Security in hydrogen geopolitics

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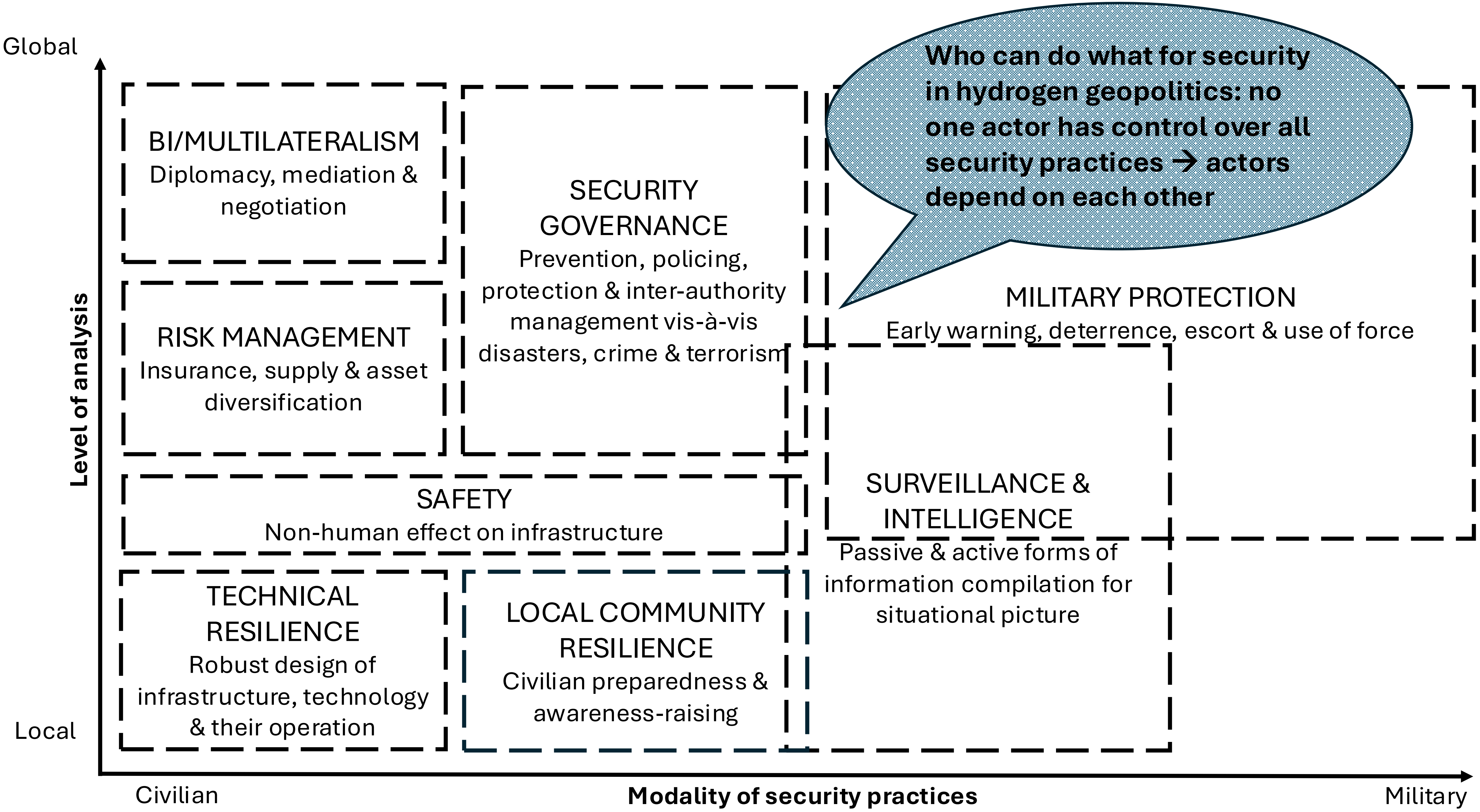

Global
Local
Level of analysis
Civilian
Modality of security practices
Military
BI/MULTILATERALISM
Diplomacy, mediation & negotiation
SECURITY GOVERNANCE
Prevention, policing, protection & inter-authority management vis-à-vis disasters, crime & terrorism
Who can do what for security in hydrogen geopolitics: no one actor has control over all security practices → actors depend on each other
MILITARY PROTECTION
Early warning, deterrence, escort & use of force
RISK MANAGEMENT
Insurance, supply & asset diversification
SAFETY
Non-human effect on infrastructure
SURVEILLANCE & INTELLIGENCE
Passive & active forms of information compilation for situational picture
TECHNICAL RESILIENCE
Robust design of infrastructure, technology & their operation
LOCAL COMMUNITY RESILIENCE
Civilian preparedness & awareness-raising

Which scenario?

→ return to liberal order

→ continued ‘grey zone’: increasing great power competition with hybrid operations, sphere of interest claims & regional wars

→ switch to war time?

→ *enormous implications for least-cost H2 options, supply security, etc.*

→ *security premium with business opportunities for energy/defence interface & resilient infrastructures*

How far does risk management by companies extend in global value chains?

Case of H2 fuel maritime transport

- LNG analogy: considering the vulnerability of transnational pipelines for both importer and exporter; and for the exporter, higher value added nature of e-ammonia/e-methanol than piped H2, maritime transport is a feasible option for globalising the market
- Currently, safe shipping at High Seas is ultimately guaranteed by US military protection via its global network of military presence
- <u>**If the USA gradually withdraws from its global role**</u> a combination of **risk management** (insurance), **security governance** (anti-crime & terrorism), plus **surveillance & intelligence**, can become costly
- In particular, risky maritime transport may be problematic for Persian Gulf producers, but also for any producers far away from their markets
- Then trade switches to nearby markets guaranteed by regional hegemons, e.g. NATO (if it exists in its present form)
- For Finnish e-ammonia & e-methanol: Germany, UK, Benelux via Sweden, not necessarily via Baltic Sea
- Competition for Finnish H2 from e.g. Iceland, Spain, Portugal, Norway

Map: US military bases, by American Geographic Society (2024).

What states can do – from H2 diplomacy to global policing to visions of energy independence, strategic autonomy

- Energy diplomacy to create the necessary order to stabilize trade conditions and to reduce transaction costs
- In most H2 cases this is done on a bilateral basis, can be suboptimal for these purposes
- Security governance relies mostly on national capacities, also in the EU and NATO context since not all information can or will be shared (e.g. Hungary, Slovakia, Turkiye)
- Security governance by authorities works when credible threat exists or crime has taken place, i.e. often the damage to infrastructure has already been done, with new targets waiting
- Targets are too numerous to be all militarily protected with current technologies; autonomous weapons (drone vs. drone) would have enormous implications
- Armies can provide early warning & deterrence
- State action is necessary in a grey zone world where state aid is a necessary competitive edge, and state capitalism makes inroads

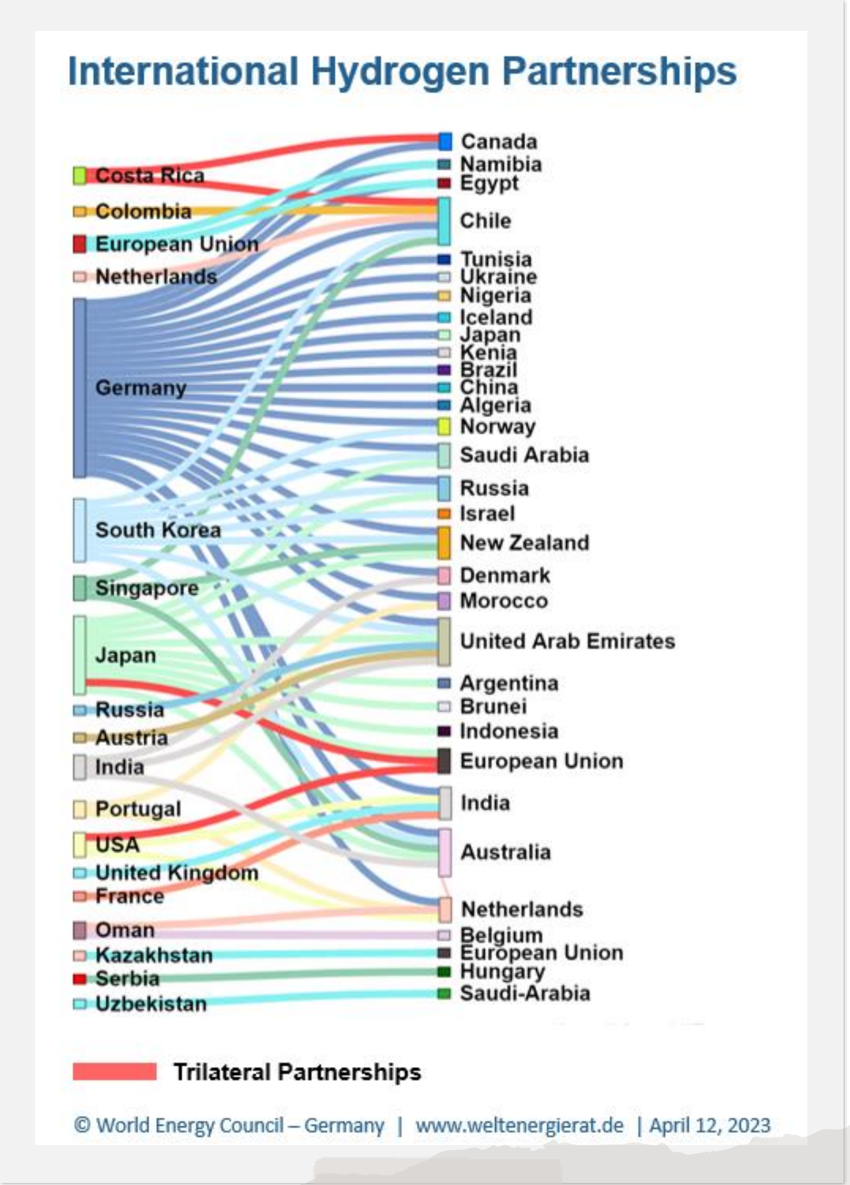
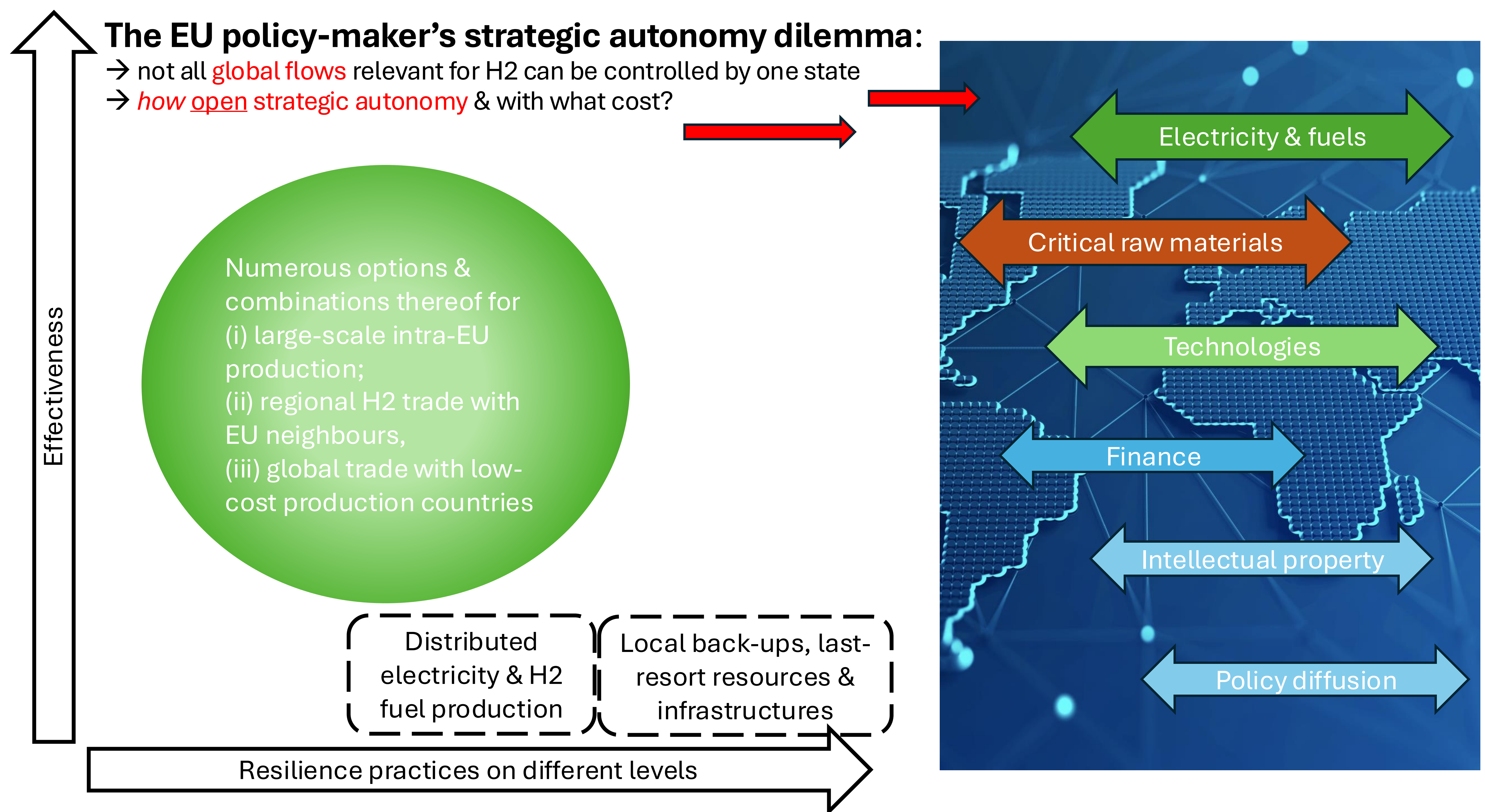
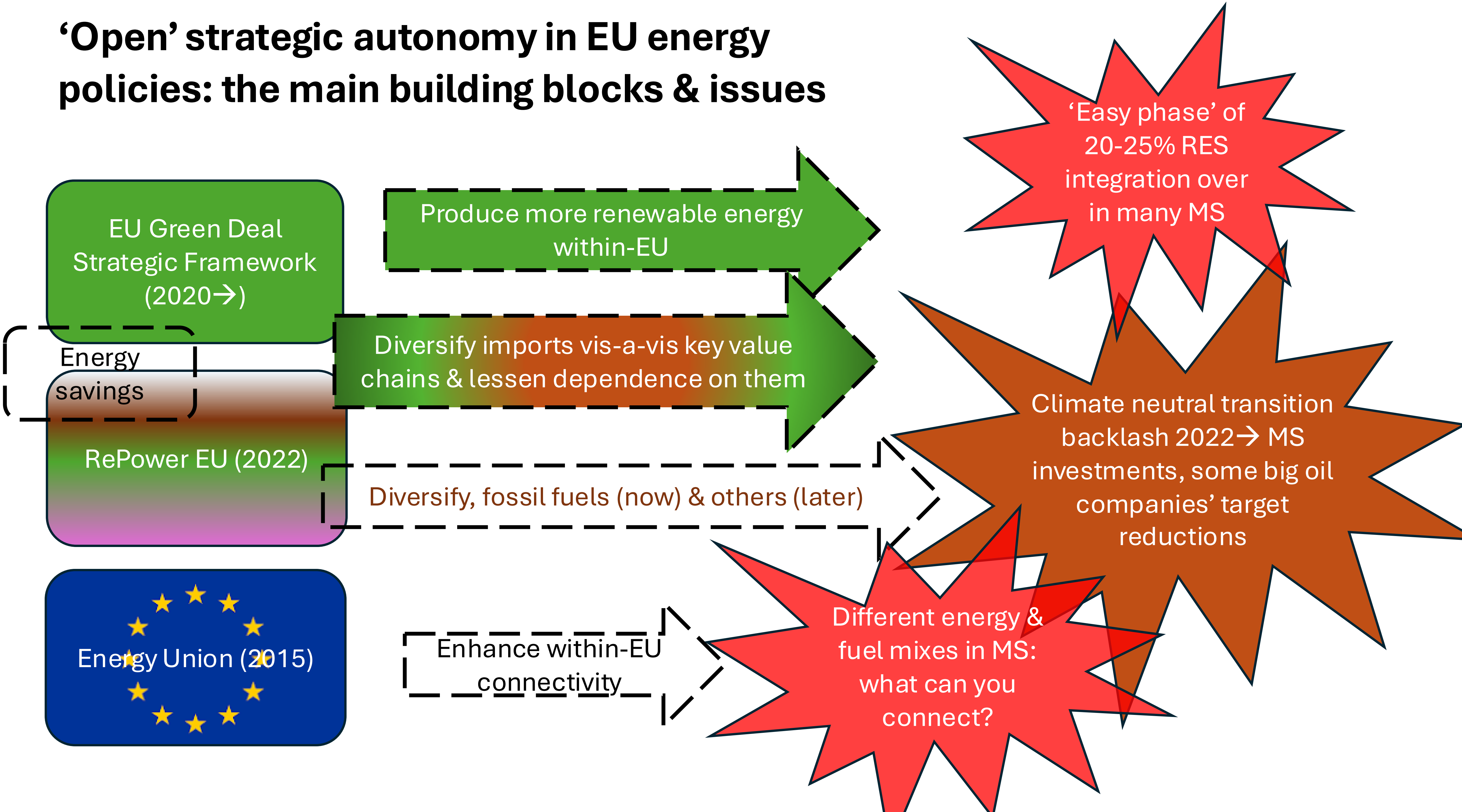


Figure: World Energy Counbcil (2023)


The EU policy-maker's strategic autonomy dilemma:
→ not all global flows relevant for H2 can be controlled by one state
→ how open strategic autonomy & with what cost?
Numerous options & combinations thereof for (i) large-scale intra-EU production; (ii) regional H2 trade with EU neighbours, (iii) global trade with low-cost production countries
Distributed electricity & H2 fuel production
Local back-ups, last-resort resources & infrastructures
Effectiveness
Resilience practices on different levels
Electricity & fuels
Critical raw materials
Technologies
Finance
Intellectual property
Policy diffusion

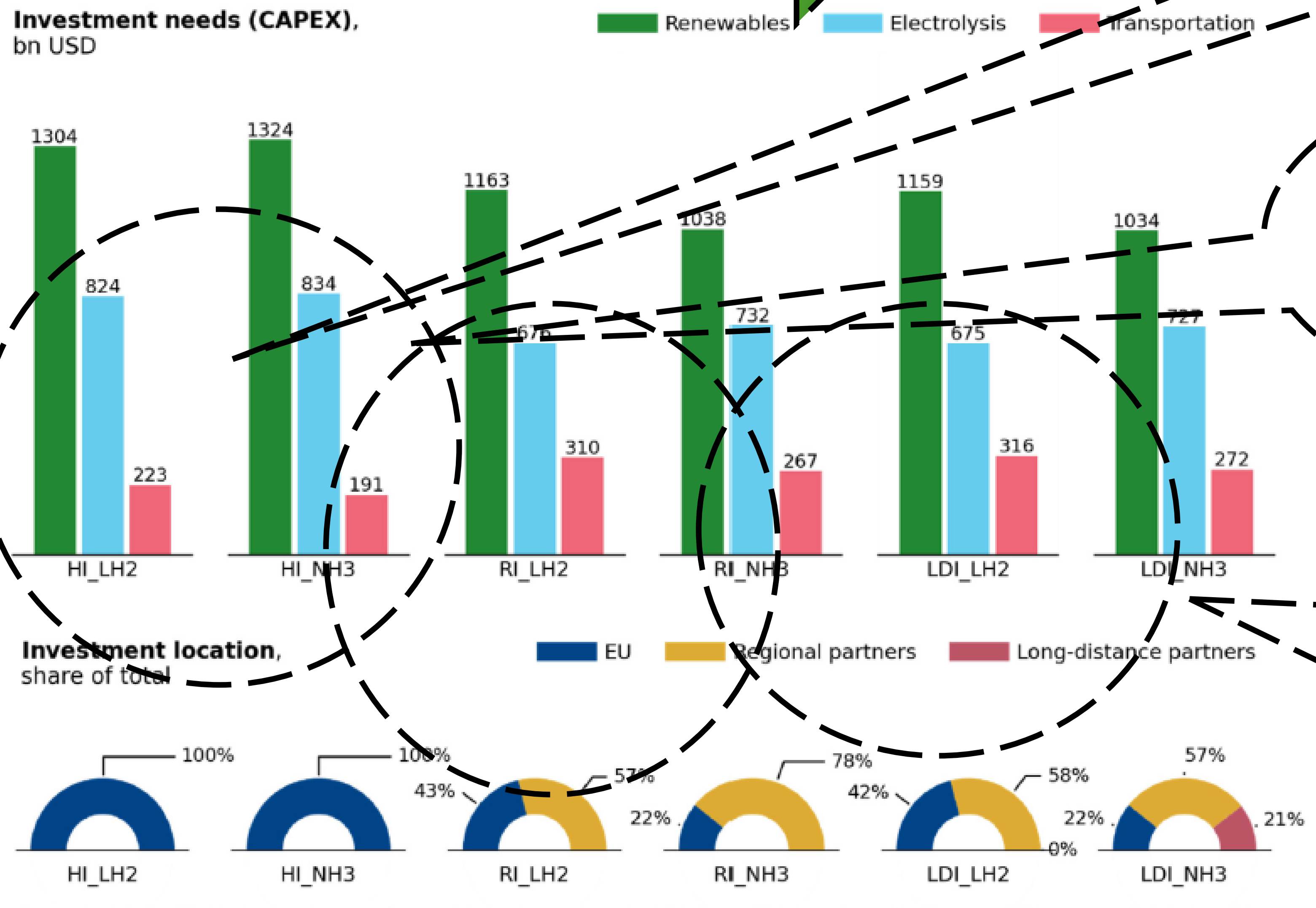
‘Open’ strategic autonomy in EU energy policies: the main building blocks & issues



Diversify imports vis-a-vis key value chains & lessen dependence on them

Strategic independence scenario is possible → intra-EU investment & extensive coordination + policy

FIN exports work best only here....



Scenario labels: HI: Hydrogen Independence, RI: Regional Imports, LDI: Long-Distance Imports. Transportation scenario labels: LH2: hydrogen gas pipelines and liquefied hydrogen shipping, NH3: hydrogen gas pipelines and ammonia shipping.

Trade with neighbours scenario → northern Africa, ICE, NOR → energy diplomacy, long-term contracts, strategic stocks → cheaper investment costs → *this scenario is already in progress…*

High global trade scenario: USA, AUS, etc. → unlikely: how to guarantee security, agree on standards for H2 fuel transport, handling, certificates, etc.?

Source: Nunez-Jimenez & DeBlasio 2022

What can critical infrastructure owners do?

Technical resilience and beyond (Hanhijärvi 2024)

- Critical infrastructure operators/owners have primary responsibility for **technical resilience** & **safety**
- Robust design: undergound & reinforced pipes & storage, security zones, etc.
- Surveillance is a cost but can also serve dual-use purposes esp. at infrastructure close to borders
- However, other actors required for handling organizational & societal aspects of overall resilience + situational picture

	Protection before disruption		Reconstruction after disruption	
	RESISTANCE	**ROBUSTNESS**	**RECOVERABILITY**	**ADAPTABILITY**
Organizational	Crisis preparedness; Anticipation ability	Responsiveness	Financial & human resources; Recovery processes	Risk management; Education and D&I processes.
Technical	Detection capability; Security measures	Physical resistance; Redundancy	Material resources	Technology &system R&D&I
Societal	Crisis preparedness; Regulation, long-term strategies, planning; Identifying CIs; Coordination; Information sharing;	Societal responsiveness	Human, financial & material resources; societal recovery processes	Risk management; Evaluation of strategies, plans; R&D&I

DISRUPTION

Decentralised model & local level resilience:

H2 in resilient microgrids based on local renewables
→ can be small cities, villages, apartment blocks, hospitals, etc.

- **Decentralised local energy production →** numerous targets for hostile actors, many targets likely to survive attacks
- **Micro-grids & energy communities with island operation capacity →** can flexibly decouple from the larger grid in case it fails, using their own renewable resources backed up with H2; or can support grid during its restart/recovery
- **Energy storage (battery, biomass), alternative fuels (fuel cell technology) →** can help to cope with supply chain disruptions
- **Flexible energy consumption in a 'third-phase' smart grid →** such development requires more data on production & consumption (sensors, IT solutions such as data hubs, etc.), all of which can well be tested on the local level

Incl. smal-scale solar, local biomass, fuel cells & micro-H2, biogenic H2, etc.

Resilient Finland with 300 communities & 100+ microgrids with island operation capacity?

Key take-aways

- energy security is about ensuring low vulnerability
- low vulnerablity requires mobilisation of diverse set of actors and agreement on joint/ coordinated actions → dynamic, cross-sectoral nature
- actors can engage multiple energy security practices to enhance energy security
- overlap among diverse security practices, dependent on scenario at play
- overlap also among level at which energy security practices are located (local – national – EU/regional – global)