THE FUTURE OF CARBON

Building Resilience in a Defossilized World

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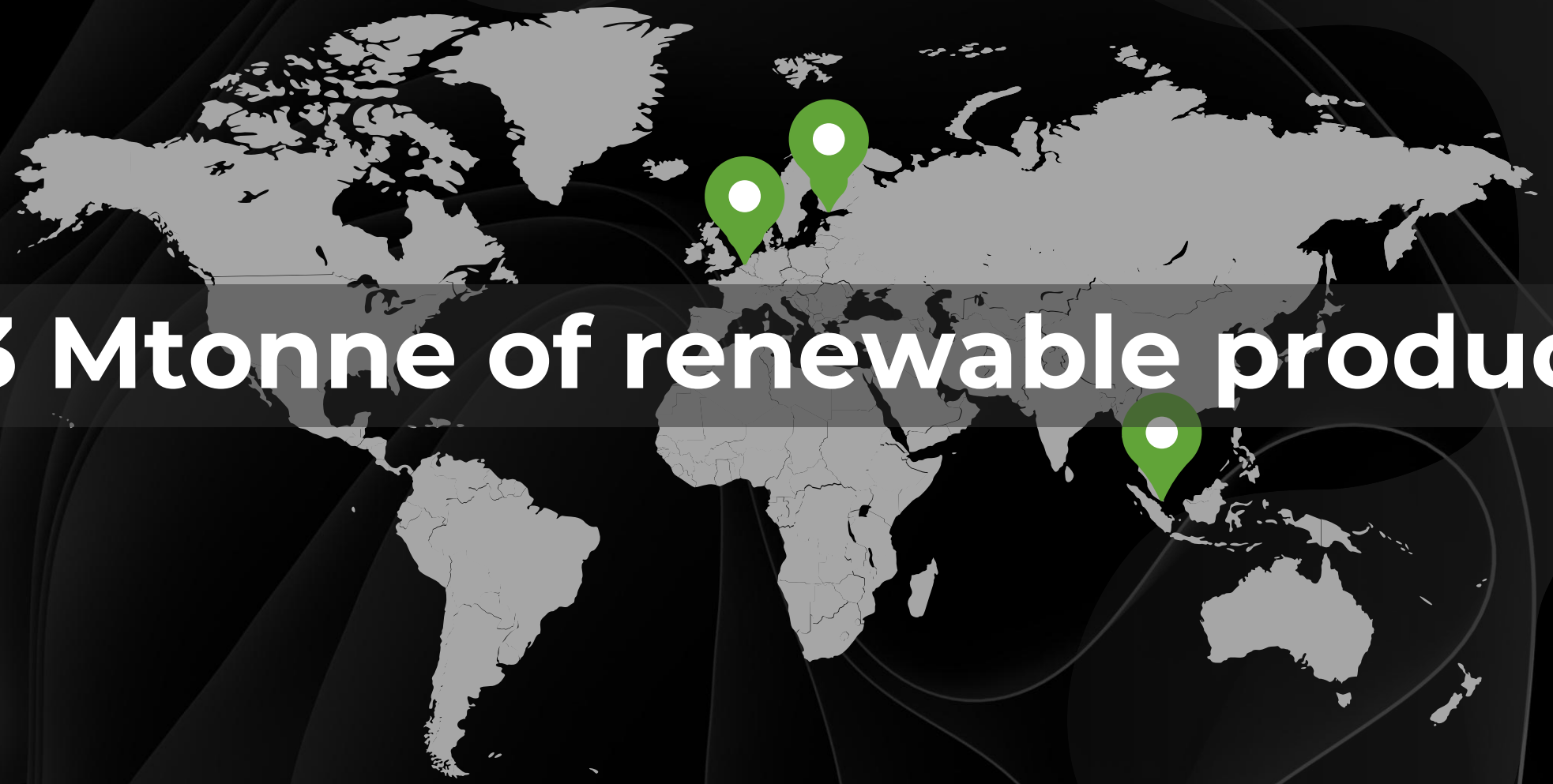
A STORY OF EVOLUTION

5 **B** Boron 10.81	6 **C** **Carbon** **12.01**	7 **N** Nitrogen 14.01
13 **Al** Aluminum 26.98	14 **Si** Silicon 28.08	15 **P** Phosphorous 30.97

Image source: Neste

NESTE'S RENEWABLE DIESEL SITES



3.3 Mtonne of renewable products

NESTE'S GLOBAL PARTNERSHIPS

PE & PP plastics

LyondellBasell

Polyurethanes

covestro

SK

Terephthalic acid

ENEOS

三菱商事

SUNTORY

NESTE'S TIMELINE FOR THE FUTURE

2020
Launched formal evaluation to transition Porvoo into global renewable and circular site

2025
Aims to support carbon-neutral aviation

2030
Aims to reduce customers' greenhouse gas emissions by 20 Mtonne/y

2030s
End crude oil refining and reach carbon-neutral production

2040
Aims to reduce "use phase" emissions of products sold and value chain emissions

Finland's Neste shares plummet on downbeat biofuel sales margin outlook

By **Reuters**

February 8, 2024 2:12 AM PST · Updated 9 months ago

REUTERS

Neste to deprioritize sustainable chemicals, polymers amid refocus on fuels

6:06 PM | February 14, 2025

Chemical Week
by S&P Global

Oil refiner Neste says CEO Matti Lehmus will be stepping down

By **Reuters**

April 29, 2024 12:33 PM PDT · Updated 6 months ago

REUTERS

Refiner Neste warns of weaker biofuel outlook, shares drop

By **Elviira Luoma** and **Essi Lehto**

September 11, 2024 4:46 AM PDT · Updated 2 months ago

REUTERS

A STORY OF EVOLUTION

Renewable hydrocarbons for fuels

NESTE

2000s

2025

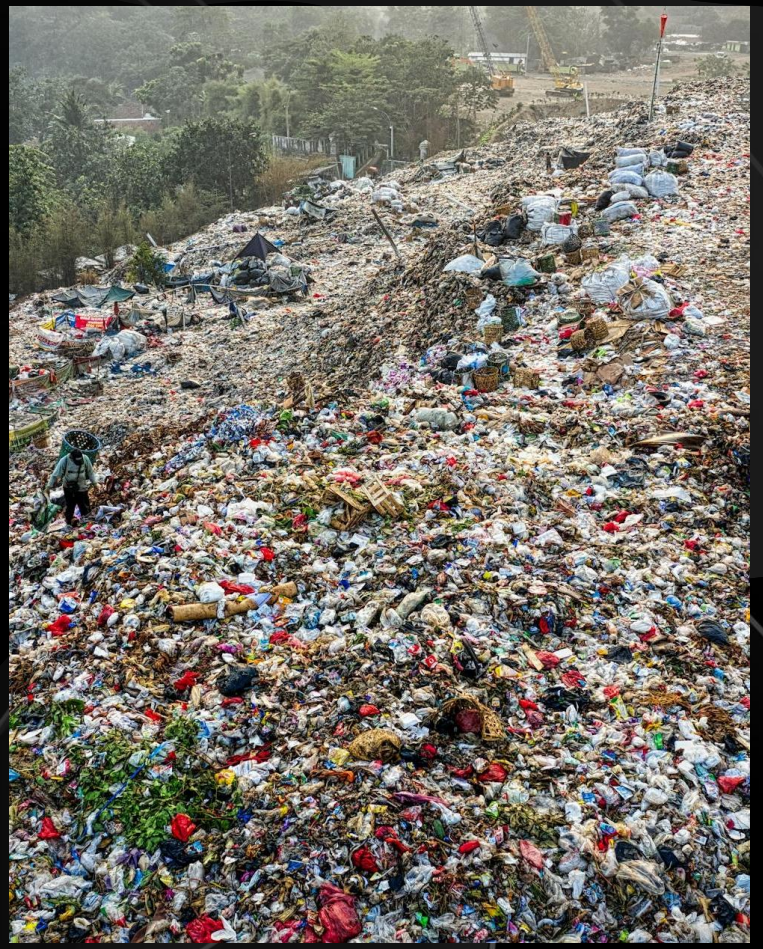
?

The Future

SUPPLY CHAIN RESILIENCE

DECARBONIZING MATERIAL INPUTS

WASTE VALORIZATION



The evolution of carbon has begun — your job is to identify the future-proof opportunities

AGENDA

01 **Understanding the pathways to defossilize**

02 Evaluating defossilization opportunities

03 Finding the right time to engage

IMPACT OF INDUSTRIAL DEFOSSILIZATION

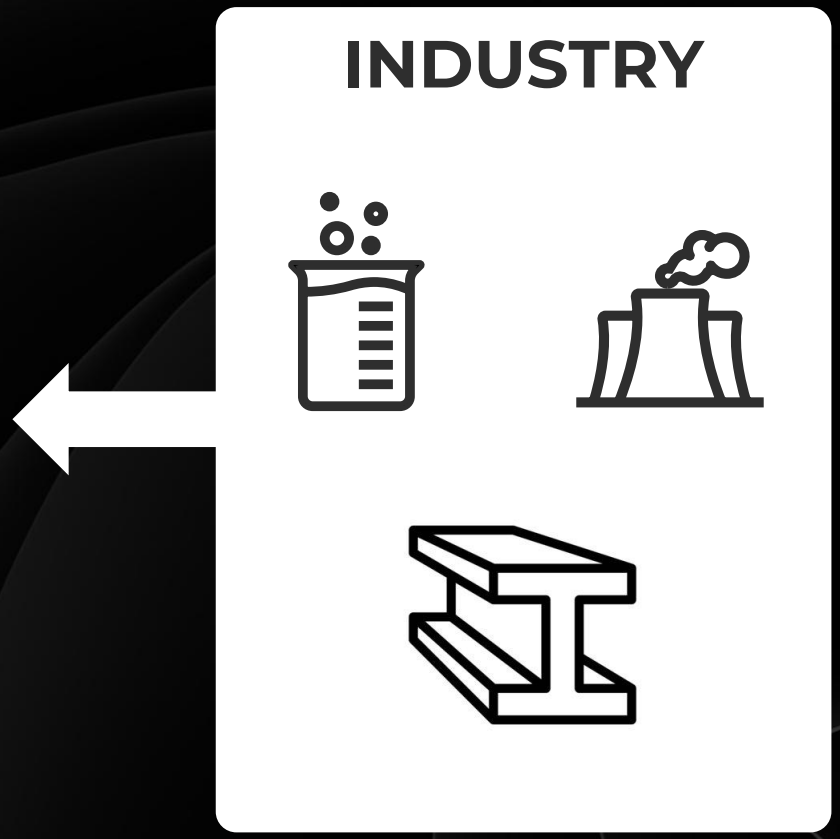
Upstream and downstream impacts

IMPACT OF INDUSTRIAL DEFOSSILIZATION

Upstream energy providers risk losing customers

Oil & Gas Industry

- **Crude oil**
- **Naphtha**
- **Natural gas**

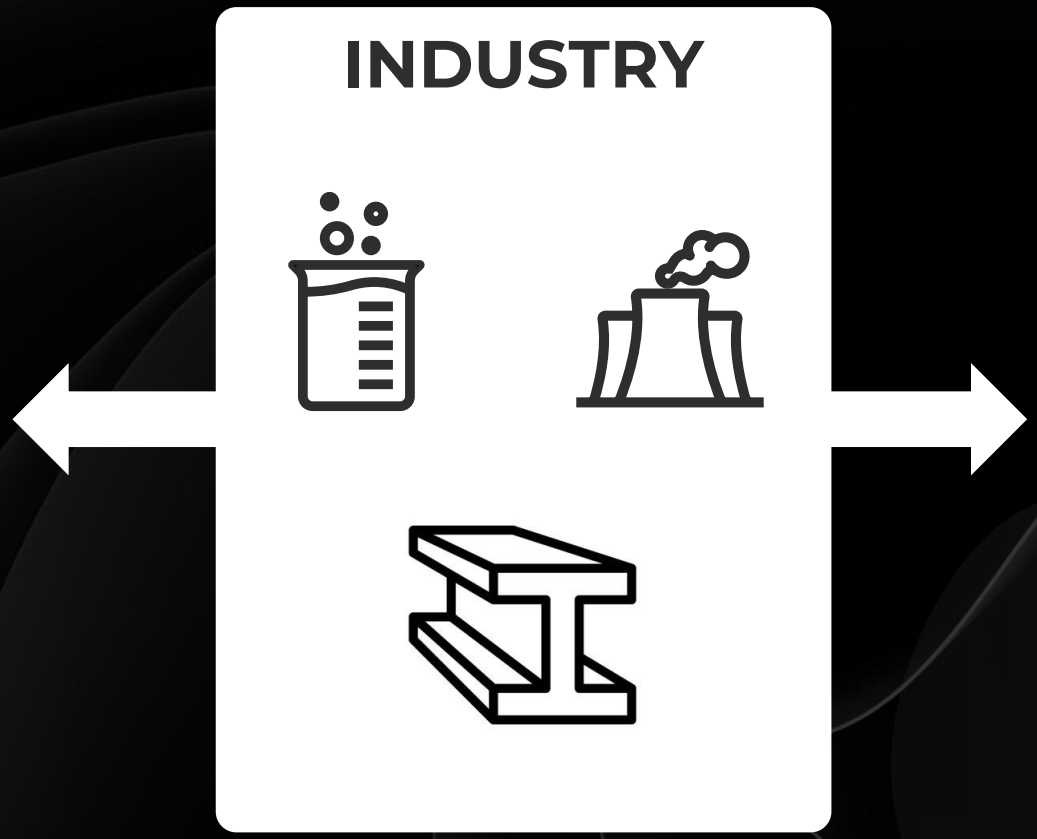


IMPACT OF INDUSTRIAL DEFOSSILIZATION

Downstream customers risk higher raw materials cost

Oil & Gas Industry

- Crude oil
- Naphtha
- Natural gas

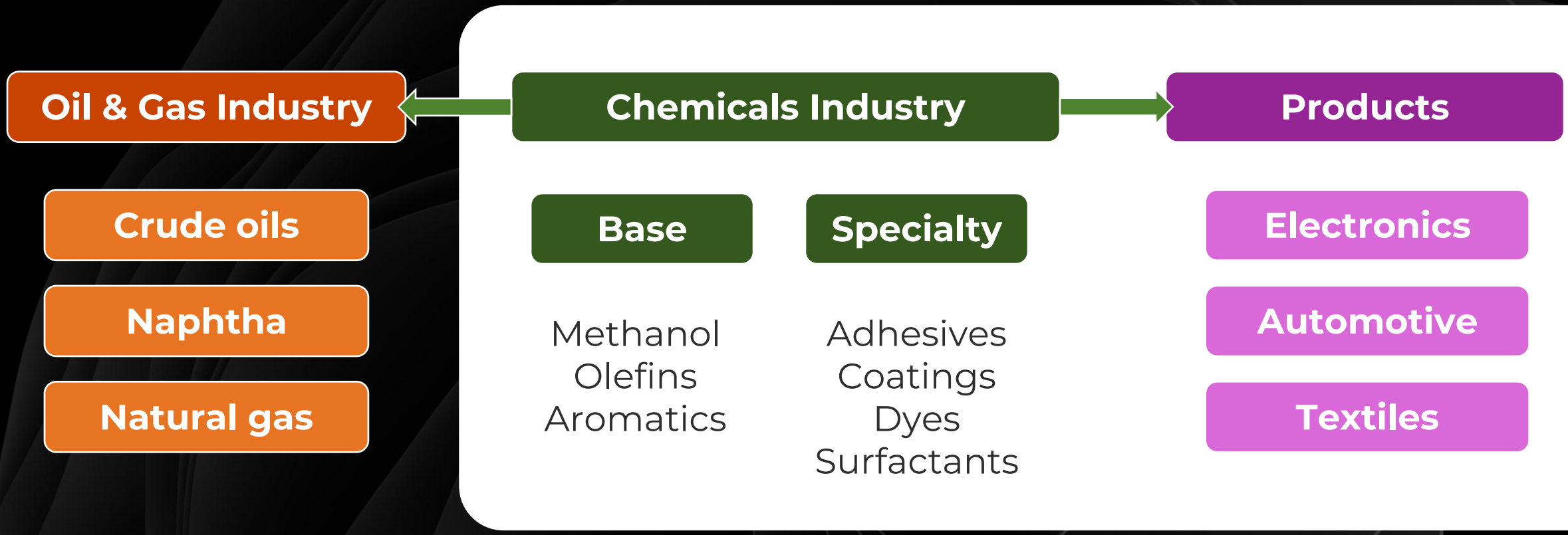


Products

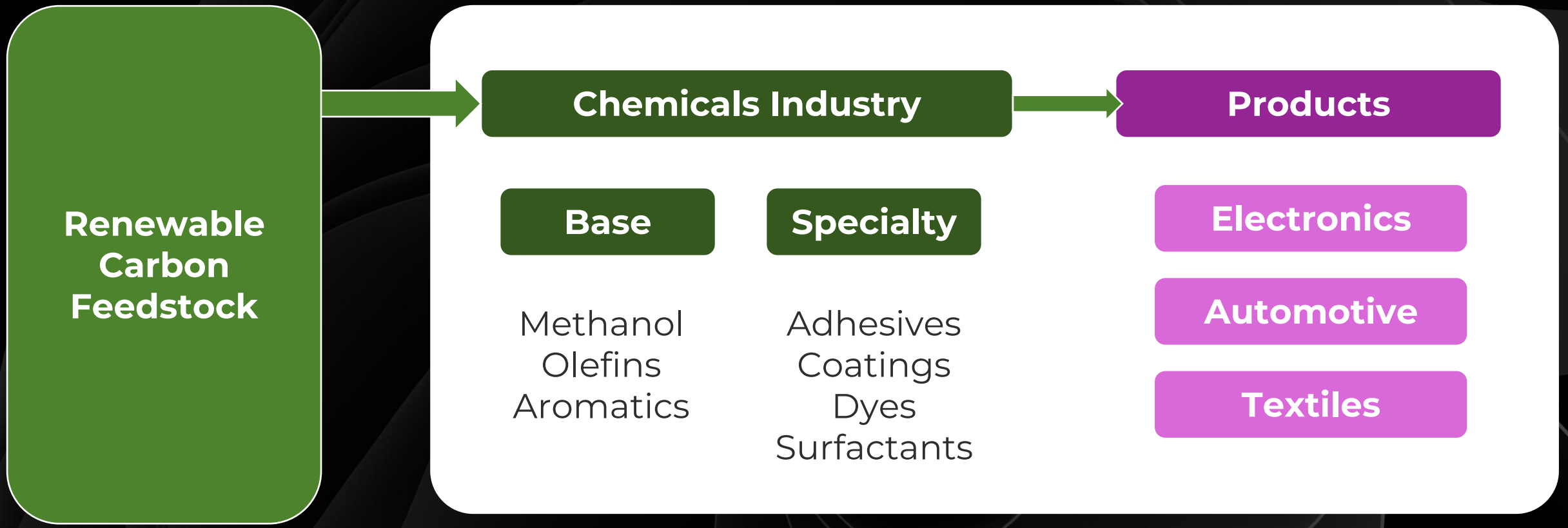
- Electronics
- Automotive
- Textiles

IMPACT OF DEFOSSILIZATION

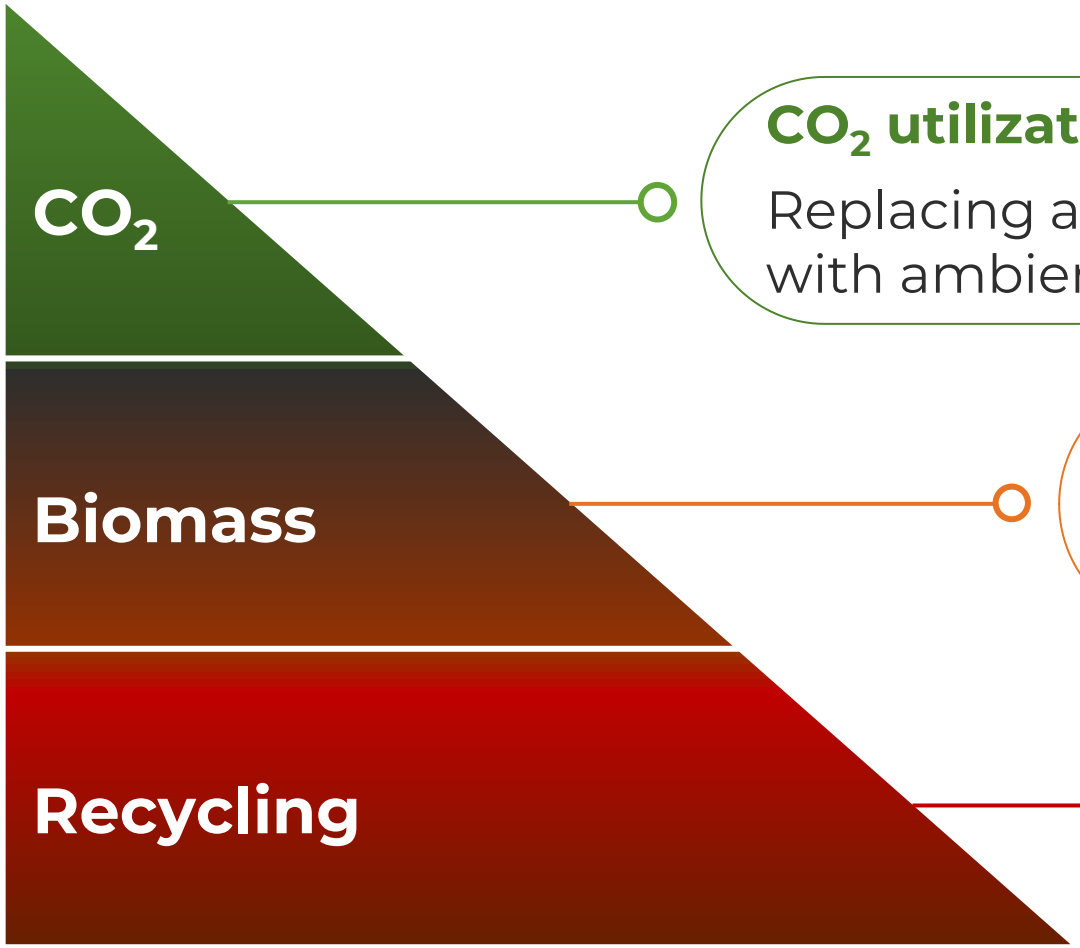
ASSUMING PRODUCTS DON'T CHANGE



THE FEEDSTOCK LEVER MUST EVOLVE



SIMPLIFIED FEEDSTOCK HIERARCHY



CO_2 utilization (long term)

Replacing all remaining fossil carbon with ambient CO_2, but at heavy cost

Biobased feedstock (midterm)

Replacing fossil carbon with biobased carbon, but often more costly than recycling

Plastic recycling (near term)

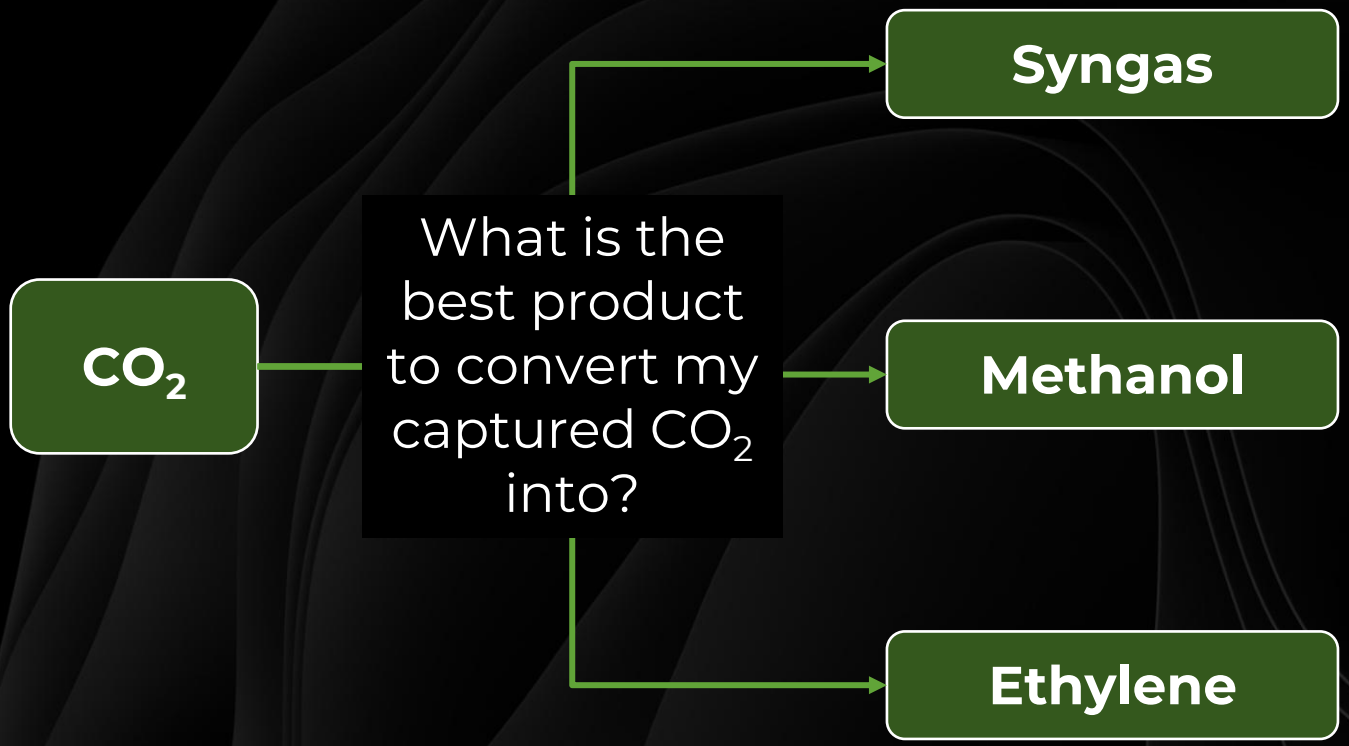
Retaining existing assets while eliminating virgin fossil inputs

BUT REALITY IS LESS LINEAR

Feedstock-process-product alignment is critical to evolve carbon sources

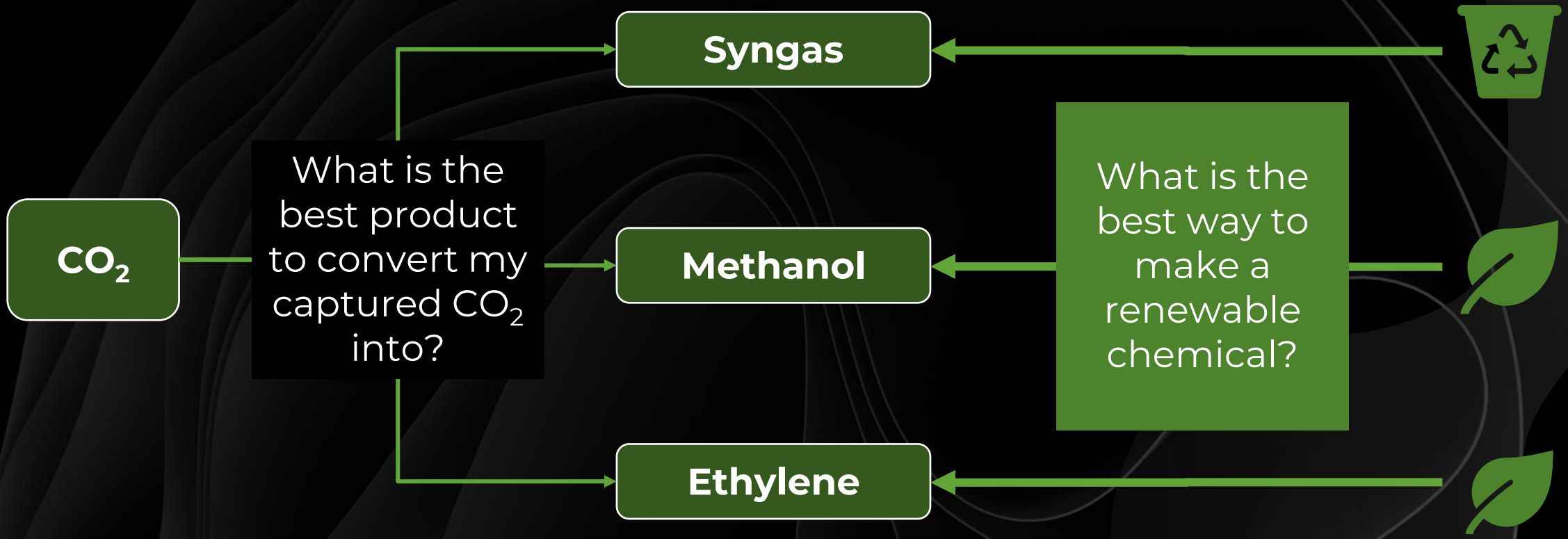
2 WAYS OF VIEWING THE PROBLEM

The feedstock lens



2 WAYS OF VIEWING THE PROBLEM

The product lens

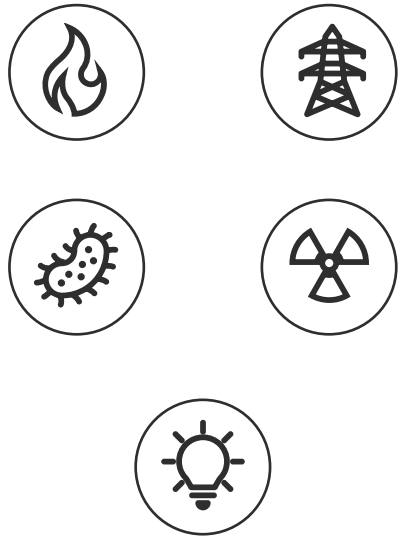


FEEDSTOCK-PROCESS ALIGNMENT

Different feedstocks will require different processing

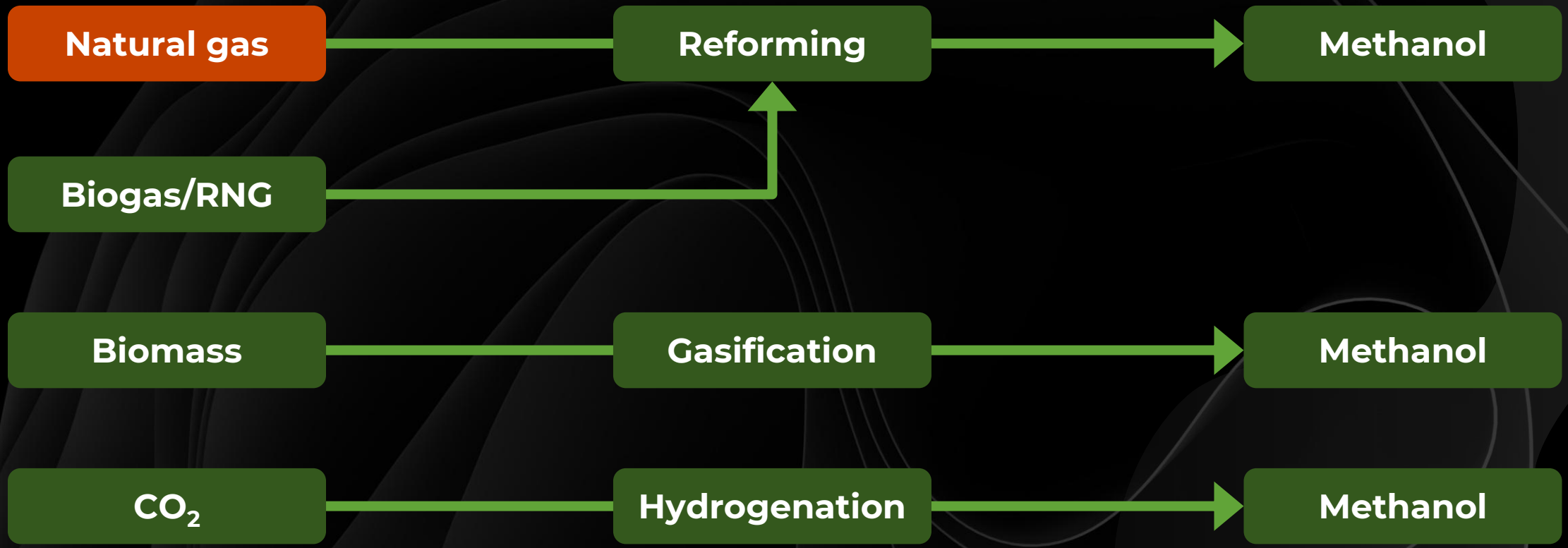
FEEDSTOCK

PROCESS



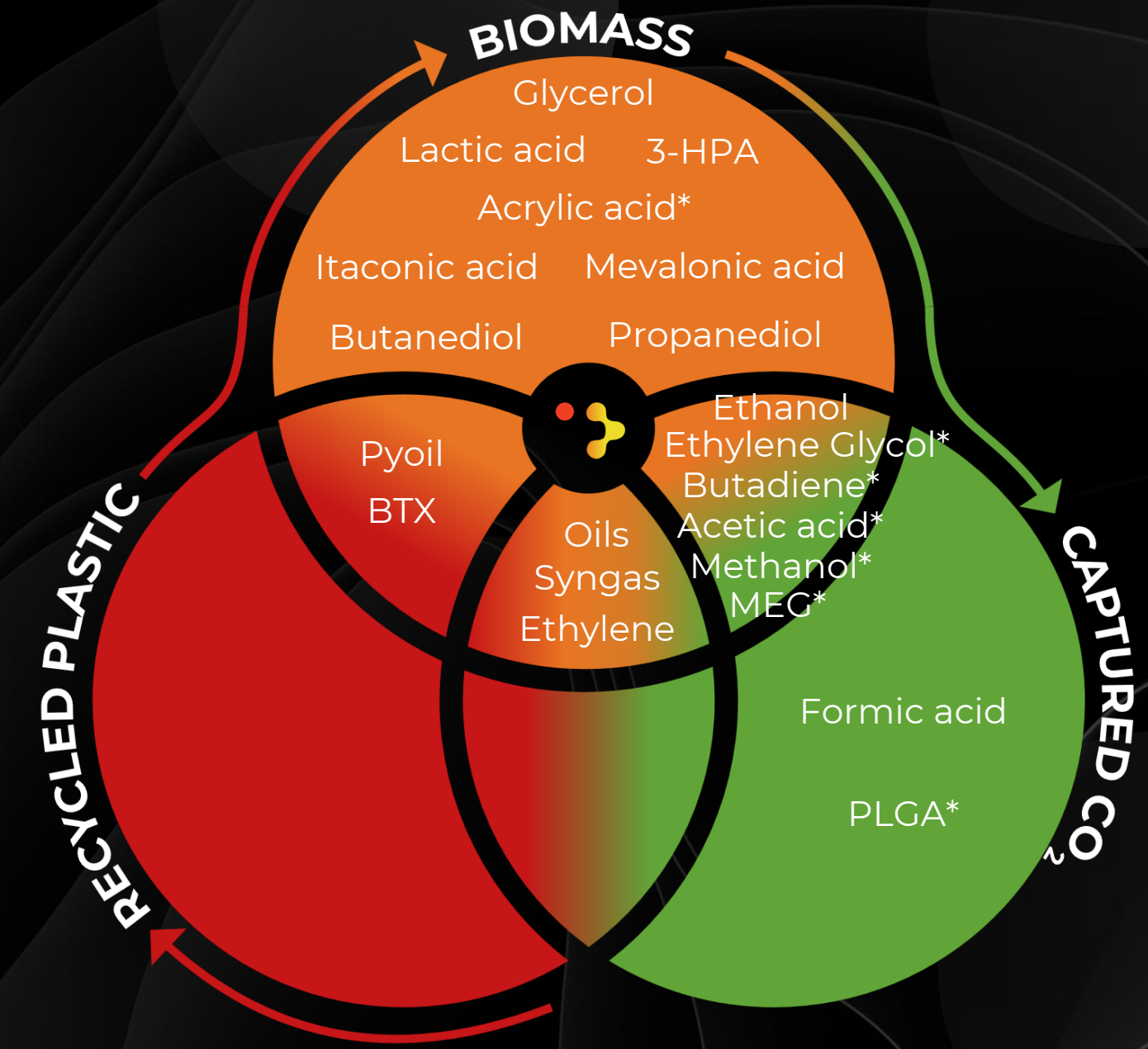
PRODUCT

BUT NEW FEEDSTOCK NEEDS NEW TECH

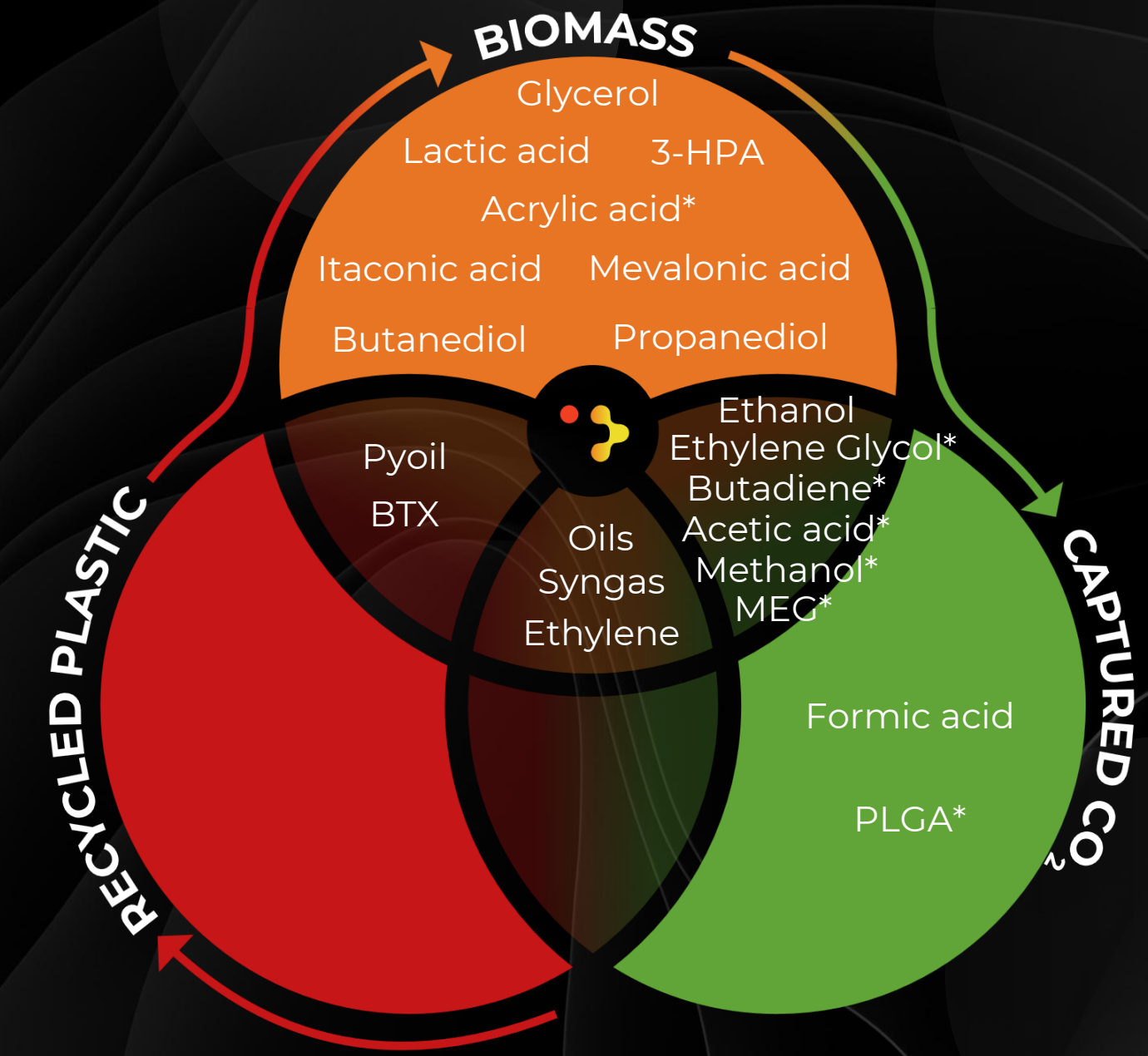


FEEDSTOCK-PRODUCT ALIGNMENT

Not all feedstocks are suitable for all products



*Indirectly produced from the feedstock via an intermediate



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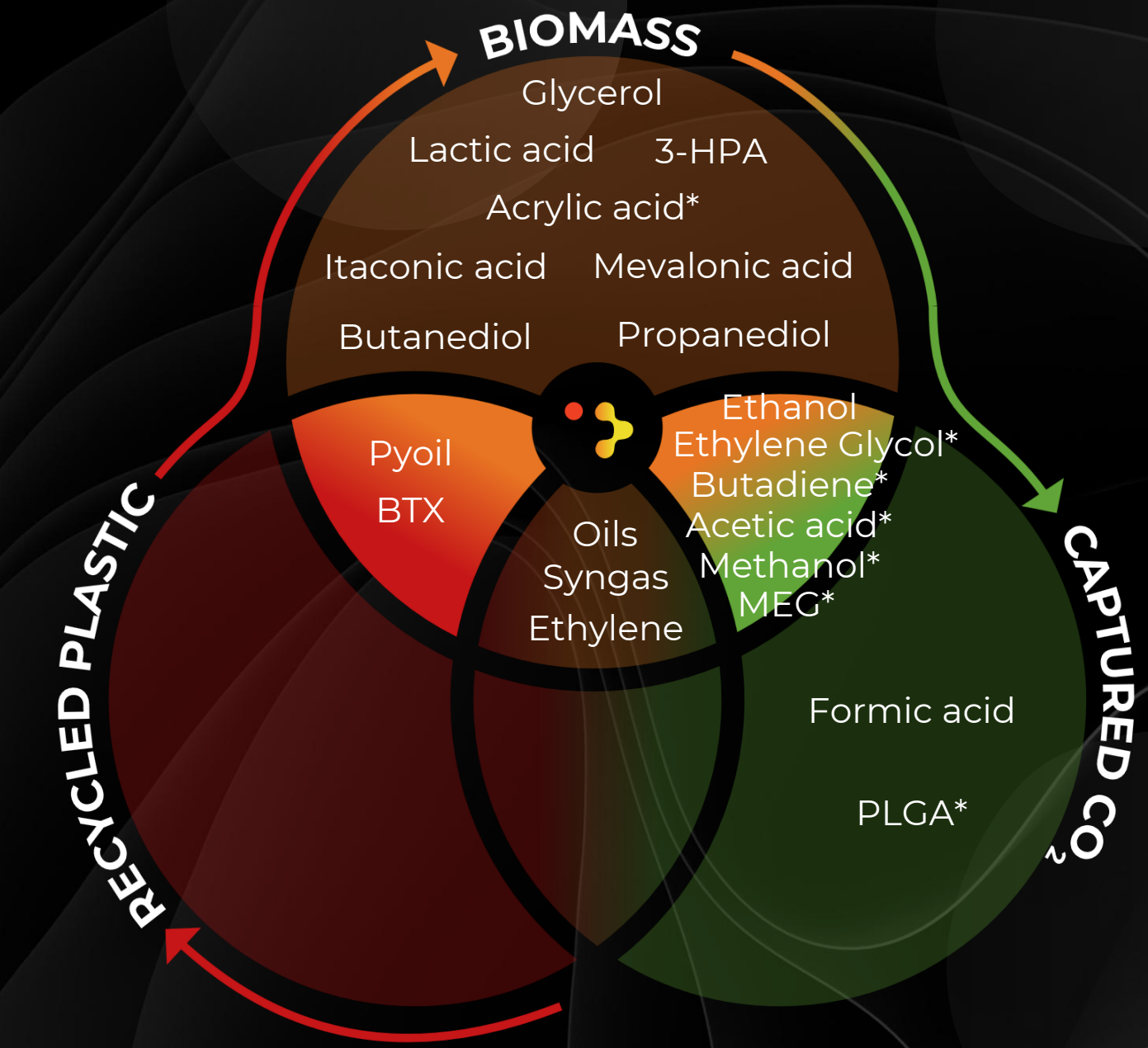
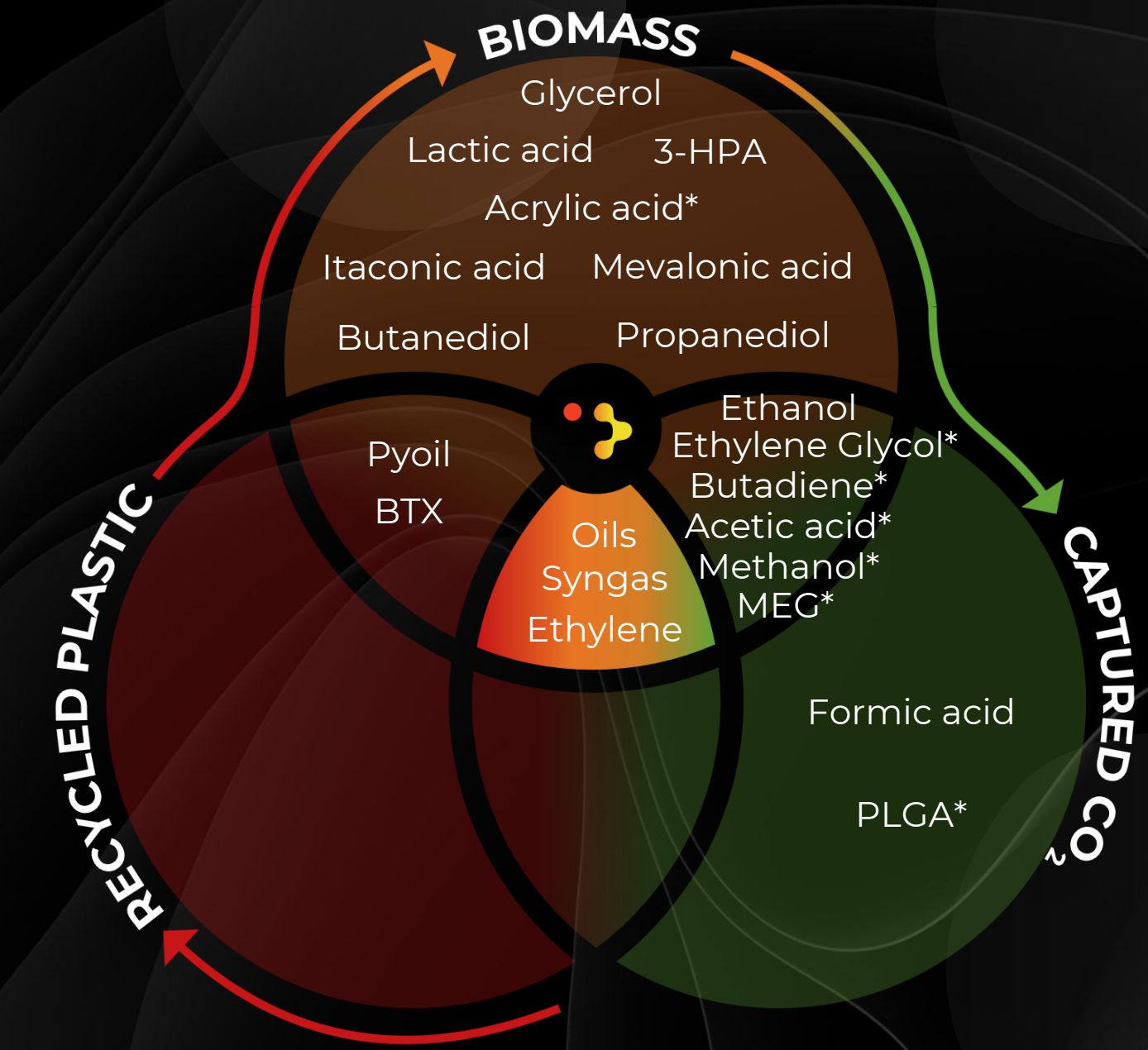


*Indirectly produced from the feedstock via an intermediate



*Indirectly produced from the feedstock via an intermediate

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02 **Evaluating defossilization opportunities**

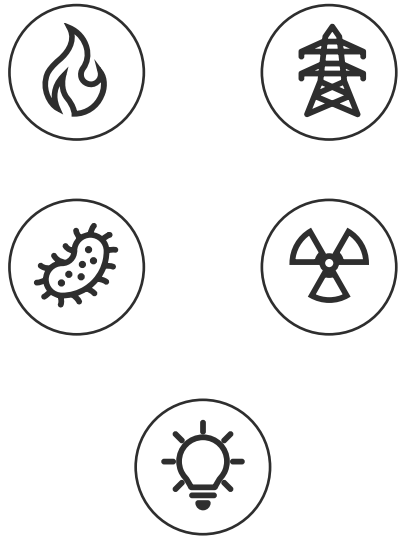
03 Finding the right time to engage

ASSESSING DEFOSSILIZATION OPTIONS

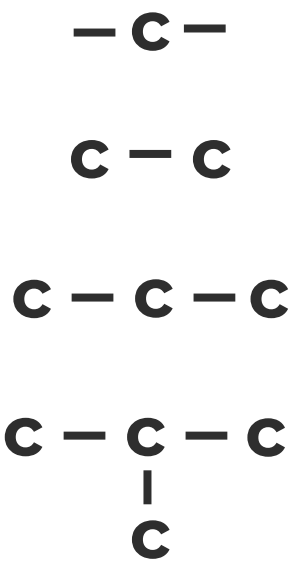
Feedstock-process-product alignment is critical to evolve carbon sources

FEEDSTOCK

PROCESS



PRODUCT

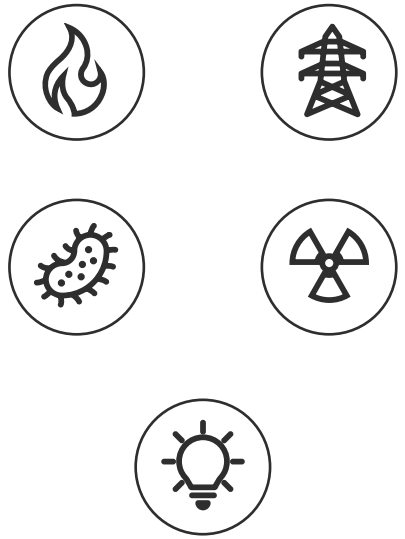


ASSESSING DEFOSSILIZATION OPTIONS

A methodology to evaluate defossilization opportunities

FEEDSTOCK

PROCESS



PRODUCT

Demand

Marketability

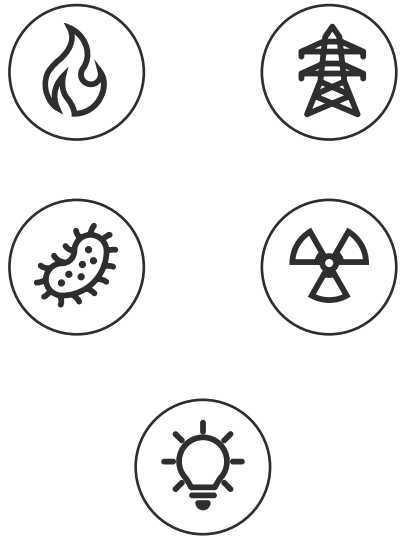
ASSESSING DEFOSSILIZATION OPTIONS

A methodology to evaluate defossilization opportunities

FEEDSTOCK

Availability

PROCESS



PRODUCT

Demand

Marketability

ASSESSING DEFOSSILIZATION OPTIONS

A methodology to evaluate defossilization opportunities

FEEDSTOCK

Availability

PROCESS

Resource intensity

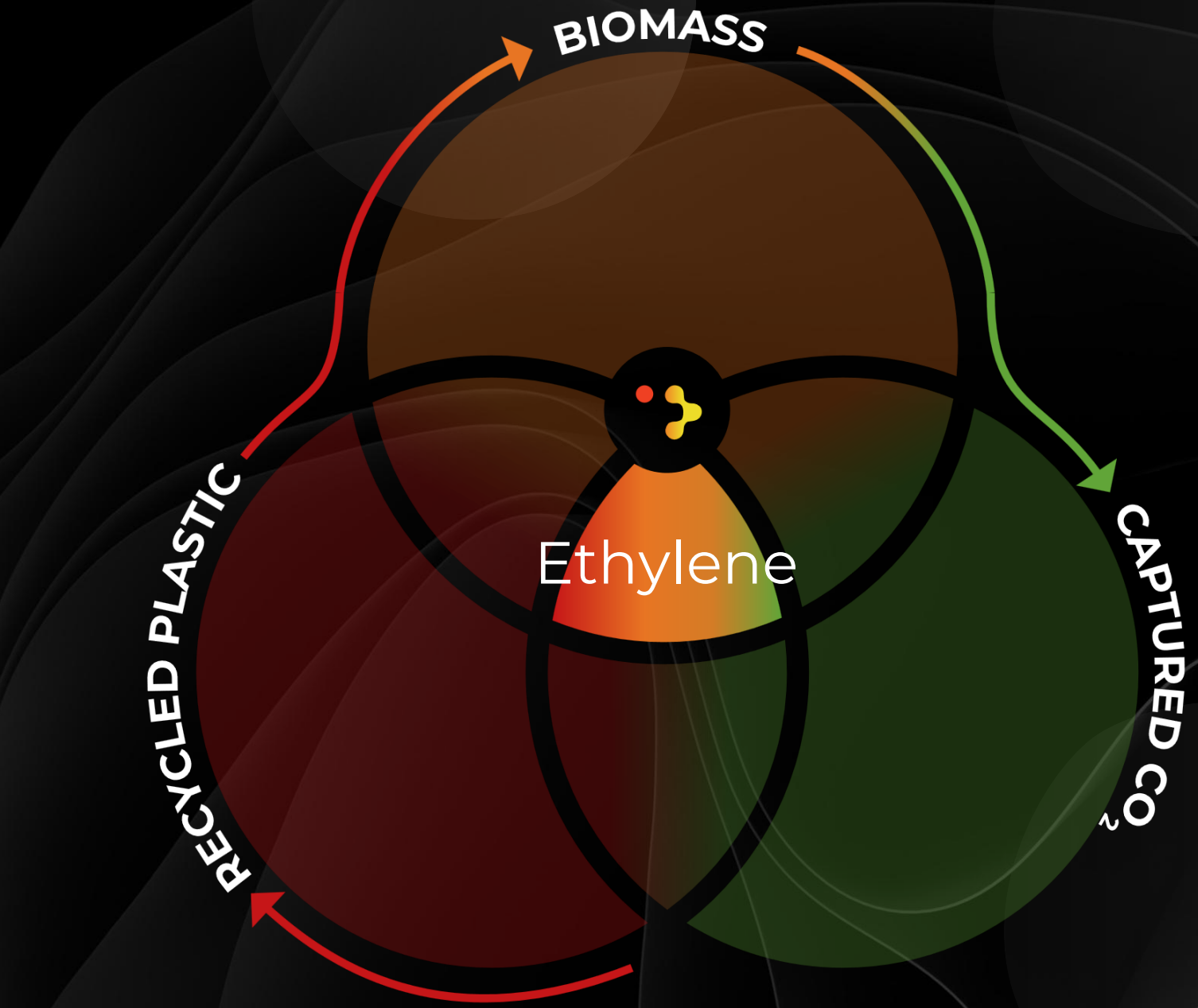
Tech maturity

Production cost

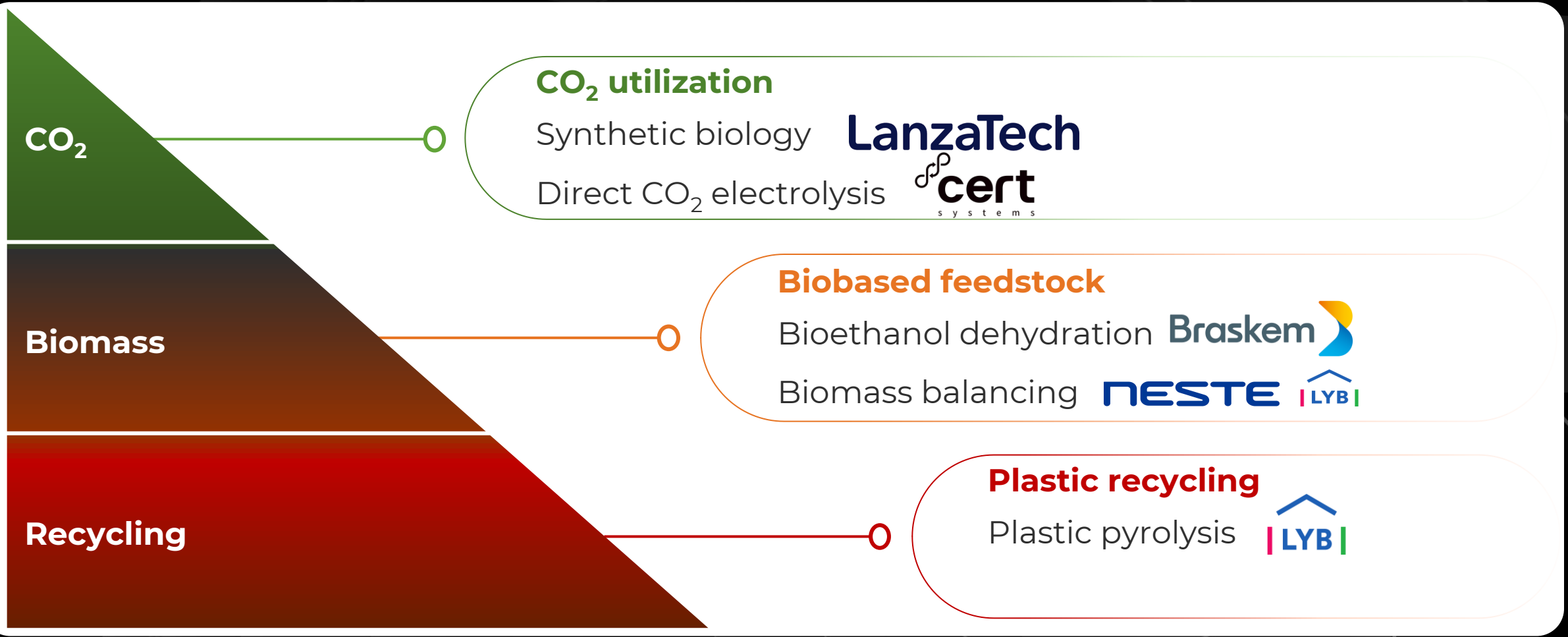
PRODUCT

Demand

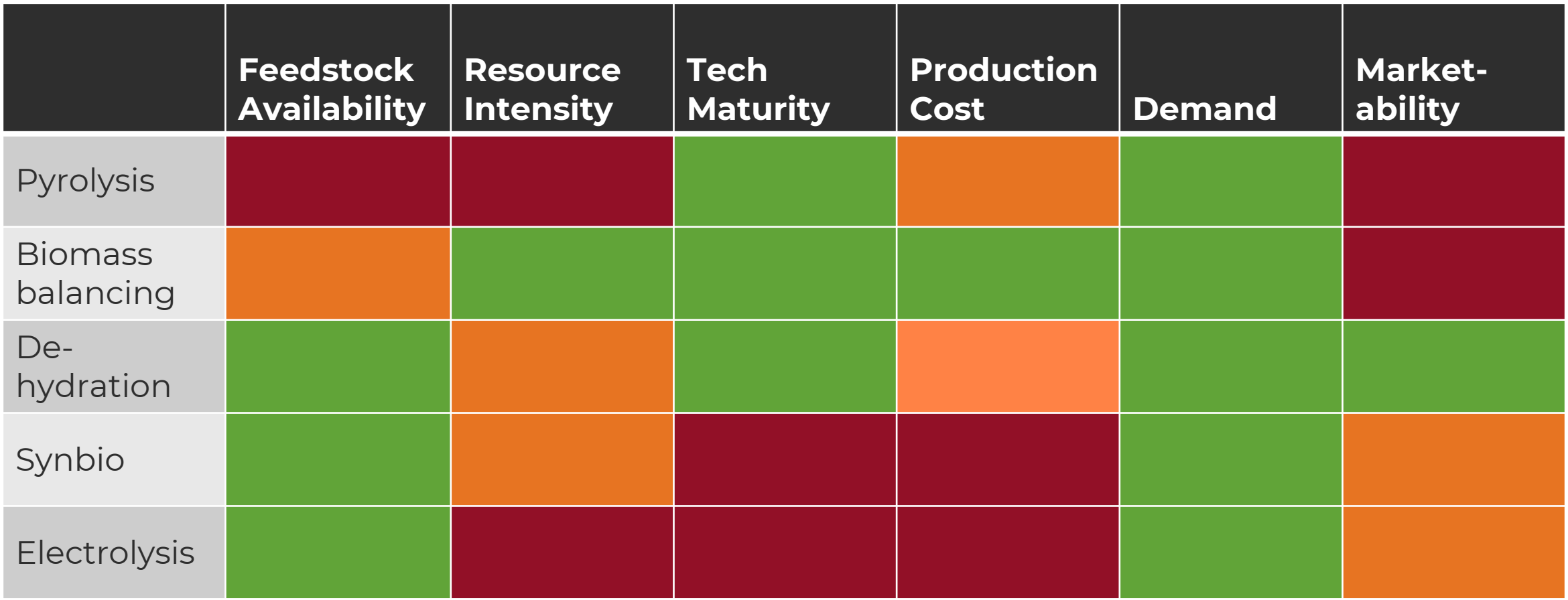
Marketability



DEFOSSILIZING ETHYLENE



ETHYLENE DEFOSSILIZATION OPTIONS



	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pyrolysis						
Biomass balancing						
De-hydration						
Synbio						
Electrolysis						

Major challenge | Moderate challenge | Low challenge

DEFOSSILIZATION STRATEGY – STEP 1

	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pyrolysis						
Biomass balancing						
De-hydration						
Synbio						
Electrolysis						

Assess the link between feedstock availability and technology maturity for the long term

Major challenge | Moderate challenge | Low challenge

DEFOSSILIZATION STRATEGY – STEP 2

	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pyrolysis						
Biomass balancing						
De-hydration						
Synbio						
Electrolysis						

Create near-term opportunities through infrastructure investment

Major challenge | Moderate challenge | Low challenge

DEFOSSILIZATION STRATEGY – STEP 3

	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pyrolysis						
Biomass balancing						
De-hydration						
Synbio						
Electrolysis						

Explore the link between cost and marketability

Major challenge | Moderate challenge | Low challenge

DEFOSSILIZATION STRATEGY – STEP 4

	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pyrolysis						
Biomass balancing						
De-hydration						
Synbio						
Electrolysis						

Stay aware of external defossilization drivers that impact demand

Major challenge | Moderate challenge | Low challenge

DEFOSSILIZATION STRATEGY – STEP 4

	Feedstock Availability	Resource Intensity	Tech Maturity	Production Cost	Demand	Market-ability
Pathway 1						
Pathway 2						
Pathway 3						
Pathway 4						
Pathway 5						

Major challenge | Moderate challenge | Low challenge

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SUPPLY CHAIN RESILIENCE

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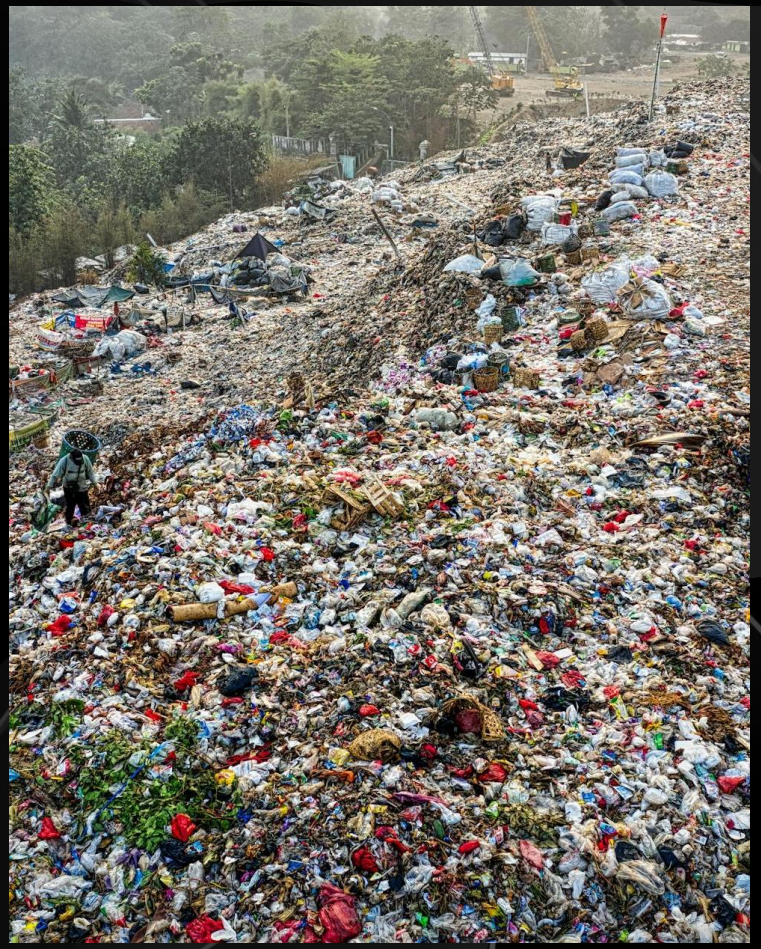
WASTE VALORIZATION



KEY TAKEAWAYS

1

Feedstock-process-product alignment is critical to understanding opportunities for unlocking future carbon sources.

2

There will be near-term opportunities exploiting the marketability of products — but pay attention to the overall strength of defossilization drivers impacting demand.

3

Value chain developments could also unlock pathways to defossilize, especially when they can stand in the way of mature technologies.

THANK YOU

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