Carbon in transition

Systemic innovation for the fossil carbon industry

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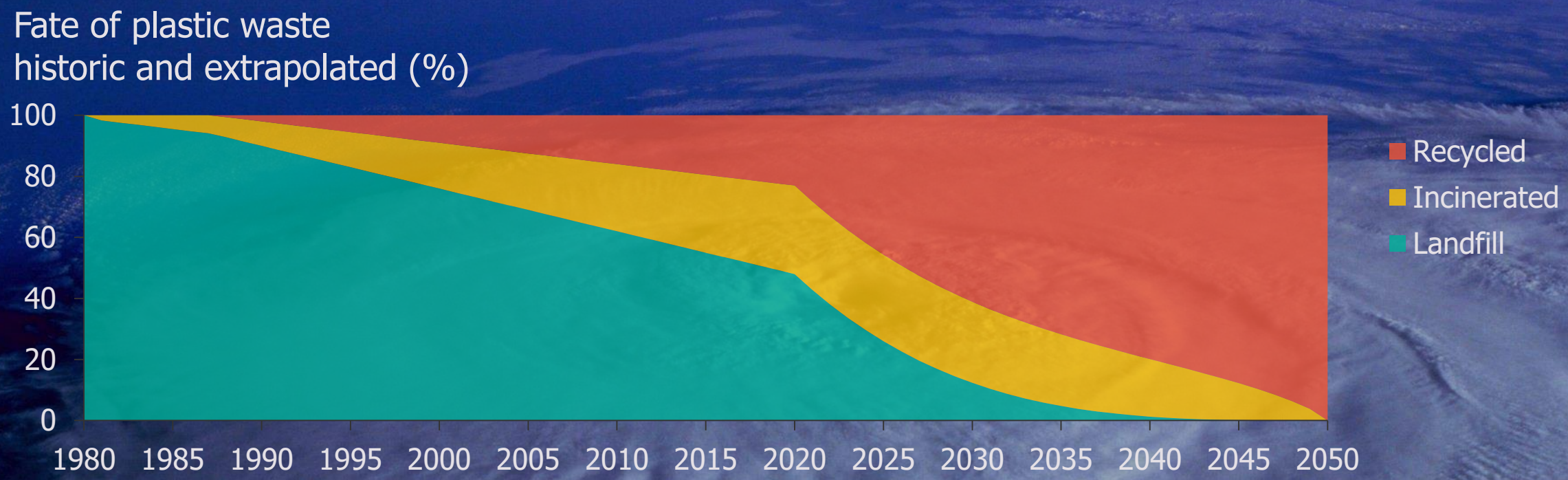
THE PERFECT STORM BREWING FOR PLASTICS

Environmental pressure leads to circular economy policy



- End all landfilling by 2040
- Completely circular plastic economy by 2050
- Still 0.7 GT/a CO_2 emission due to losses in recycling

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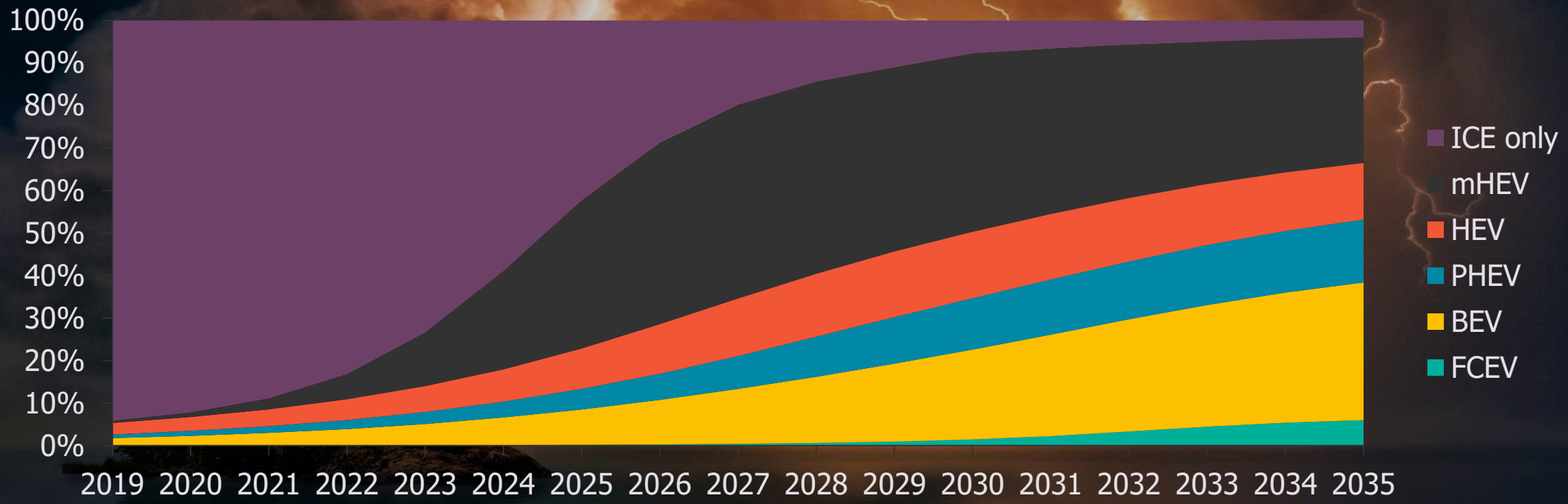
THE PERFECT STORM BREWING FOR PLASTICS

Electrification erodes the feedstock base of the industry

Global new vehicle powertrain market share



- In 2035: 53% of global vehicle sales battery or fuel cell electric, 38% uses no fossil fuel at all
- About 18% of the fleet will not use fossil fuel by 2035
- Decline in fuel demand in 2035 is approximately 14%, compared to 2019

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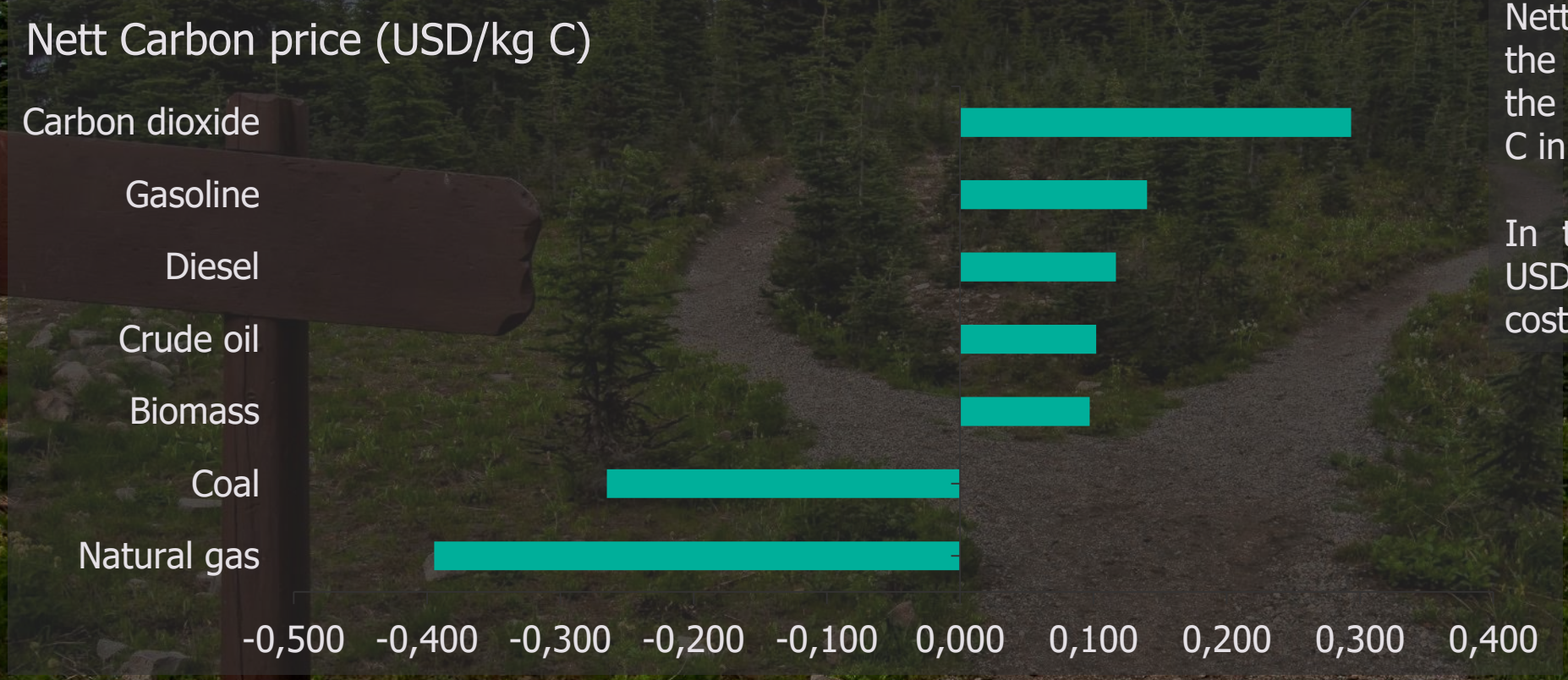
AT THE CROSSROADS BETWEEN TWO CHEMISTRIES

Biobased chemistry doesn't fit in



Nett carbon price is the price of the feedstock minus the value of the energy contained in it per kg C in the feedstock.

In this graph energy costs 40 USD/MWh and carbon capture costs are 80 USD/tonne

- Carbon from biomass is not fundamentally more expensive than carbon from crude
- However the chemistry is different, making it hard to introduce biobased chemicals
- The worlds is at a crossroads: continue fossil petrochemistry or start afresh?

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IN PERIL OF DISRUPTION

The incumbent fossil industry can adapt, but may lose

ADAPTING

- Plastic recycling can feed the existing crackers
- Recycling will boost the image of plastics and reduce concerns in the general public
- Incumbent materials do not require redesign of products

LOSING

- Recycling only captures 60% of the carbon
- Supplementing with biobased or CO2-based makes incumbent materials expensive
- Superior biodegradable CO2 based materials may be cheaper
- New materials will hinder the recycling value chain

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