



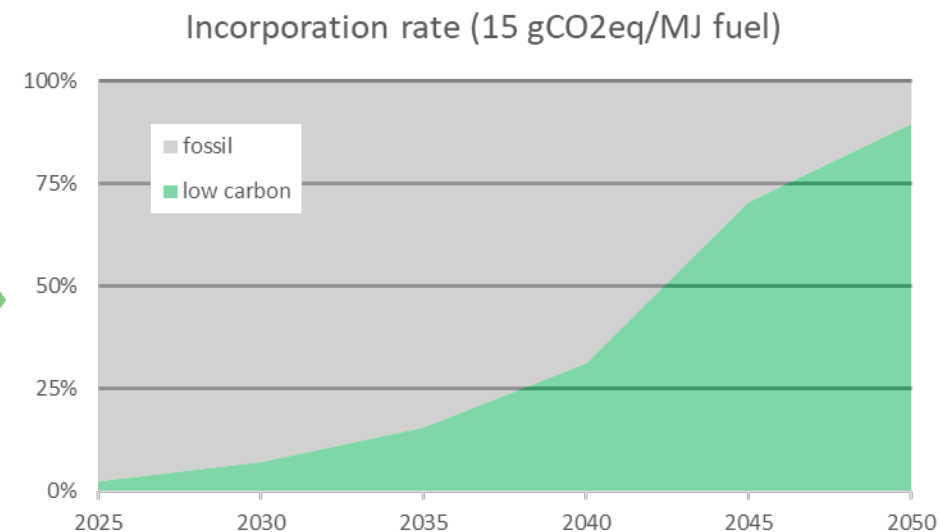
Need of a supporting regulation to accelerate shipping decarbonation

EU Shipping BCE

19/09/2022

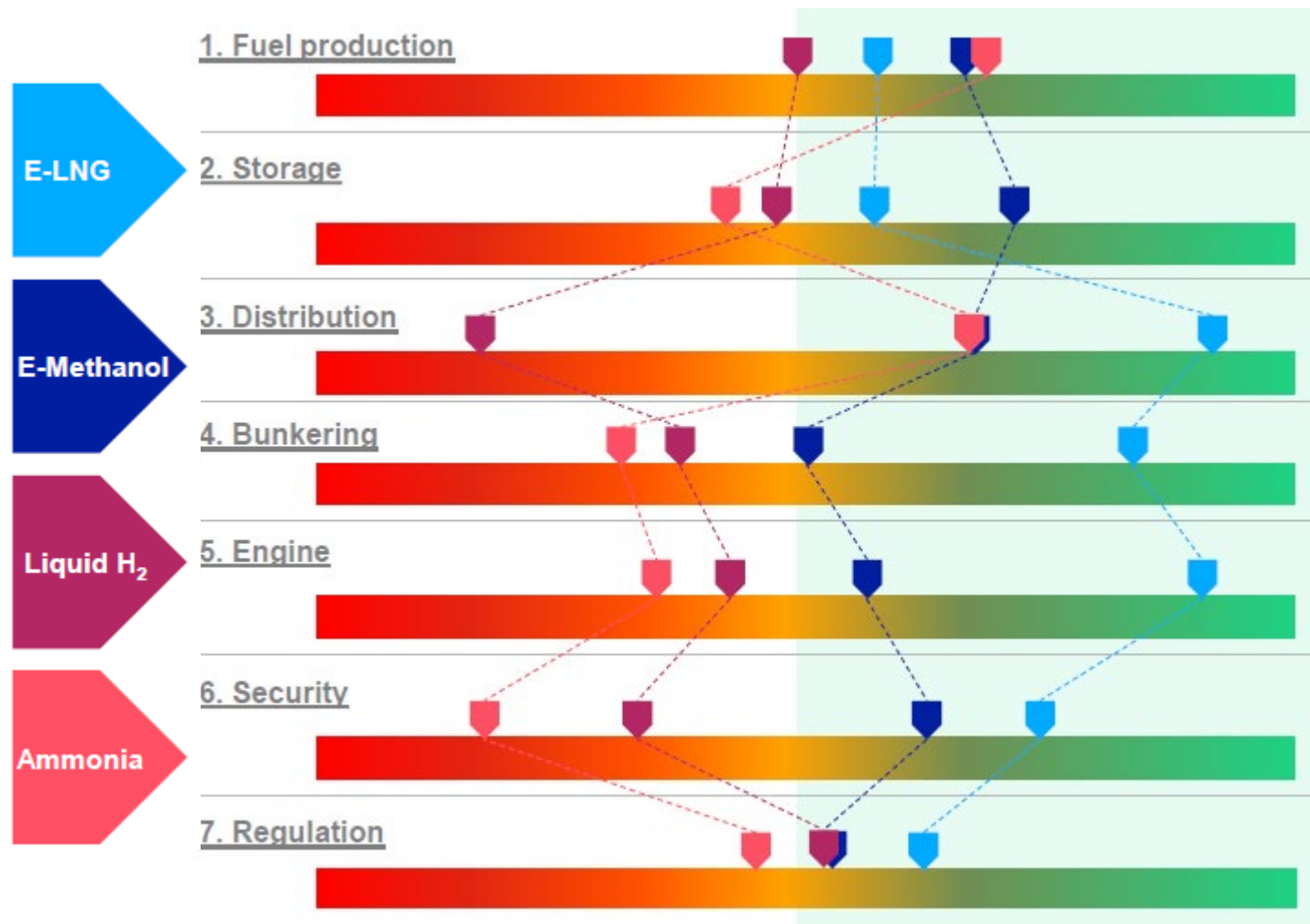
Massive incentives in place to impose decarbonization of EU shipping

- 3 layers of penalties by 2025, voted or nearly voted :
 - Fuel EU Maritime : ~200 €/MWh penalty (~2500 €/toe)
 - on shipping companies
 - on progressive volumes, but... becoming dominant in the lifetime of a ship commissioned now
 - ETS : 20 €/MWh (depends on CO₂ quota price)
 - On shipping companies
 - On all fossil volumes
 - 2023 Renewable energy directive : penalty to be set by MS (already 100 €/MWh in France)
 - on maritime fuel suppliers
 - detailed trajectory to be set
- + IMO to follow (could substitute fuel EU, or be added to the list...)



Expected supply of available and competitive renewable fuel :
key factor to define now what in which ship to invest

What are the options : e-fuels



Source : CMA-CGM, ENGIE, TotalEnergies, Wärtsilä study

- Key advantage of e-LNG :
can be blended with LNG that has a lower carbon content than VLSFO/MDO and already use injected biomethane
- All other technologies must create a 100% renewable supply chain from scratch
- TCO e-LNG ~ TCO e-methanol
- E-diesel not considered in the study :
- significantly more costly,
- in direct competition with aviation
- E-Ammonia as a fuel still a challenge :
not mature, not dense, toxic
LH₂ for short haul because of density

What are the options : biofuels

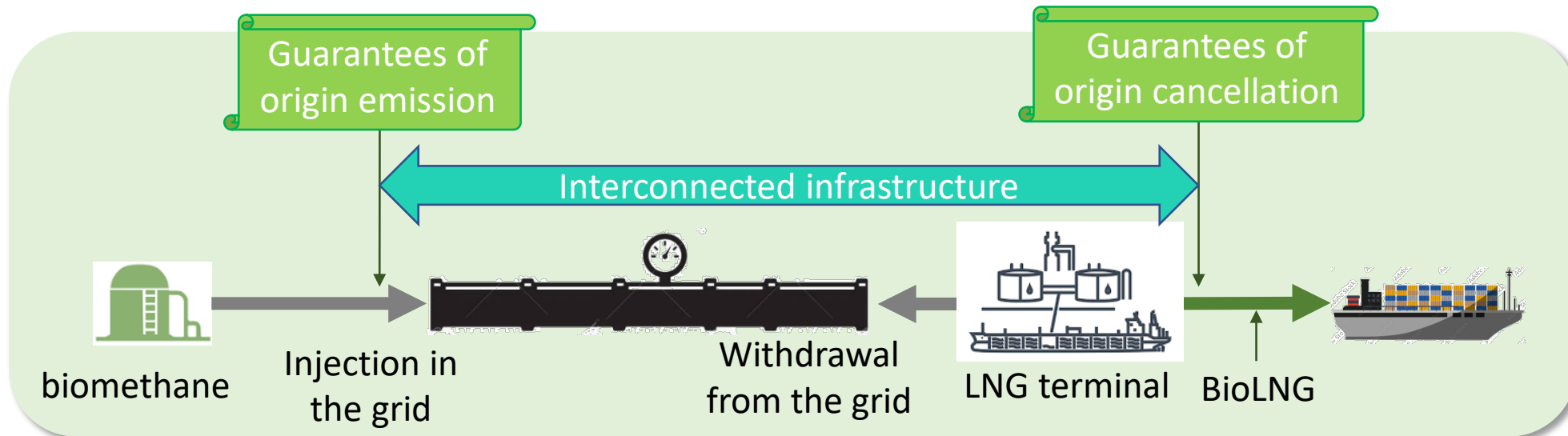
- Drop-in advanced biofuels (i.e. biodiesel not from food or feed crops) :
 - Niche options (e.g. used cooking oil, oily or sugar residues) → limited volumes
 - Gas-to-liquids : more expensive than methane or methanol
 - Fuels from food or feed crops not a considered option
 - Major competition with aviation
- BioLNG :
 - most efficient and less costly route to produce energy from most agricultural residues (on par with biomethanol)
 - Significant biomethane production expected in Europe by 2030 (35 bcm/y i.e. 32 Mtoe/y) not all for maritime, but maritime has the best willingness to pay can already be proposed in EU LNG terminals
 - Required now to hedge LNG prices till e-LNG massively available at competitive prices

Adapted regulation to launch the transition
to bio-/e-LNG or methanol required now

Regulatory progresses...

- LNG Terminals part of the “interconnected grid” (RED implementing act voted 14th June 2022)
 - ➔ Access now to the injected biomethane potential in LNG terminals without investments
 - ➔ Ships can buy bioLNG from any European LNG terminal

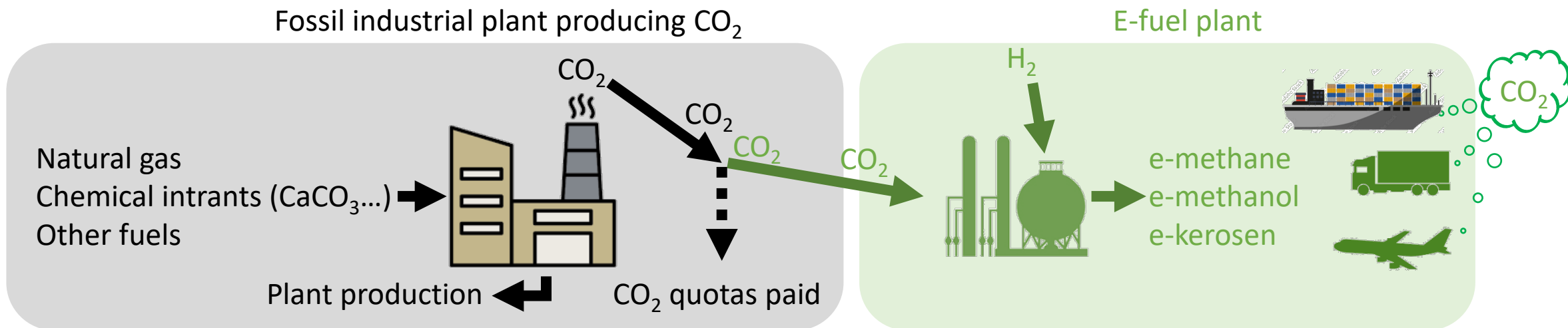
Perfectly justified as 1 MWh of biomethane injected in the EU grid means 1 MWh of LNG not imported in Europe



... but still major questions to be solved

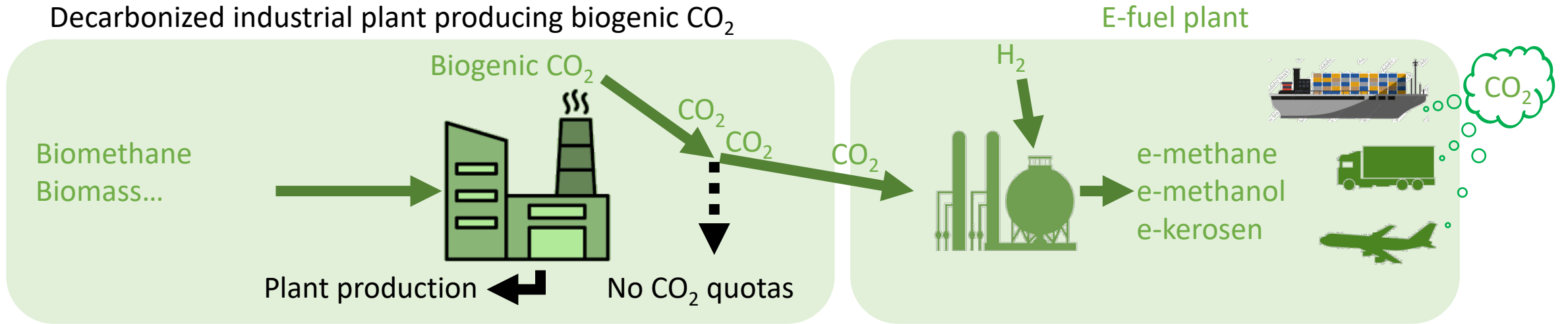
- Carbon content computation : all bio- or e-fuels must respect carbon content thresholds, and their value depends on their carbon content
 - ➔ proper computation methods absolutely required, but...
 - ➔ ... extremely complex methodology, require to add production, transport, usage emissions,
 - ➔ ... not known, and potentially limiting (typically for low or medium pressure LNG engines...)
- All e-fuels exposed to stringent H₂ production requirement, favoring electrolyzers directly connected to PV or wind farms
 - ➔ strongly in favor of imported H₂ from high wind and high sun areas
 - ➔ may be changing with relaxed position voted in extremis by EU parliament
- E-LNG / e-methanol exposed to 2035 limitation to use industrial CO₂, allowing only biogenic CO₂

Why use of fatal industrial CO₂ is justified ...



- Only one fossil carbon molecule extracted from the ground
This molecule used once for the plant production, once to produce e-fuels
Carbon cost should be split between the two usages
- The carbon cost remains at the industrial plant, that is not reputed decarbonized. Logic, as :
 - ➔ an e-fuel for which combustion emissions are counted present 0 interest
 - ➔ most of the costs are related to the e-fuels production (notably the H₂), not to the capture facility
- The e-fuels produced has 0 combustion emissions

...and paves the way to fully decarbonized chain



- Only biogenic molecules used in the process
- No carbon cost to take into account