METHANOL INSTITUTE

Renewable methanol and DME developments

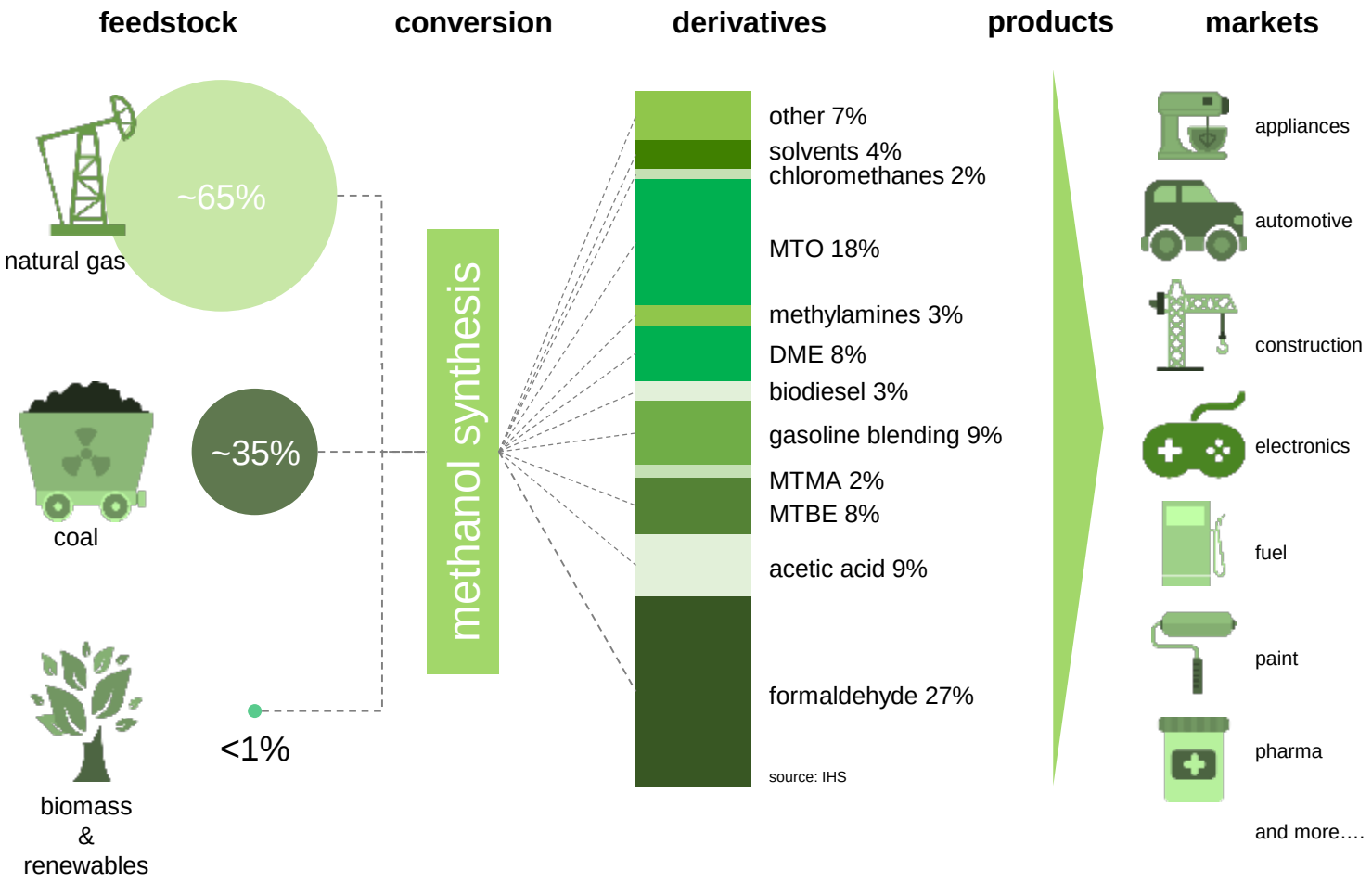
Eelco Dekker, Chief EU Representative

Methanol Institute

Gothenburg, September 19th, 2018

01 Driving forces

Broad feedstock range, many applications



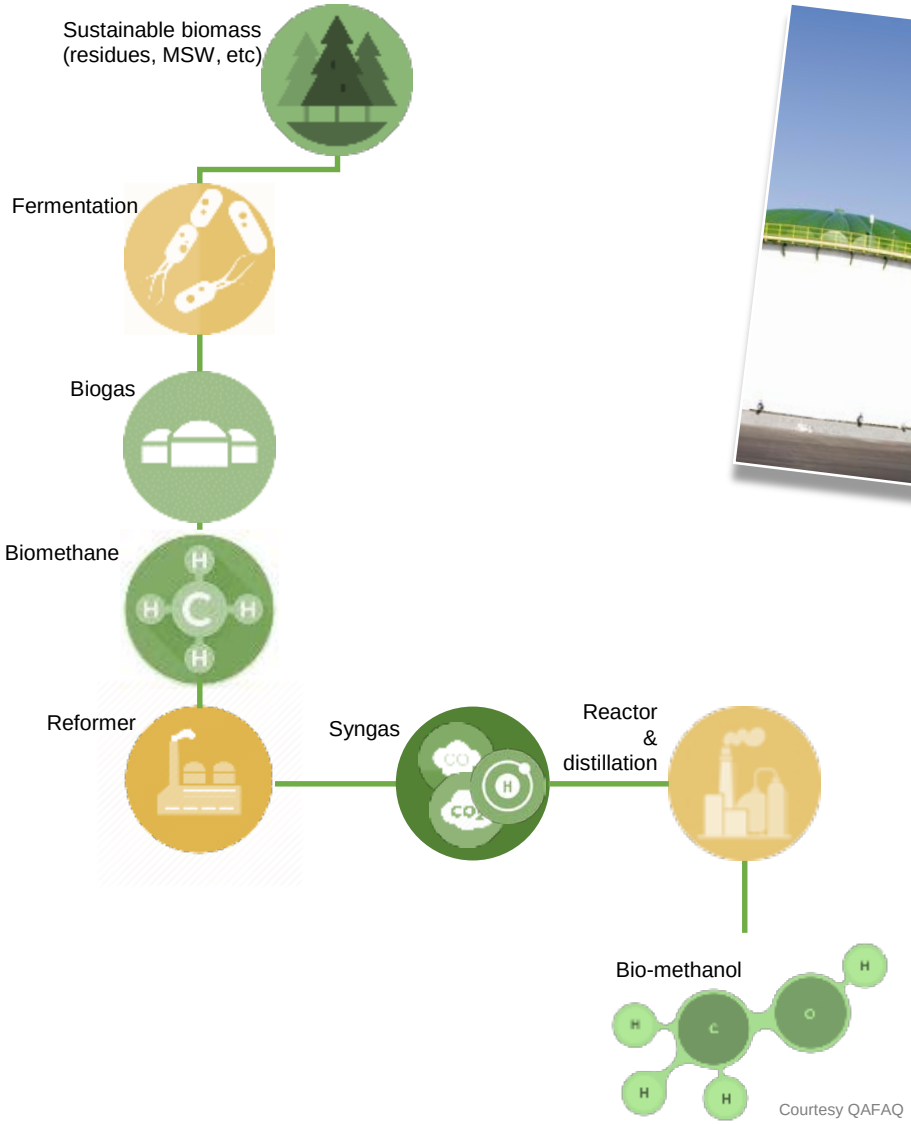
Developments driven by three forces

02 Renewable methanol supply

Starting with biomass

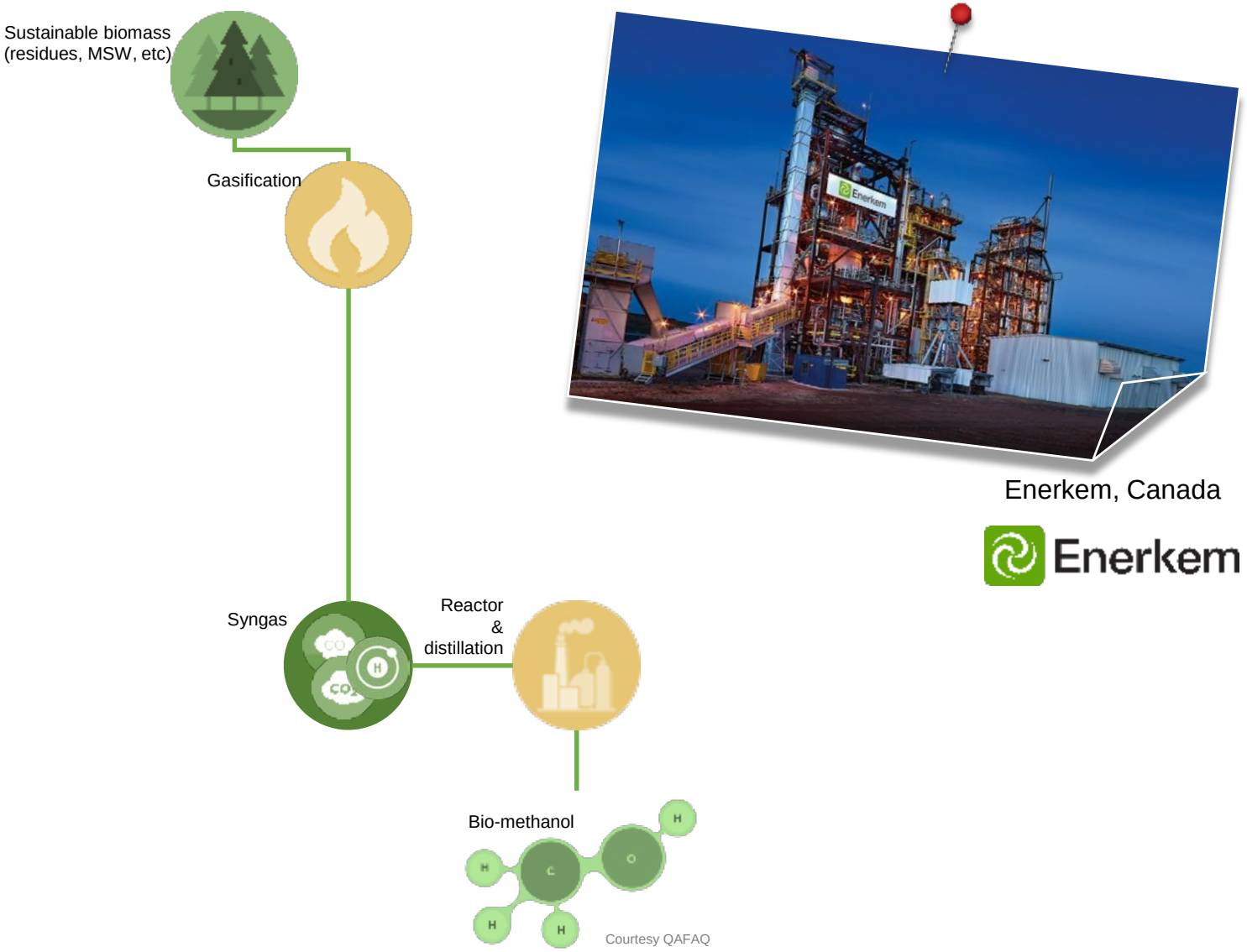
Sustainable biomass
(residues, MSW, etc)

Modern approach to biorefining



BioMCN, The Netherlands

Or gasification to syngas



Enerkem, Canada

Enerkem

And from pulp mill processes

Sustainable biomass
(residues, MSW, etc)

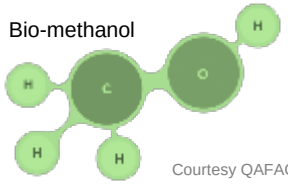
Kraft
process

Södra, Sweden

SÖDRA

Reactor
&
distillation

Bio-methanol

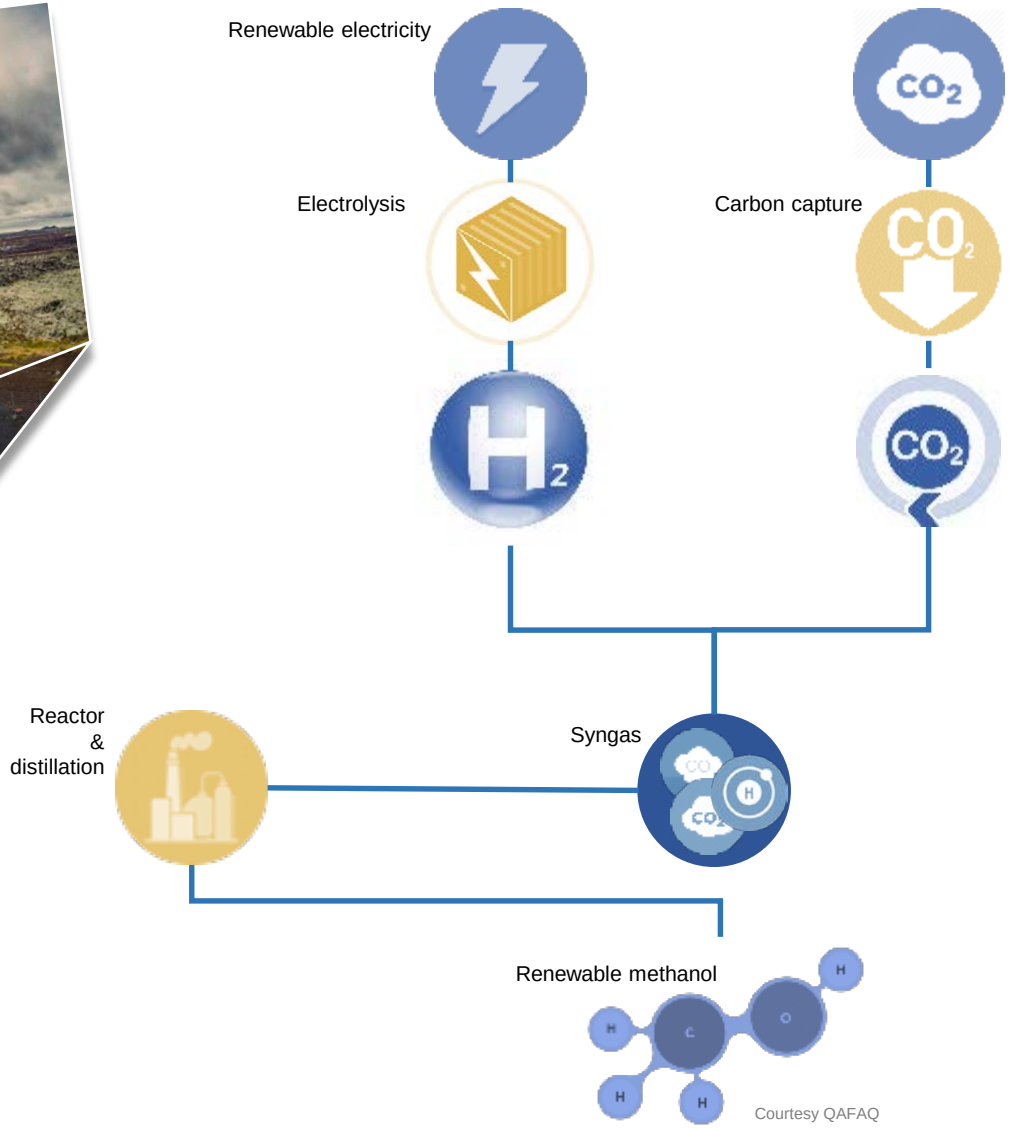


Courtesy QAFAQ

E-methanol provides a whole different route

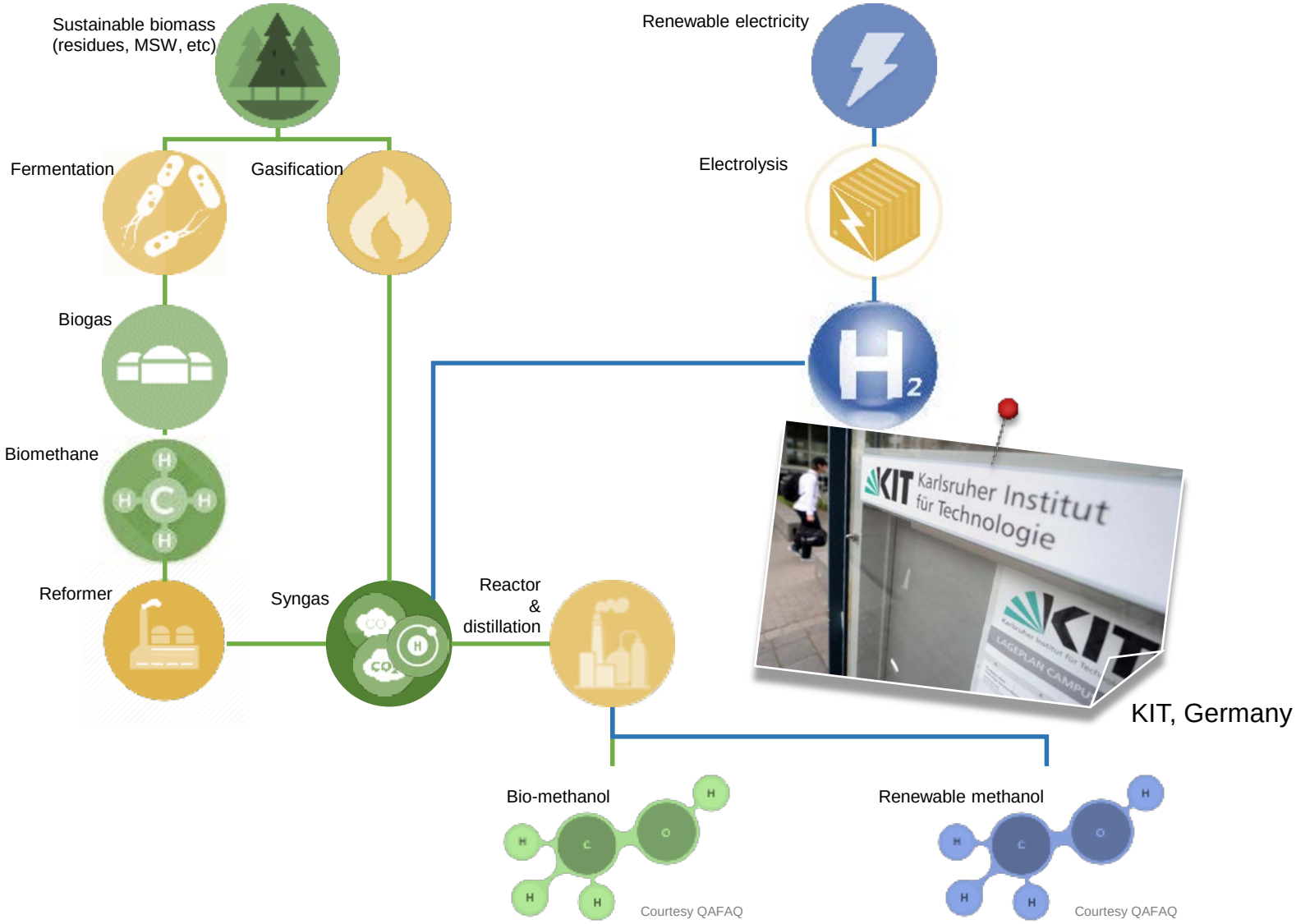
CRI, Iceland

CARBON RECYCLING INTERNATIONAL

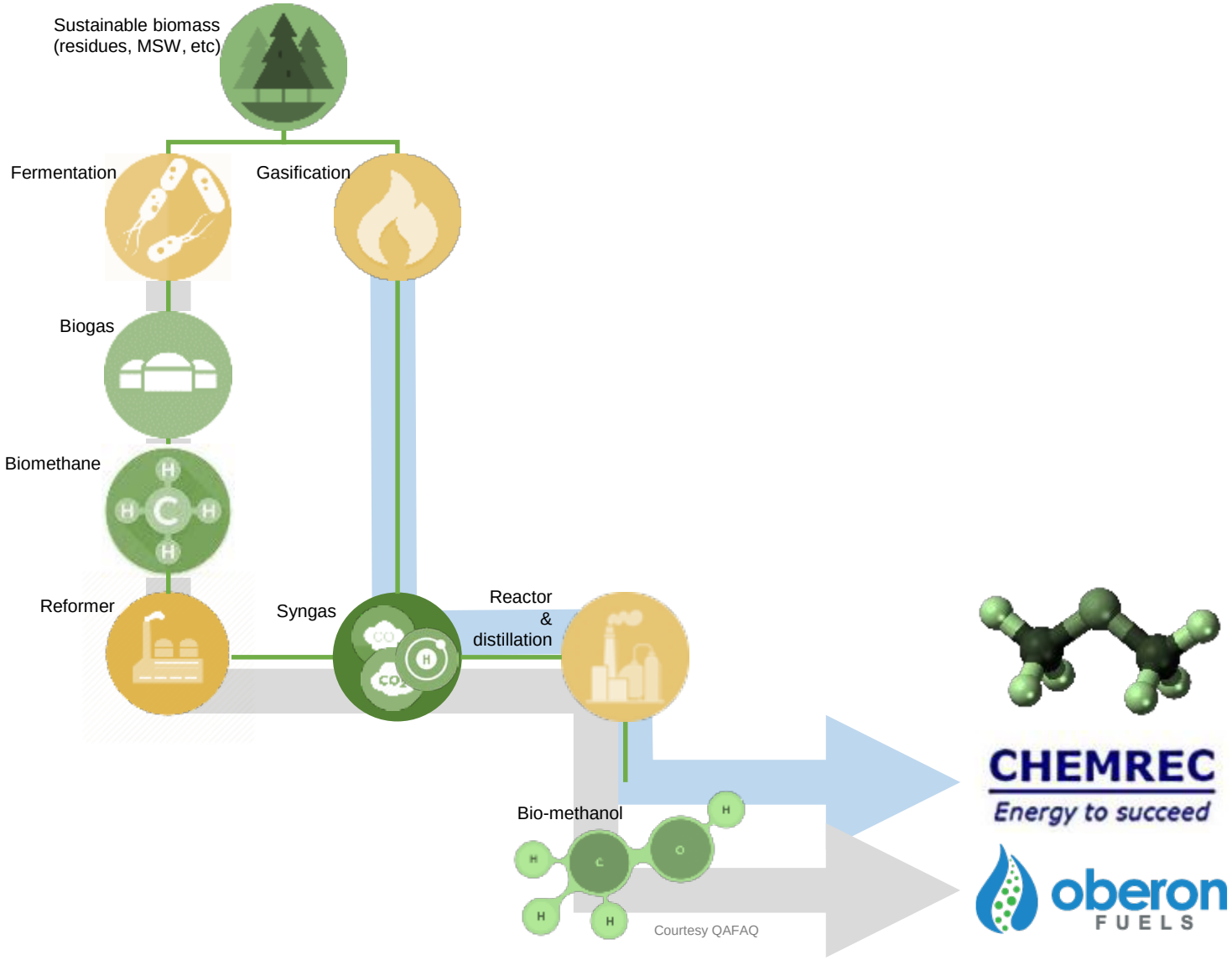


Courtesy QAFAQ

Whereas hybrid pathways increase efficiency



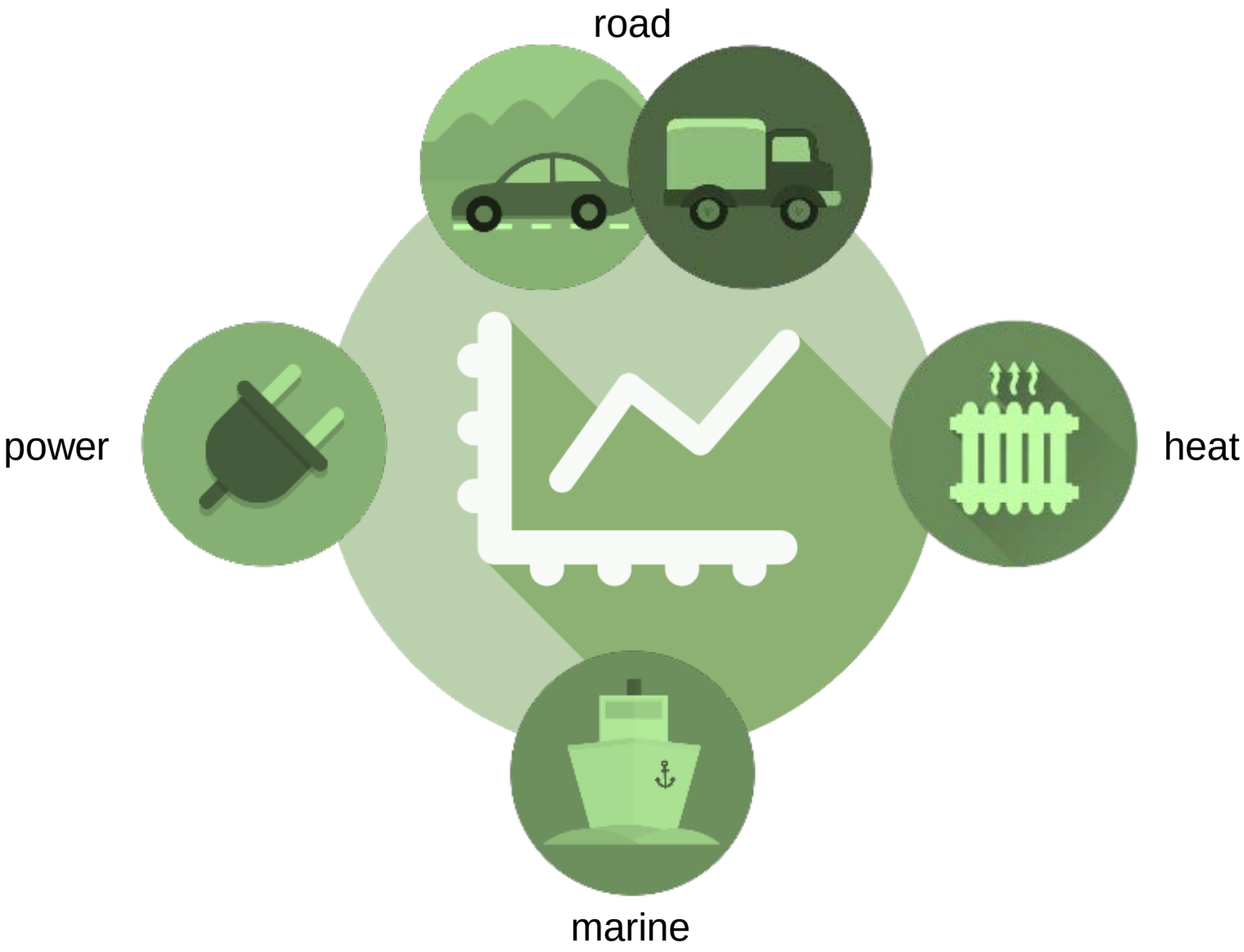
Opening routes to bio-DME



03 Methanol fuel use increasing

Fuel use developing globally

Clean energy solutions drive new markets



Solutions for gasoline ànd diesel engines

gasoline

diesel

Low blends

Mid level blends

High blends

FAME

MD95

DME

Alternative marine fuel developments

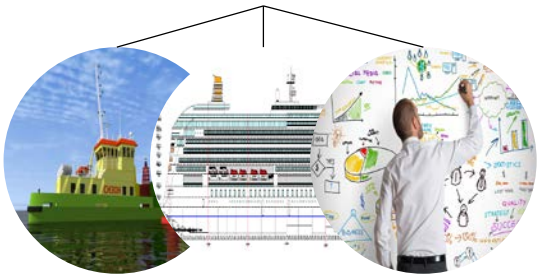
COMBUSTION ENGINE

7x *+4x*	1x	1x
chemical tankers	ROPAX ferry	Pilot boat
MOL, WL, Marinvest	Stena Line	Swedish Maritime Admin.
2 stroke MAN	4 stroke Wärtsila	high speed Scania, Volvo, a.o.
new build	retrofit	retrofit

FUEL CELL

2x	1x
Tourist boat	Ferry
Innogy HTWG Konstanz	Viking Line
Serenergy fuel cell stacks	
retrofit	retrofit

PROJECT and R&D



Cruise ships, fishing boat, barge, dredge, a.o.
Billion Miles, Summeth/Martec, HyMeth Ship, Lean Ships, Methaship, a.o.
SI hybrid, dual fuel, etc.
new build & retrofit

Powering low emissions electricity

Fuel cells

- Stationary back up power
- Hotel load
- Range extender

Gensets

Turbines

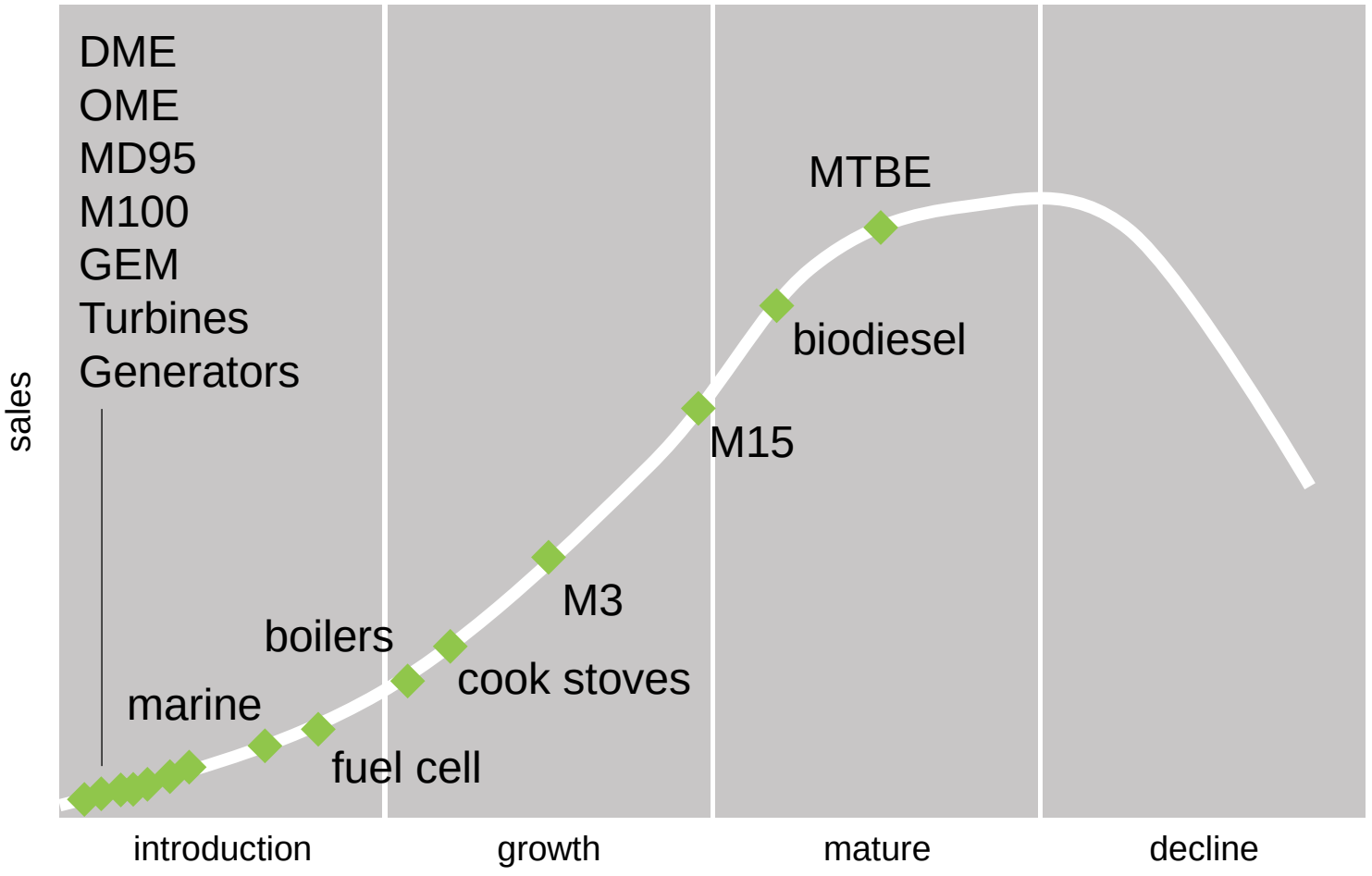
Displacing solid fuels to provide clean heat

Industrial boilers

PROJECT GAIA ENERGY REVOLUTION

Cook stoves

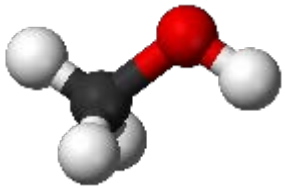
Different stages of the life cycle



04 Moving forward

The future is bright

Legislation drives changes to clean, renewable alternatives



Methanol, and its derivatives offer many benefits

Especially when made from sustainable feedstocks

In a range of different applications from cars to ships, from power to heat

Essential to remove prejudices against methanol

05 Contacts

CONTACTS

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Appendices

A global industry association

- First formed in 1989, the Methanol Institute (MI) serves as the trade association for the global methanol industry.

- MI represents the world's leading methanol producers, distributors and technology companies from offices around the world

MI provides value to its members by:

- Ensuring safe handling of methanol and its derivatives
- Promoting methanol growth by furthering methanol as an essential chemical commodity and an emerging source of clean and renewable energy
- Influencing global regulatory and public policy initiatives that impact the methanol industry

2018 members

At different stages of development

Methanol category	Commercial	Feasibility and R&D	Stopped or On-hold
Bio-methanol	• BioMCN (NL) • Enerkem (CAN) • New Fuel (DEN) • Oberon (USA)	• Biogo (GER) • Enerkem (NL) • LowLands Methanol (NL) • Södra (SE)	• BioMCN (glycerine) (NL) • Chemrec (SE) • Range Fuels (USA) • Schwarze Pumpe (GER) • Värmlands Metanol (SE) • Woodspirit (NL)
Renewable methanol	• CRI (IC) • Innogy (GER)	• Blue Fuel Energy (CAN) • CRI (CN) • Infraserv (GER) • Liquid Wind (SE) • Port of Antwerp (BE) • STEAG (GER) • Swiss Liquid Future (CH) • ZASt (GER)	
Hybrid methanol		• Haldor Topsoe (DEN) • OPTIMeoH (GER)	
Low carbon methanol	• GPIC (BAH) • Methanex (CAN) • QAFAC (QAT) • SABIC (KSA)	• Carbon2Chem (GER) • FRESME (SE) • NCF (CN)	