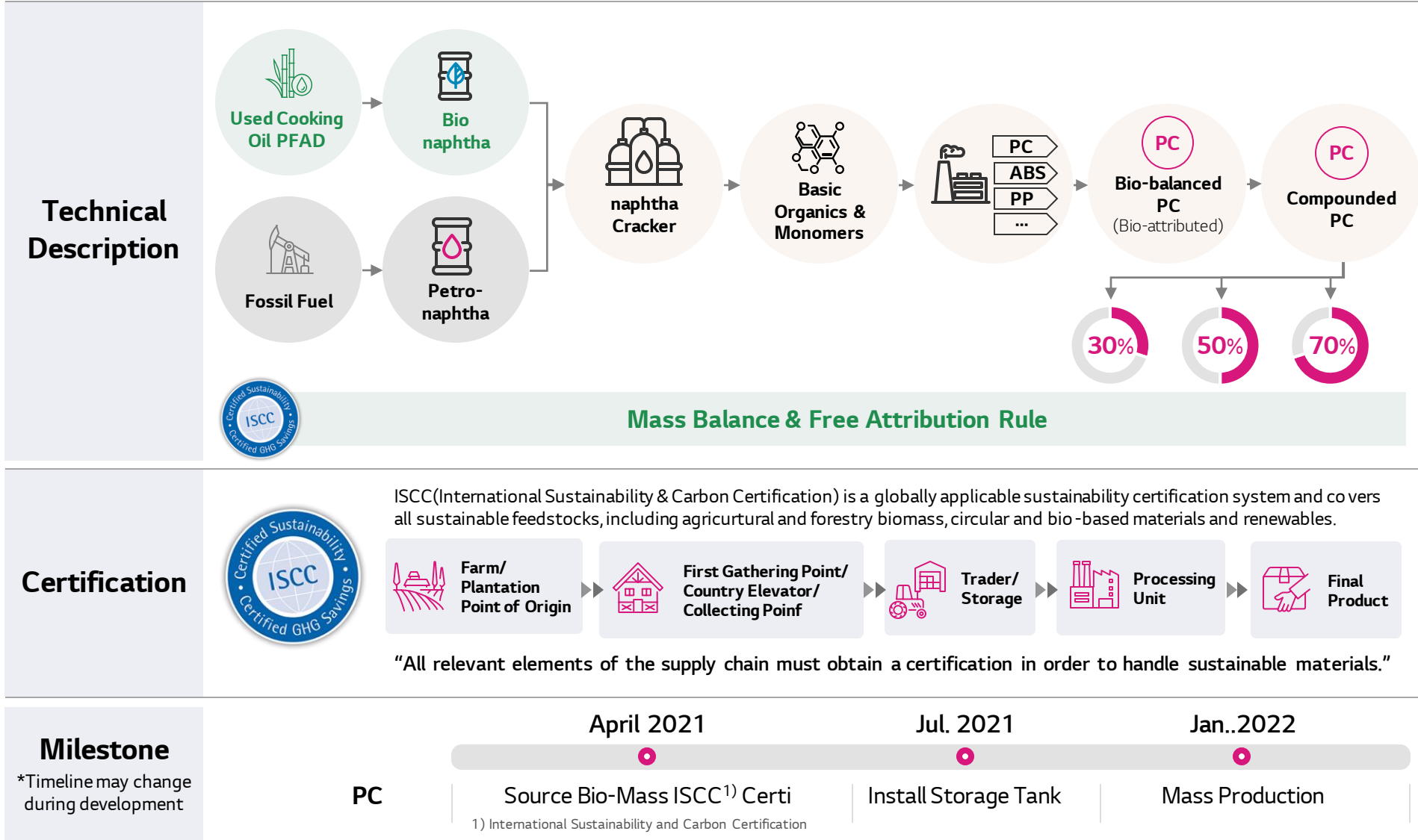
Bio-Based

BasedMain benefits of bio-based product is that it is an option for phasing out from fossil fuel, it can be used as a good marketing tool. Also since the production is starting from the monomer stage, after polymerization it is considered as virgin like quality.

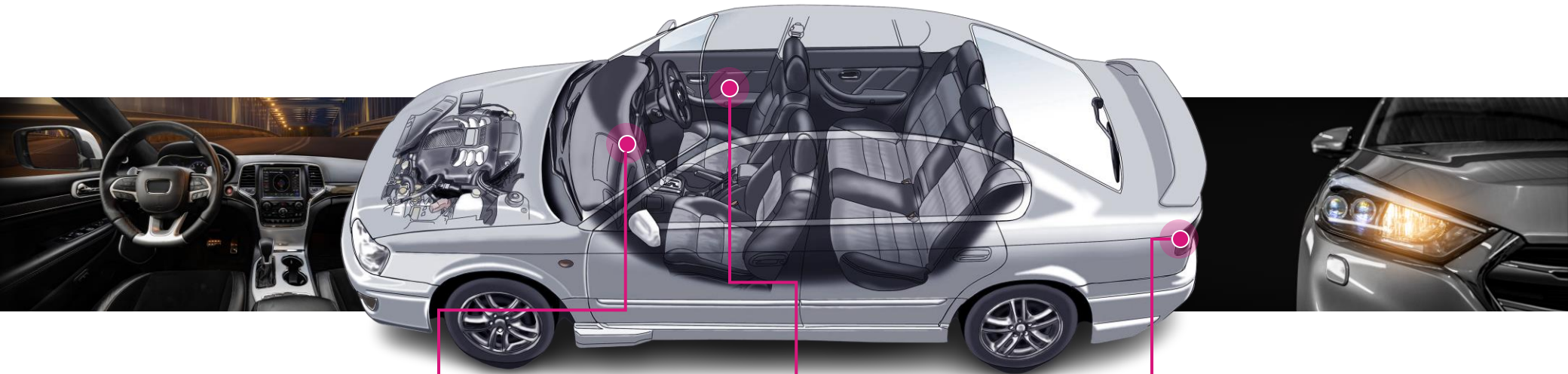
Source	Sugarcane	Corn
		
Technical Description	<div><p>TPA(PBT, TPEE) Adipic Acid(PA56)</p><p>Bio-BDO(PBT, TPEE) Bio-PMDA(PA56)</p><p>ASTM D6866 distinguishes carbon resulting from contemporary biomass-based inputs from those derived from fossil-based inputs. Biomass contains a well-characterized amount of carbon-14 that is easily differentiated from fossil-based materials.</p></div>	
	<div><div><div><div>Jan, 2022</div><div>Dec. 2024</div></div><div><div><div>PBT/TPEE</div><div>PA56</div></div><div><div>Feasibility Test</div><div>Mass Production</div></div><div><div>Bio-BDO Production (In-house)</div></div></div></div></div>	

Bio-Mass Balanced

Benefits are it can reach virgin like quality since we are using same production process same as the existing petrochemical production. Also for Polycarbonate there is no other bio option than bio-mass balanced so I think it would be a good alternative option



Applicable Parts in Automotive



Interior - Cockpit

- **Cluster, I/P Dash board, C/Facia**
 - 1) ER5002N(PCR 50%, Low Heat)
 - 2) ER5006N(PCR 50%, Mid Heat)
 - 3) ER5006NC(PCR 50%, Mid-high Heat)
 - 4) ER5007N(PCR 50%, High Heat)
- **AVN**
 - 1) ER1000MU(PCR 50%, Transparent)
 - 2) ER2201F(PCR 50%, V-0 @ 1.5 mm)

Interior - Trim

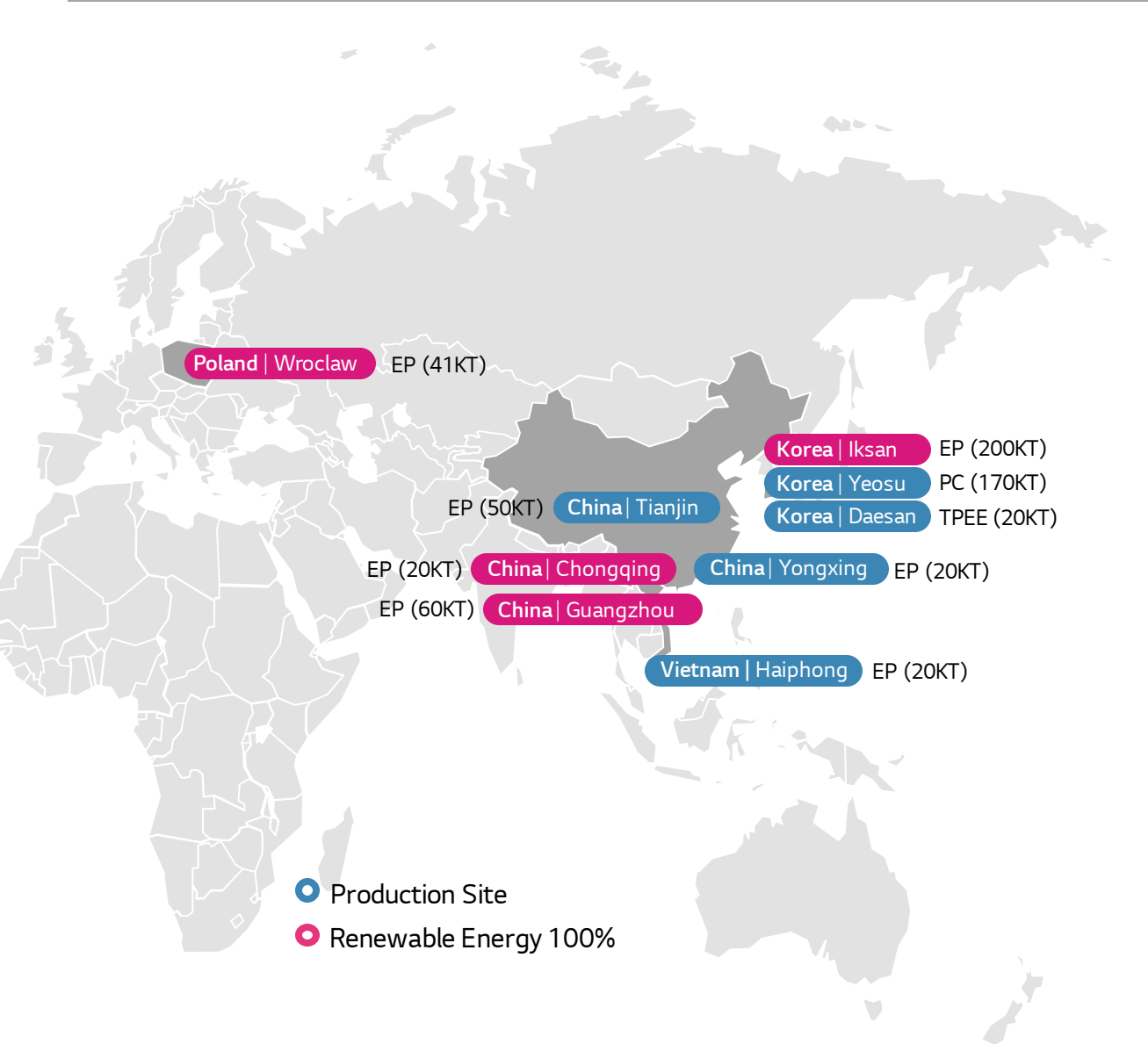
- **Cluster, I/P Dash board**
 - 1) ER5100A(PCR 30%, Glass Fiber 10%)
 - 2) ER5200A(PCR 30%, Glass Fiber 20%)
 - 3) ER5300N(PCR 50%, Glass Fiber 30%)

Mechanical Lamp Module

- **H/L Bezel**
 - 1) ER1000L (PCR 50%, High Flow)
- **R/L Housing**
 - 1) ER5007N(PCR 50%, High Heat)

Global Location

LG Chem can supply PCR products to customers no matter where they are located globally





WeConnectScience

Thank You



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Tel. 02-3773-1114 / www.lgchem.com



Q&A