Innovative Partnership to Promote Bio-Based Materials Through the Value Chain

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Advanced Biochemical (Thailand) Co, Ltd

EPICEROL®
Sustainability begins at the source

Company Introduction

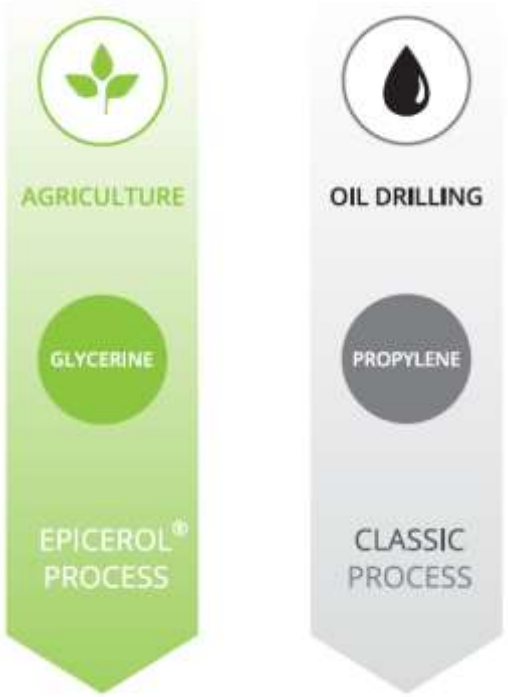
- ABT is owned by **Vinythai PCL**, a leading chlor-alkali and PVC producer in Thailand.

VINYTHAI
AGC Group

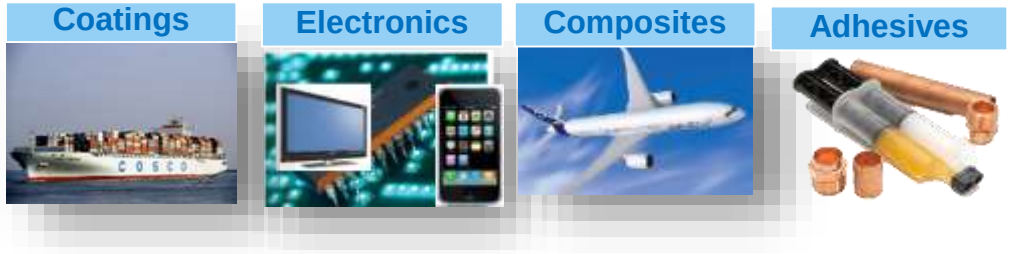
AGC	58.9%
ptt GLOBAL CHEMICAL	24.9%
Public shareholders	16.2%

- ABT operates **the first world scale Epicerol® bio-based epichlorohydrin plant** (100 kt/y) in Map Ta Phut Industrial Estate since February 2012.

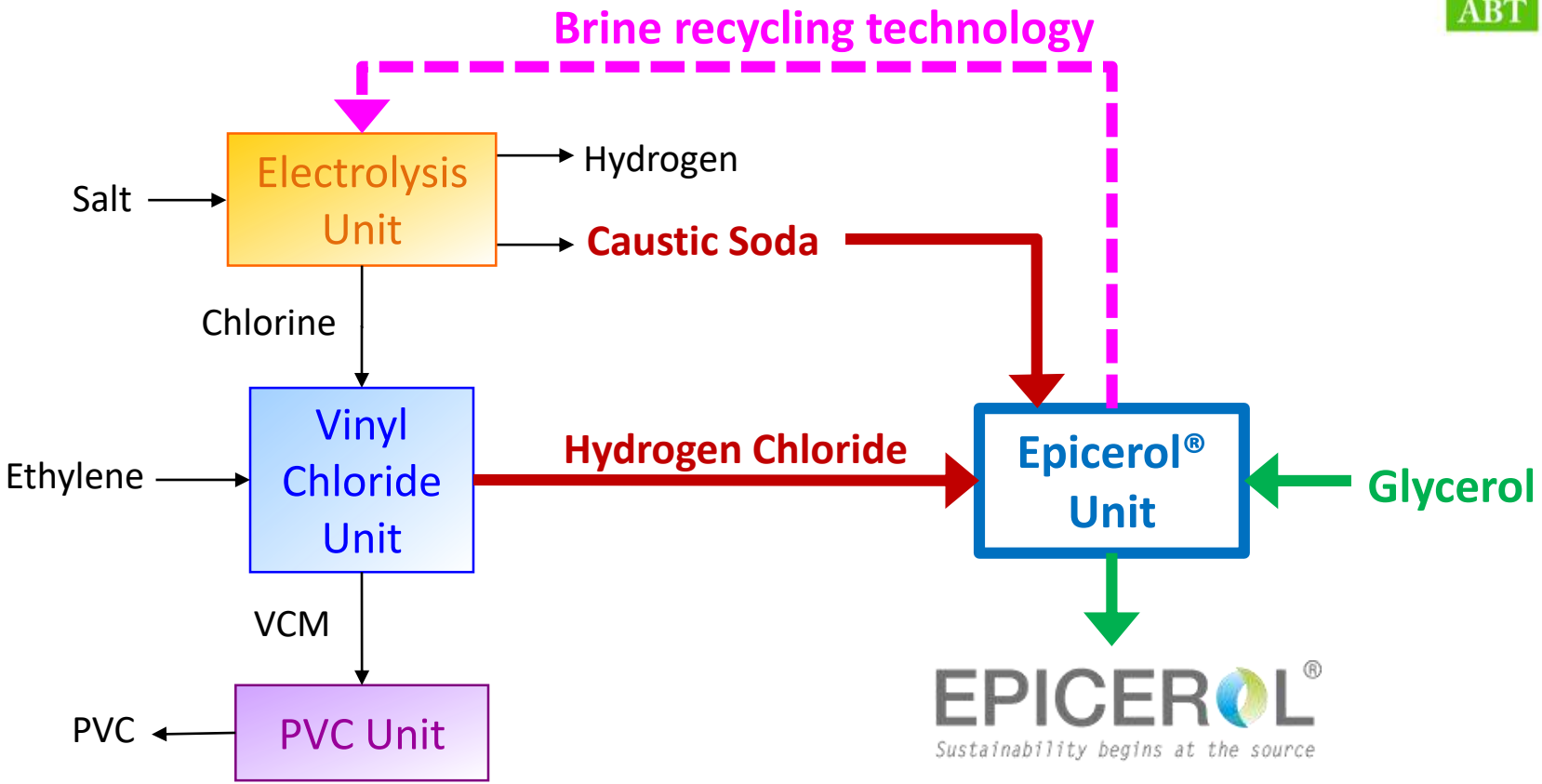
Product Introduction



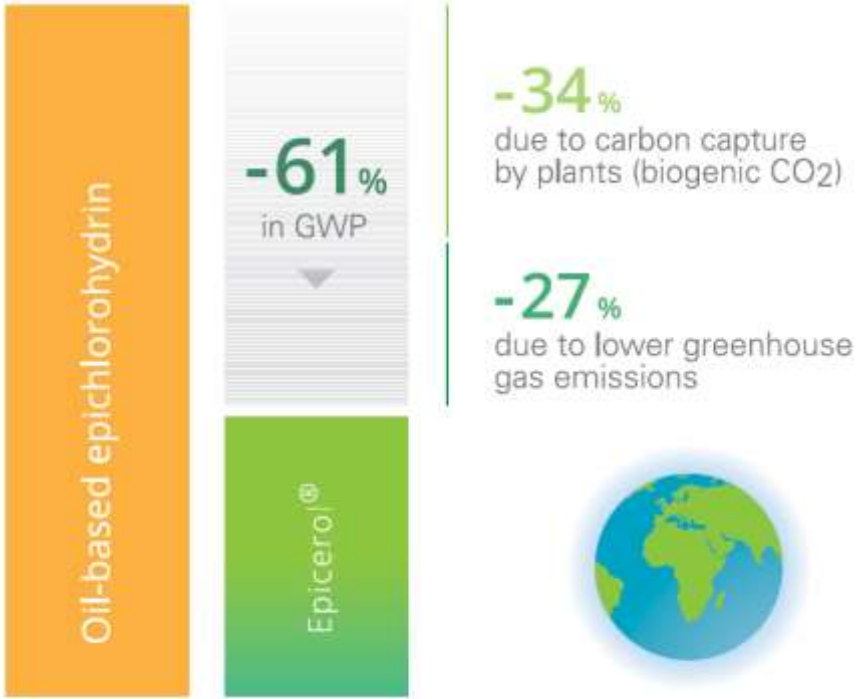
- Epicerol® is 100% bio-based epichlorohydrin (ECH) produced from **vegetable glycerol** via an innovative and patented technology. It is a **drop-in** for petro-based ECH.
- Glycerol is a **by-product of manufacturing biodiesel and oleochemicals**.
- ECH is used as an **intermediate of epoxy resins** and other derivatives. Epoxy resins are used in the following applications:



VNT/ABT Production Process



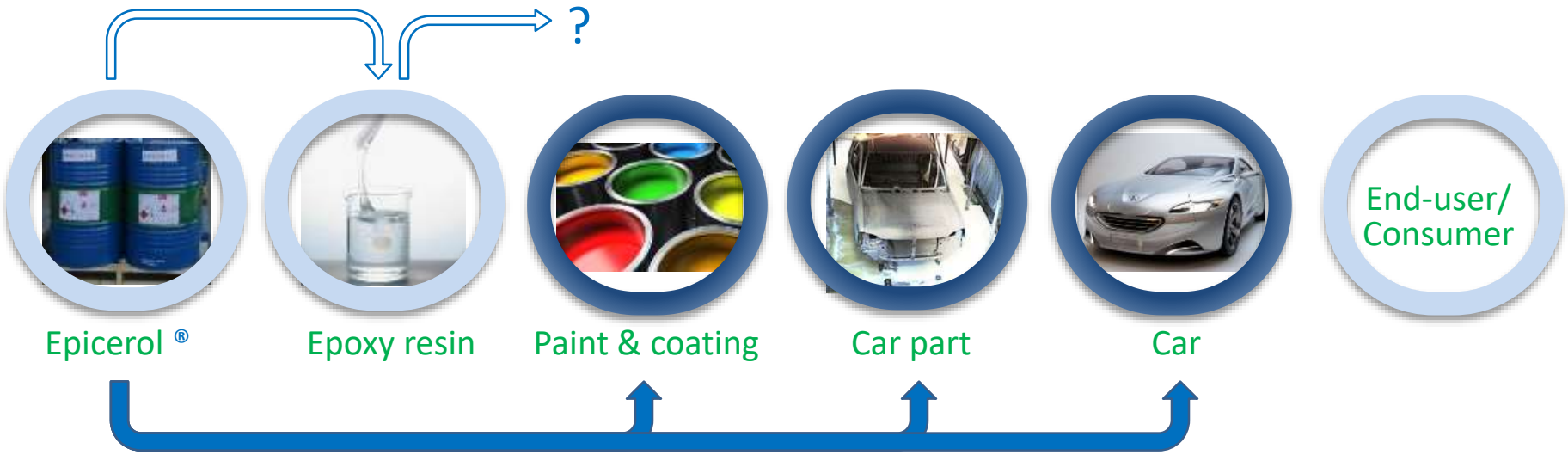
Comparative Life-Cycle Assessment



- A **comparative, cradle-to-gate LCA of Epicerol® vs. petro-based ECH** was conducted in 2012 and peer reviewed by Dekra Consulting.
- For each kg Epicerol® consumed (vs. petro-based ECH), the **carbon footprint is lowered by 2.56 kg CO_2 eq. or 61% reduction** including biogenic CO_2.
- ABT has been certified by **Roundtable on Sustainable Biomaterials (RSB)** since 2015.

Sustainability-Assisted Pull Marketing

Push Marketing - Targeting immediate customers

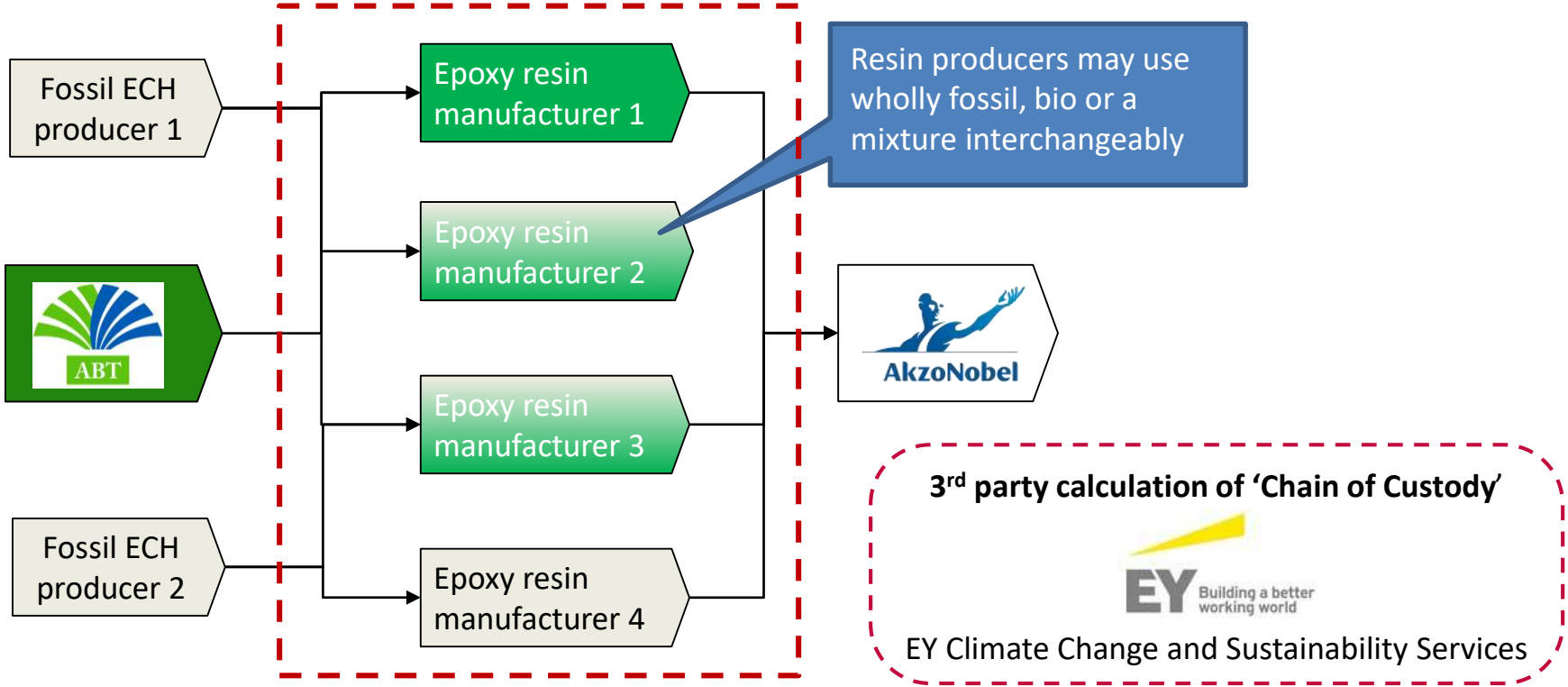


B2B PULL MARKETING **-** Direct communication with downstream users on the environmental benefits of Epicerol® that might impart to their products

Early Partnership with AkzoNobel

- [June 5, 2013] AkzoNobel will increase the use of renewable raw material in its paints and coatings by **progressively increasing the use of Epicerol®-based epoxy resins** that it is already using. By 2016, AkzoNobel aims to source 20 percent of its total epichlorohydrin demand as bio-based material.

Obstacle about Tracking & The 3rd Partner EY



Current Status of the Partnership

Media release

March 31, 2017

New tool launched to monitor bio-based materials in the chemical industry

AkzoNobel, ABT and EY join forces to encourage more transparent, sustainable chemistry

A new online tool which can track the use of bio-based raw materials in products has been launched as a pilot by project partners AkzoNobel, Advanced Biochemical (Thailand) Co., Ltd. (ABT) and EY.

It will be the first ever tool to use e-certification to track bio-based content along the value chain

Conclusions

- LCA not only gives insight about environmental footprint and room for improvement but also provides a **scientific back-up for marketing activities**.
- **Partnerships** especially about sustainability and new idea take energy and time to evolve.
- **Communication and data sharing**, to a compliant extent, along the whole value chain are essential to create a win-win partnership.
- Such partnership of Epicerol® may also be achieved in **other value chains**, for example, non-epoxy applications. This concept can be applied more broadly to other chemical value chains too.

Thank you!

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