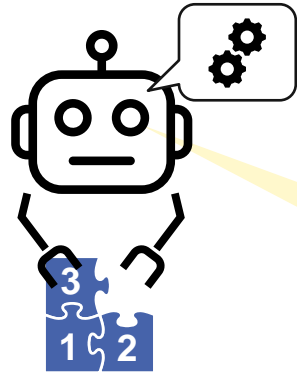


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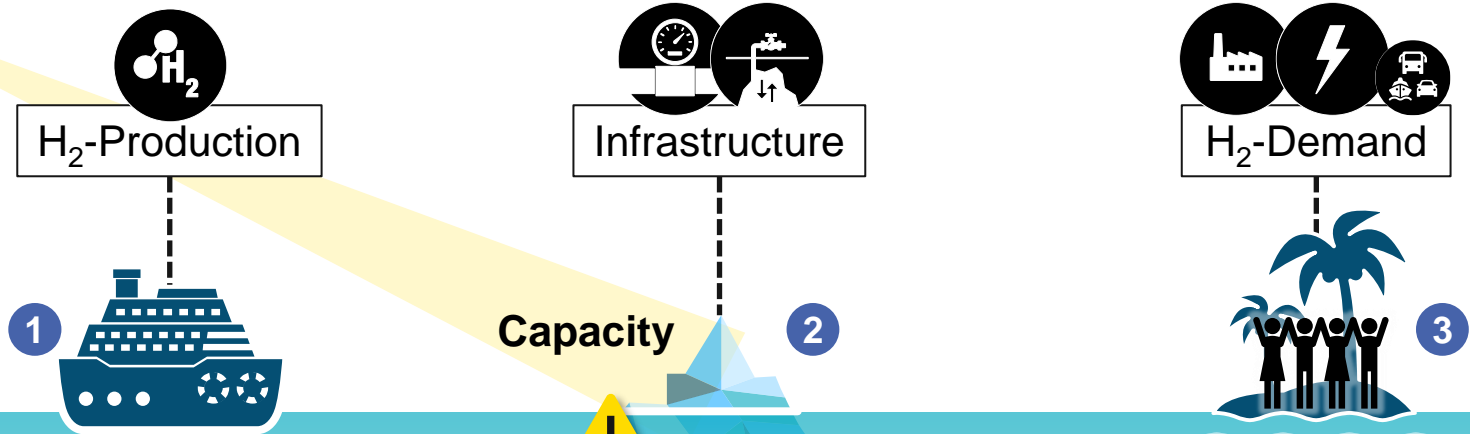
Developing a European Hydrogen Infrastructure

A full scale Model

Maximilian Heneka | 10.02.2026 | e-World, Essen

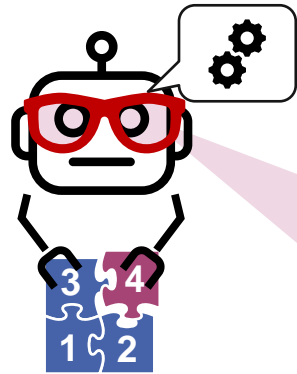


Energy system modeling perspective...

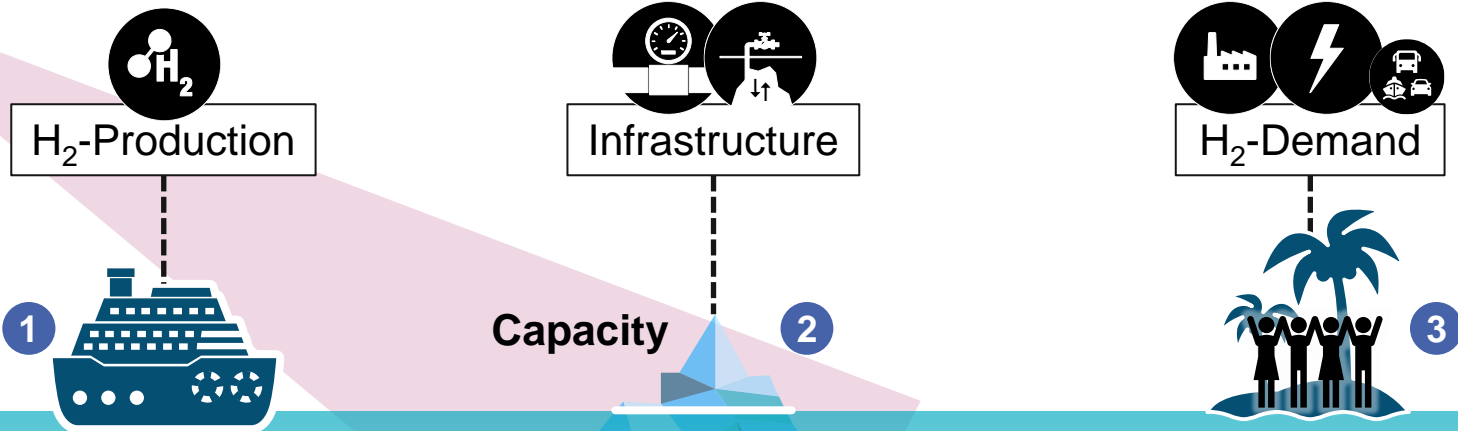


Hydraulic effects

- Pressure levels
- Flow velocities
- Flow directions



Energy system modeling perspective...



...combined with hydraulic network simulation

- Identify bottlenecks
- Analyse storage operation and supply strategies
- Asses robustness of the network under stress

Hydraulic effects

- Pressure levels
- Flow velocities
- Flow directions

Modelling European Hydrogen Transport Networks in TransHyDE-System Analysis

- **TransHyDE System Analysis** is part of the hydrogen flagship project TransHyDE, which develops and demonstrates technologies for a future hydrogen infrastructure. The project is funded by the German Federal Ministry for Research, Technology and Space and supports the German National Hydrogen Strategy.
 - Energy system modeling for climate-neutral Europe (2050)
 - Explicit representation of European gas and hydrogen transport infrastructures
 - Hydraulic validation of pipeline-based supply scenarios



Graphic: Project Management Jülich on behalf of the BMFT

Project duration
04/2021 – 12/2025

Partners
> 35

Funding
ca. 17.5 Mio. €

 Flagship Project
TransHyDE

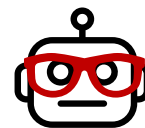
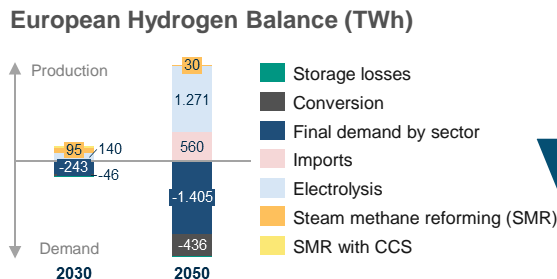
With funding from the:



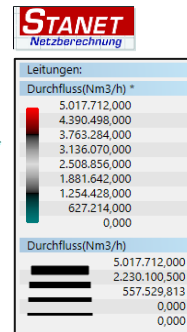
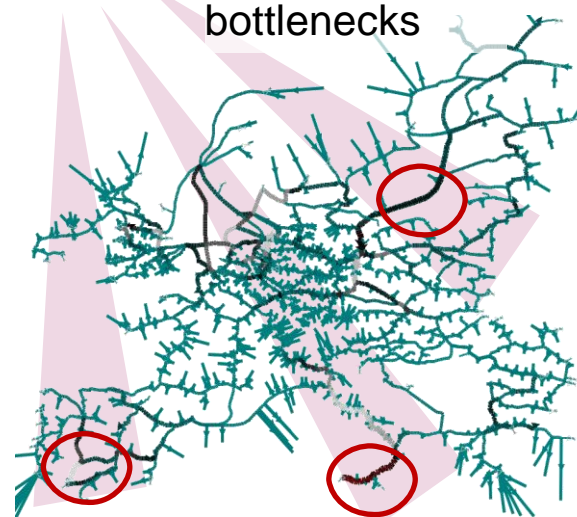
1 Energy System Modelling

Time series of hydrogen injections and withdrawals

Power generation
Industry
Sectoral demand
Production
...



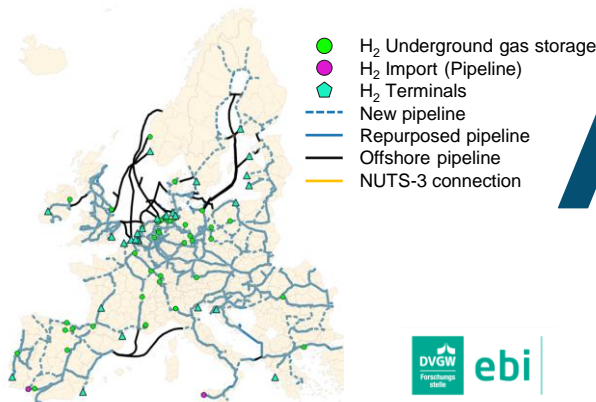
Identification of bottlenecks



2 GIS Model

Spatial topology of the European hydrogen backbone

Pipelines,
Storage facilities,
Terminals,
Import entry points
...

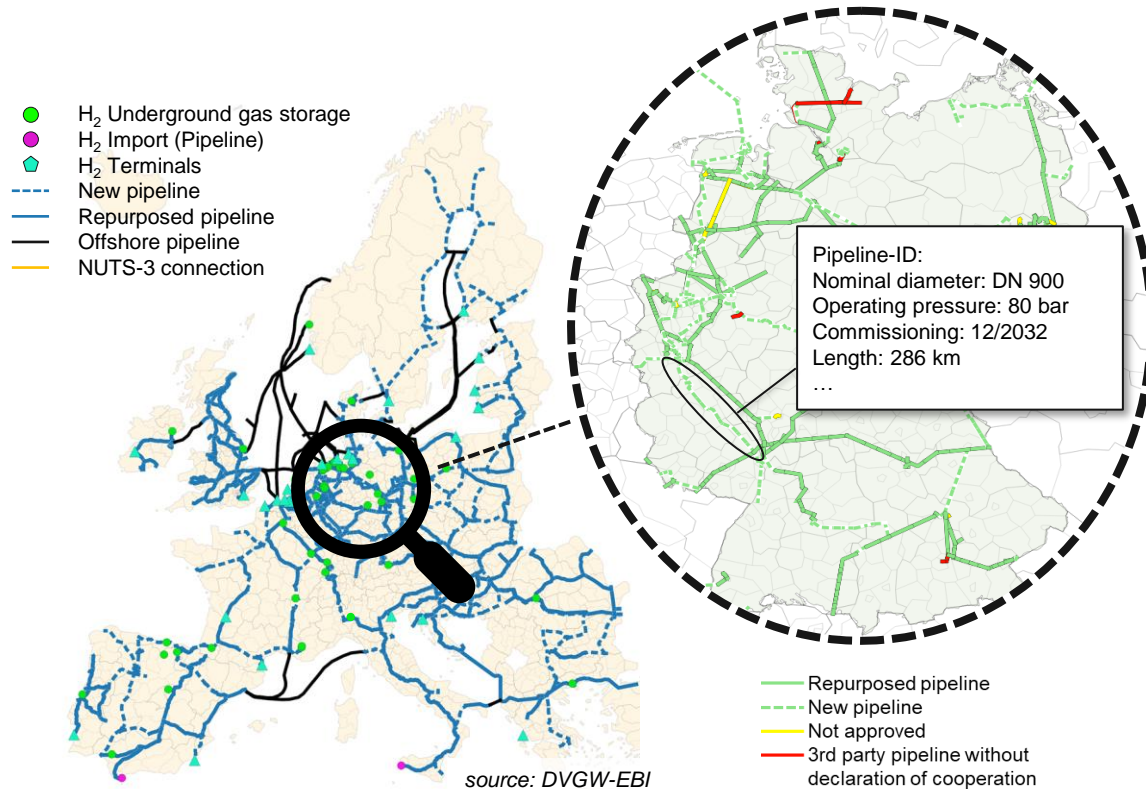


3 Hydraulic Network simulation

Pressure, flow velocities, ...



GIS = Geographic Information System



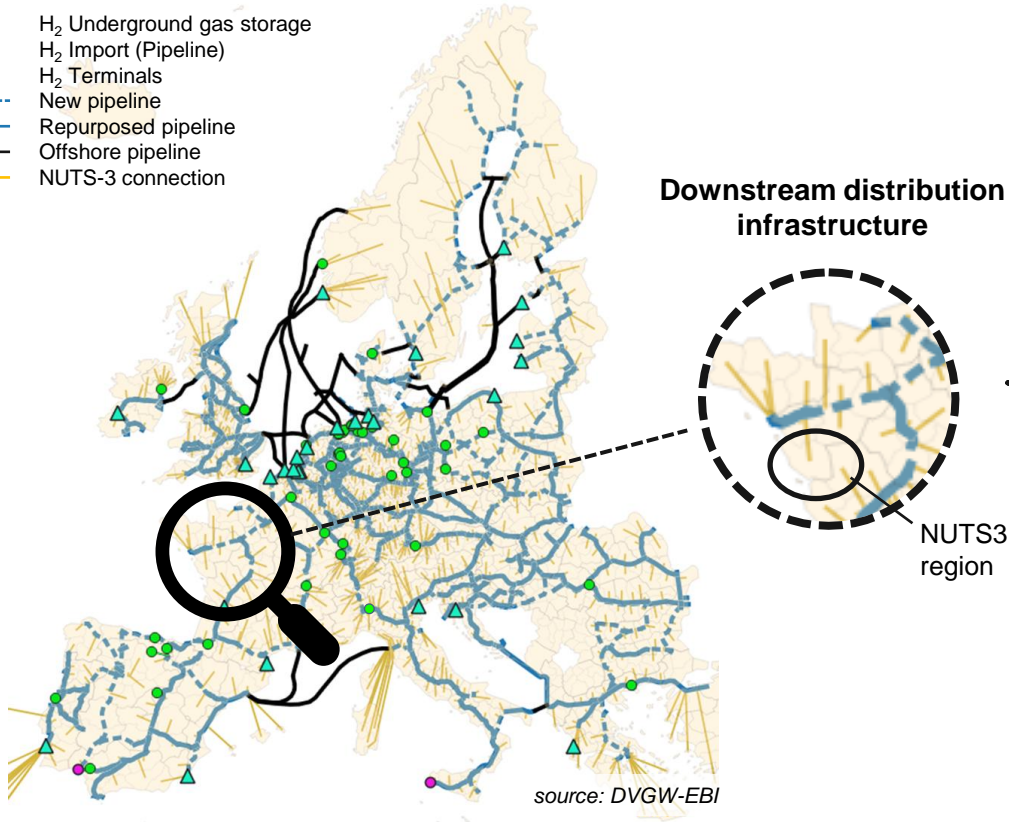
Network elements

- Import entry points (terminals/pipelines)
- Interconnection points
- Compressor stations
- Pressure regulators
- Pipelines

Data availability and sources

- 🇪🇺 Hydrogen Infrastructure Map + European Hydrogen Backbone Initiative (status **07/2023**), complemented by own research
- 🇩🇪 Hydrogen core network (status **10/2024**)

- H₂ Underground gas storage
- H₂ Import (Pipeline)
- ▲ H₂ Terminals
- - - New pipeline
- - - Repurposed pipeline
- - - Offshore pipeline
- - - NUTS-3 connection



Energy system modelling ^{FFE}

Time series of hydrogen production and demand

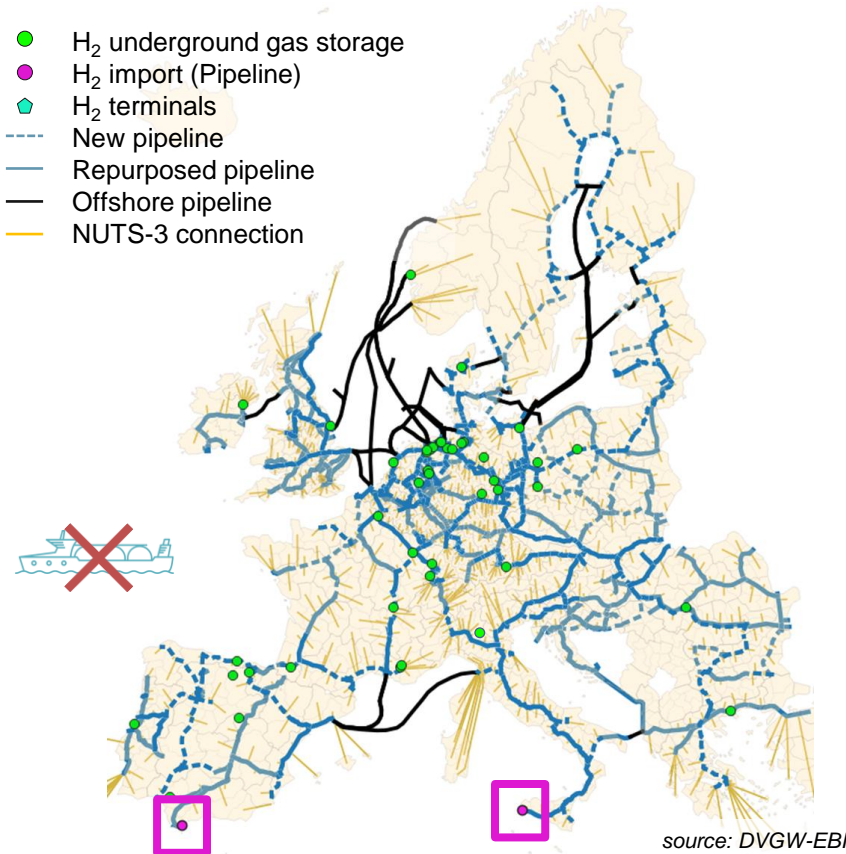
- **NUTS-3 („district/ county level“)**

- H₂ Power plants
- H₂ production
- Sectoral H₂ demand (industry, households, transport, ...)

- **NUTS-0 („country level“)**

- H₂ storage facilities
- H₂ terminals (ship-based imports)
- H₂ pipeline imports

NUTS = Nomenclature des unités territoriales statistiques

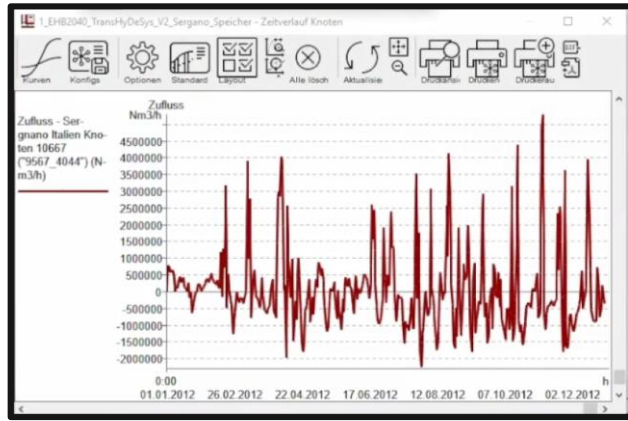


European Hydrogen Backbone (EHB) 2040

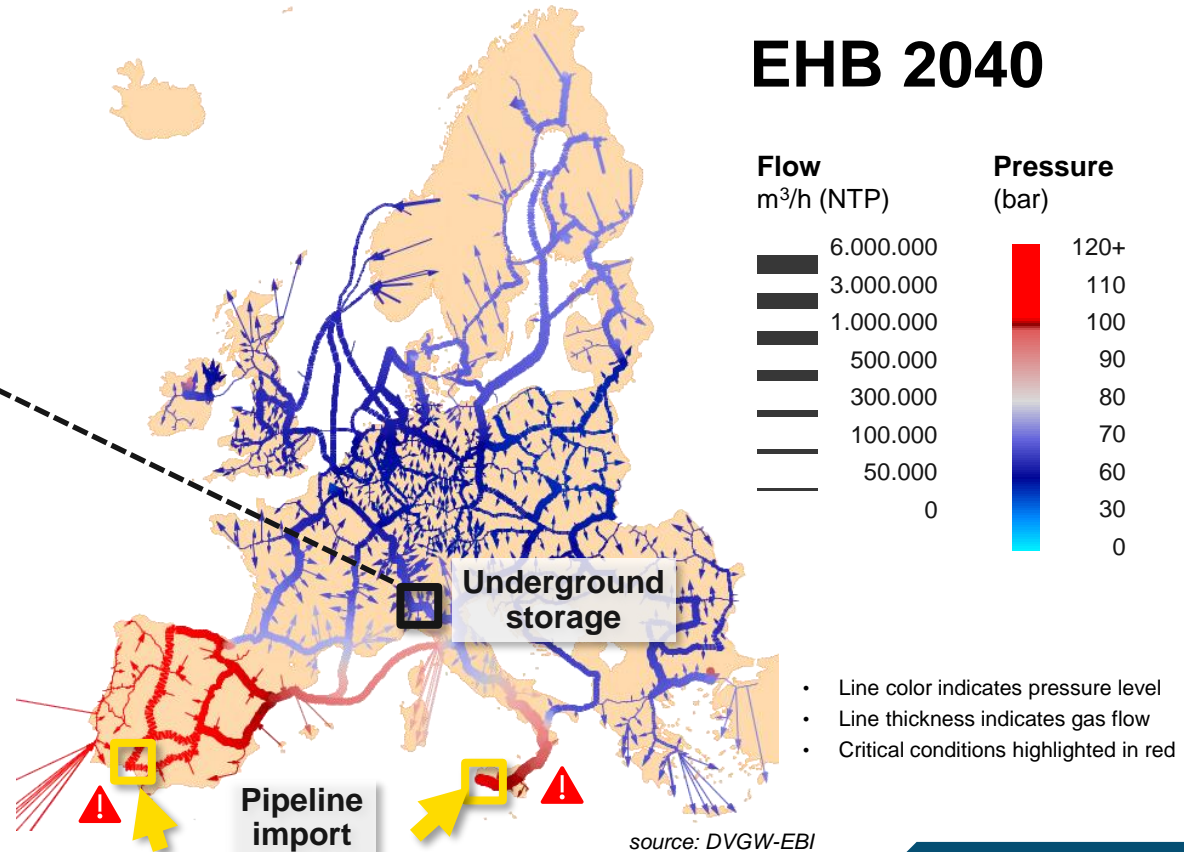
- Largely interconnected European hydrogen network
- Hydrogen imports mainly via pipeline entry points in Spain and Italy
- No ship-based hydrogen imports in this scenario
- Share of imports: ~ 20 %

Hydraulic Network Simulation Results

EU Hydrogen Backbone (EHB) 2040



- Hourly simulation over the full year 2040
- Maximum load shows bottlenecks in Italy, Spain and Portugal and limited transport capacity from the Iberian Peninsula to Central Europe
- Assessment of underground gas storage utilization (load profile)



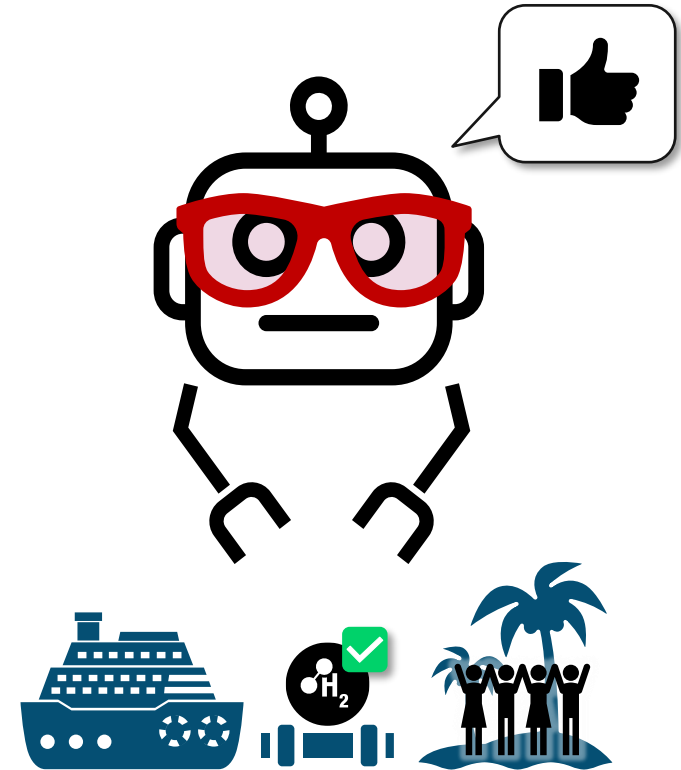
- **Energy system modelling and infrastructure modelling must be considered jointly**

A purely capacity-based representation of hydrogen transport infrastructure is not sufficient.

- **Hydraulic network simulation makes physical constraints explicit**

It enables the analysis of maximum load cases as well as alternative and stress-test supply scenarios, including delayed availability or temporary outages of key infrastructure elements.

- Hydraulic network modelling is an **integral component of robust and realistic hydrogen system analysis.**





Thank you.

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Find out more about us:

