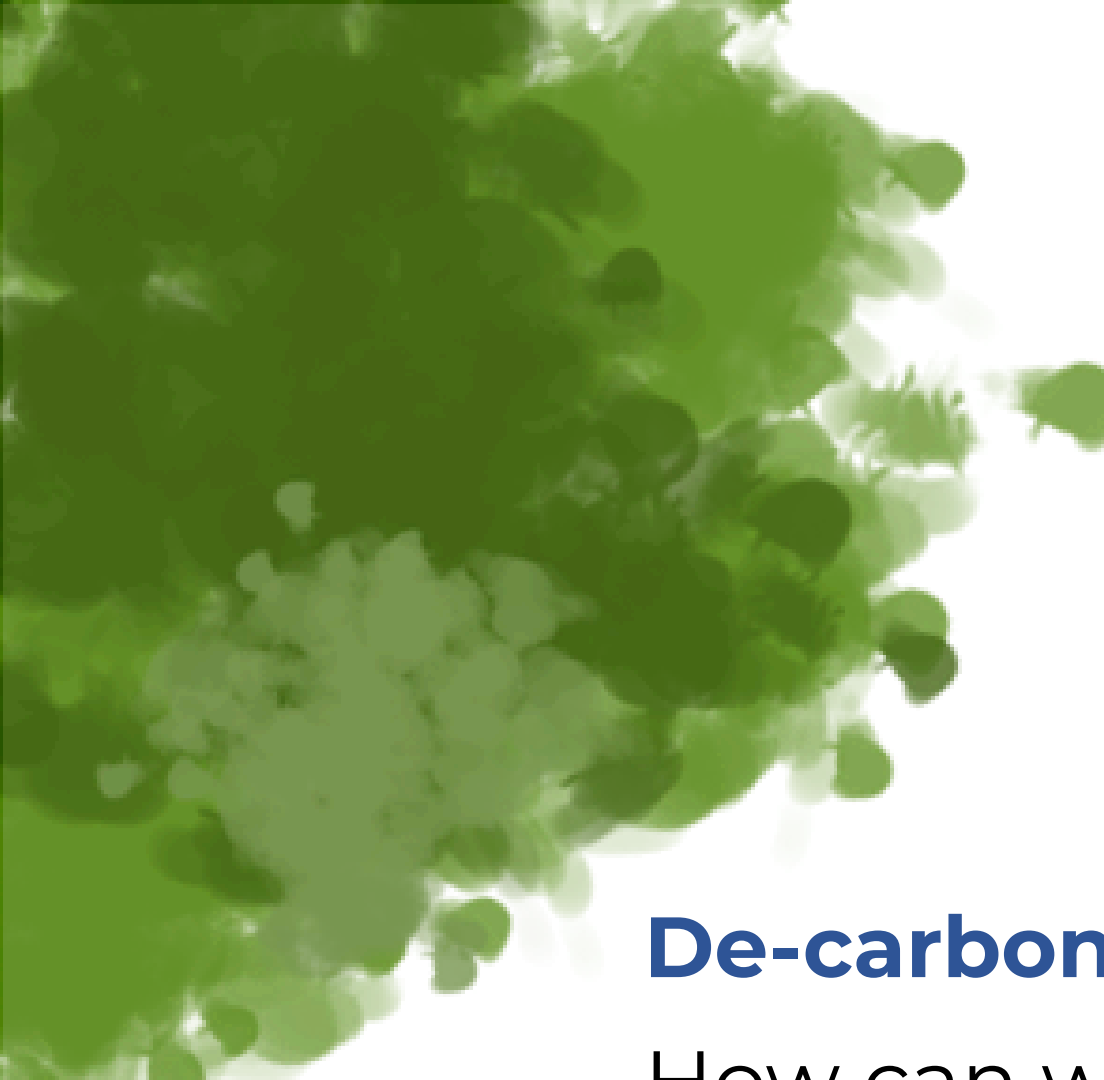




De-carbonising heavy-duty transport

How can we move heavy loads over long distances without relying on fossil fuels?

DT-HATS explores one part of the answer.



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Why is it difficult?

Heavy-duty vehicles need:

- High energy density
- Long driving ranges
- Short refuelling times
- High power for heavy loads

One technology may not fit every application.



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So, what are the options?

Battery-electric → Direct electrification

Hydrogen fuel cells → Electricity from H₂

Hydrogen combustion → H₂ in an IC engine

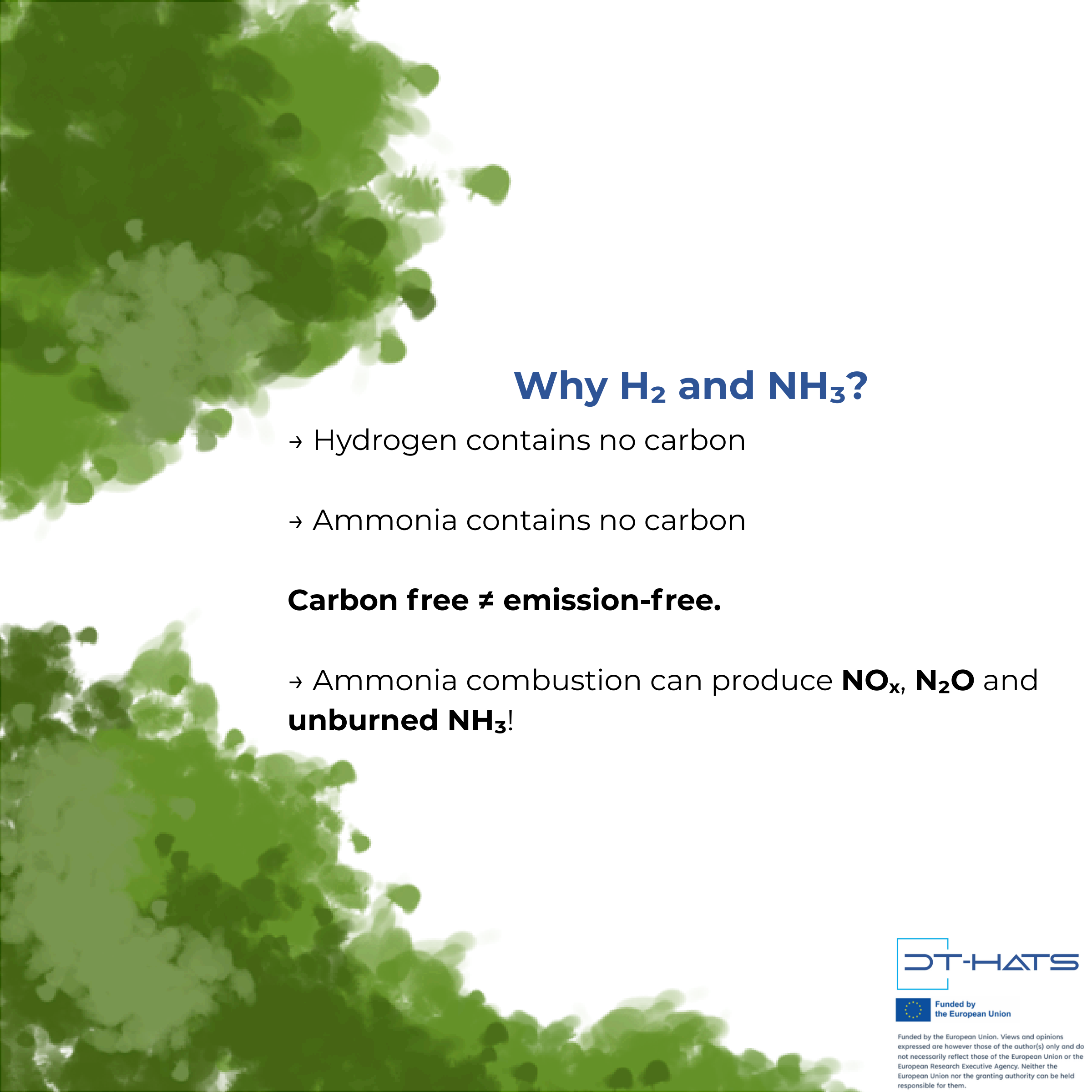
Ammonia combustion → NH₃ as a carbon-free fuel

Different technologies with different strengths and challenges.



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Why H₂ and NH₃?

→ Hydrogen contains no carbon

→ Ammonia contains no carbon

Carbon free ≠ emission-free.

→ Ammonia combustion can produce **NO_x**, **N₂O** and **unburned NH₃!**



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Problem: NH_3 is not easy to burn.

NH_3 has:

- Low reactivity
- Low flame speed
- High ignition temperature

This can lead to:

**Poor combustion + efficiency challenges
+ unwanted emissions.**



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But Hydrogen could help!

Hydrogen is highly reactive and has fast flame propagation.

When combined with ammonia, it can:

- Improve ignition
- Enhance combustion
- Increase combustion stability

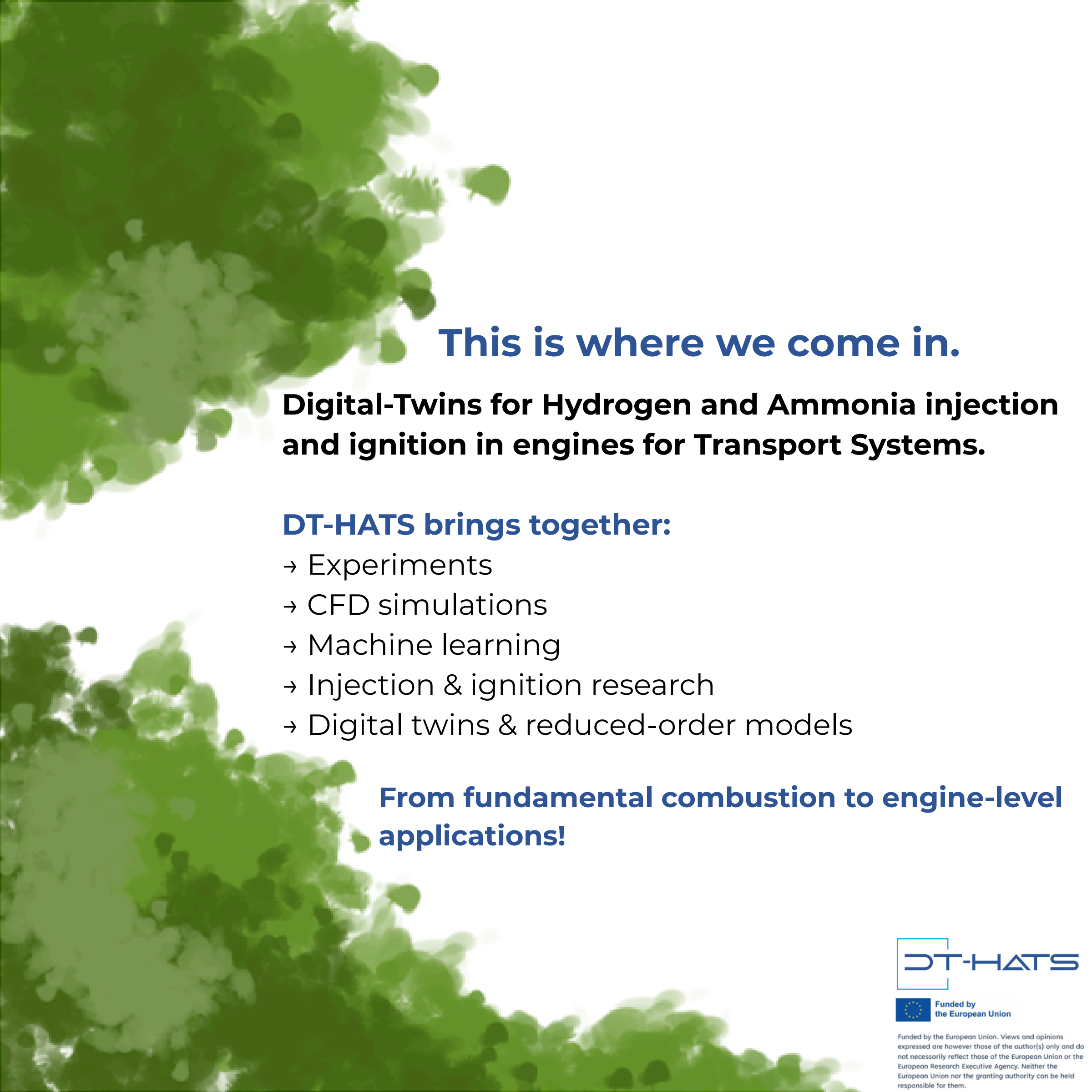
But the challenge remains:

How do we optimise the entire process?



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This is where we come in.

Digital-Twins for Hydrogen and Ammonia injection and ignition in engines for Transport Systems.

DT-HATS brings together:

- Experiments
- CFD simulations
- Machine learning
- Injection & ignition research
- Digital twins & reduced-order models

From fundamental combustion to engine-level applications!



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THE FUTURE OF HEAVY-DUTY TRANSPORT WILL LIKELY NEED MORE THAN ONE TECHNOLOGY.

DT-HATS is working at the intersection of these technologies.

Decarbonisation isn't just about finding a new fuel. It's about learning how to use it **efficiently**.



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