Sustainable Development and Low Emissions Economies

Climate Policies towards Net Zero

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Directing (?) Innovation and Progress

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Chance, therefore or secret and unknown causes, must have a great influence on the rise and progress of all the refined arts...But I am persuaded that in manycases good reasins might be given, why a nation is more polite and learned than any of its neighbors

David Hume (1742)

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- The ***characteristics of environmental policy*** framework can affect the rate and direction of innovation in pollution abatement technologies
- Policy Initiatives attempt to address Green Tech Externalities
  - Financially ***internalizing the environmental costs***
  - Imposing a ***limit on the level of environmental pollution***

Characteristics of Efficient Environmental Policies

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- **Incidence**
  Does the policy target directly the externality, or is the point of incidence a "proxy" for the pollutant?

Environmental Policy Types (1/2)

- **Market-based Instruments**
  - Market signals as ***Incentives*** for sound environmental behavior and ***Disincentives*** for ***brown*** activities
  - ***Internalizing externalities*** by affecting firm's relative cost mechanism
  - Carbon Taxes, (R&D) Subsidies, Trading Scehems, Feed-in tariffs for renewable energy

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- **Non-Market Instruments**
  - **Regulatory** approaches, often called 'command-and-control' measures $\rightarrow$ ***explicit directives***
  - ***Limiting Production*** and/or dictating specific (green) processes
  - Emission standards, bans of toxic substances, land planning instruments, and emission limit values

Environmental Policy Types (2/2)

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  - Public R&D, Tax Credits, Patent protection
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- **Technology Support**
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  - Includes policies ***not directly*** attributed to green technologies
- Environmental (market and non-market) and technology policies work best when used ***in tandem***
  - Technology support $\rightarrow$ creation of new environmentally-friendly technologies, but provides ***little incentive for their adoption*** unless there is also an environmental policy in place

Environmental Policy Stringency OECD

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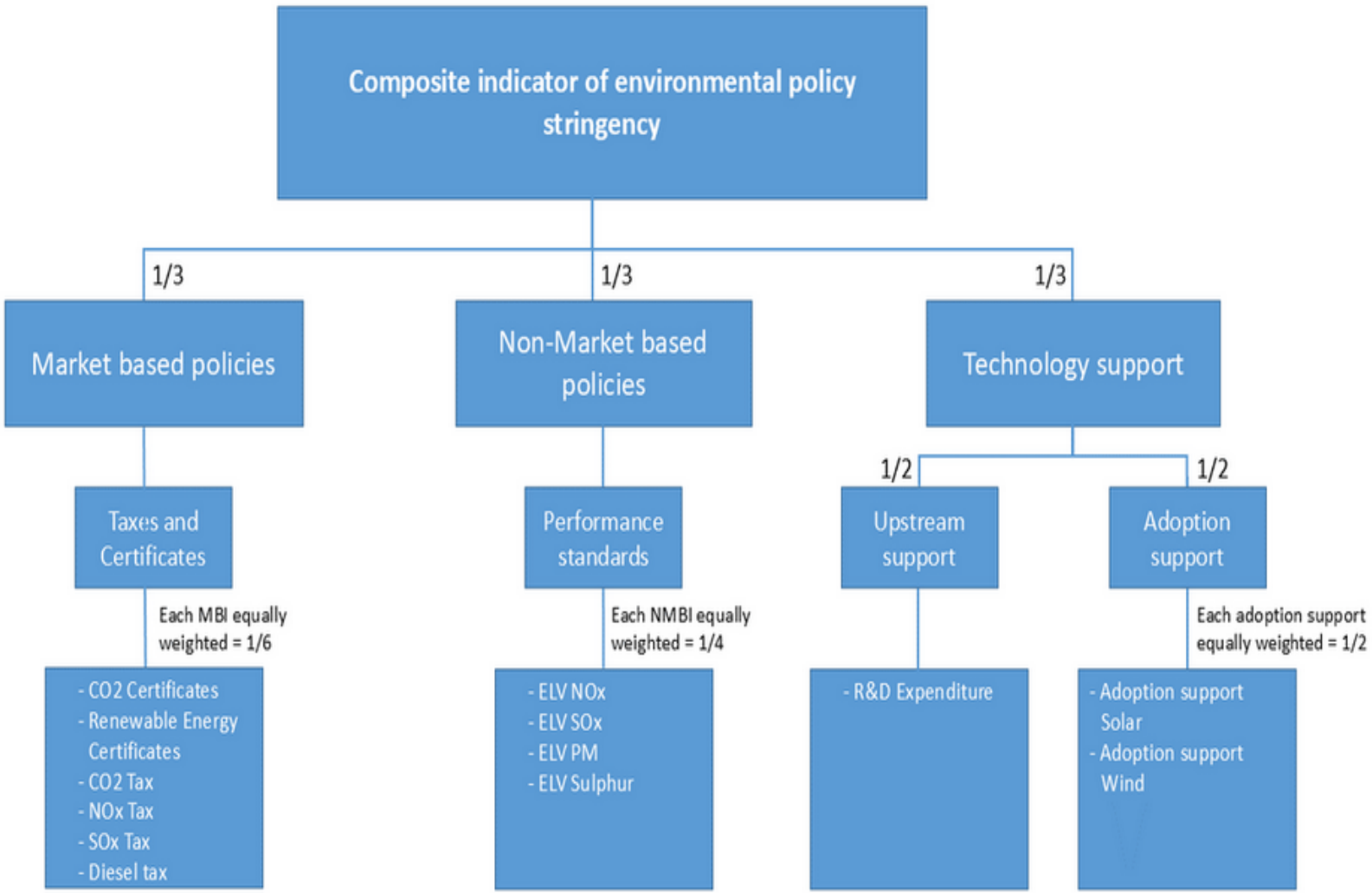
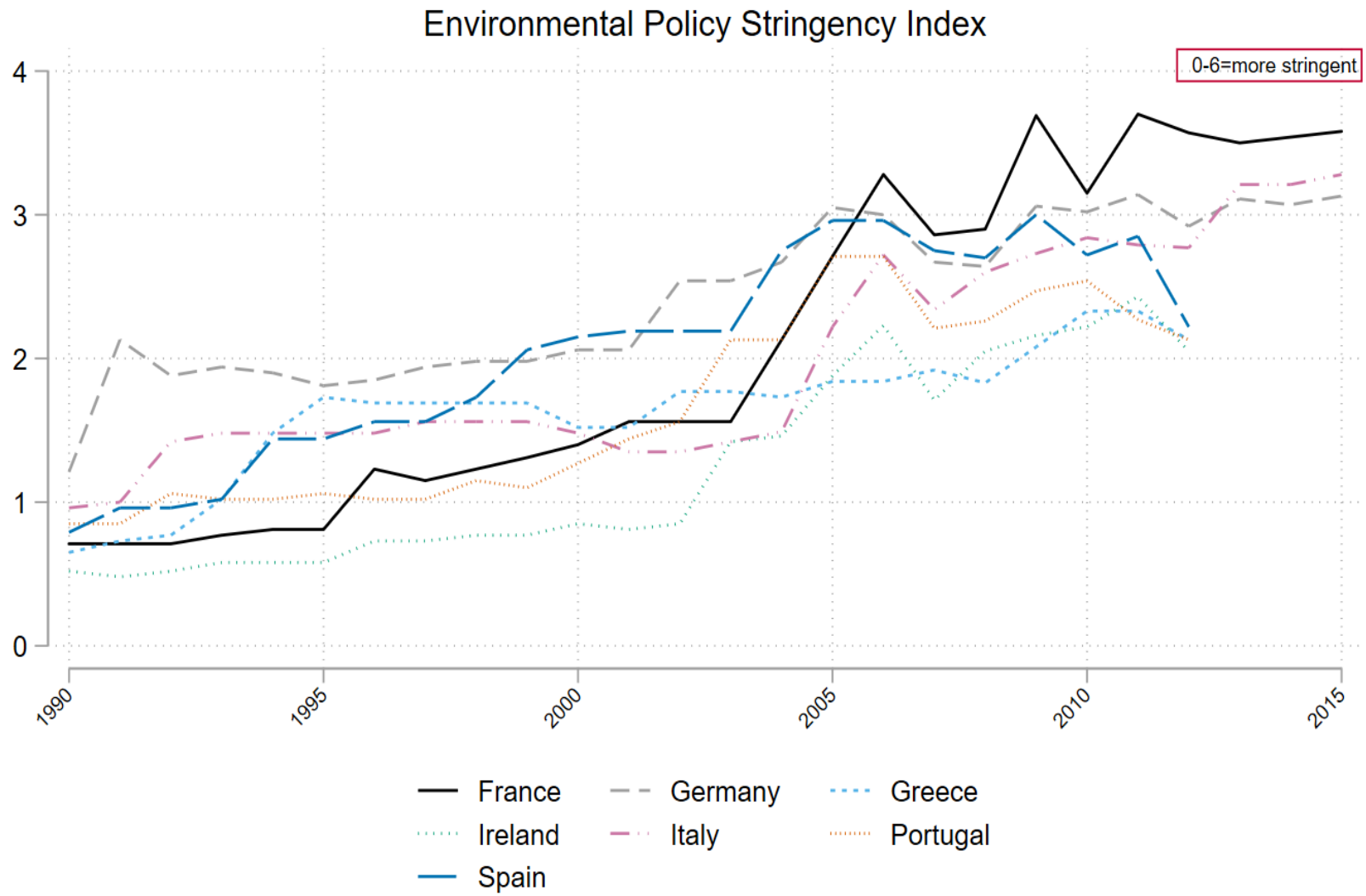
- Stringent Environmental Policies can be ***Growth-Enhancing*** if designed and implemented correctly

Environmental Policy Stringency Index



EPS trajectory



Source: OECD EPS

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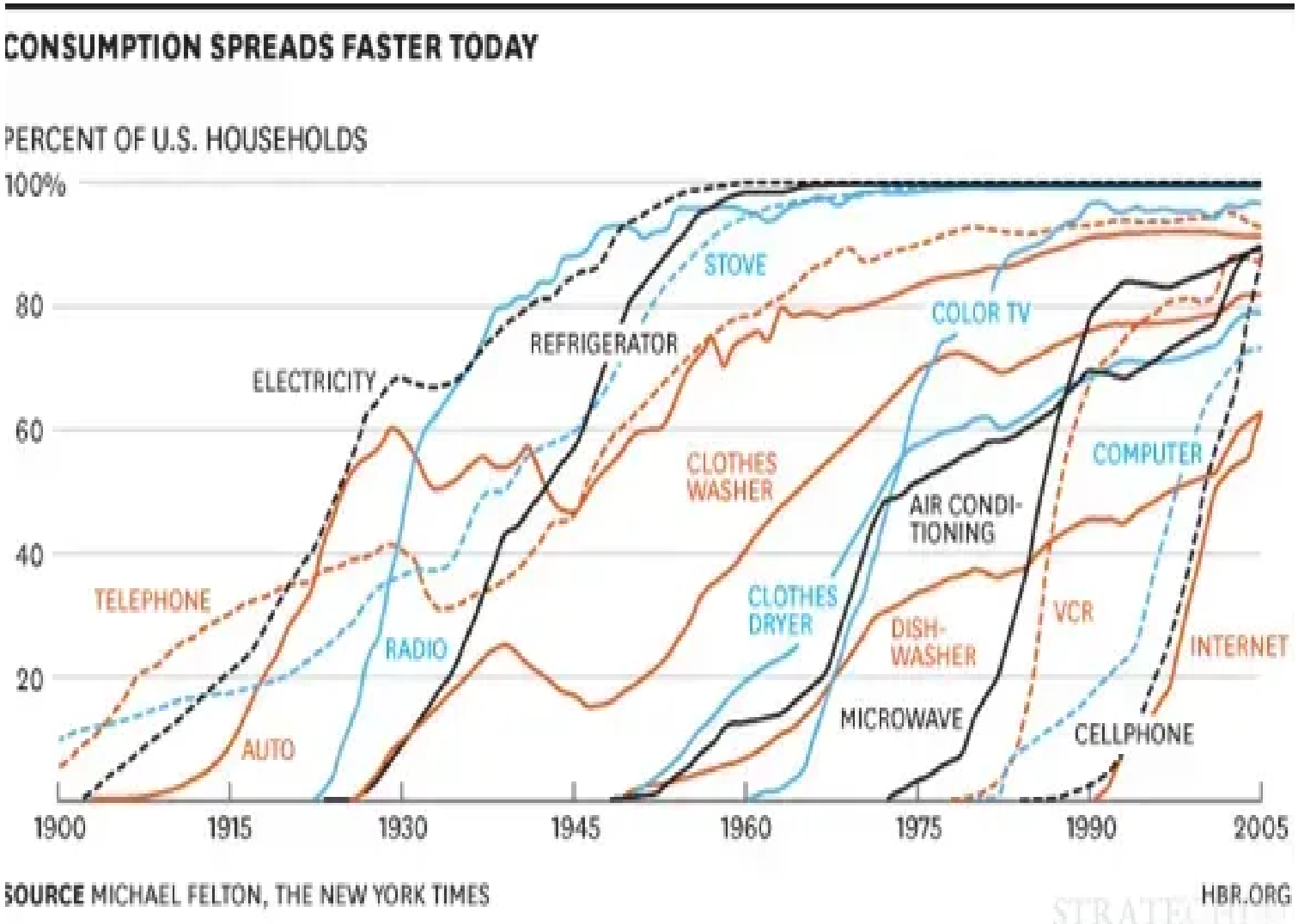
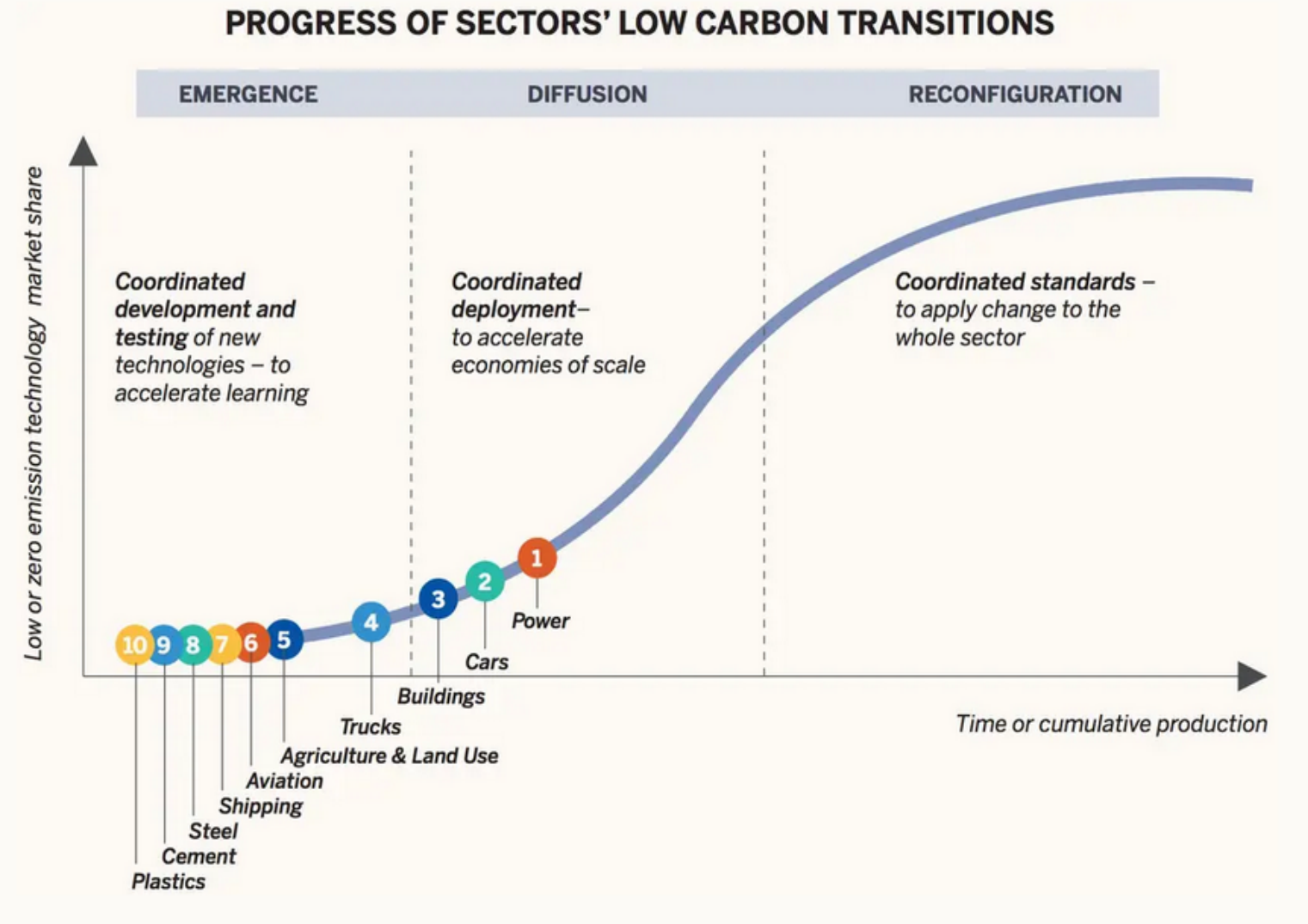
- Material Green Technologies (wind & solar) follow this pattern
  - Rapid technological & cost achievements held back by regulatory & behavioral barriers (and from the top...)

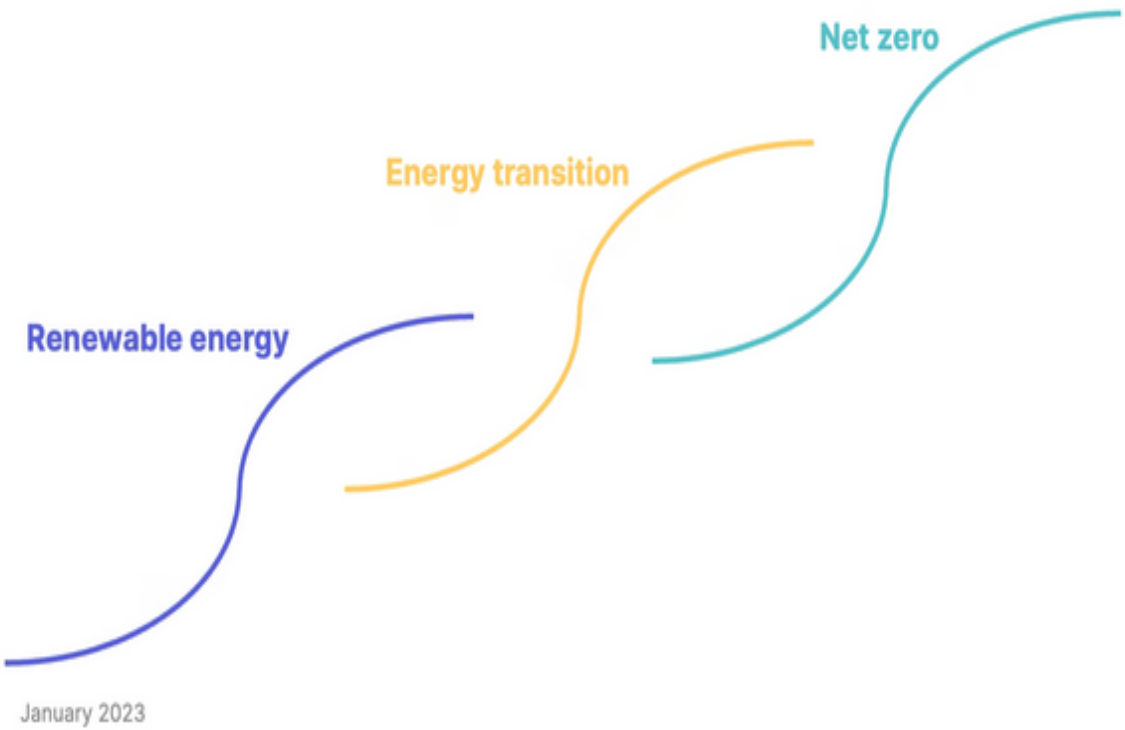
Historical S-Curve



Green Tech S-Curves



3 S-Curves for Deep Decarbonization



Source:
Nat Bullard

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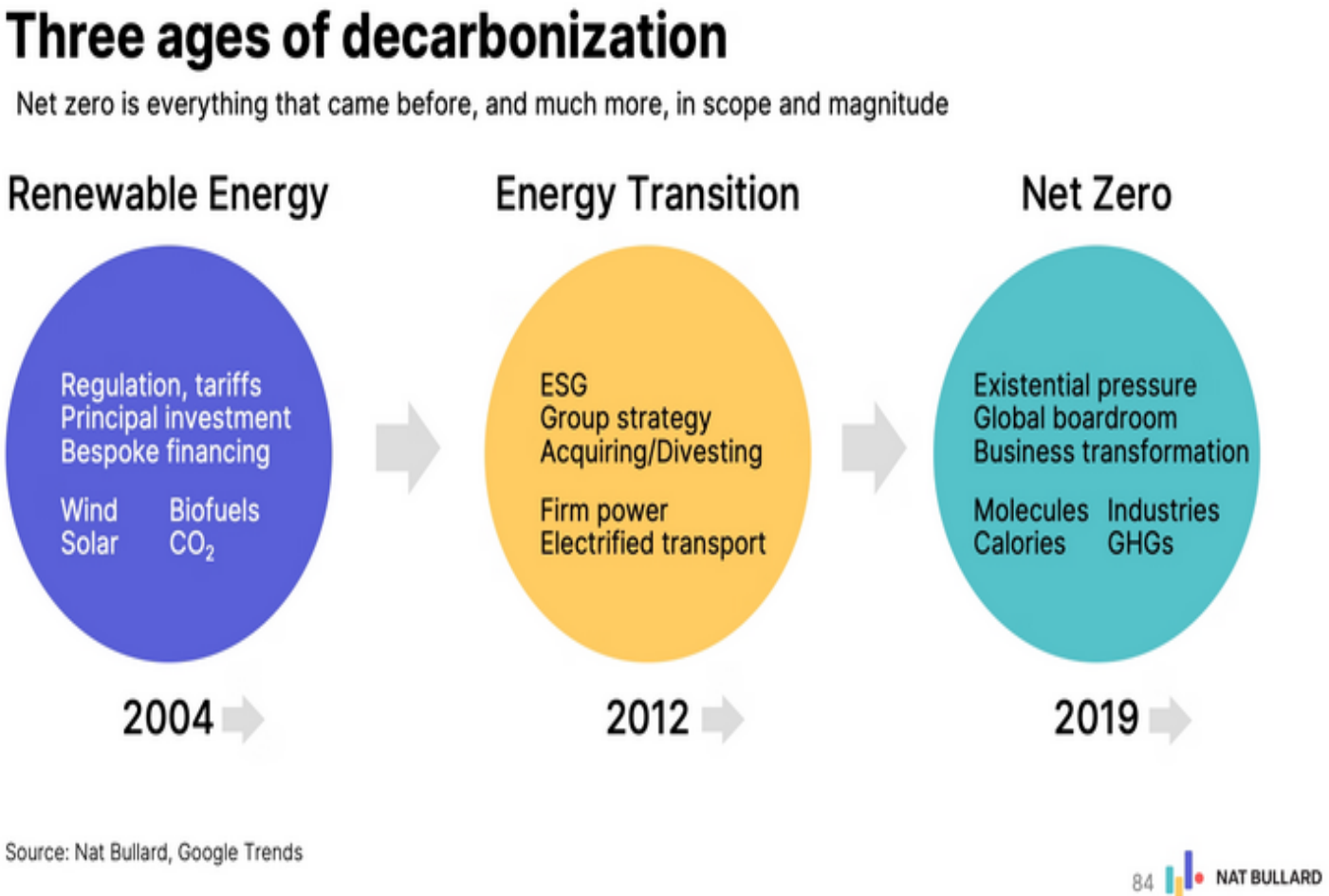
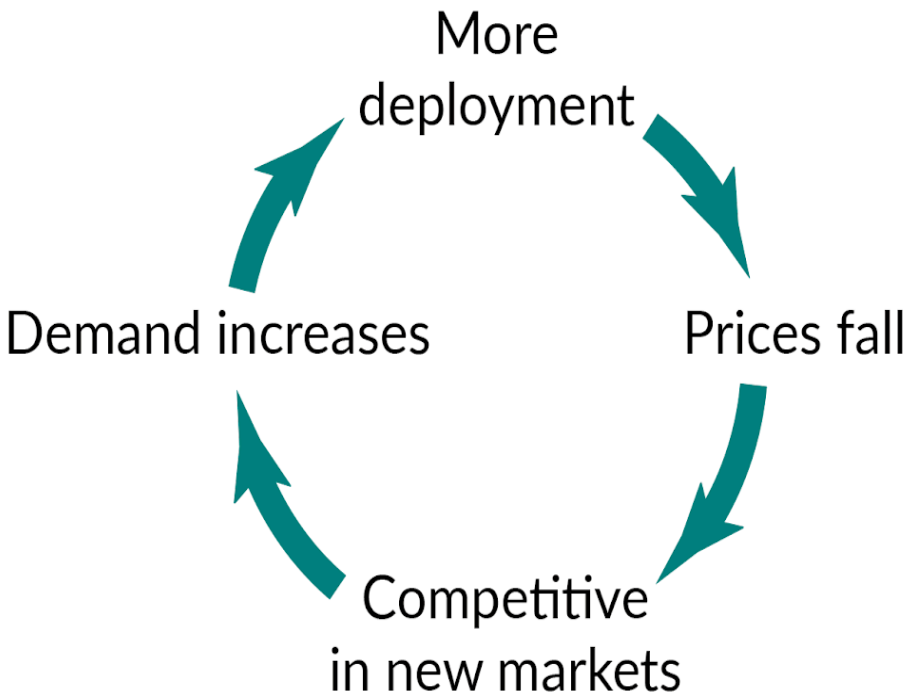
- Need for ***Coordinated Innovation Policy***

Road to Decarbonization



Green Technology Virtuous Cycle

Technologies that become cheaper with increasing production enter a virtuous cycle



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- **MENA Maritime Accelerator** (Link) incubates Start-ups in Green Technology for Shipping across the Mediterranean

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  - Who decides and who is ***accountable***?
  - Is our Wellbeing aligned with that of ***future generations***?

In search of Prosperity

Επειδή κάθε γνώση και εσκεμμένη απόφαση επιδιώκει κάποιο "αγαθό" (καλό), ας εξετάσουμε ποιό είναι το αγαθό στο οποίο αποβλέπει η πολιτική και ποιο είναι το υπέρτατο αγαθό που πρέπει να επιτευχθεί. Όσον αφορά το όνομά του, υπάρχει σχεδόν γενική συμφωνία. Δηλαδή τόσο οι απλοί άνθρωποι όσο και οι πεπαιδευμένοι αποφαίνονται ότι το αγαθό αυτό είναι η ευδαιμονία, και την ευζωία και την επιτυχία στη ζωή θεωρούν ότι ταυτίζονται με την ευδαιμονία

Αριστοτέλης - Ηθικά Νικομάχεια

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- Net Zero Transition $\rightarrow$ ***Multiple Gains***
  - Economic Growth
  - Markets and Jobs
  - Technological Development

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  - **EU Climate Law**
    Writes into law the goals set out in the EGD and Fit for 55

European Green Deal

The benefits of the European Green Deal

The European Green Deal will improve the well-being and health of citizens and future generations by providing:

fresh air, clean water, healthy soil and biodiversity

renovated, energy efficient buildings

healthy and affordable food

more public transport

cleaner energy and cutting-edge clean technological innovation

longer lasting products that can be repaired, recycled and re-used

future-proof jobs and skills training for the transition

globally competitive and resilient industry

European Green Deal Elements

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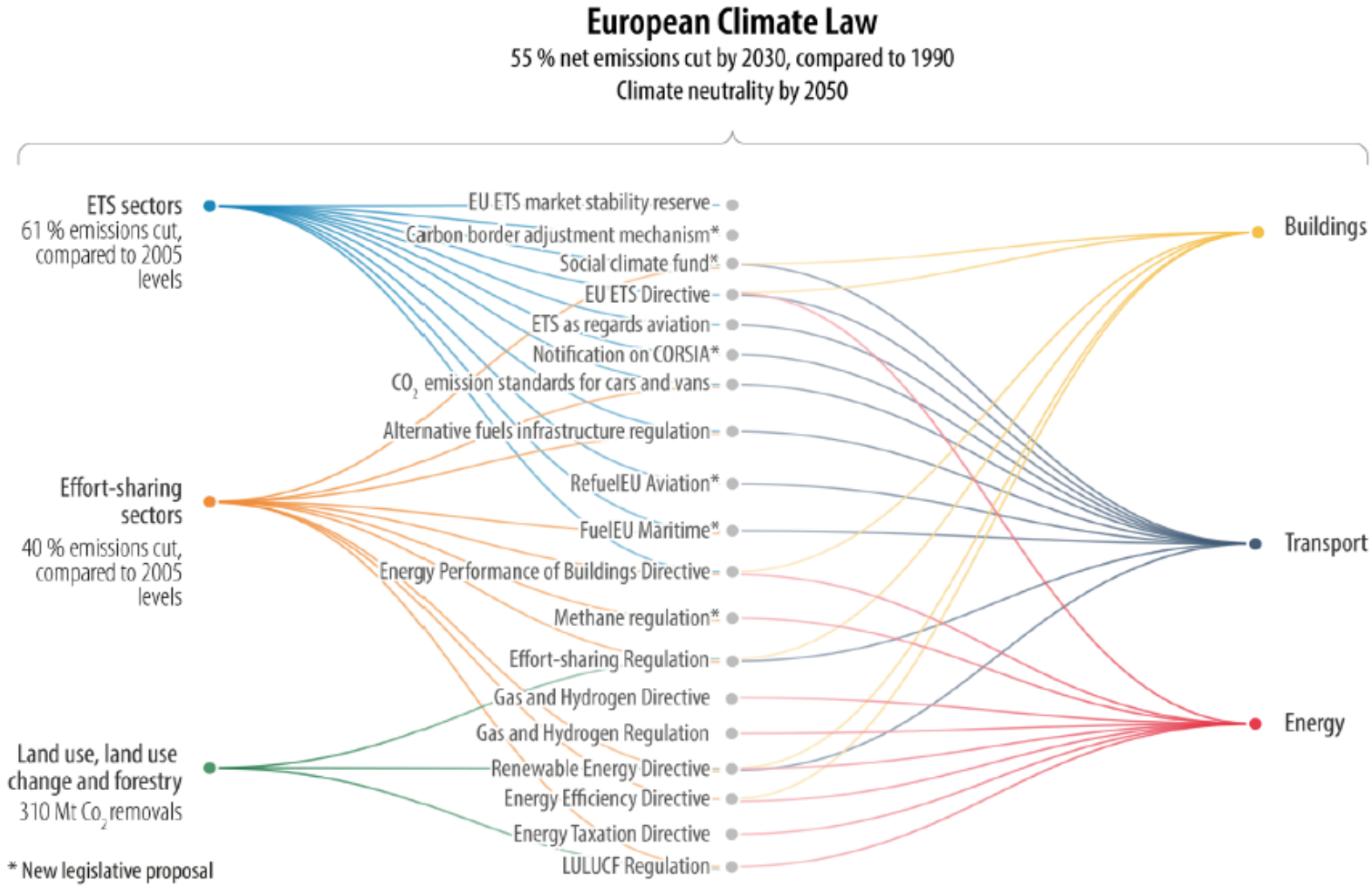
- EU Legislation → 2030 SDG Strategy

Fit-for-55 Targets & Sectors



Pillars of Re-Power EU

SAVING

Every citizen, business, and organisation can save energy. Small behavioural changes, if we all commit to them, can make a significant difference. Contingency measures for supply interruptions will also be needed.

DIVERSIFYING

The EU is working with international partners to find alternative energy supplies. In the short-term, we need alternative supplies of gas, oil and coal as quickly as possible, and looking to the future we will need renewable hydrogen too.

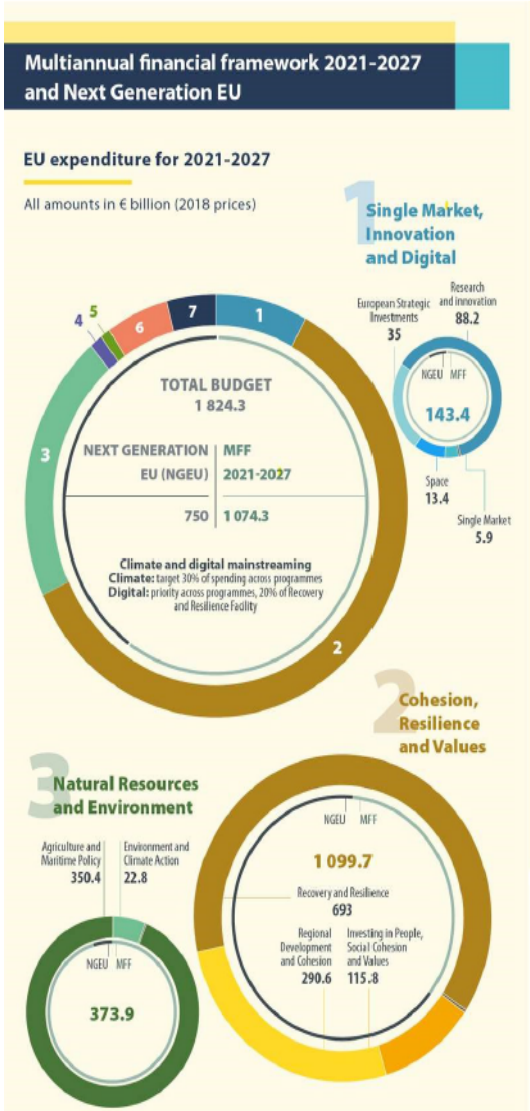
ACCELERATING CLEAN ENERGY

Renewables are the cheapest and cleanest energy available, and can be produced domestically, reducing our need for energy imports. **REPowerEU** will speed up the green transition and spur massive investment in renewable energy. We also need to enable industry and transport to substitute fossil fuel use faster to bring down emissions and dependencies.

INVESTMENT AND REFORM

Additional investments of €210 billion are needed between now and 2027 to achieve our independence from Russian fossil fuel imports, currently costing European taxpayers nearly €100 billion per year. The Commission proposes that Member States develop national **REPowerEU** plans to implement these new priorities.

Next Generation EU



NextGenerationEU breakdown

Recovery and Resilience Facility (RRF)	€672.5 billion
of which, loans	*€360 billion*
of which, grants	*€312.5 billion*
ReactEU	€47.5 billion
Horizon Europe	€5 billion
InvestEU	€5.6 billion
Rural Development	€7.5 billion
Just Transition Funds (JTF)	€10 billion
RescEU	€1.9 billion
TOTAL	**€750 billion**

Source: Conclusions of the European Council of 21 July 2020

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  4. **Just Transition Fund**
     Regional Development: Leaving no one behind in the Green Transformation

EU - ETS I

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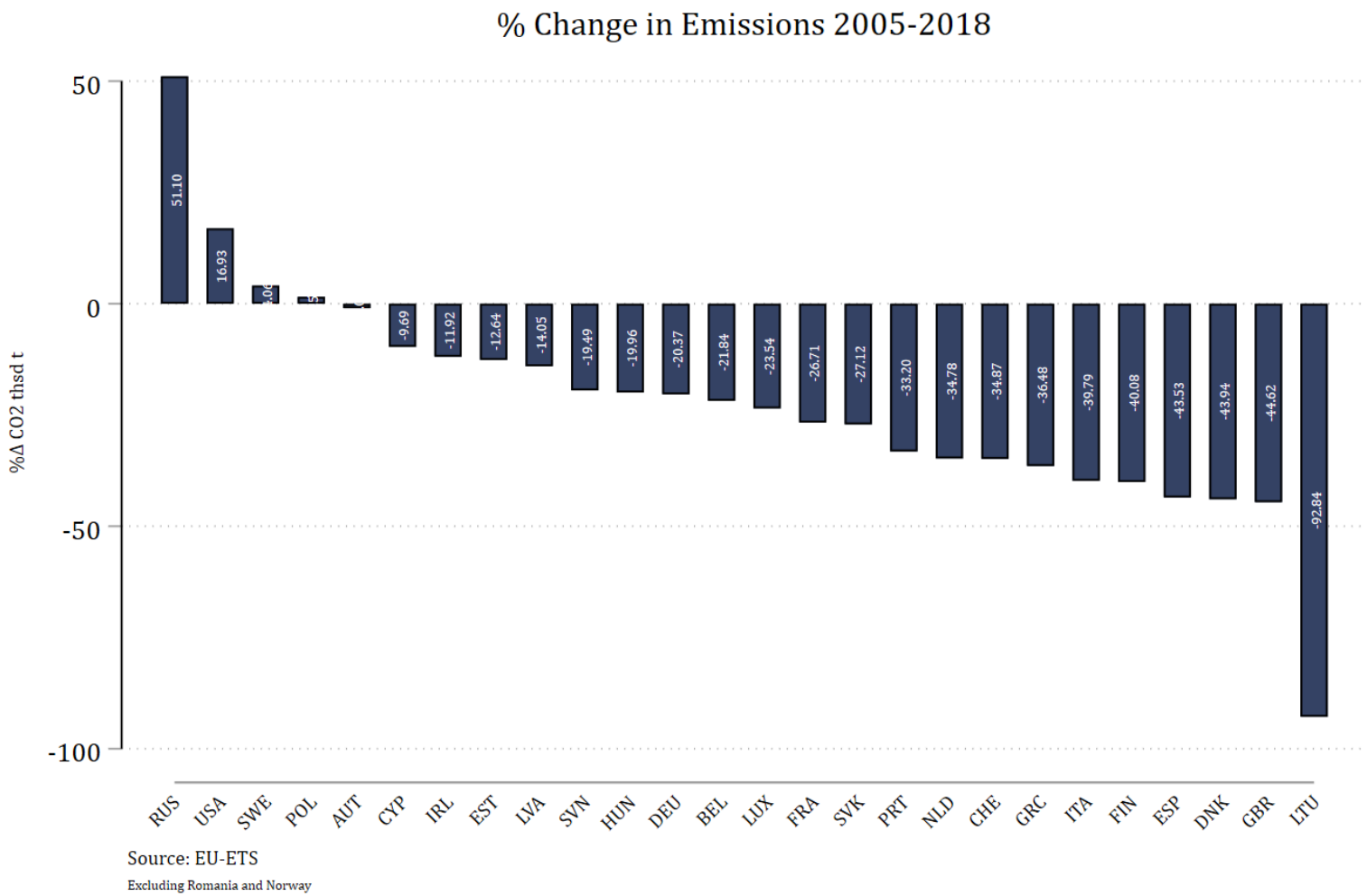
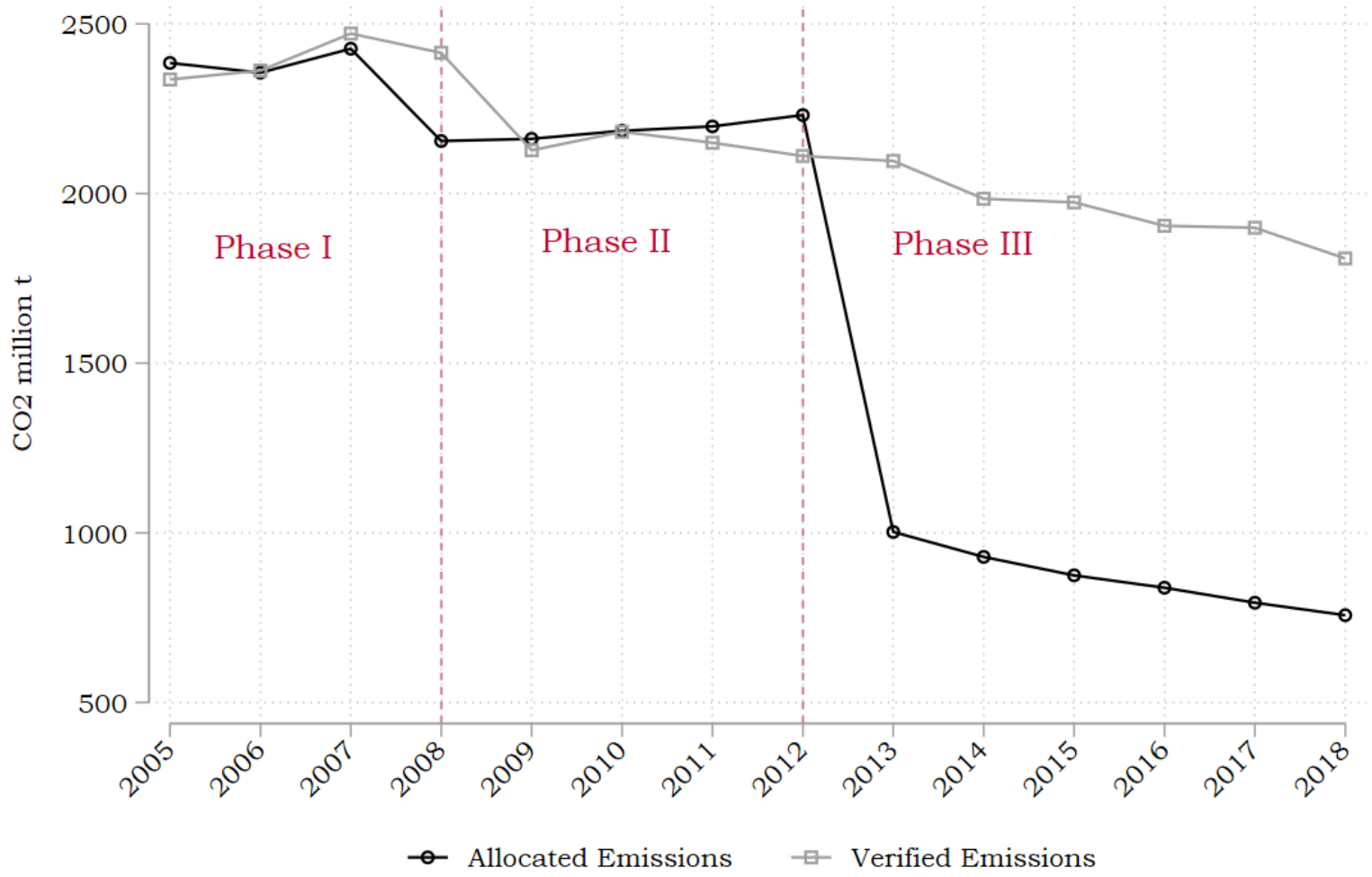
- **Carbon Border Adjustment Mechanism (CBAM);** Import Tariff from Economies with no Carbon Market to avoid ***Carbon Leakage***

Carbon Price EU-ETS

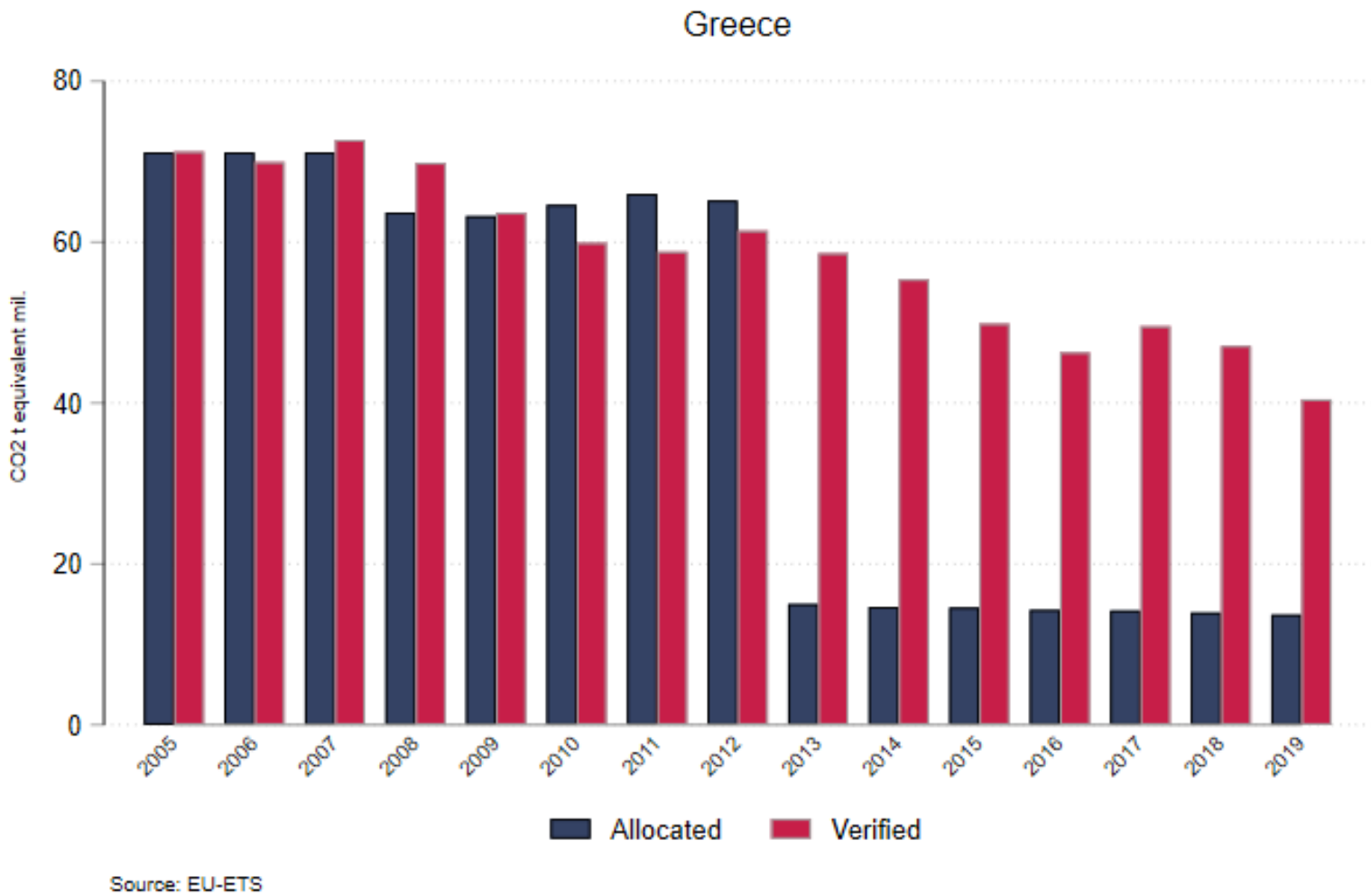
Drop in Emissions EU-ETS



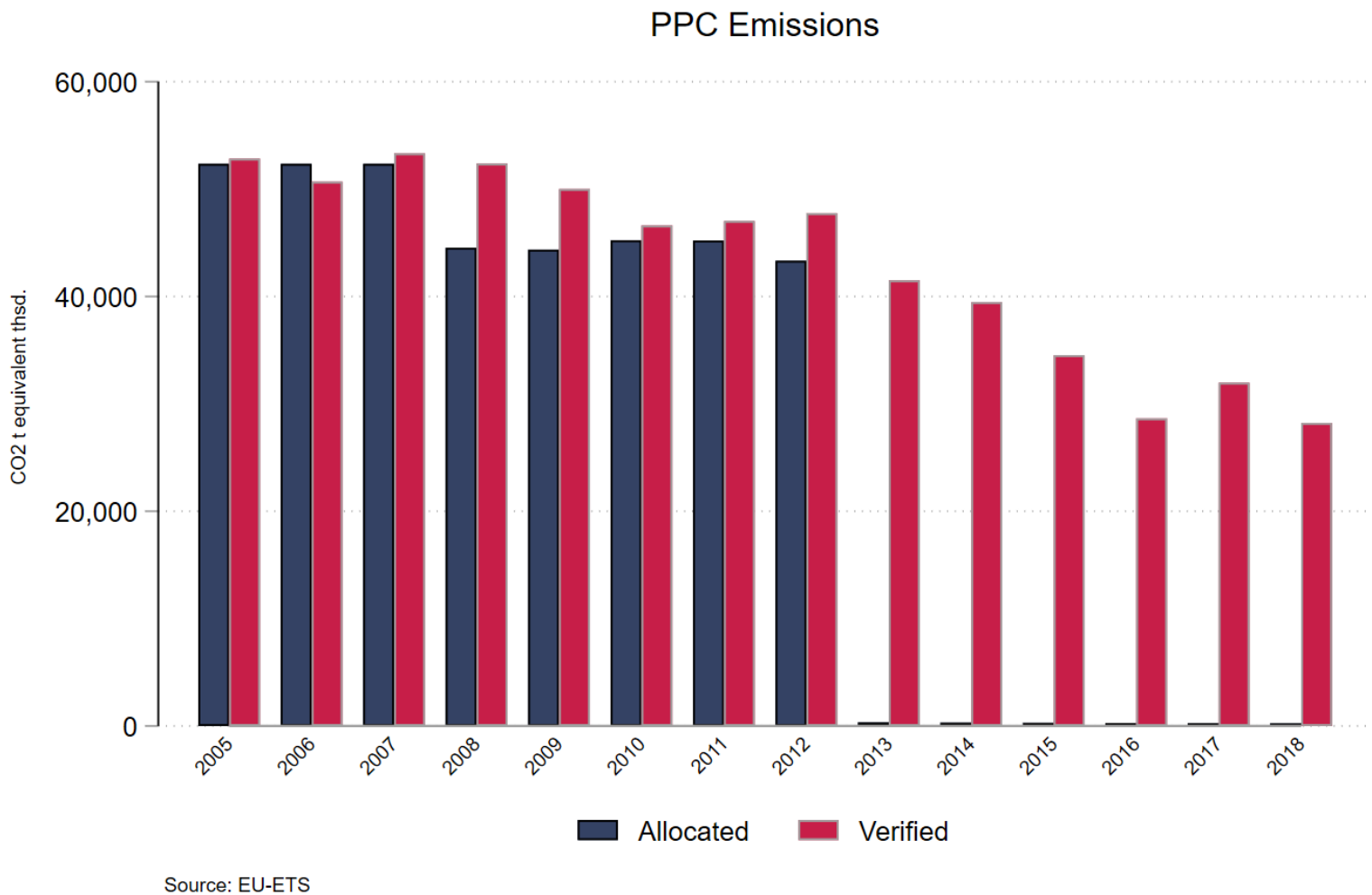
Emissions EU-ETS Phases



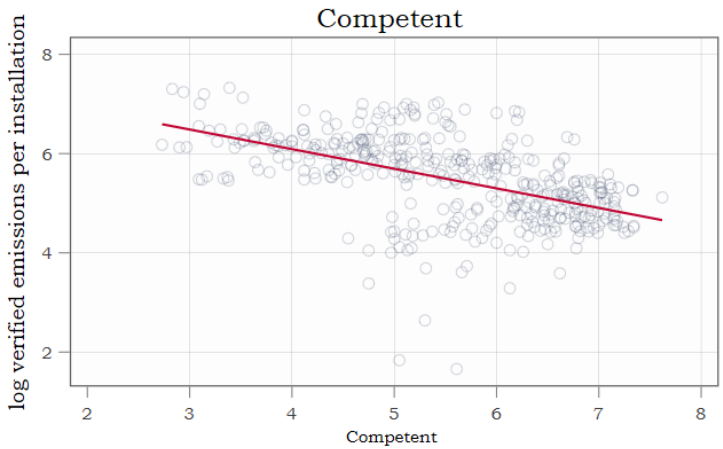
Greece: Emissions in EU-ETS sectors

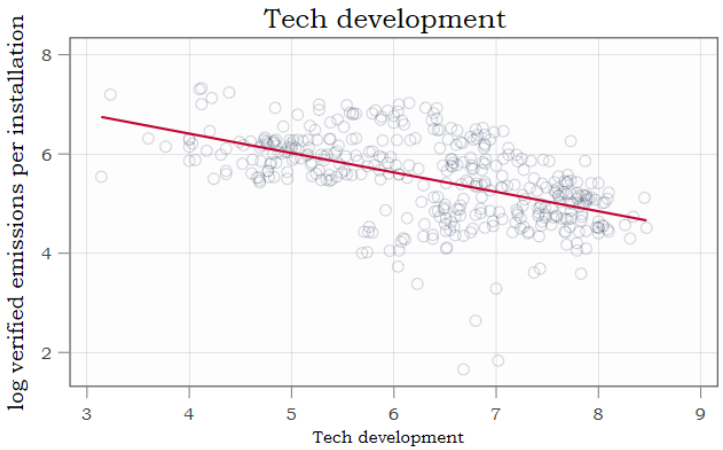


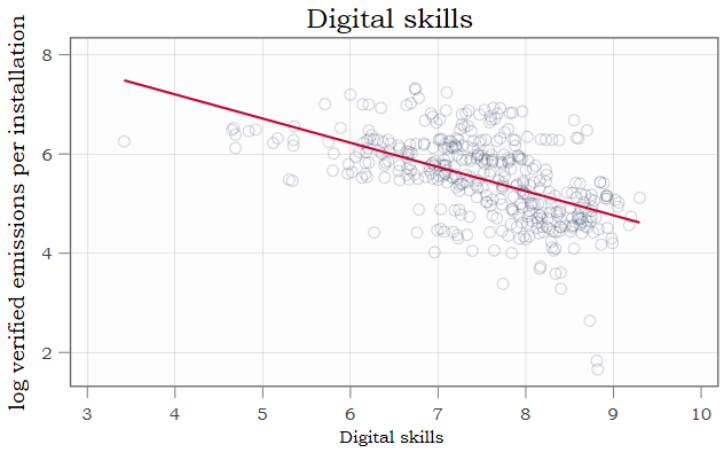
PPC Emissions 2005-18



Technology, Skills and Emissions in EU-ETS sectors







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- % of the revenues → support **vulnerable households and micro-enterprises** through a dedicated Social Climate Fund (SCF)

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- Revenues from ETS2 directly allocated to consumers and indirectly through National Governments → National Social Climate Plans (Details)

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- Finland, Norway, Sweden and Switzerland, are currently the only countries that have carbon prices above 40$/tCO2

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- Smart Industrial Policy for the 21st century
  - Steering towards ***Transformation***

Successful Industrial Policy (Terzi et al. (2023)

	Policy recommendation	Description	Example of EU policy
1	Future oriented	Policies must be future oriented and hence innovation oriented	EIC
2	Sector and technology driven	Focus on a sector, not a specific company	Horizon Europe (Pillar II: Global Challenges and European Industrial Competitiveness)
3	Competition is a strength	Avoid weakening the competitive nature of the Single Market	Capital Markets Union
4	Top-down, but also bottom-up	The policy goal must be defined in a balanced way that is tangible enough to make it concrete but broad enough to allow for creativity in achieving it	IPCEI
5	Accountable, non-partisan, and adaptable	Policies, outcomes, and assumptions must be constantly monitored, questioned, and quickly adapted if need be	Strategic Forum for IPCEI: identification of Strategic Value Chains
6	Holistic approach	Offensive and defensive tools must be designed consistently and shaped in tandem with a supportive regulatory environment	European Chips Act

Successful IP: The Concorde

- 1960s Innovation is **Supersonic Transport**
- UK & France Collaboration
- 3-5 billion USD development costs
- Operated by Air France & British Airways

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- Inflation Reduction Act : Flagship US Green Industrial Policy Initiative

Inflation Reduction Act

What's the Inflation Reduction Act, or IRA?

The most significant federal climate legislation in US history!

$350 BILLION TOTAL FOR NEW ENERGY AND CLIMATE PROVISIONS

$60 BILLION INVESTED IN ENVIRONMENTAL JUSTICE & COMMUNITIES

CLEAN ENERGY TAX CREDITS EFFECTIVE IMMEDIATELY

HOME ENERGY EFFICIENCY AND APPLIANCE TAX CREDITS, START JAN. 1 2023

DIRECT REBATES, GRANTS, & OTHER FINANCING OPTIONS WILL TAKE ~ 12-24 MO. TO BEGIN TO ROLL OUT (LATE 2023 - 2024)

SIMPLY PUT: THE IRA WILL HELP ACCELERATE THE TRANSITION OFF FOSSIL FUELS AND TOWARDS 100% CLEAN ENERGY.

How does the IRA support climate solutions?

CLIMATE SMART MISSOULA

ELECTRIFYING BUILDINGS
residential and commercial

2.4 MILLION	1.2 MILLION	7.2 MILLION	650 THOUSAND	115 MILLION
Electrification upgrades in LMI communities via the High Efficiency Electric Home Rebate (HEEHR) program	**Home energy retrofits** via the Home Energy Performance-Based, Whole-House Rebate (HOMES) program	**Heat pump installations** incentivized by the residential efficiency tax credit (tax credit 25C)	**Newly constructed, efficient homes** incentivized by the new energy efficient home tax credit (45L)	**Square feet of commercial space retrofitted** via the energy efficient commercial buildings tax credit (179D)

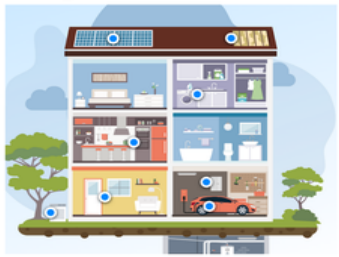
more at ElectrifyMissoula.org

RENEWABLE ENERGY
incentives for homeowners, businesses, nonprofits, & industry

ELECTRIC VEHICLES
tax credits for individuals and manufacturers

More resources & info →

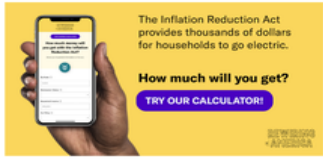
How will the IRA impact me?



GO ELECTRIC WITH YOUR APPLIANCES → GET $$ FROM HOME REBATE PROGRAMS (LOW/MIDDLE INCOME HOUSEHOLDS)

INVEST IN HEAT PUMPS, ROOFTOP SOLAR, ELECTRIC HVAC & WATER HEATERS → GET TAX CREDITS

BUY A NEW/ USED EV THAT MEETS REQUIREMENTS → GET MONEY OFF AT POINT OF SALE



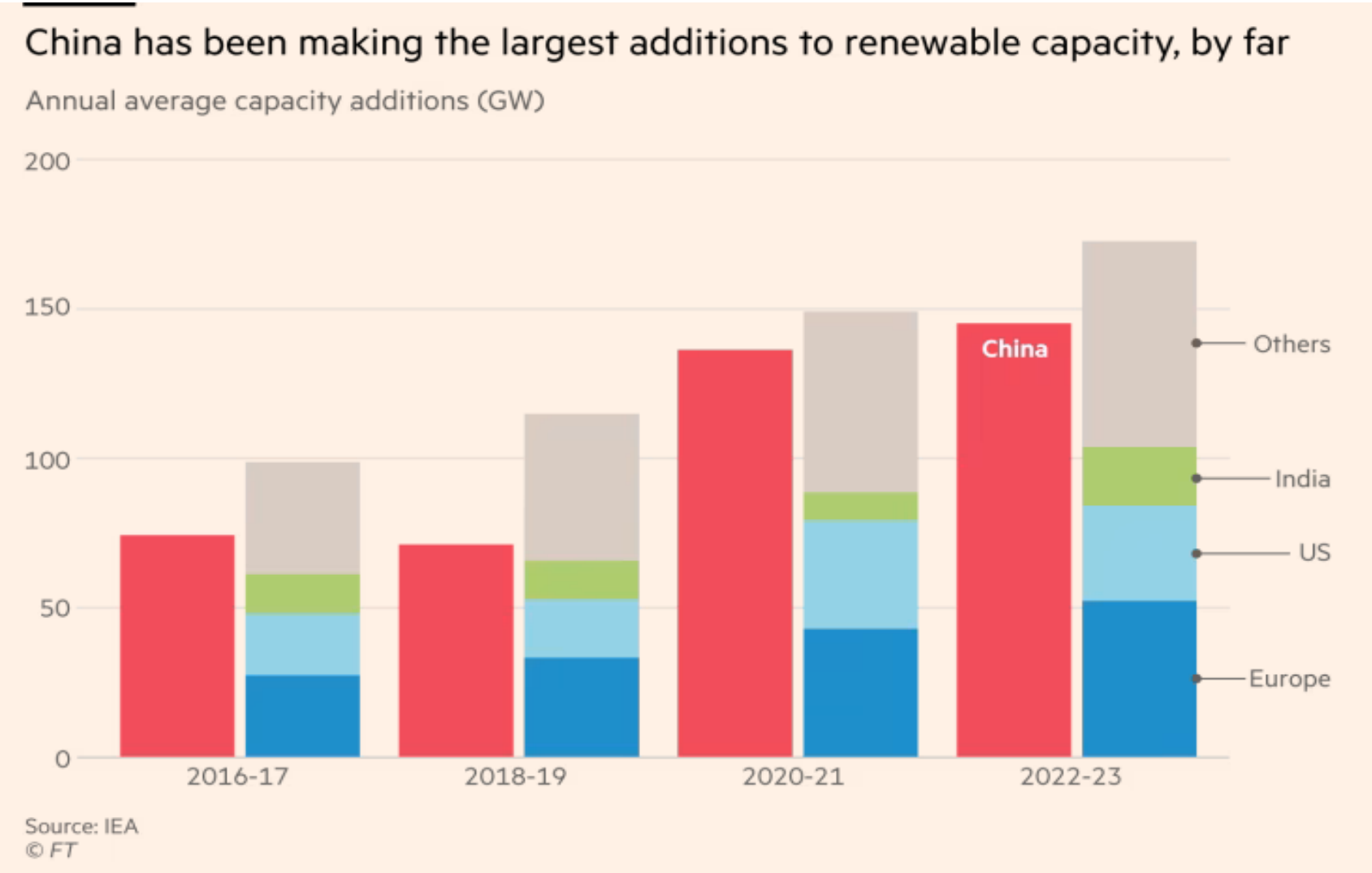
CALCULATE YOUR IRA INCENTIVES AND SAVINGS: REWIRINGAMERICA.ORG/APP/IRA-CALCULATOR

Race for Green Technologies

Volkswagen warns EU that US is beating it in race to attract battery makers

Carmaker says it is progressing faster on US factory than European one thanks to subsidies

China leading Renewable Capacity



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- Reducing ***Foreign Dependence*** in the field of Green Technologies

The Green Deal Industrial Plan

The road to net-zero

Over €100 billion

is the value of EU's net-zero start-ups ecosystem in 2021, doubling since 2020

More than 400 GW

of wind and solar renewable energy production capacity in the EU in 2022, an increase of over 25% compared to 2020

4.5 million

green jobs in the European economy in 2019 up from 3.2 million in 2000

The four pillars of the plan

To secure Europe's place as the home of industrial innovation and clean tech, the Green Deal Industrial Plan will cover four key pillars:

Predictable and simplified regulatory environment

Faster access to funding

Enhancing skills

Open trade for resilient supply chains

Net Zero Industry Act

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  March 2023 Policy Act to **scale up manufacturing of clean technologies in the EU and make sure the Union is well-equipped for the clean-energy transition**

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- Simplifying permit-granting processes

- Companies bidding for public tenders or subsidies encouraged to **source 40 per cent of their equipment from EU factories** proposals

Net Zero Industry Act Activities

Solar photovoltaic and solar thermal

Electrolysers and fuel cells

Onshore wind and offshore renewables

Sustainable biogas/ biomethane

Batteries and storage

Carbon capture and storage

Heat pumps and geothermal energy

Grid technologies

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- ***Buying and/or Building European*** → Increased input Prices (under current status)

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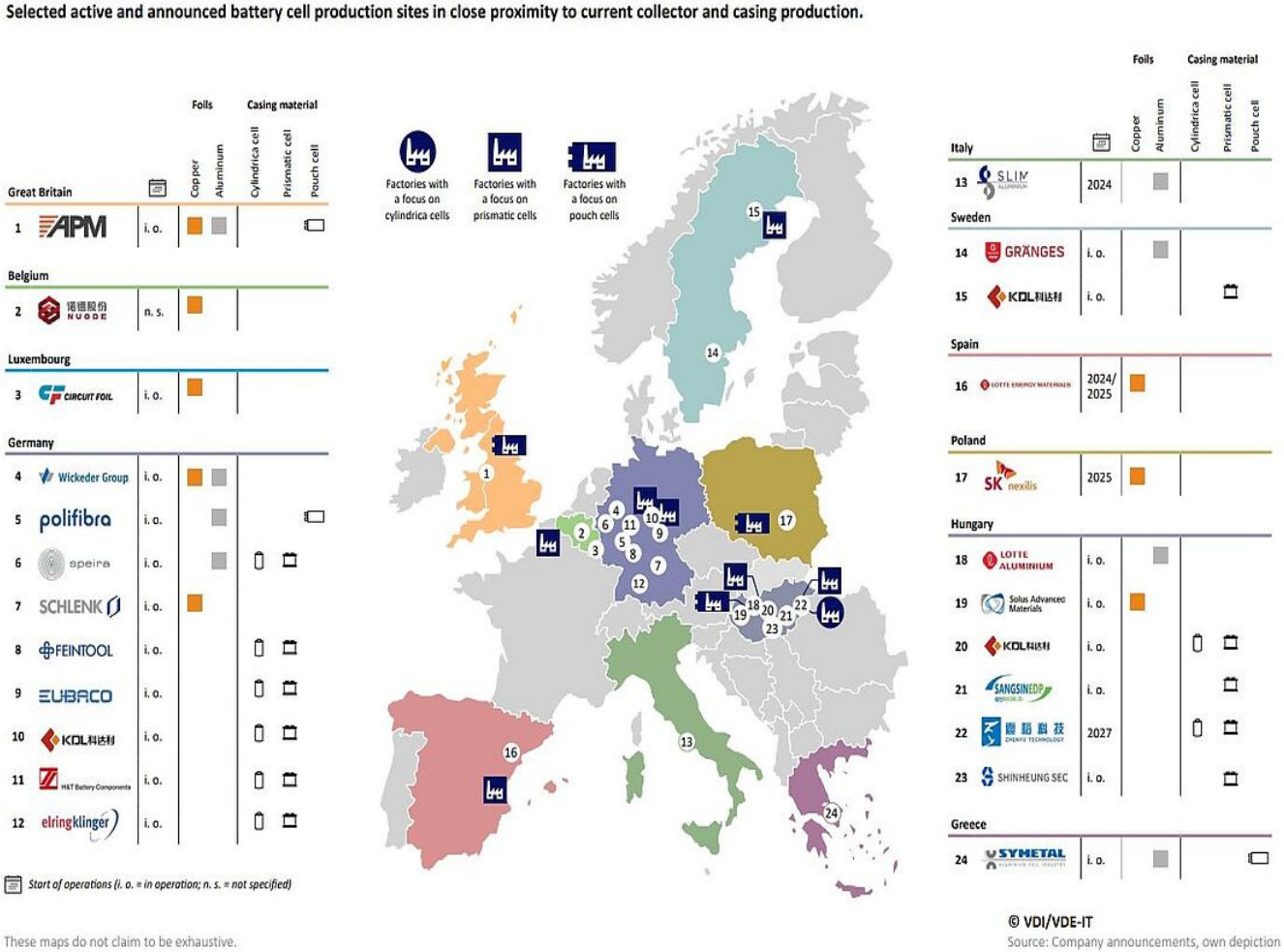
- $\rightarrow$ **Joint investments** by public authorities and industries from several EU countries

IPCEI in Batteries Value Chain



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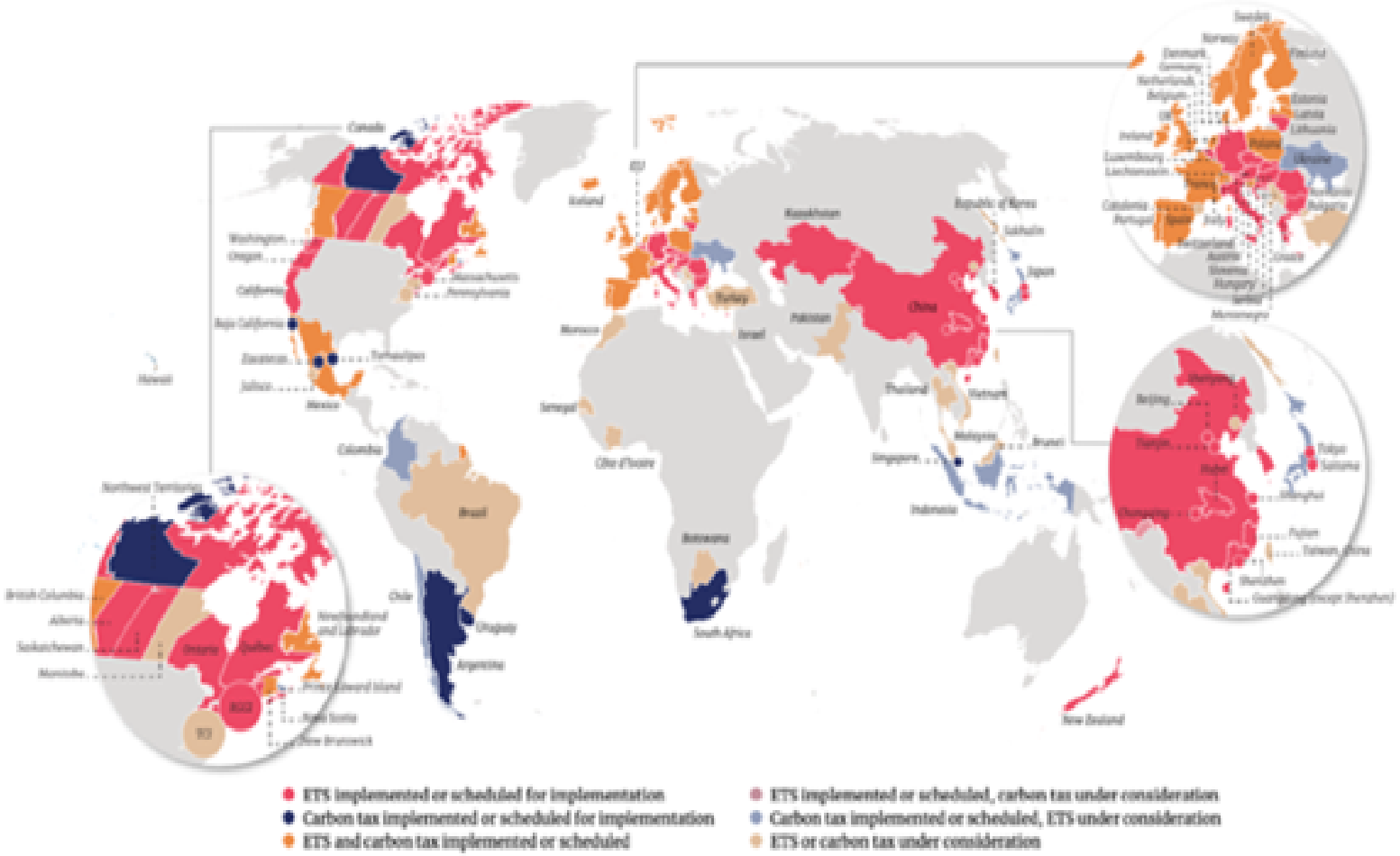
CBAM in practice

Carbon Markets around the World

FIGURE 1
Map of carbon taxes and ETSs



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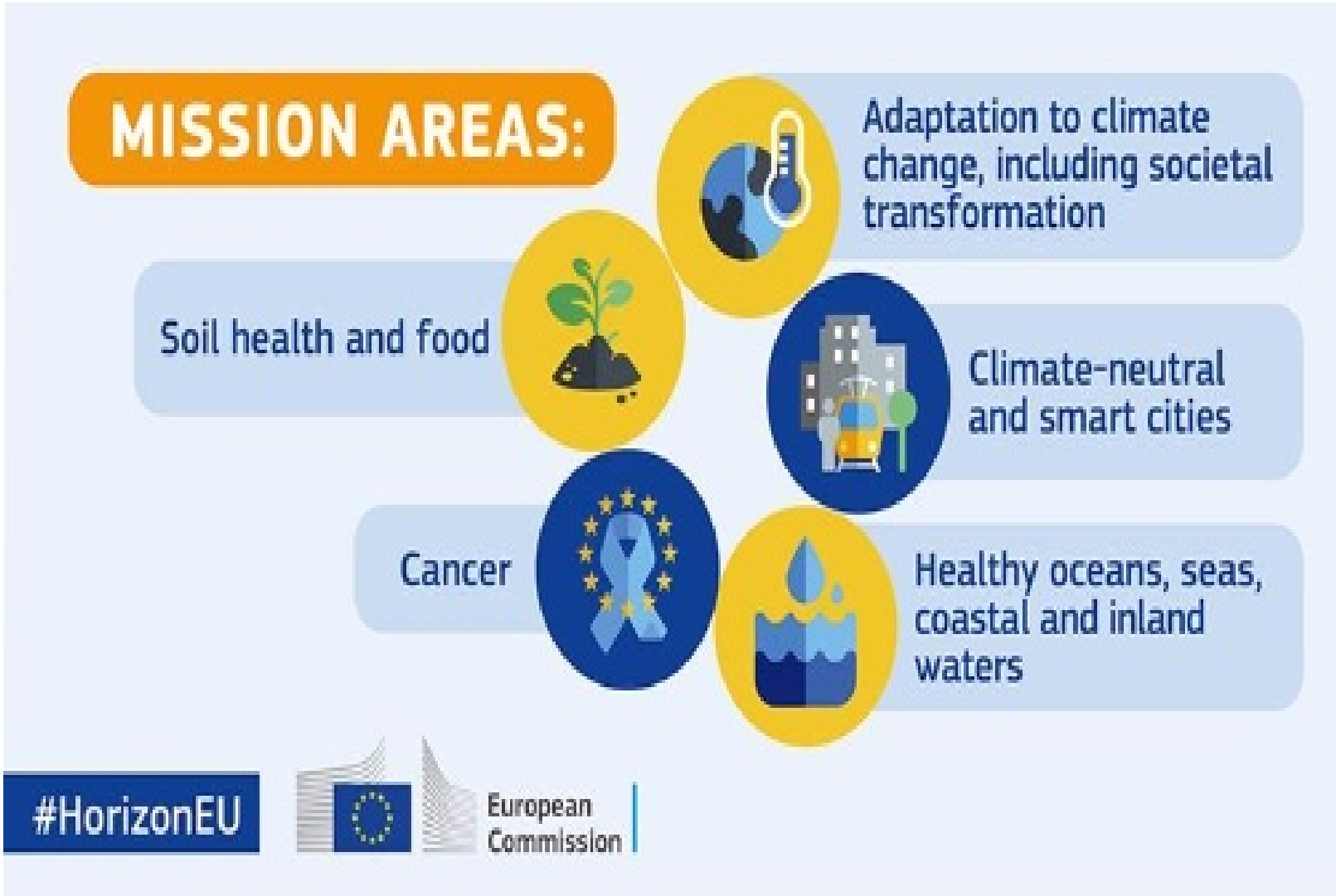
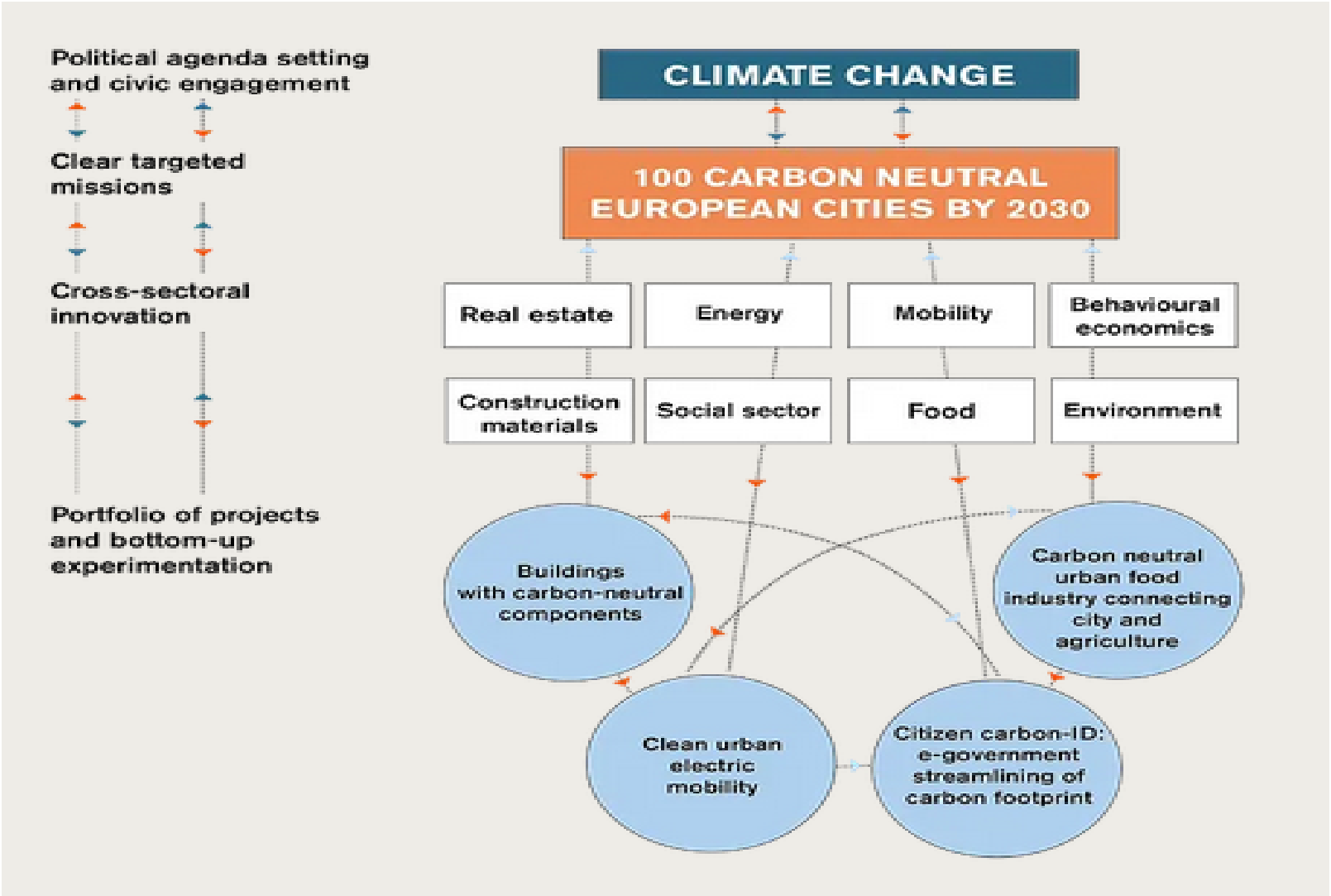
- E.g. **Carbon neutral cities** warrants collaboration across urban planning, construction, energy efficiency in buildings, mobility, behavioural aspects, food value chain, environmental technology capacity

EU Missions


MISSION AREAS:
Adaptation to climate change, including societal transformation
Soil health and food
Climate-neutral and smart cities
Cancer
Healthy oceans, seas, coastal and inland waters
#HorizonEU
European Commission

Mission Carbon Neutral Cities 2030



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- Over twenty climate change IAMs summarized here

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- The tool provides a synthesis on ***Climate Solutions*** based on the changes in Technological, Policy, Social and Economic variables

ENROADS Simulator

- The **En-ROADS Climate Solutions Simulator** is a fast, powerful climate simulation tool for understanding how we can achieve our climate goals through changes in energy, land use, consumption, agriculture, and other policies.
- Developed by: `Climate Interactive, Ventana Systems, UML Climate Change Initiative, and MIT Sloan`
- The tool provides a synthesis on ***Climate Solutions*** based on the changes in Technological, Policy, Social and Economic variables
- The **En-ROADS Baseline scenario** was created as a reasonable starting point of minimal climate action to test various changes in policies and assumptions to see the impacts on global climate

ENROADS Capabilities

- **Exploration of Policy Interactions**: Users can experiment with combinations of policies such as subsidies for renewables, carbon taxes, or reforestation to observe synergistic or counterproductive outcomes

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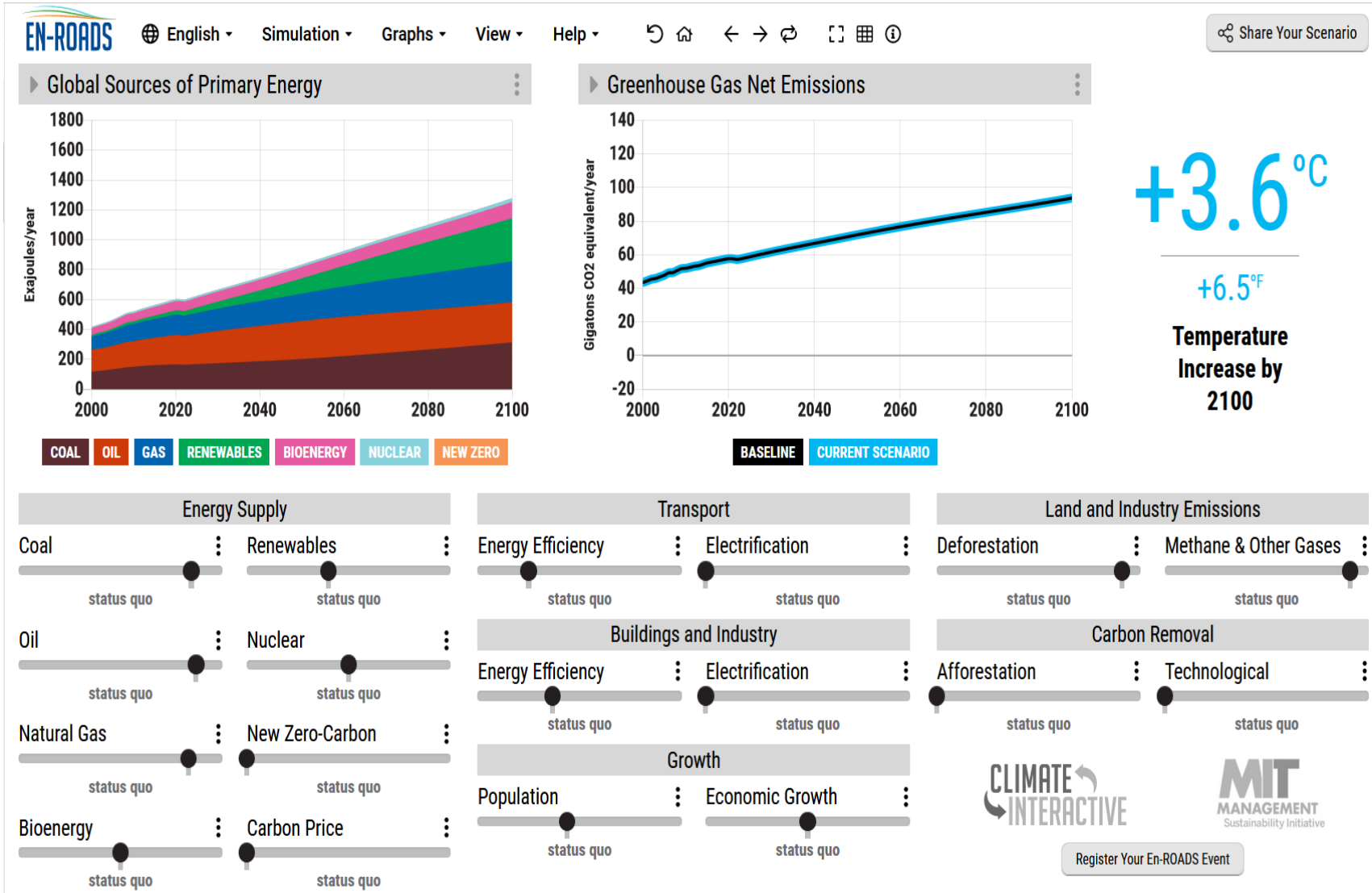
- **Sectoral Coverage**: En-ROADS covers sectors such as electricity generation, transportation, industry, land use, and carbon removal, offering a full-spectrum analysis of mitigation strategies.

ENROADS Interface



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A long way to 1.5