



THE CHARACTERISTICS OF FUTURE GLOBAL GREEN HYDROGEN AND DERIVATIVES MARKETS

A modelling study with ERIKSSON

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19.02.2026

We investigate characteristics of future global hydrogen and hydrogen derivative markets in a global market model

Background & Motivation

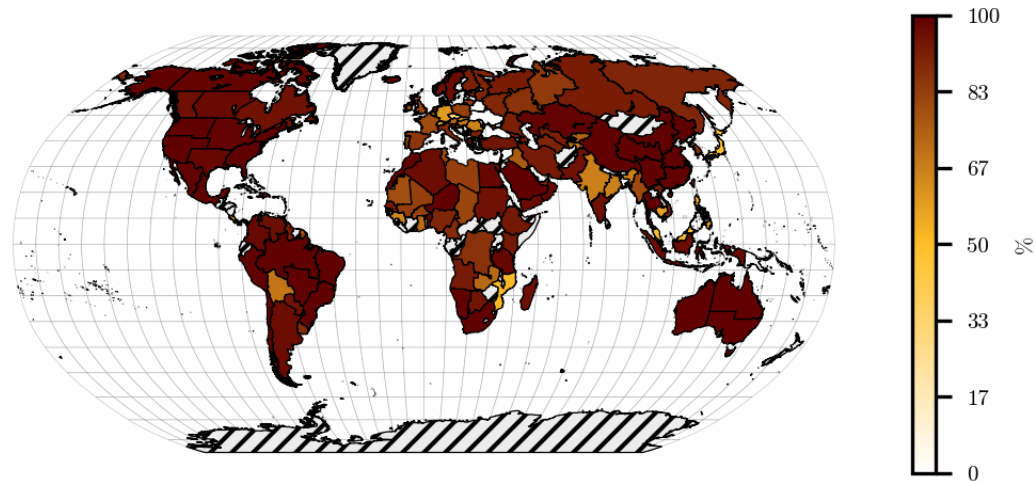
- Hydrogen and hydrogen derivatives can become globally traded goods
- Global hydrogen and hydrogen derivative markets can affect Germany's and Europe's economy and industrial resilience
- Hypothesis 1: For hydrogen, regional pipeline-connected markets will emerge. For hydrogen derivatives, a global market will emerge
- Hypothesis 2: Similar to fossil commodities, the market structure for hydrogen and hydrogen derivatives is oligopolistic.
- Further analysis on industry relocation and resilience possible

The EWI-Model ERIKSSON

- Global partial equilibrium model of renewable hydrogen, ammonia, and methanol markets
- 117 countries in all world regions considered
- Producers, exporters, storage operators, converters, pipeline operators, ship operators, and terminal operators as profit-maximizing market participants
- Strategic behavior of exporters is possible and modelling the market as a Cournot oligopoly

Our results suggest regional hydrogen markets with high domestic supply shares

Hydrogen: Domestic supply share



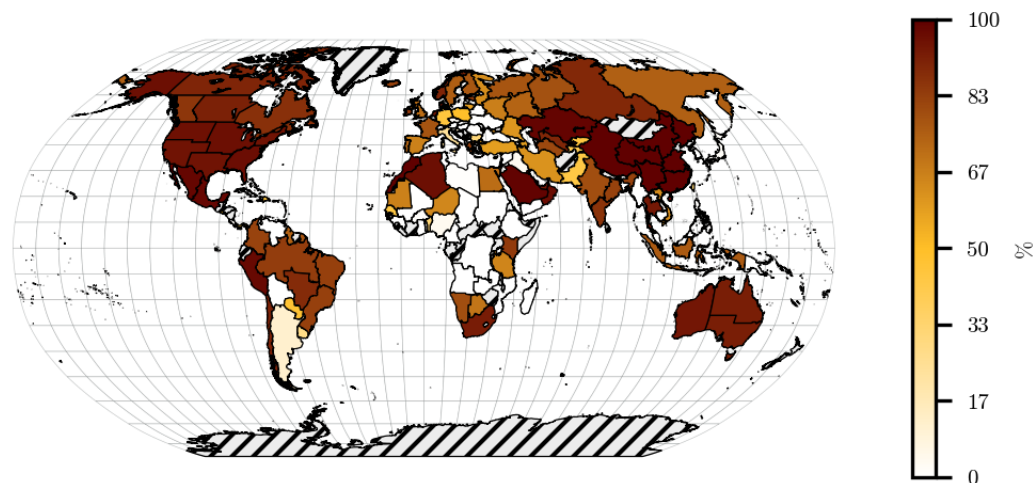
Hydrogen: Interregional and Intraregional Trade

	To										
	Australia Pacific	East Asia	Eurasia	Europe	Middle East	North Africa	North America	South America	South Asia	South East Asia	Sub Sahara Africa
Australia Pacific	36	2	0	0	0	0	0	0	0	0	0
East Asia	1	3717	16	4	7	0	0	0	74	28	4
Eurasia	1	16	793	24	44	0	0	0	9	5	1
Europe	0	0	23	054	39	1	0	0	0	0	6
Middle East	1	2	21	13	230	2	0	0	4	1	7
North Africa	1	5	4	57	20	187	0	0	0	0	24
North America	1	11	0	0	0	0	2040	1	0	0	0
South America	2	13	0	0	2	0	0	806	0	4	13
South Asia	0	1	0	0	0	0	0	0	1600	1	0
South East Asia	2	14	0	0	0	0	0	0	3	786	1
Sub Sahara Africa	2	9	0	1	1	0	0	0	0	2	732

Baseline scenario results of the ERIKKSON model for future global hydrogen and hydrogen derivative markets in the year 2050

Our results suggest global hydrogen derivative markets with importing and exporting countries

Methanol: Domestic supply share



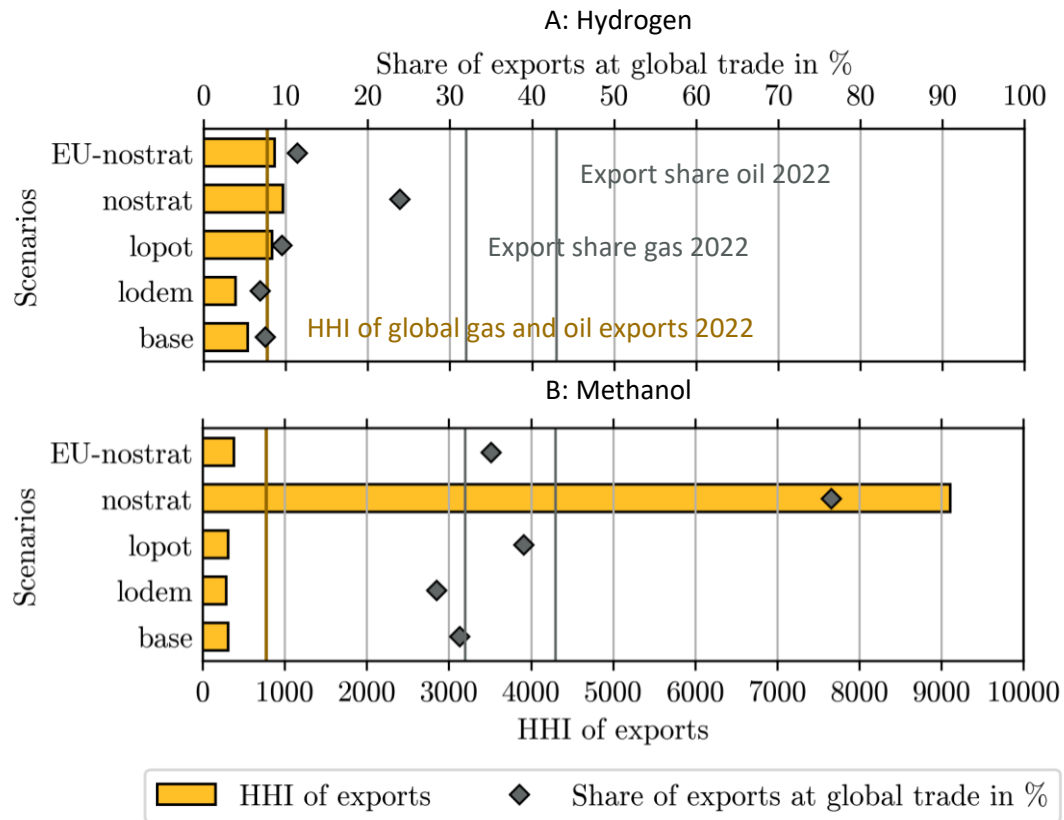
Methanol: Interregional and Intra-regional Trade

	To										
	Australia Pacific	East Asia	Eurasia	Europe	Middle East	North Africa	North America	South America	South Asia	South East Asia	Sub Sahara Africa
Australia Pacific	23	5	3	7	10	0	0	3	4	7	9
East Asia	1	815	14	21	24	2	10	12	33	20	19
Eurasia	1	15	433	20	31	1	0	8	15	16	27
Europe	2	60	31	402	106	5	0	35	32	61	116
Middle East	2	40	35	69	458	6	5	32	78	59	77
North Africa	1	23	25	45	48	83	23	24	52	35	41
North America	1	19	16	33	37	3	1050	16	30	27	34
South America	1	29	15	42	51	3	3	343	23	31	58
South Asia	0	5	2	6	10	0	0	2	874	6	9
South East Asia	1	13	5	14	20	1	0	6	9	321	21
Sub Sahara Africa	1	24	8	30	42	2	0	14	14	24	149

Baseline scenario results of the ERIKKSON model for future global hydrogen and hydrogen derivative markets in the year 2050

Our results suggest lower concentration in future hydrogen and derivative markets, despite ongoing market power

Market concentration of global exports measured by Herfindahl Hirschmann Index (HHI)



- Share of exports and market concentrations depend on demand, production potential, and strategic behavior of market participants
- Market concentration of future global hydrogen and hydrogen derivative markets could be lower than in today's fossil fuel markets
- However, the market power of exporters probably influences future global hydrogen and derivative markets, and the assumption of perfect competition might not be appropriate

Different scenario results of the ERIKSSON model for future global hydrogen and hydrogen derivative markets in the year 2050

Future work focuses on the development of demand for hydrogen and its derivatives, considering change in industry and resilience targets

Limitations of the analysis

- Exogenous demand assumption that does not account possible relocation of end product industries (e.g. steel, chemicals)
- No equilibrium to fossil fuel and low-carbon-based hydrogen markets

Outlook

- Integrating further supply chains to hydrogen end products
- Integrating other energy commodities
- Economic resilience analysis

Expertise and experience of EWI

- Partial equilibrium modelling
- Technoeconomic analyses

Possible partners & Input

- Industrial partners for data assumptions and practical validation
- Macroeconomic analyses or partners for the global demand development of hydrogen-based products
- Practical partners with experience in globally trading energy commodities