



Institute for
Innovation and
Public Purpose

Shaping green transitions: policies for industrial restructuring

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Background paper: Andreoni, A. and Rius, A (2022)

Context: climate change crises

- **Crises, and yet slow progress: approaching a tipping point?**
 - IPCC (2019,22): Nationally Determined Contributions leading to median global warming could hit 3.2°C by 2100
 - IEA (2021) Roadmap to Net Zero by 2050
 - COP26 and Ukrainian war: big targets, small implementation & resilience
- **Geopolitical landscape of green transition**
 - China frontrunner: green tech, diffusion, & U-M VCs for critical minerals
 - EU evolving: rise of a multi-layered entrepreneurial-regulatory state
 - US catching up: green technology, access to critical materials, incumbents
- ***At each crisis, industrial policy rediscovered & reloaded***

Outline

1. Green New Deals (in EU and US)

- Evolving policy rationales and framing
- Energy transition, and beyond: 'deep' industrial restructuring
- Industrial policy reloaded: shaping heterogeneous industrial landscapes, entry/exit, multi-layered policy governance

2. Emerging green industrial policy models & structural pathways

- Place-based industrial policy
 - innovation driven (cases: Basque country, NYS and Lithium Valley California)
 - efficiency enhancing (cases: Emilia Romagna)
- Cross-regional & sectoral challenge driven industrial policy
 - Hydrogen alliance in EU

3. Industrial policy lessons: instruments and state capacity

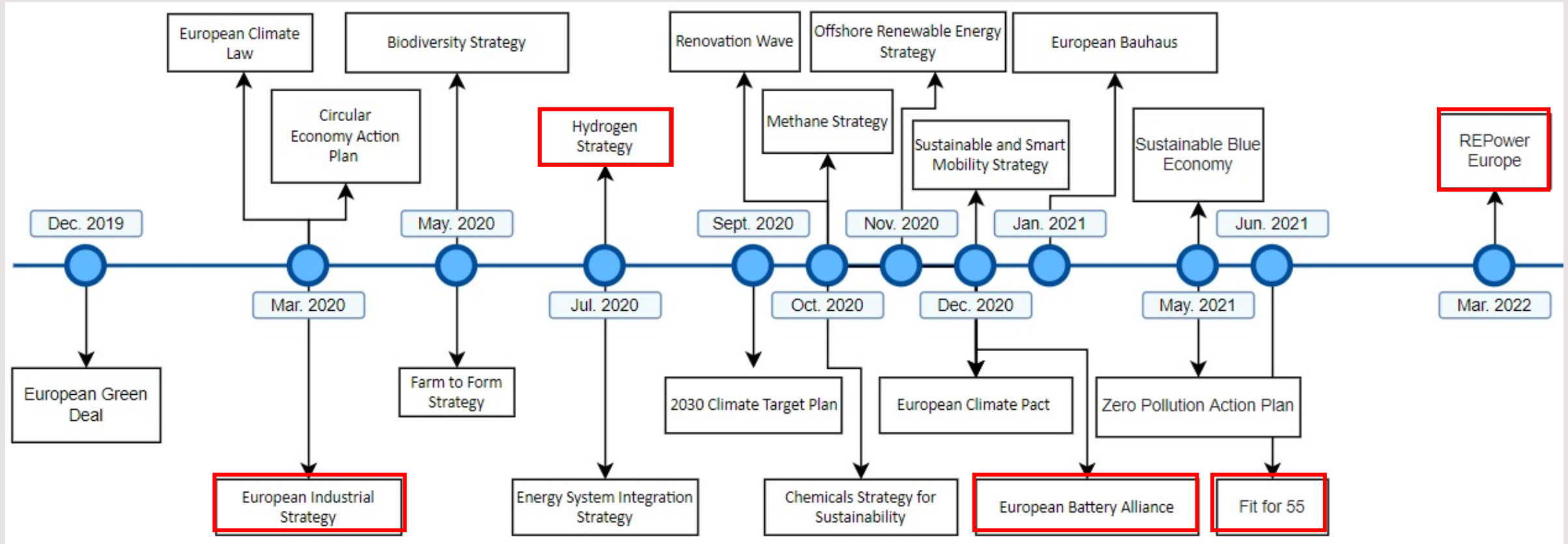
Green New Deals

Policy rationales

- Market-driven solutions (e.g. carbon pricing, feed in tariffs ...)
↓
- Macroeconomic measures and green finance
↓
- Industrial policy for accelerating energy transition and planning 'deep' industrial restructuring

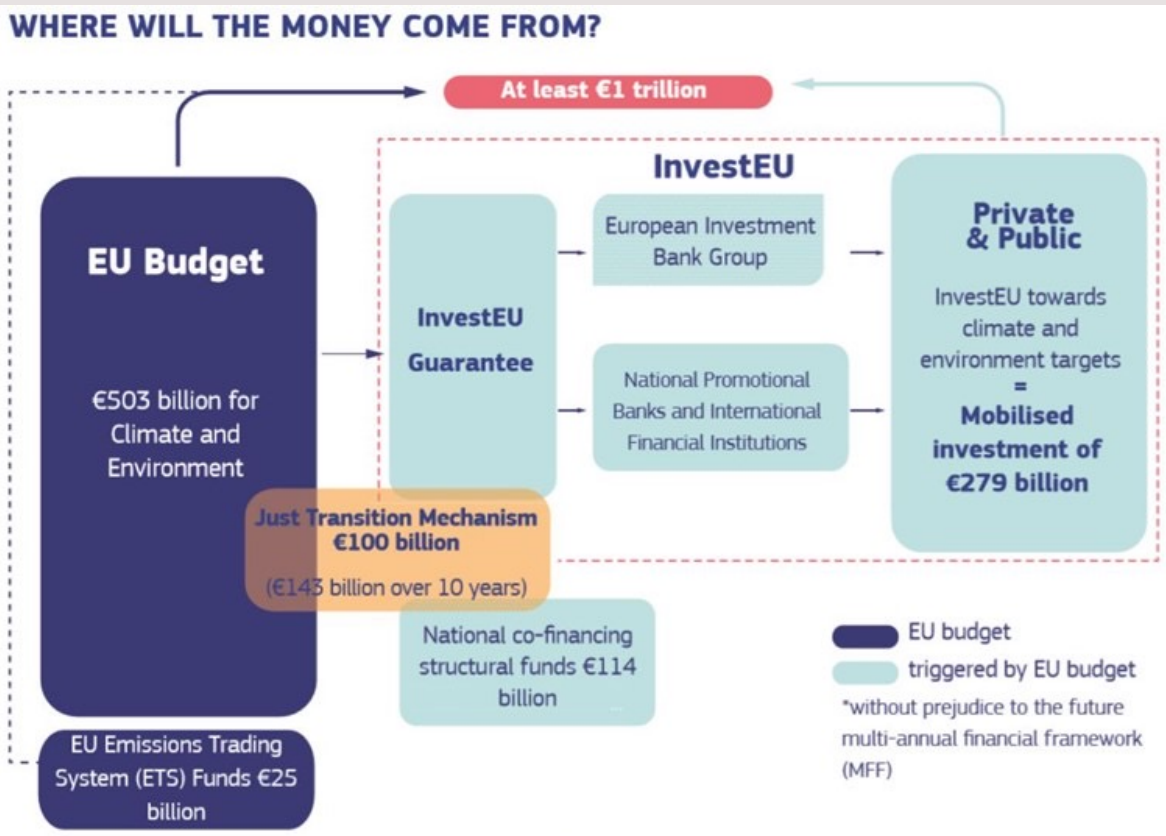


EU Green Deal (EC, 2019) evolution: energy, industry, national/continental security



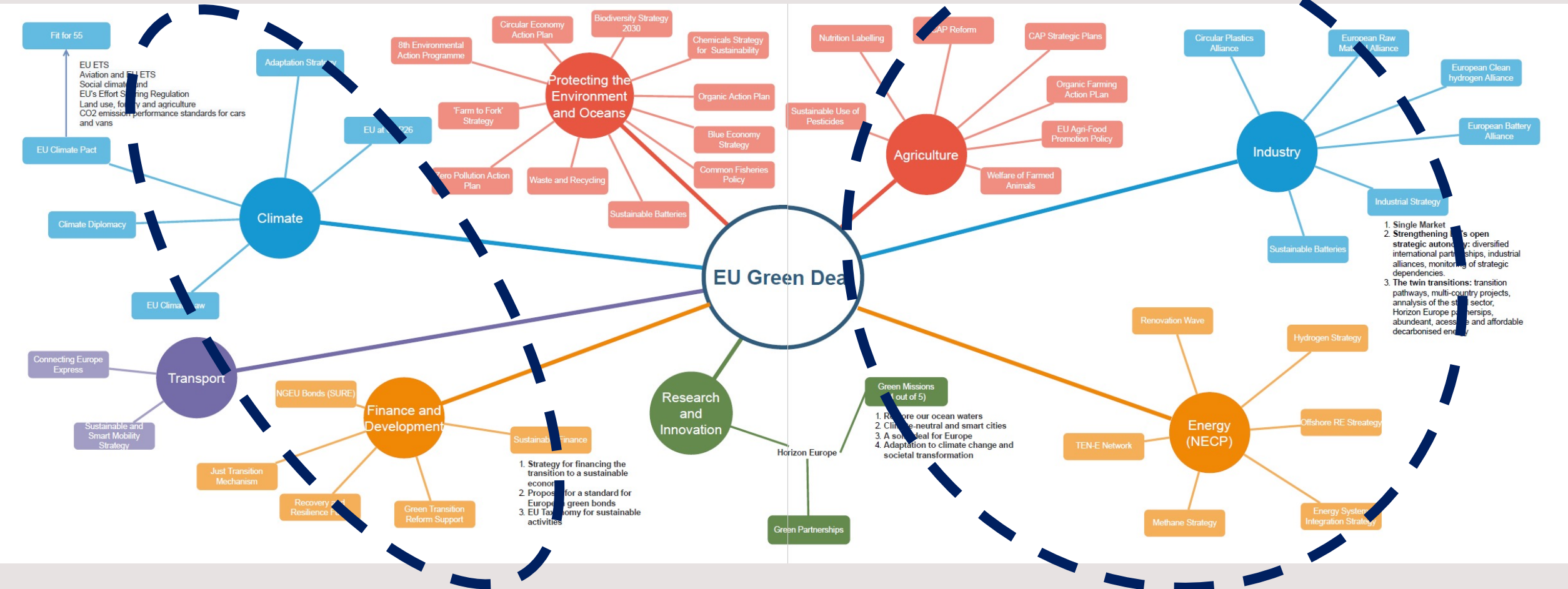
Green finance architecture & EIB

EU Green Deal - European Green Deal Investment Plan (1 trillion, 2020-30)



	MFF	NGEU	TOTAL ²	MARKEDLY GREEN
1. Single Market, Innovation, Digital				
Horizon Europe	94%	6%	91.5	35%
Invest EU	34%	66%	9.14	30%
Connecting Europe Facility – Transport, Energy, Digital	100%	0%	20.6	-
Single Market Programme	100%	0%	4.2	
EU Space Programme	100%	0%	14.8	
2. Cohesion, Resilience and Values				
European Regional and Development Fund	100%	0%	226.0	30%
Cohesion Fund	100%	0%	48.0	37%
Recovery and Resilience Facility	1%	99%	724.6	37%
React-EU (through ERDF & ESF)	0%	100%	50.6	25%
European Social Fund Plus	100%	0%	99.2	
Erasmus +	100%	0%	24.5	
RescEU	38%	62%	3.2	
3. Natural Resources and Environment				
European Agricultural Guarantee Fund	100%	0%	291	-
European Agricultural Fund for Rural Development	92%	8%	95.5	-
Programme for Environment and Climate action (LIFE)	100%	0%	5.4	100%
Just Transition Fund	44%	56%	19.2	100%
4. Migration and Border Management				
Asylum and Migration Fund	100%	0%	9.8	
Integrated Border Management Fund	100%	0%	6.2	
5. Security and Defence				
Internal Security Fund	100%	0%	1.9	
European Defence Fund	100%	0%	7.9	
6. Neighbourhood and the World				
Neighbourhood, development, and international cooperation	100%	0%	79.4	
7. European Public Administration				
Administrative expenditure of the institutions			62.9	
TOTAL³	1,210	806	2,018	25%

EGD: climate finance and 'deep' industrial restructuring



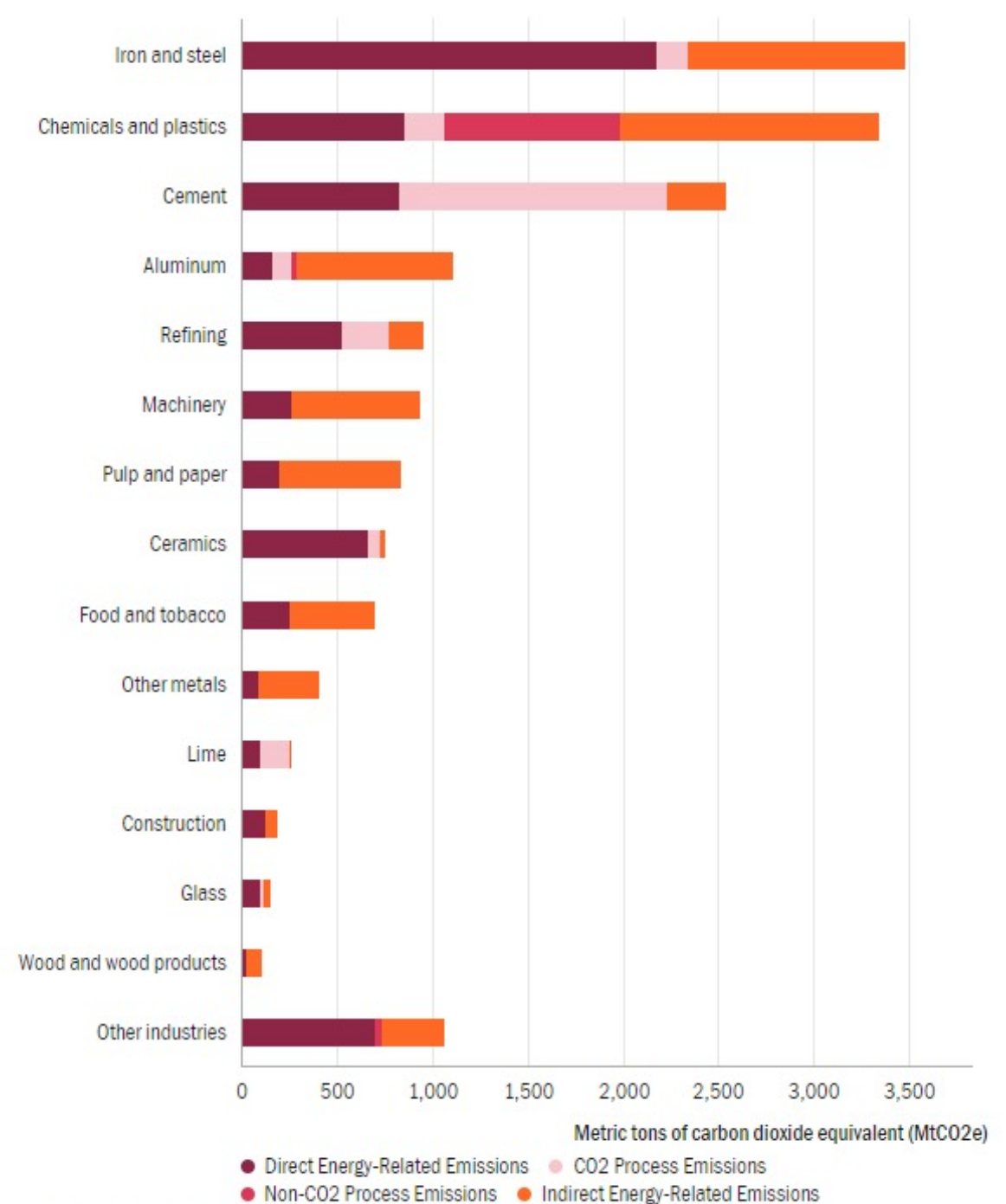
Complexities of 'deep' industrial restructuring:

heterogeneity across and within sectors & interdependencies along sectoral value chains (and places)

- **Differences in production processes, energy intensity, product embedded materials in use and technologies, investment cycles (and lock-in potential), SVC structure, ALL result in varied emissions and energy use patterns**
 - **Cement:** the use of some dry processing techniques can be half as energy-intensive (e.g. GJ/t per clinker, the key energy-intensive component of cement) as wet processes (UNIDO, 2014)
 - **Steel:** the use of green hydrogen-fed production processes (Hydrogen Breakthrough Ironmaking Technology) and fully recyclable practices can reduce emissions dramatically (Ghoneim et al., 2022)
 - > **Cement and Steel account for just over 50% of all industrial emissions, alternative production technologies are already available but need to be scaled-up and large-enough markets created to sustain 25Y investment cycles**
- **Agriculture:** beef has the highest average GHG emissions per 100 grams of protein, but these can range from less than 5 kgCO₂eq to as much as 30 kgCO₂eq (Poore & Nemecek, 2018)
- **Buildings:** Solutions must address issues ranging from changing the energy supply, which in itself can draw from various renewable energy technologies, to external and internal thermal insulation, windows, lighting, smart devices (e.g. meters), and Heating, Ventilation, and Air Conditioning (HVAC) systems (Ascione et al., 2017; Luddeni et al., 2018)

Global greenhouse gas emission:

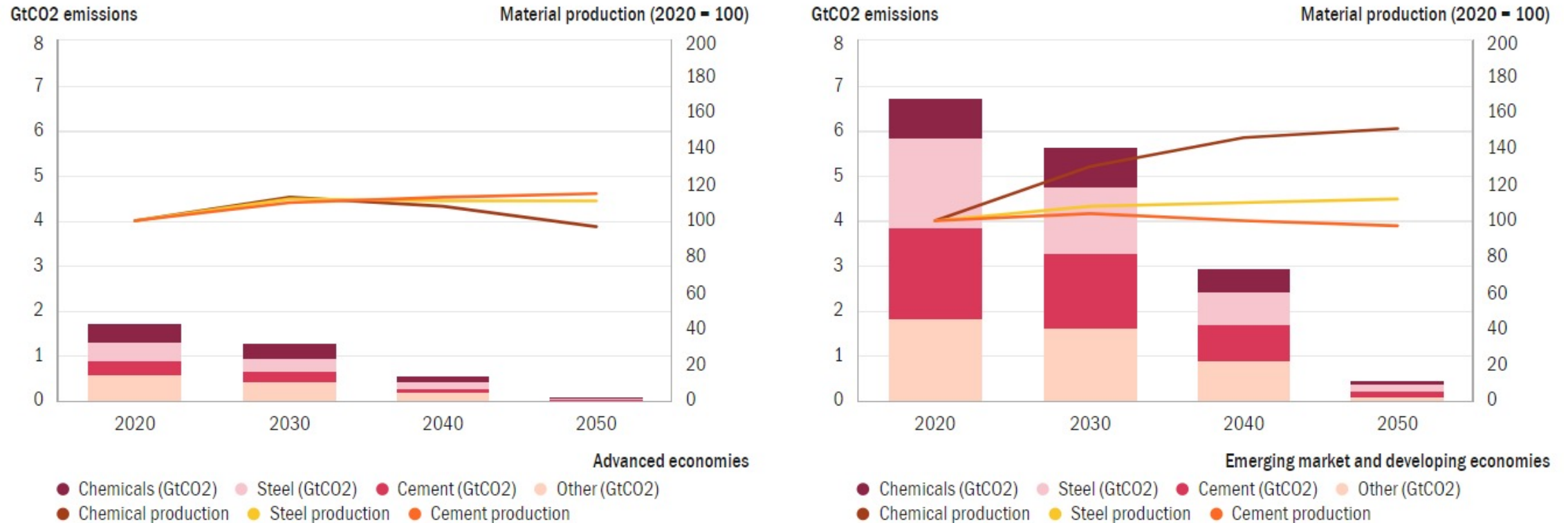
heterogenous industries and interdependencies



Source: [Rissman, J., Bataille, C., Masanet, E. et al., \(2020\).](#)

Global greenhouse gas emission reduction pathways under Net Zero targets:

Global emissions from steel and cement production will have to decrease by more than 90% by 2050



Note: Emission reductions necessary in 2020-2050 for industry sectors to be compatible with a 50% likelihood of limiting global warming to 1.5°C above pre-industrial levels.

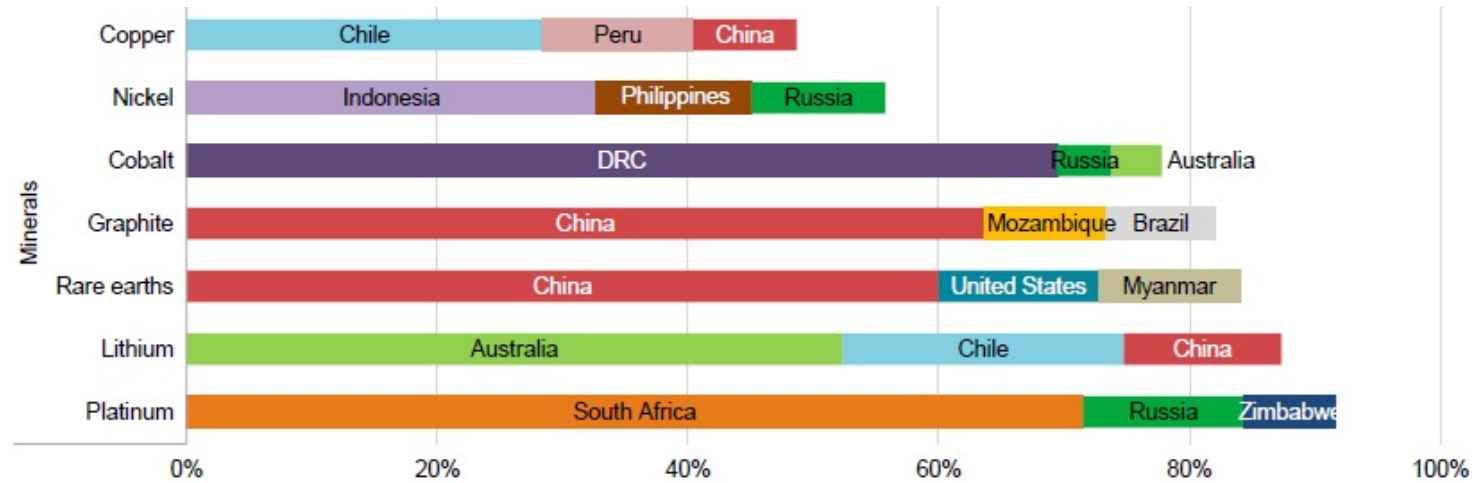
Source: [Maltais, A., Gardner, T., Godar, J., Lazarus, M., Mete, G., and Olsson, O. \(2021\).](#)

Global interdependencies and shifting resource constraints in green transition

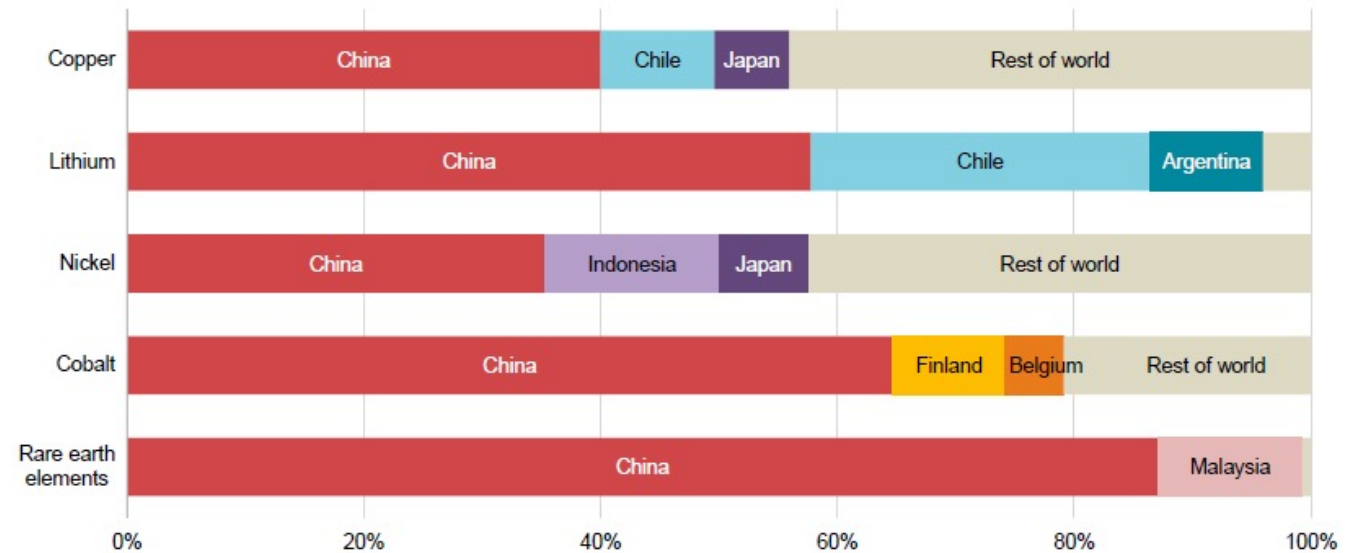
Contestation in upstream and midstream industries (especially critical minerals)



1a: Share of top three producing countries in total production for selected critical minerals, 2019



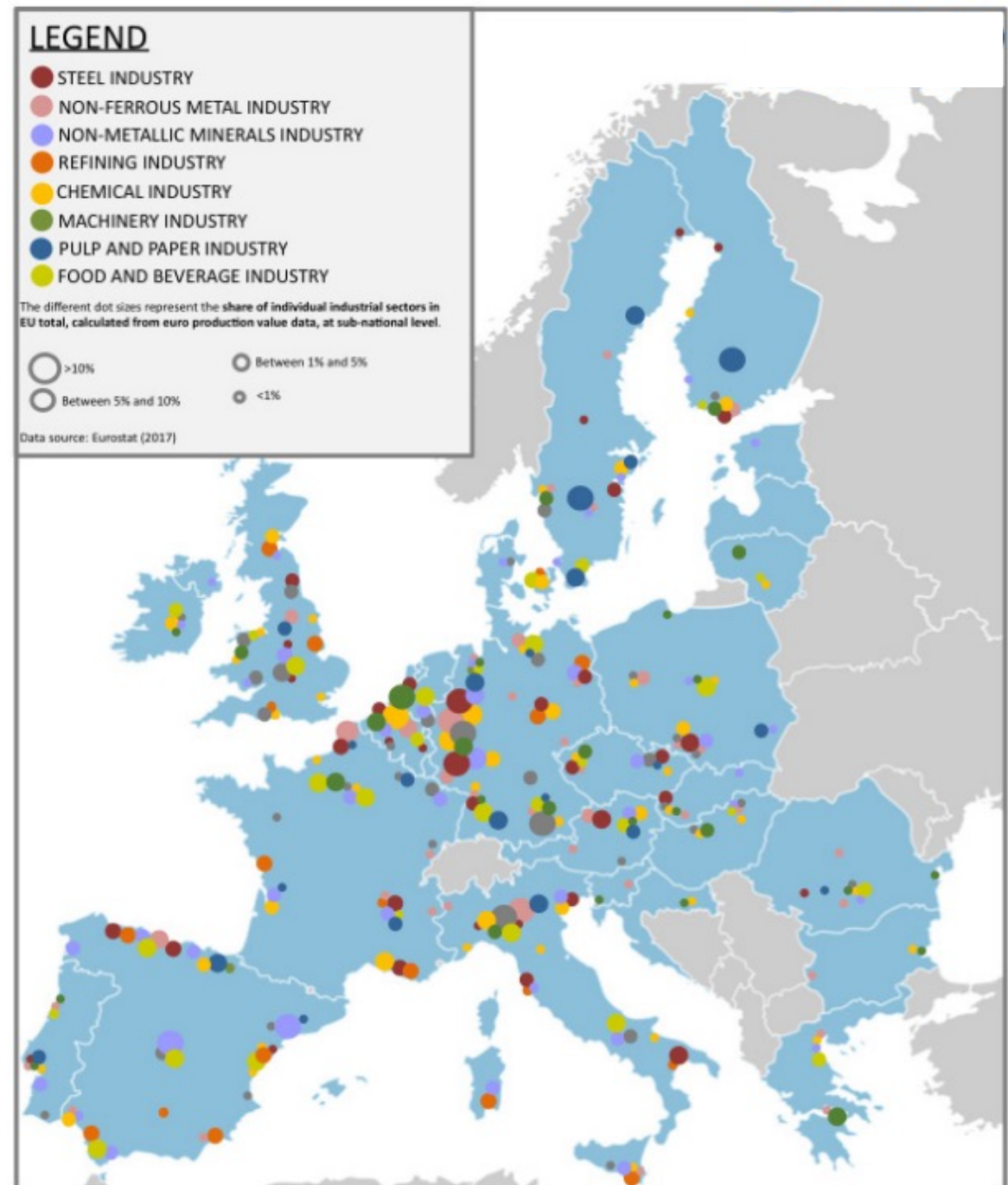
1b: Shares of processing volume by country for selected critical minerals, 2019



Deep industrial restructuring across EU countries and regions:

structurally-determined heterogenous needs and priorities

Location of energy-intensive manufacturing activities by share of value added over EU sector totals (CEIP 2017)



Political economy of industrial restructuring:

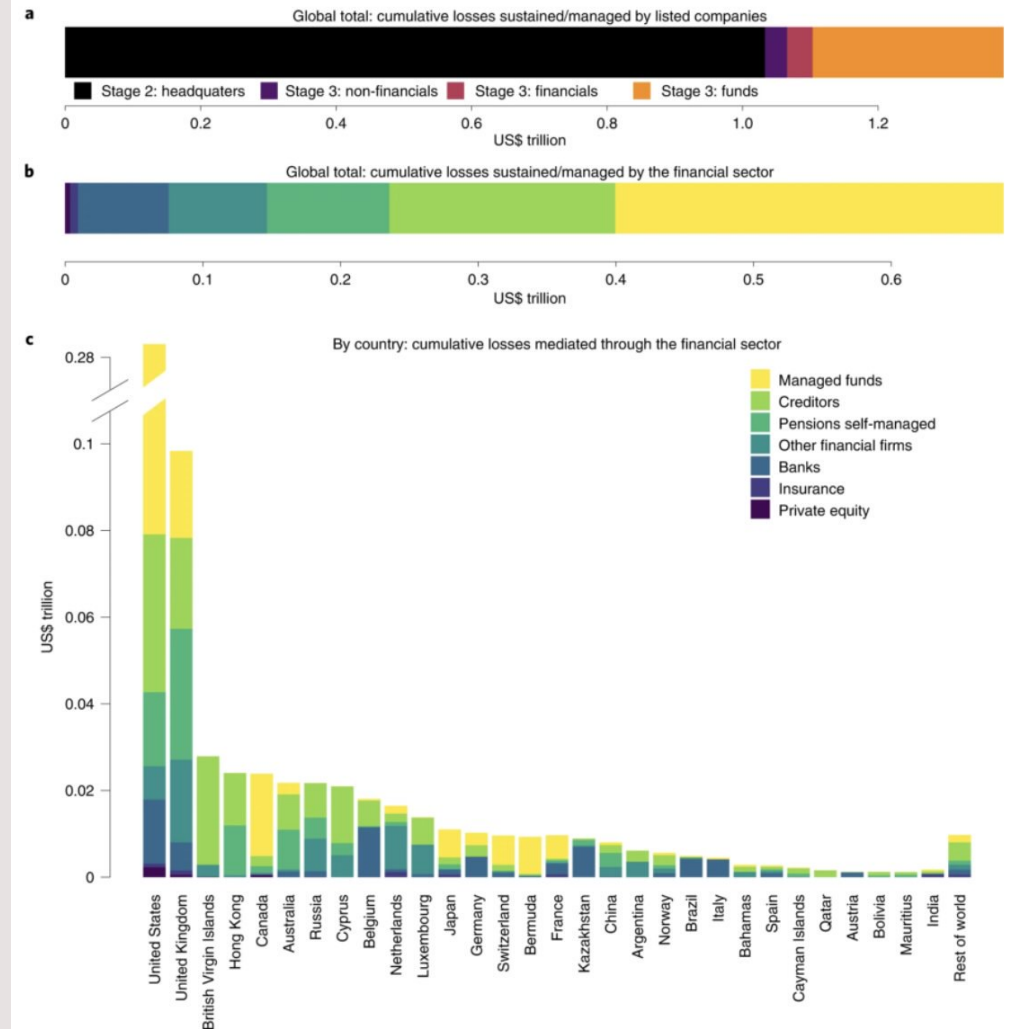
who pays for it (and the most)?

who has capacity to respond?

- **Equity, just transition, and resistance from asset holders** (Driscoll & Blyth, 2022; Andreoni, 2022; Semieniuk et al., 2022)
 - Yellow Vests protests (France, Canada)
 - Resistance from asset holders/managers (e.g. Vanguard, oil & gas lobby in the US) to end new fossil fuel investments (FT, 2021; FT, 2022)
 - US and UK listed companies exposed the most driving a de-risking narrative
- **EU risk of reinforcing unbalances:** Limited state capacity for implementation and effective spending in peripheral regions

Fig. 4: Cumulative losses by listed companies and in financial markets.

From: [Stranded fossil-fuel assets translate to major losses for investors in advanced economies](#)



a. Global losses affecting stock-market-listed fossil-fuel headquarters, intermediate and ultimate corporate owners, and listed fund managers in the medium realignment. b. Same as in a, but for all financial institutions. See c for legend. Creditors equal negative equity, reducing creditors' collateral. c. Same as in b, but split by country. The y axis is compressed between US\$0.10 and US\$0.28 trillion.

Different structural tensions, but also different windows of productive opportunities for related/unrelated innovative industrial restructuring: emerging patterns

EU (See for example: Grillitsch and Hansen (2019), Fløysand et al (2022))

- Fossil fuel-dependent regions (e.g. Rogaland, Norway), some are also among those where innovation in energy technologies are emerging (green steel, Sweden)
- Old industrial regions specialised in 'brown' industries (Ruhr Valley, North Rhine-Westphalia, Germany but also Emilia Romagna, Italy) alongside innovative industrial renewal in solar panel valley (Saxony-Anhalt, Germany)
- Regions with a strong specialisation in green industries are emerging (e.g. Jutland, Denmark), with some of them having made significant transitions from 'Brown' to 'Green' industries
- EU level emerging alliances across regions and sectors

US

- Federal mission-driven agencies (ARPA-E)
- State-level initiatives (NYSERDA)
- Lithium Valley and Battery Industry development (Salton Sea, South California)

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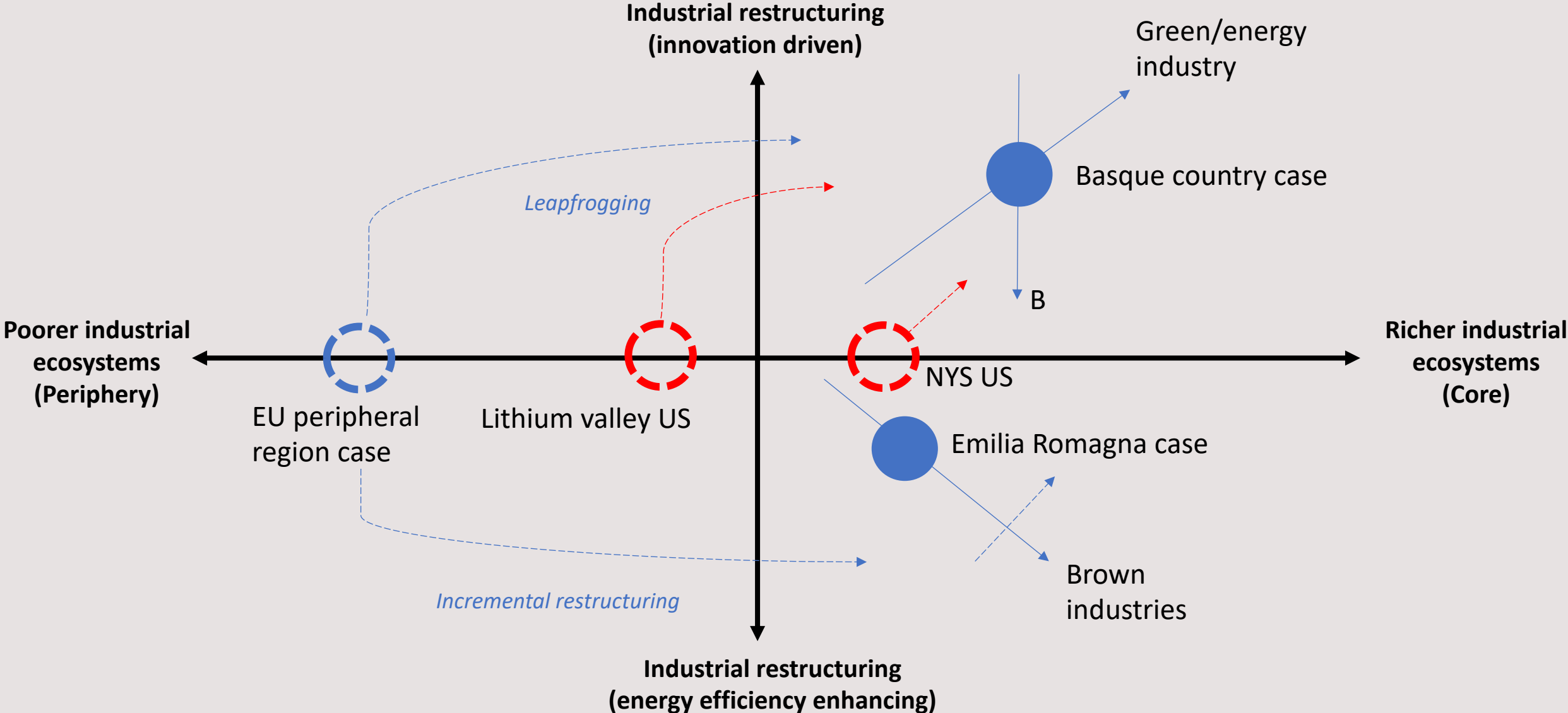
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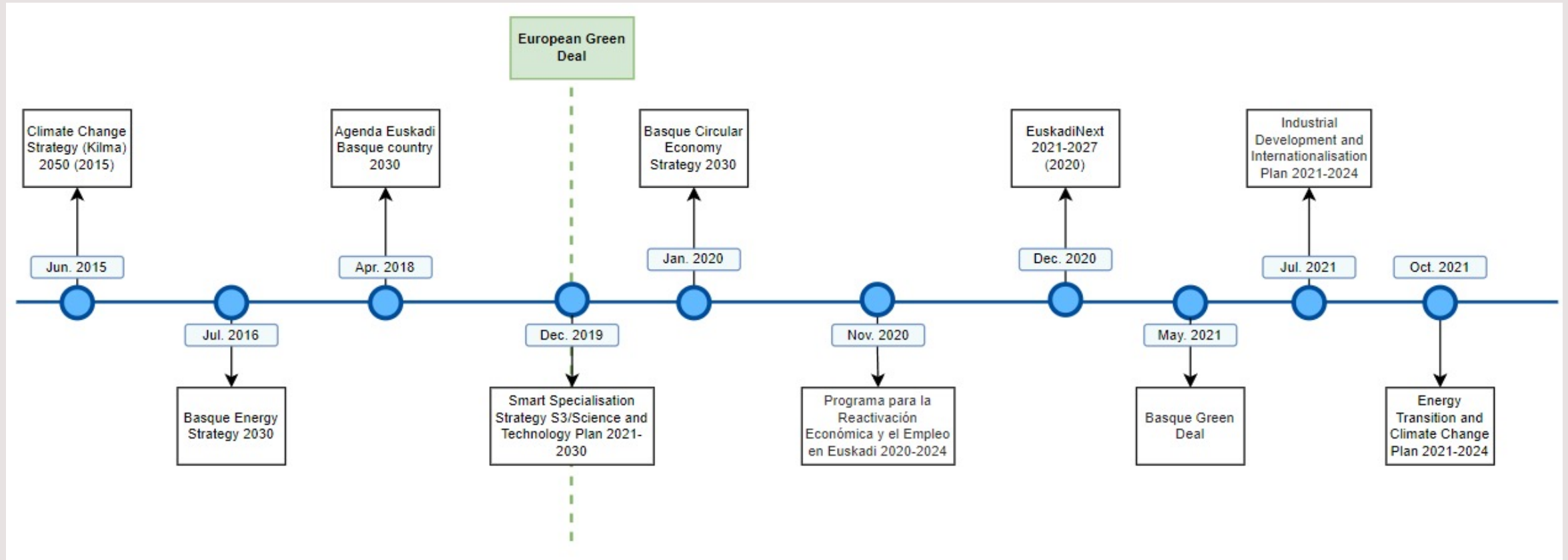
Place-based industrial policy: types



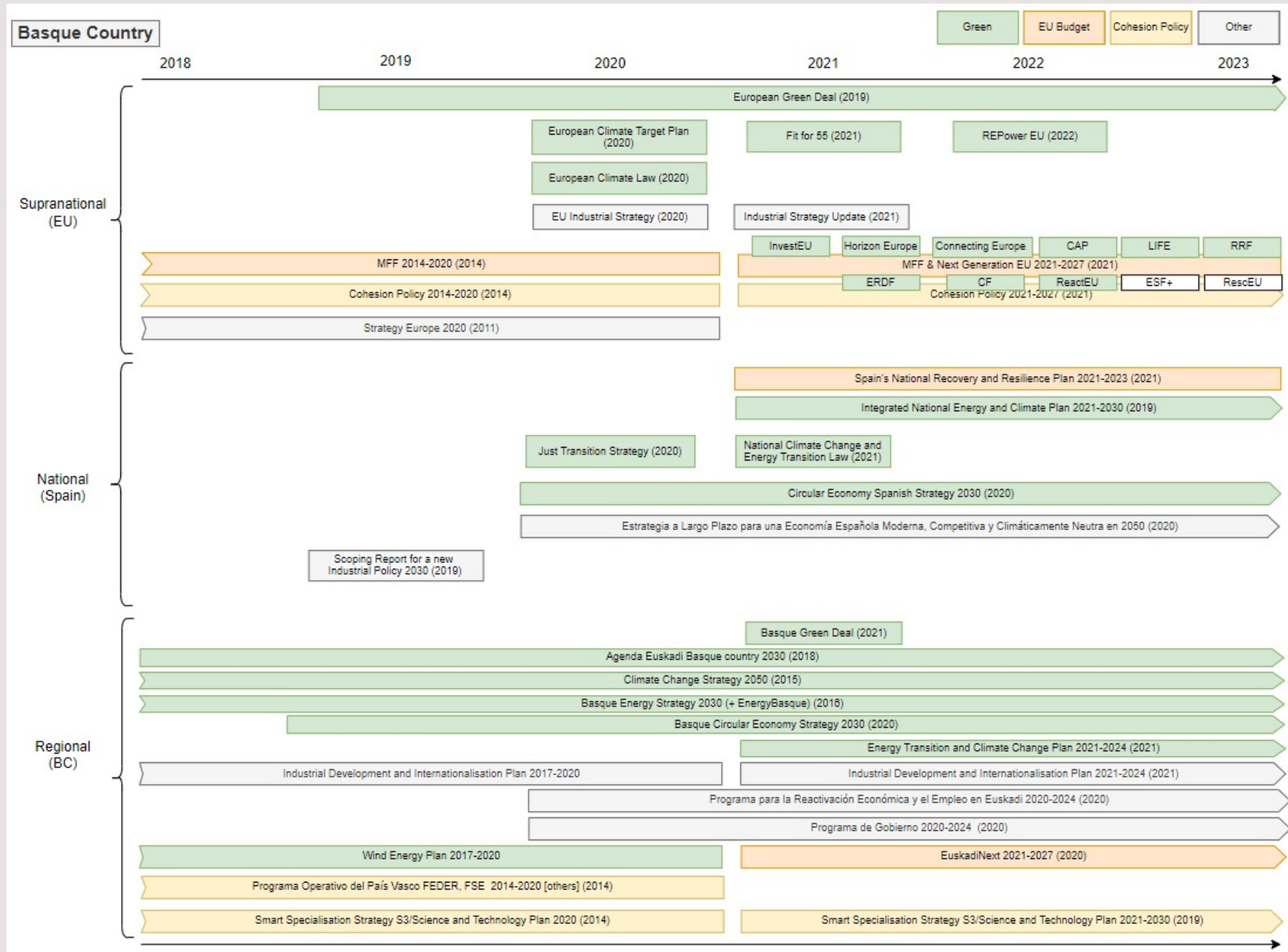
Basque Country - Overview

- Home to a dynamic industrial ecosystem, with shares of industrial employment and value added historically above 20% and continuous adaptation/restructuring to new forms of competition.
- Comprehensive green transition policy package:
 - Overarching strategies: Climate Change Strategy (2015), Basque Green Deal (2021), EuskadiNext 2021-2027 (2021), Energy Transition and Climate Change Plan 2021-2024 (2021)
 - Thematic/sectoral strategies: Basque Energy Strategy 2030 (2016), Basque Country Electric Mobility Plan (2018), Basque Circular Economy Strategy 2030 (2019)
- Approach:
 - Before EGD/NGEU: leaders in new markets/technologies, especially targeting energy technologies (onshore wind, floating offshore, wave energy)
 - After EGD/NGEU: more holistic approach: circular economy, mobility, renewable energy consumption

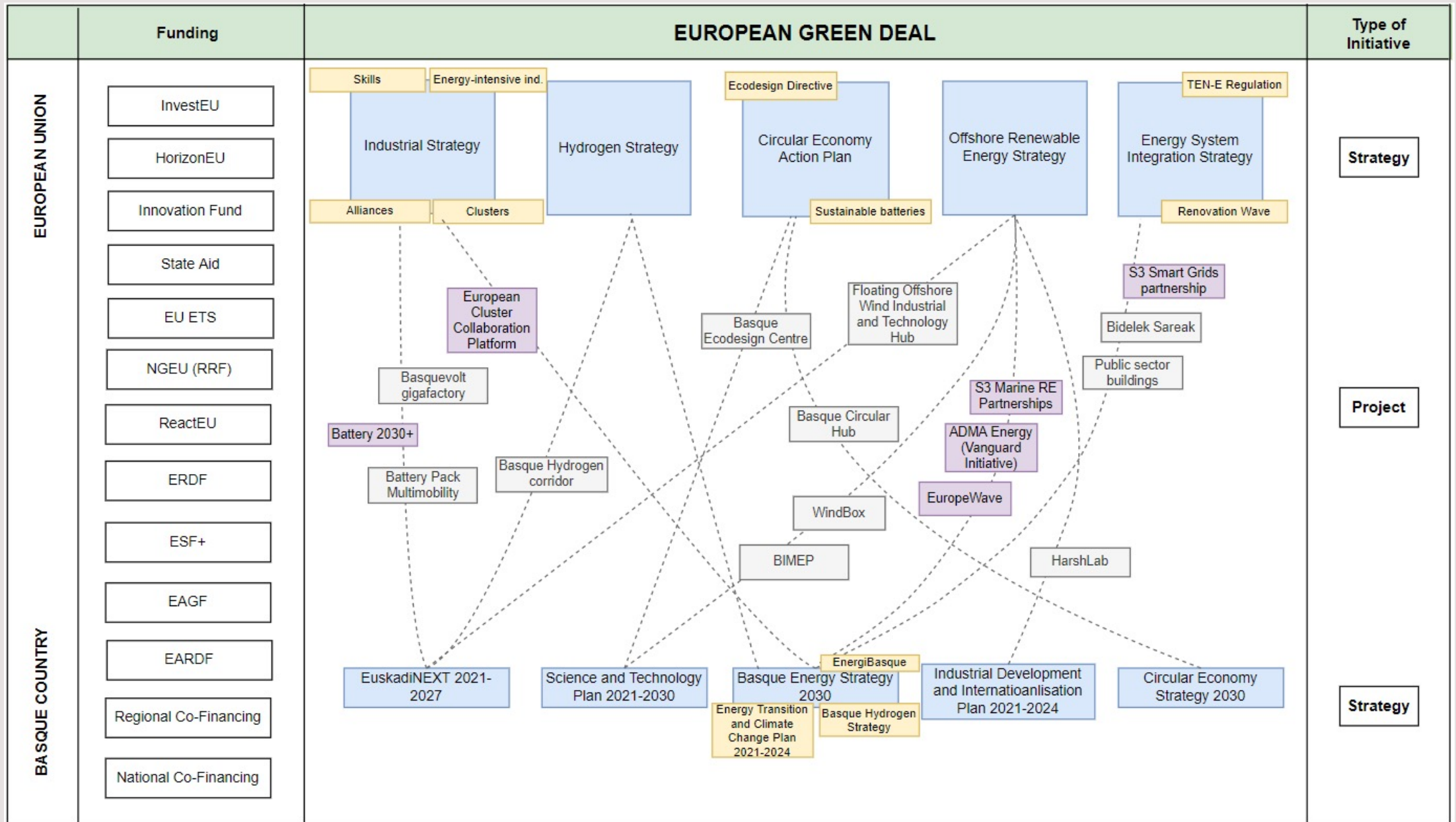




Source: authors from policy documents



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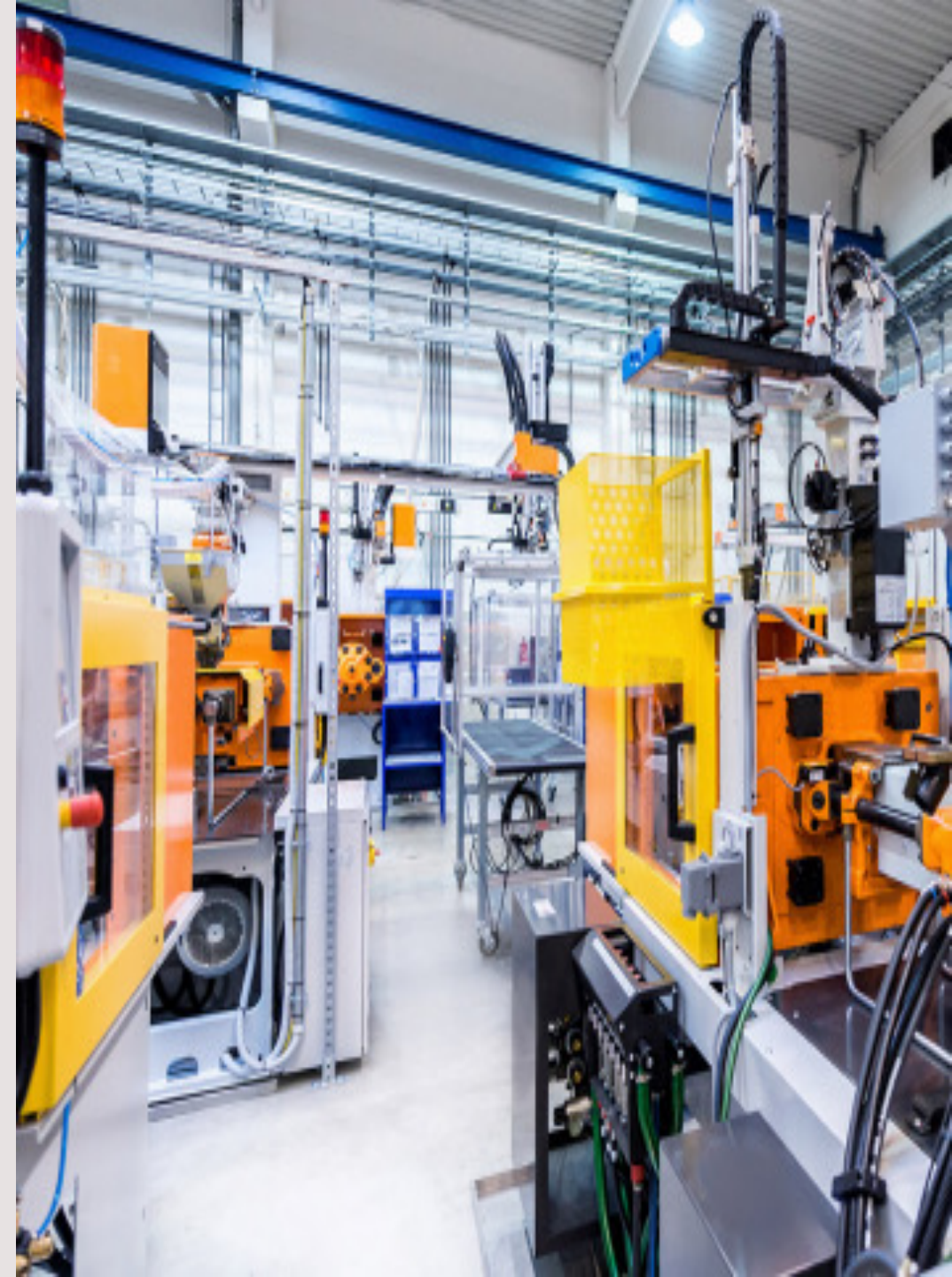
Basque Country – Policy Instruments

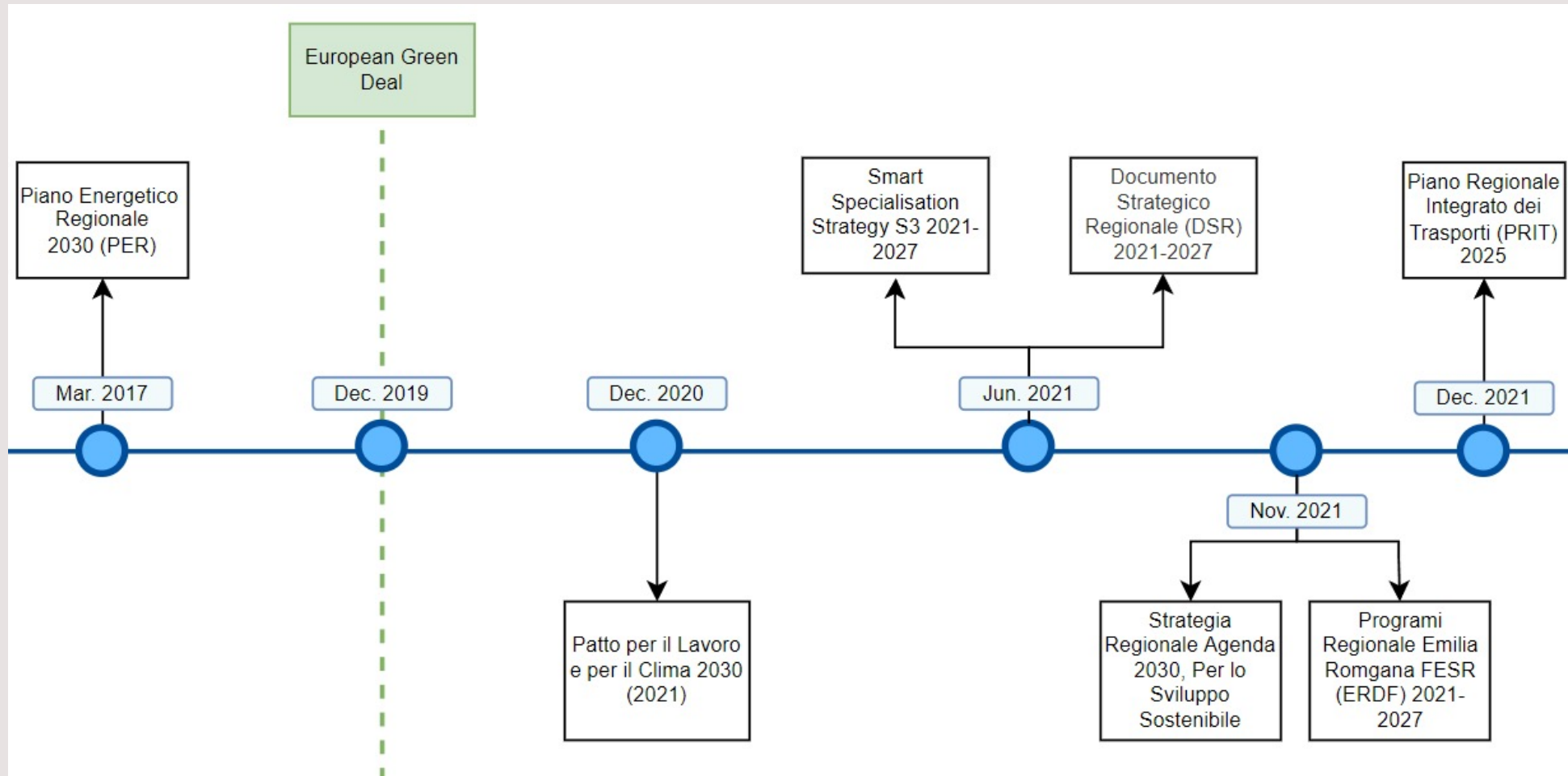
Example: pioneering wave energy technologies

- Dedicated public sector agency coordinating policy – Basque Energy Agency (EVE, in Spanish)
- Technology services: Biscay Marine Energy Platform (BiMEP)
- Public funding:
 - Grants covering up to 25% of investments in demonstration and validation of marine energy technologies
 - Pre-commercial procurement: EuropeWave (with Government of Scotland)
- Support to innovation system agencies: Tecnalia → Oceantec

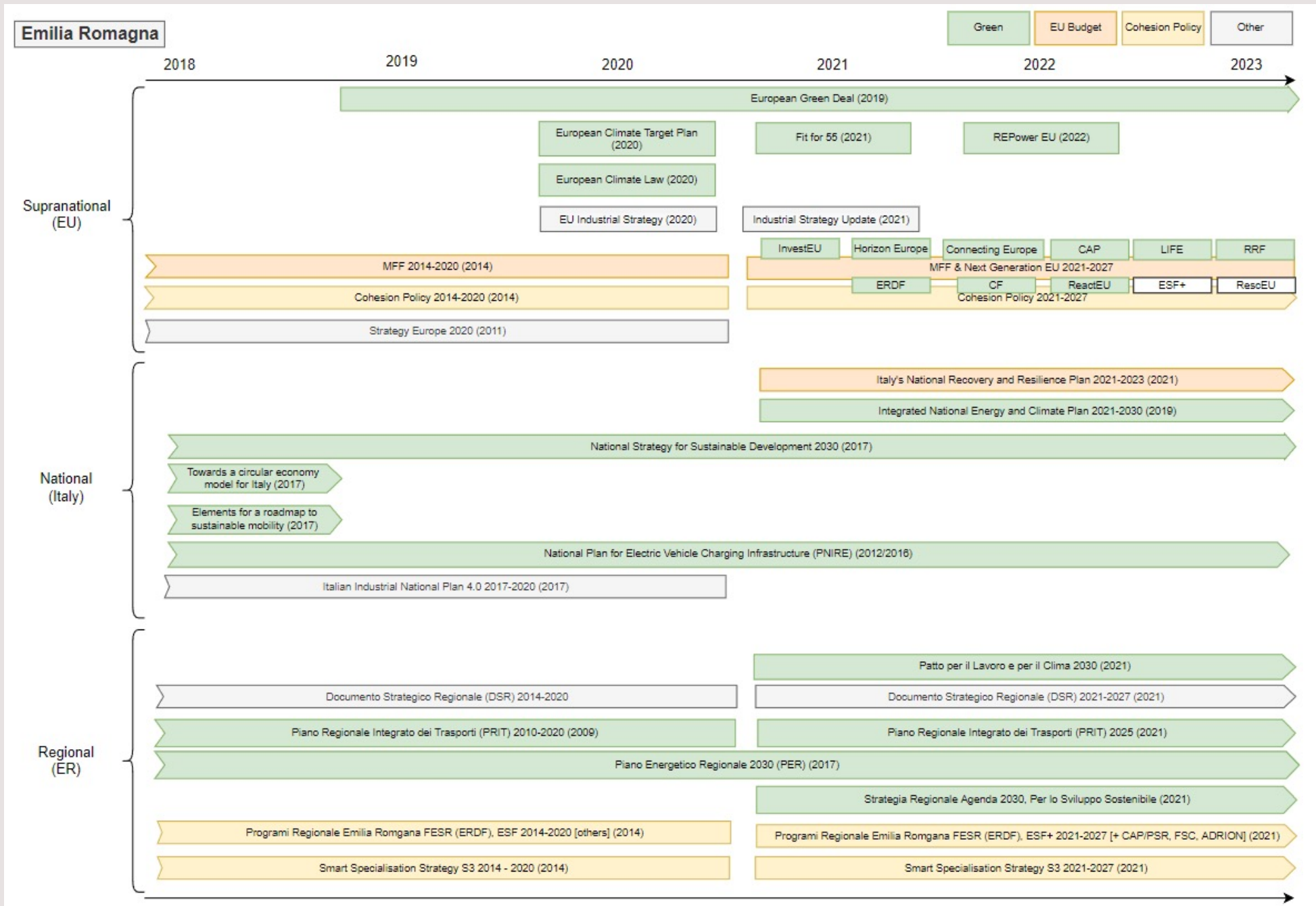
Emilia Romagna - Overview

- Home to the ‘Third Italy’ model of ‘flexible specialisation’, with significant success in the post-WWII period
- Green transition policy package:
 - Overarching strategies: Pact for Labour and Climate (2021), Strategia Regionale Agenda 2030, Per lo Sviluppo Sostenibile (2021), 2020-2025 Programma di Mandato, Regional Strategy Document 2021-2027
 - Thematic/sectoral strategies: Piano Regionale Integrato dei Trasporti (PRIT) 2025 (2021), Regional Energy Plan 2030 (2017), Rural Development Programme (linked to EAFRD)
- Approach:
 - Before EGD/NGEU: energy efficiency throughout industrial structure, focus on environmental standards
 - After EGD/NGEU: upscaled efforts in RE production and consumption, value chain and technological development (e.g. Hydrogen Valley Modena).

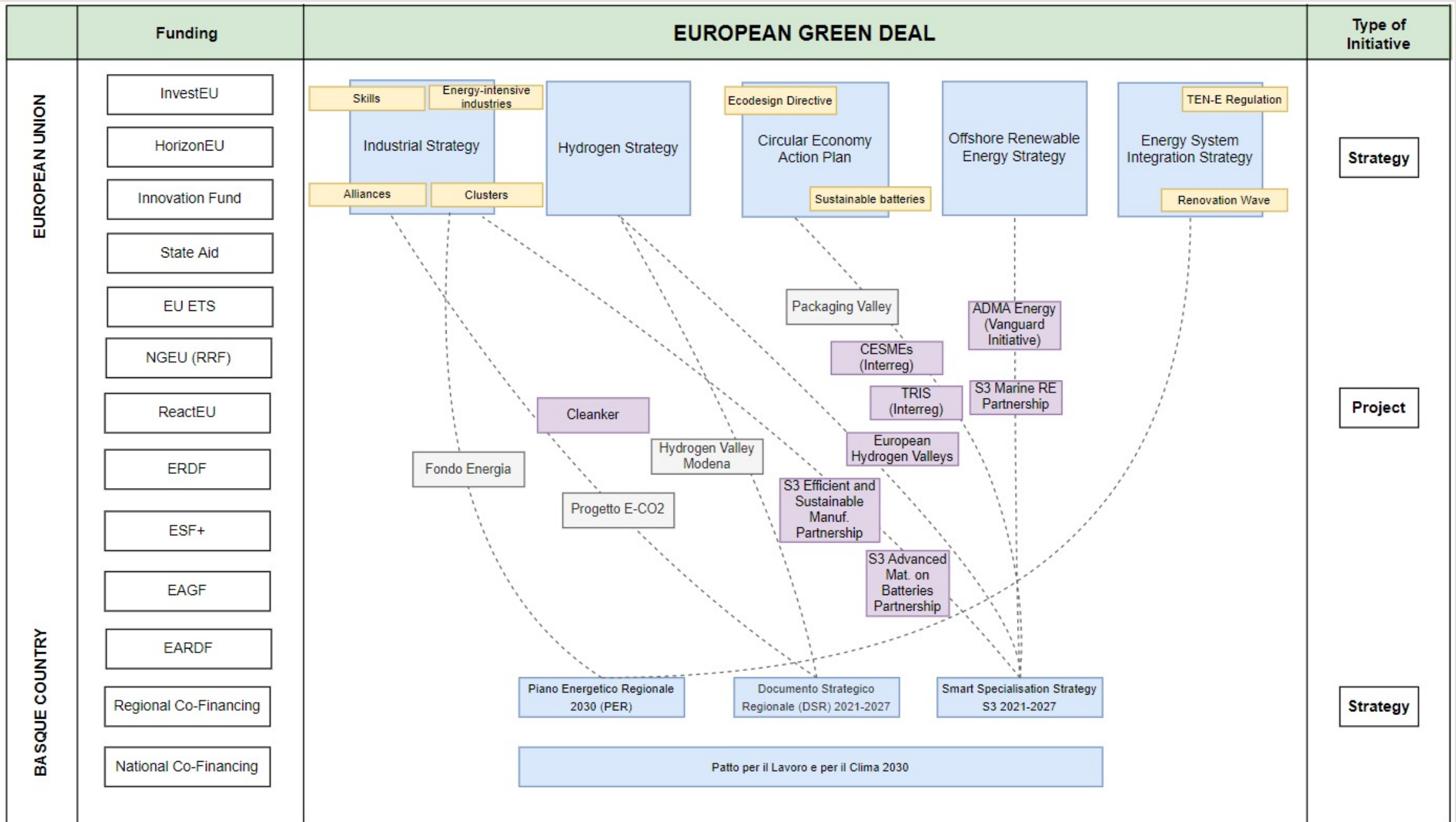




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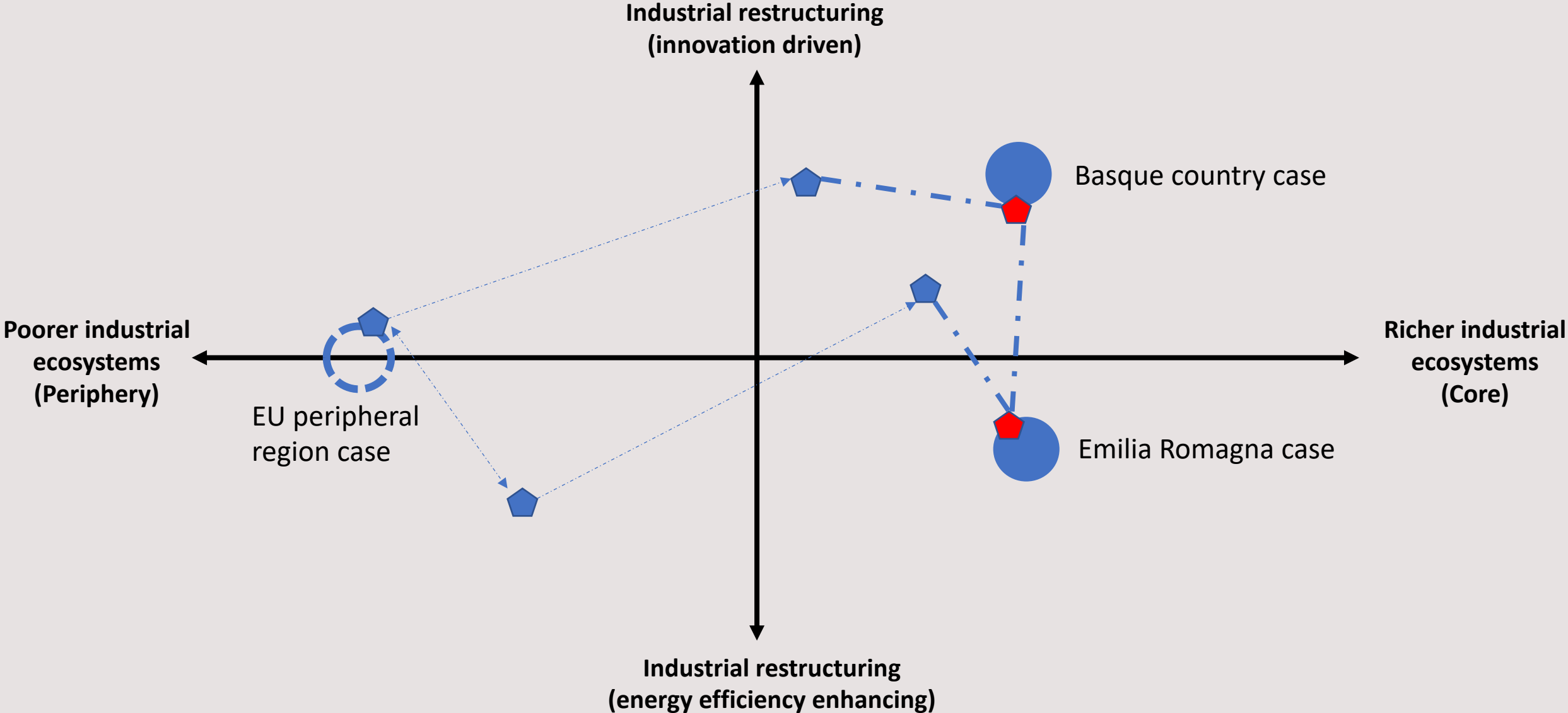


Emilia Romagna – Policy instruments

Mainstreaming through public finance

- Established climate/green organisations: Arpae, Osservatorio GreenER, ClustER
- Public funding: (i) grants, (ii) guarantees, (iii) revolving funds, and (iv) subsidised loans
 - Fondo Energia: Revolving funds covering up to 70% of the cost of projects aimed at either increasing energy efficiency within firms or increasing the production of energy from renewable energy sources

Cross-regional and sectoral challenge-driven alliances



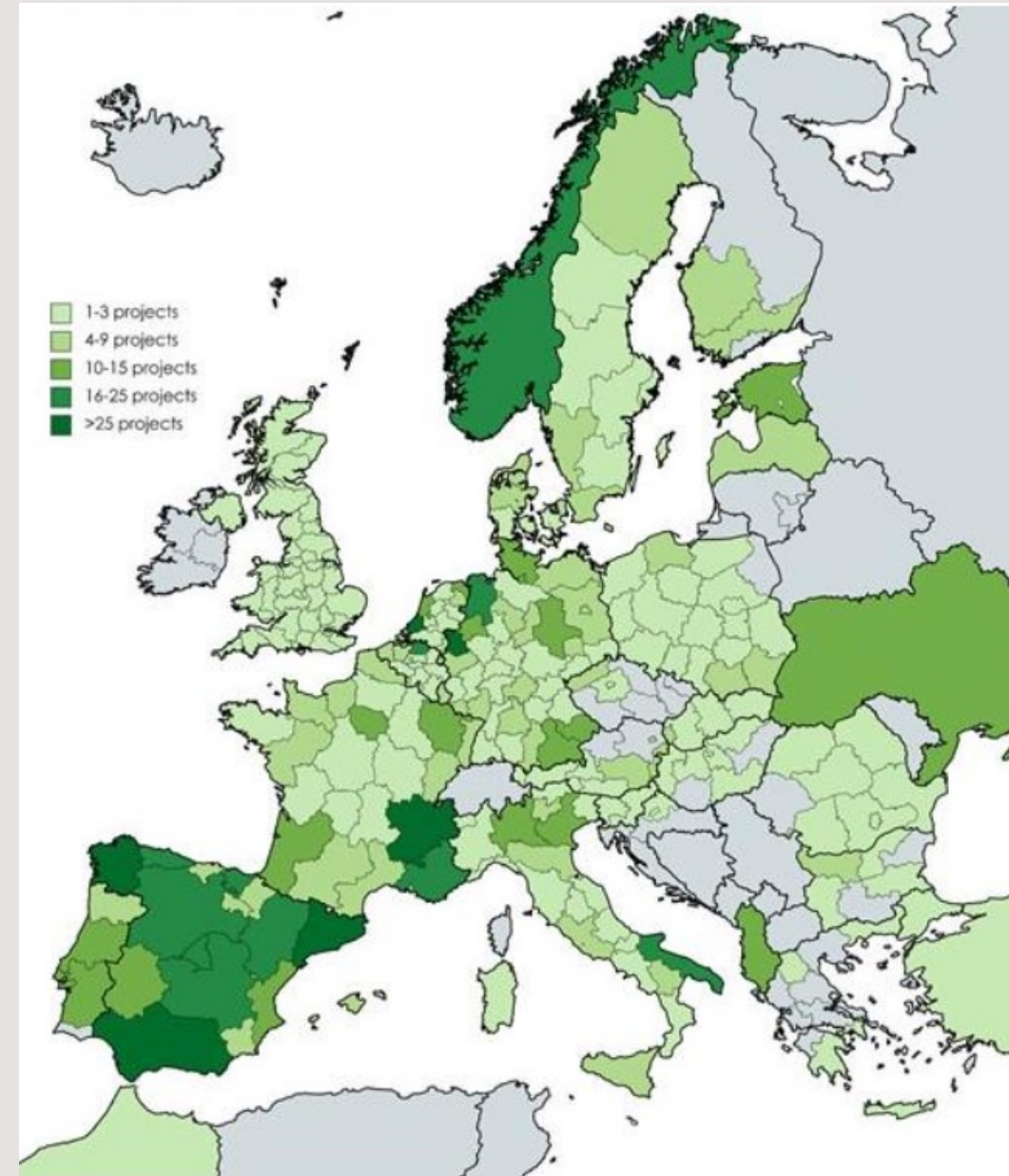
Hydrogen Alliance and EIB

- Part of EGD - Hydrogen Strategy (2020)
 - Policy levers of the strategy: regulation, standards, innovation (Clean Hydrogen Joint Undertaking), infrastructure (TEN-E), coordination (Hydrogen Alliance)
- Includes:
 - Hydrogen Forum to discuss large-scale deployment
 - Over 750 projects
 - Covering different parts of the value chain: production, transmission and distribution, application in industry, transport, energy systems, buildings
- Through EIB
 - Technical advice (InnovFin Advisory)
 - Funding: €550m direct financing during the period 2010-2021

Hydrogen Alliance and EIB

- Potential opportunity for regions with less dynamic ecosystems to chip in
- E.g. Andalucía (SPA)
 - One of the region's with the highest number of Projects in the pipeline (43 Projects)
 - 15 organisations (public and private)
 - Several areas – e.g. Manufacturing, production, mobility.

Location of pipeline projects



Source: European Clean Hydrogen Alliance webpage

Industrial policy lessons

Different deep industrial restructuring pathways

Different mix of industrial policy instruments:

- **Public Finance:** *Directing finance matters more than increasing the amount of finance available as directionality is what makes finance transformative and capable to crowd-in resources*
- **Public procurement:** *Public procurement can be used to discover and experiment functional solutions to challenges posed by climate crisis (also international to create global markets, e.g. Industrial Deep Decarbonization Initiative (IDDI) for cement and steel)*
- **Standards and Technology Services:** *Adoption of new technologies need system-level coordination and services to increase diffusion in the industrial ecosystem*

Overall approach to policymaking:

- **Balancing risks and rewards (including ‘managing exits’) via conditionalities and policy alignment**
- **Linking policy implementation to state capacity development (within multi-layered framework)**



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Thanks!

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US examples: extra comparators

- **Vast lithium reserves in the Salton Sea, Imperial County – Southern California**
- Reserves could satisfy more than 1/3 of current global lithium demand
- Imperial County one of the most disadvantaged communities in CA (e.g. one of the highest unemployment rates in the state)
- Salton sea – environmental hazards (pollution & toxicity) due to agricultural runoffs
- Potential for building the supply chain locally leveraging the synergies between renewable energy and lithium extraction in geothermal plants
- BUT – poor levels of local capabilities partly due to long period of deindustrialisation and the Silicon Valley growth model

A case of green restructuring of a poor industrial ecosystem aiming at green innovative restructuring