

Decarbonizing electricity: a key role for state-owned power companies

A critical discussion

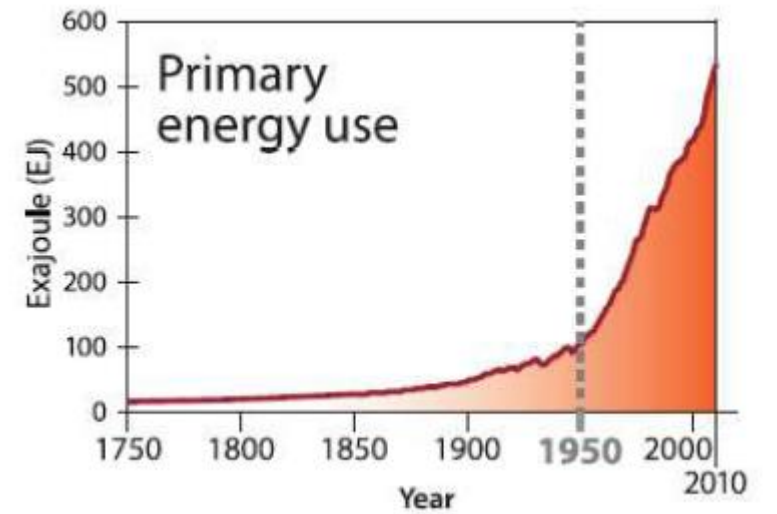
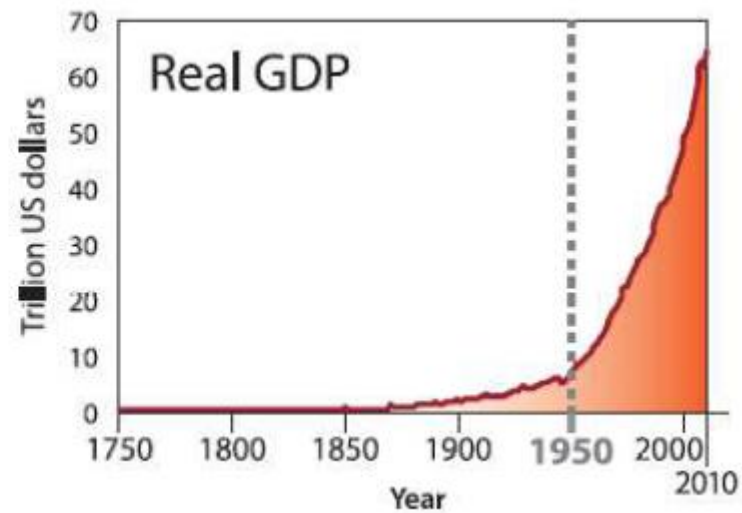
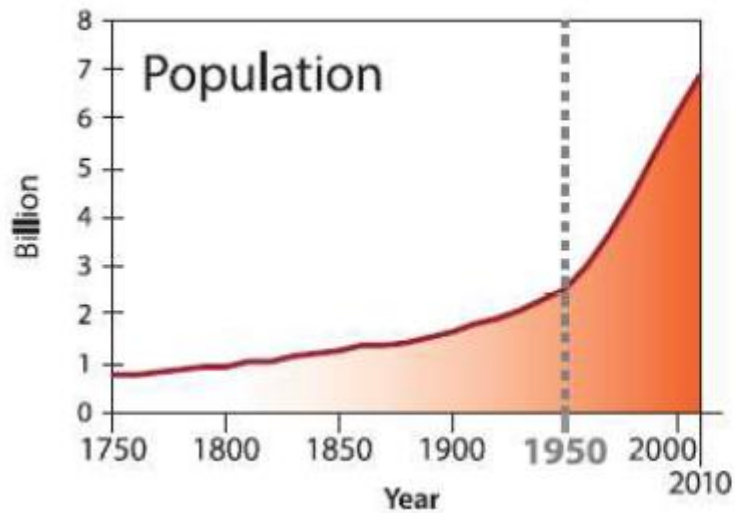
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CIRIEC WORKSHOP

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Ecological boundaries

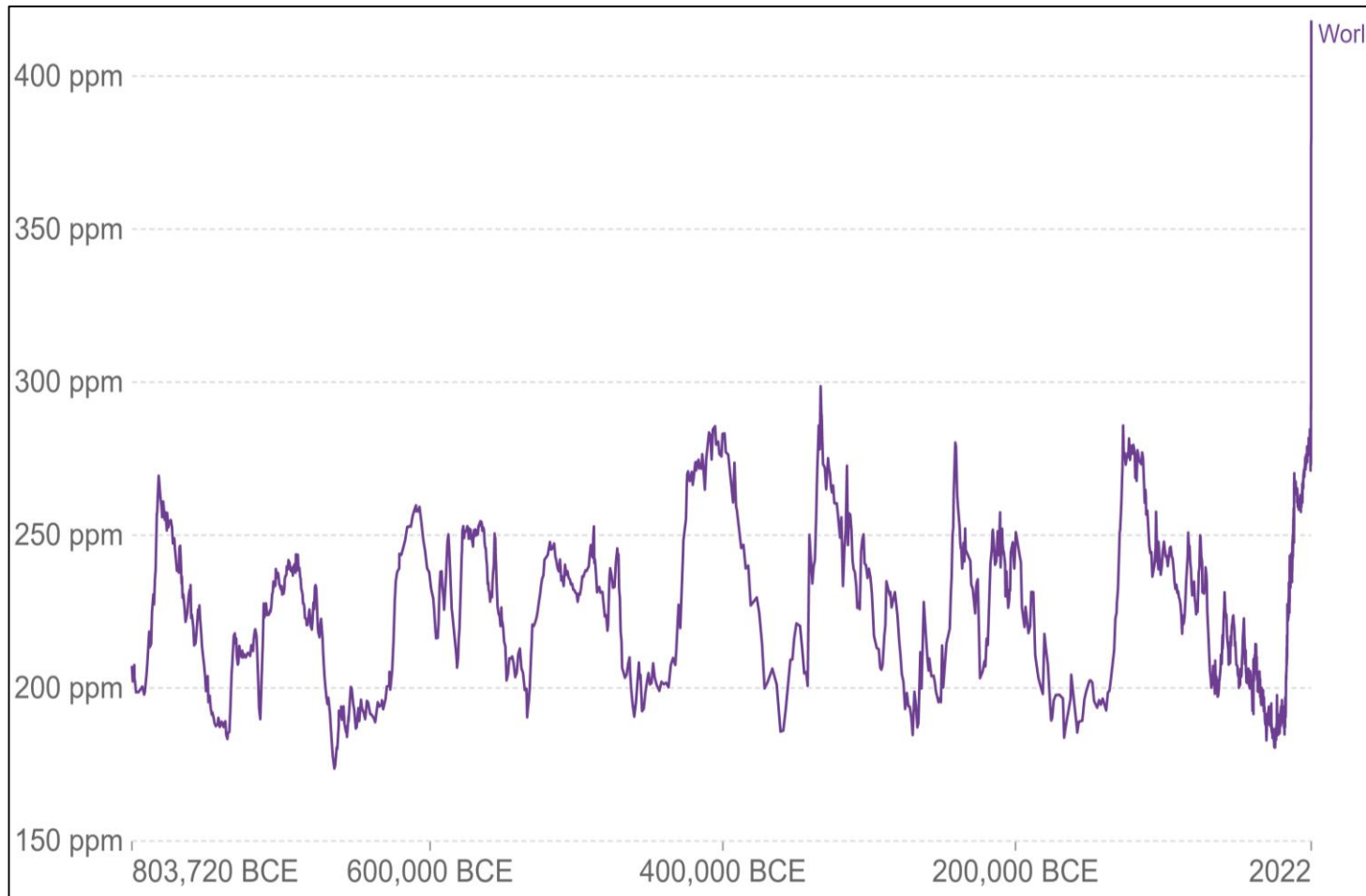
Last centuries characterized by an unprecedented growth



Ecological boundaries

Economic systems exert an increasing and unsustainable pressure on ecosystems

CO2 atmospheric concentration



Ecological boundaries

Anthropocene

In a single lifetime humanity has become a planetary-scale geological force ... This is a new phenomenon and indicates that humanity has a new responsibility at a global level for the planet Steffen et al. 2015

- declining resilience of our ecosystems can bring to extreme and unexpected shocks
- If the Holocene ecological boundaries were surpassed, our ecosystem would irreversibly move to new unsustainable environmental conditions
- Our prosperity and well-being crucially depend to keep the Holocene climate and environmental conditions
- Urgent need to keep our economic systems within a plurality of ecological boundaries
- Lowering the stock of greenhouse emissions to avoid temperatures to grow beyond 1.5-2° C

How to keep our economy within a secure operating system?

Techno-optimistic view

- Absolute decoupling: possible to reduce environmental impact without limiting economic growth
- Innovation is the key: Huge investments in clean technologies.
- Always growth, but green growth

Absolute Decoupling



How to keep our economy within a secure operating system?

European policy shares this vision.

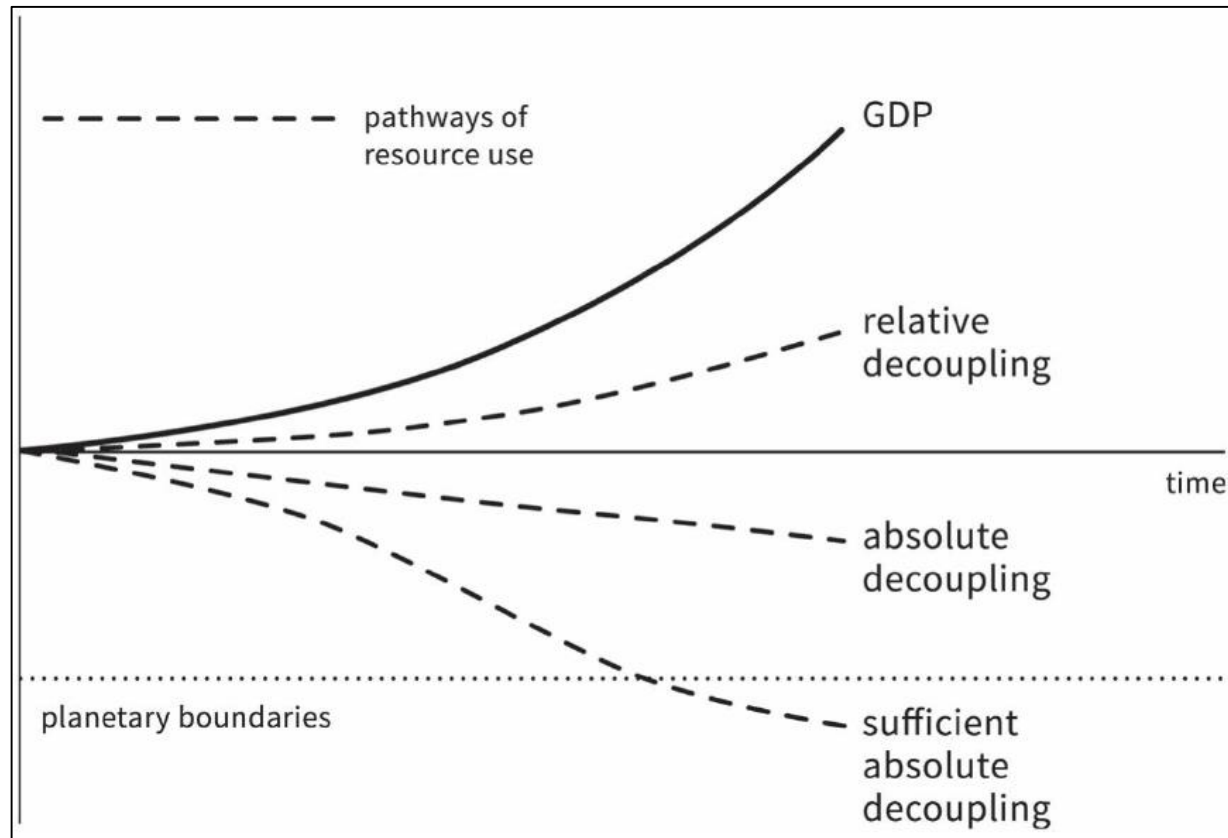
Focus on green growth according to four pillars

1. Decarbonization of the energy systems (from fossil to renewable)
2. Full electrification of our energy systems: transport, building and heating
3. create a resource-efficient circular economy: linear material flows become circular flows
4. expand the "immaterial" economy thanks to digital products and services

How to keep our economy within a secure operating system?

Eco-conservative view

- Technological innovation is necessary, but not sufficient
- Growth in population, production and consumption pushes us beyond the environmental limits
- Absolute Decoupling cannot be reached in a time compatible with our ecological boundaries



Abandon the economic growth paradigm to move towards an a-growth stationary state economy (or even degrowth)

How to keep our economy within a secure operating system?

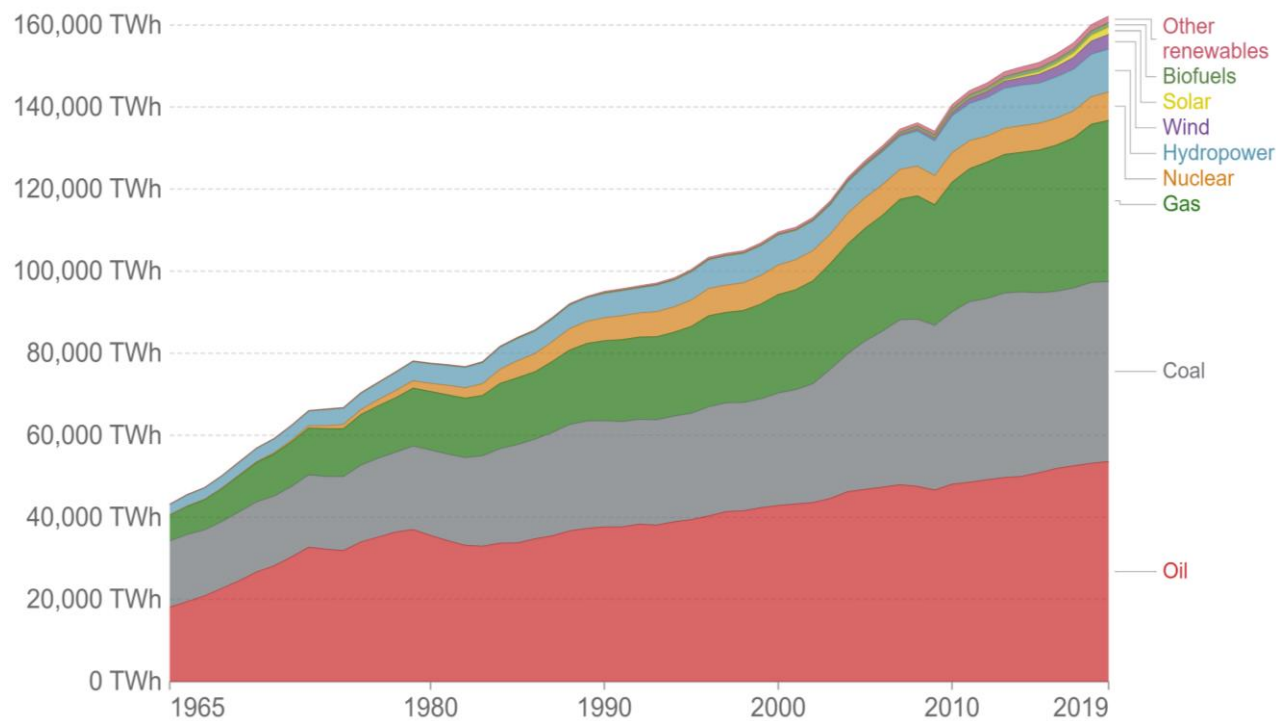
World Point of view:

Substantial increase in energy consumption: +258% in 55 years

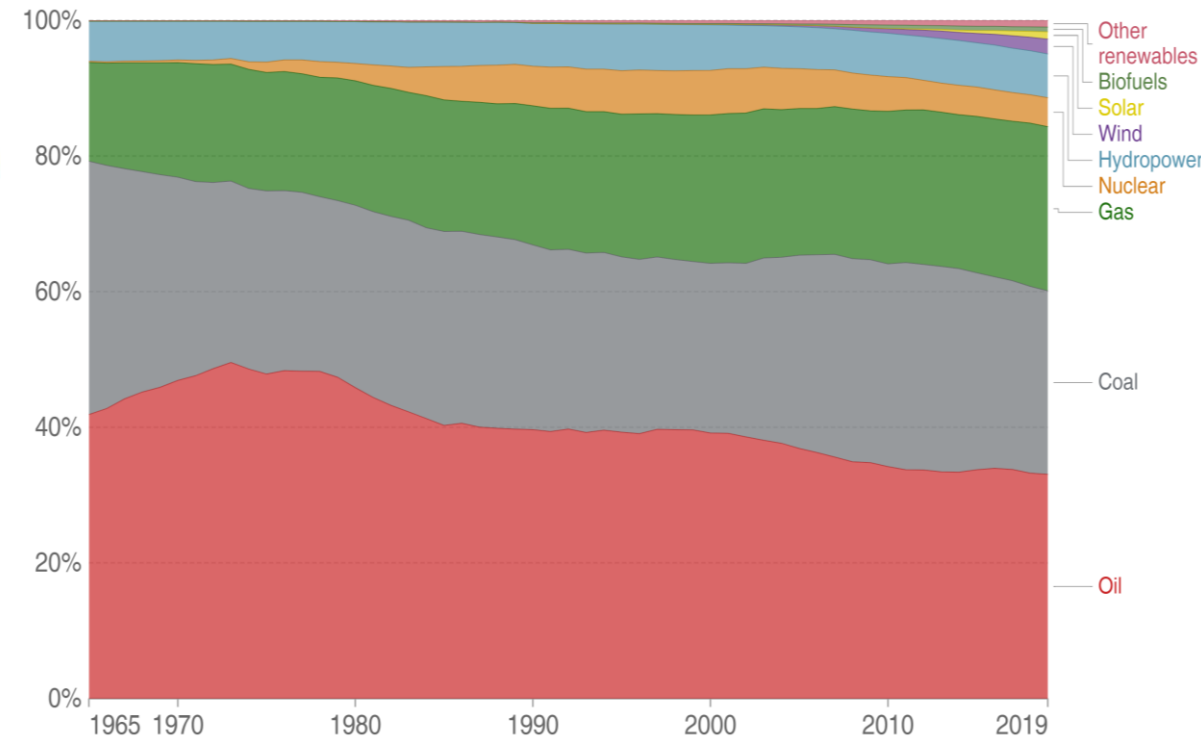
Increase in renewables, but marginal decline in the share of fossil fuels: from 95% to 84% in 55 years

With increasing energy consumption, renewables add to fossil fuels, without replacing them

Energy Consumption by source, World (TWh)

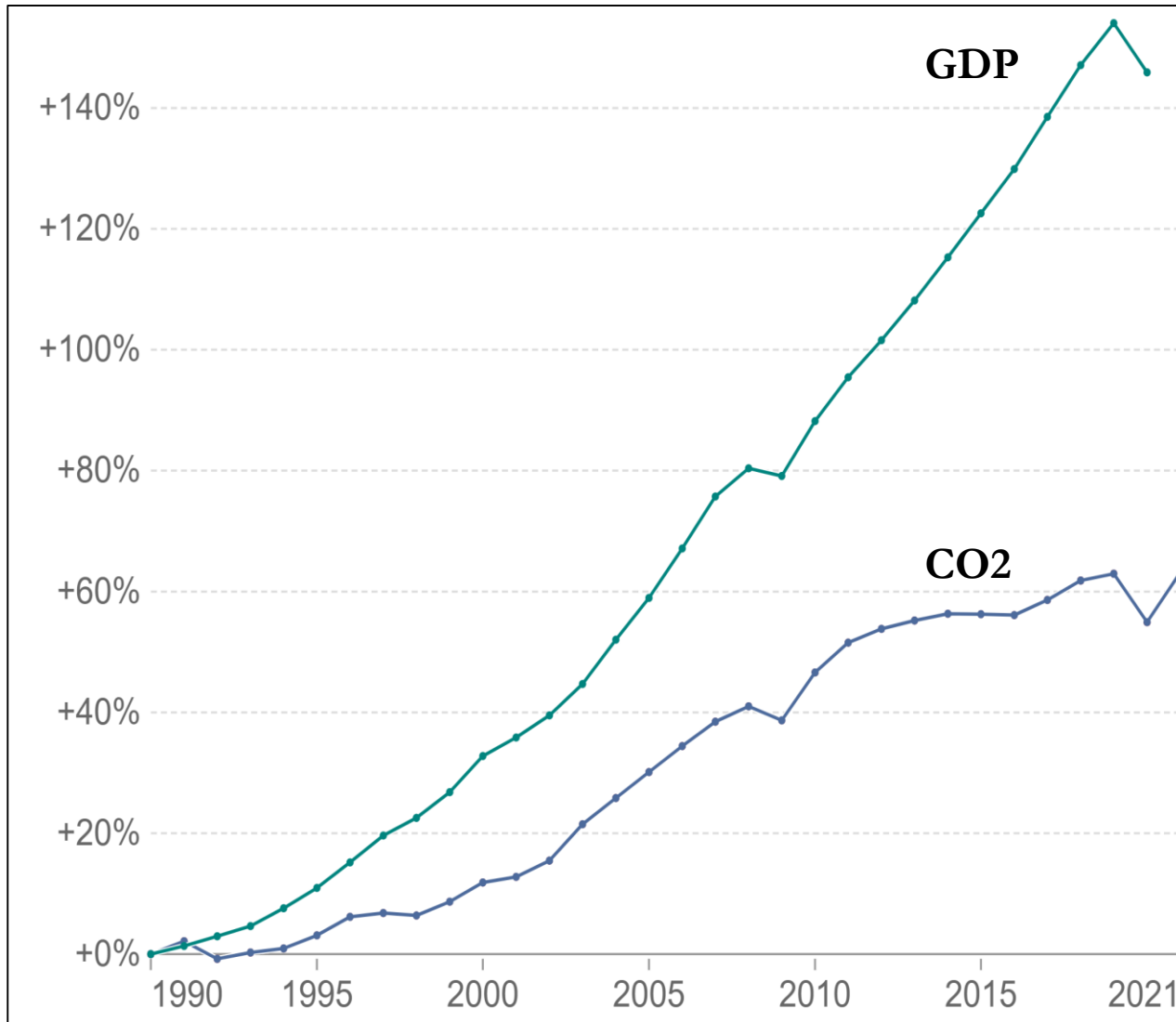


Energy Consumption by source, World (%)



How to keep our economy within a secure operating system?

Variation in Global GDP and CO2 emissions



We observe just a relative decoupling between economic growth and environmental

Innovation and path of technological change is not consistent with the absolute decoupling goal

How to keep our economy within a secure operating system?

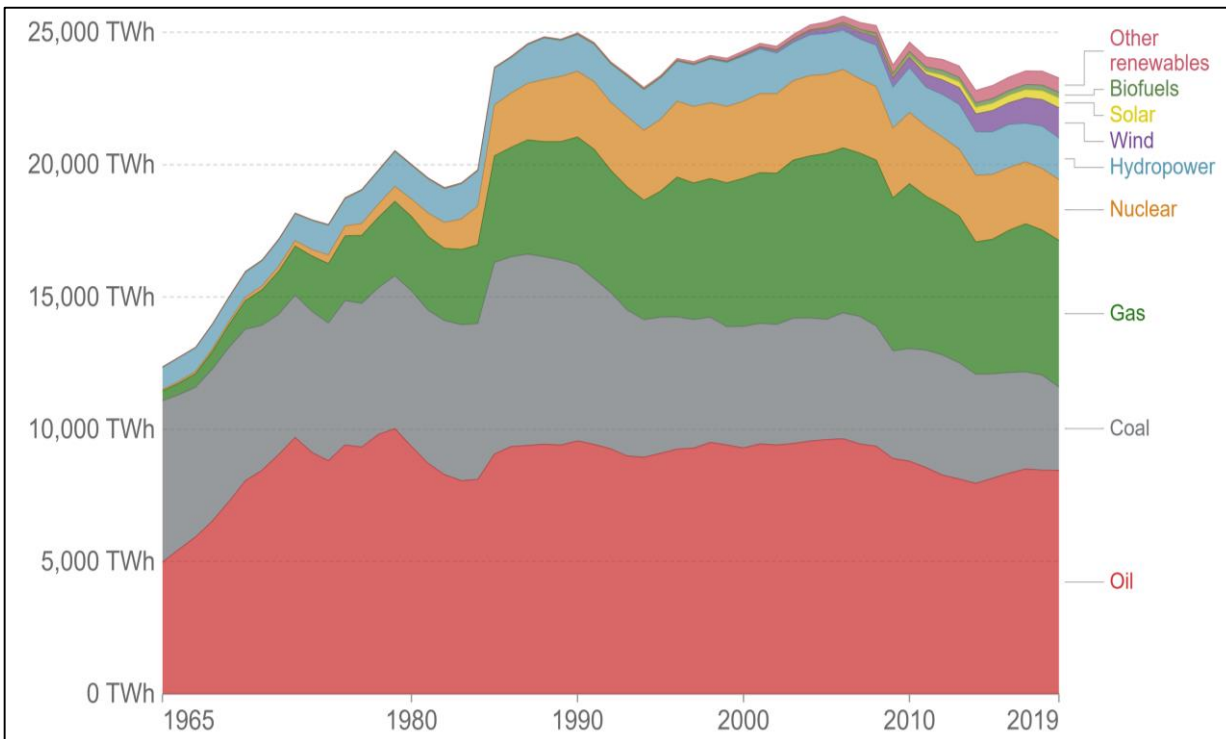
OECD point of view

Reduction of energy consumption and increase in Renewable technologies

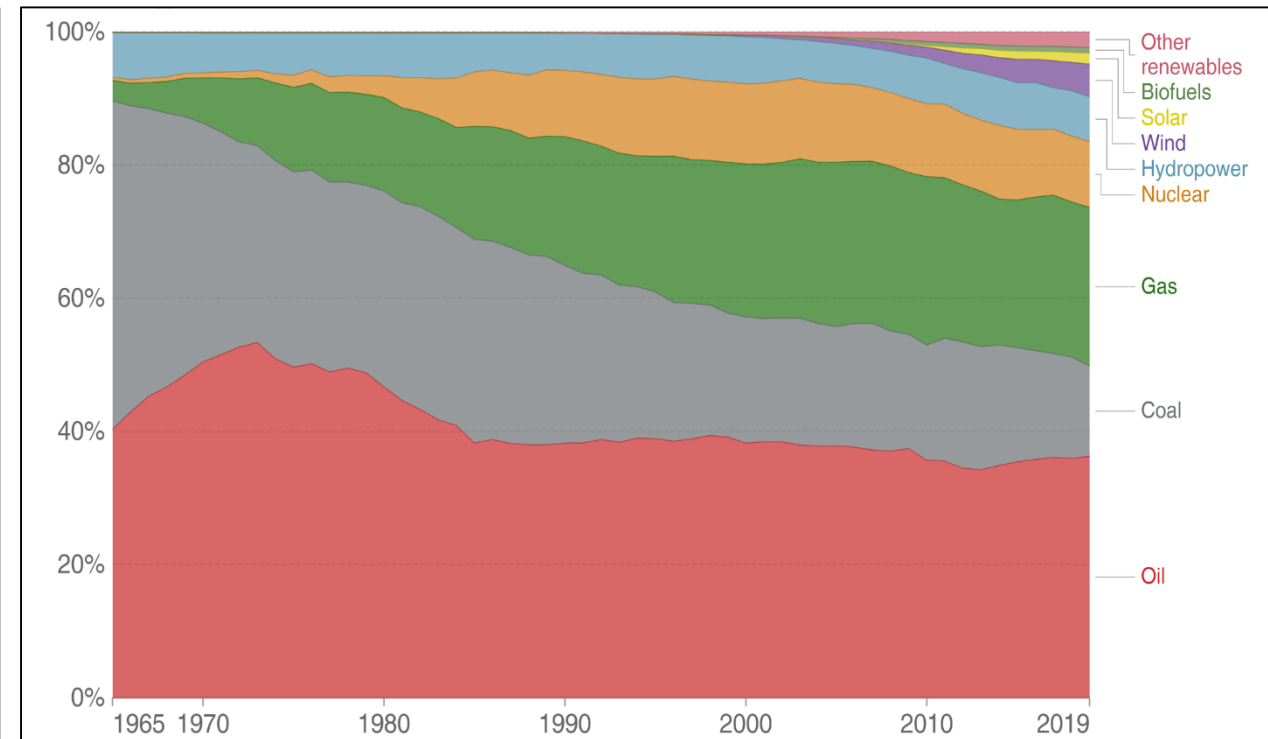
thanks to reduced consumption, renewables are replacing fossil fuels in the energy mix

In 50 years, fossil fuels decreased by only 20 percentage points, they still account for 75% of the energy mix

Energy Consumption by source, OECD (TWh)



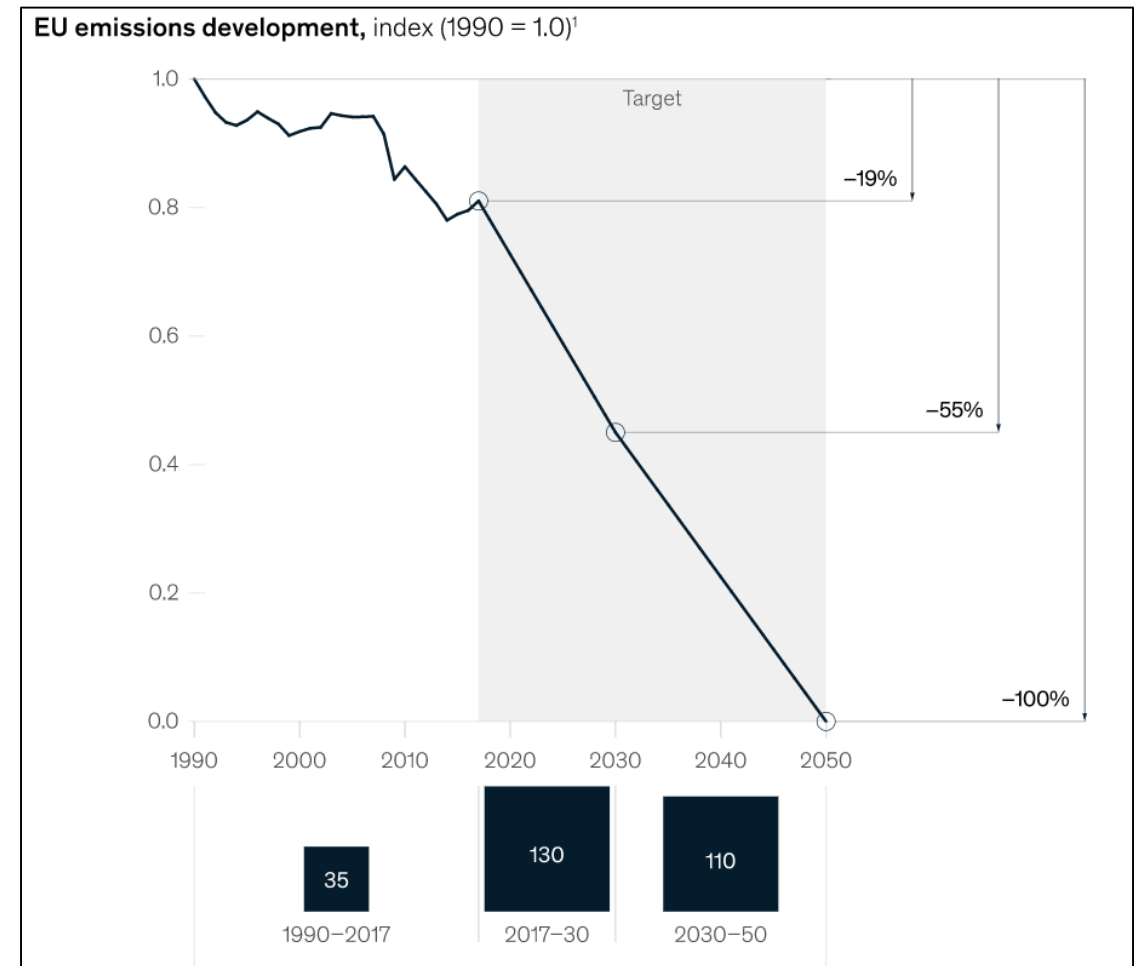
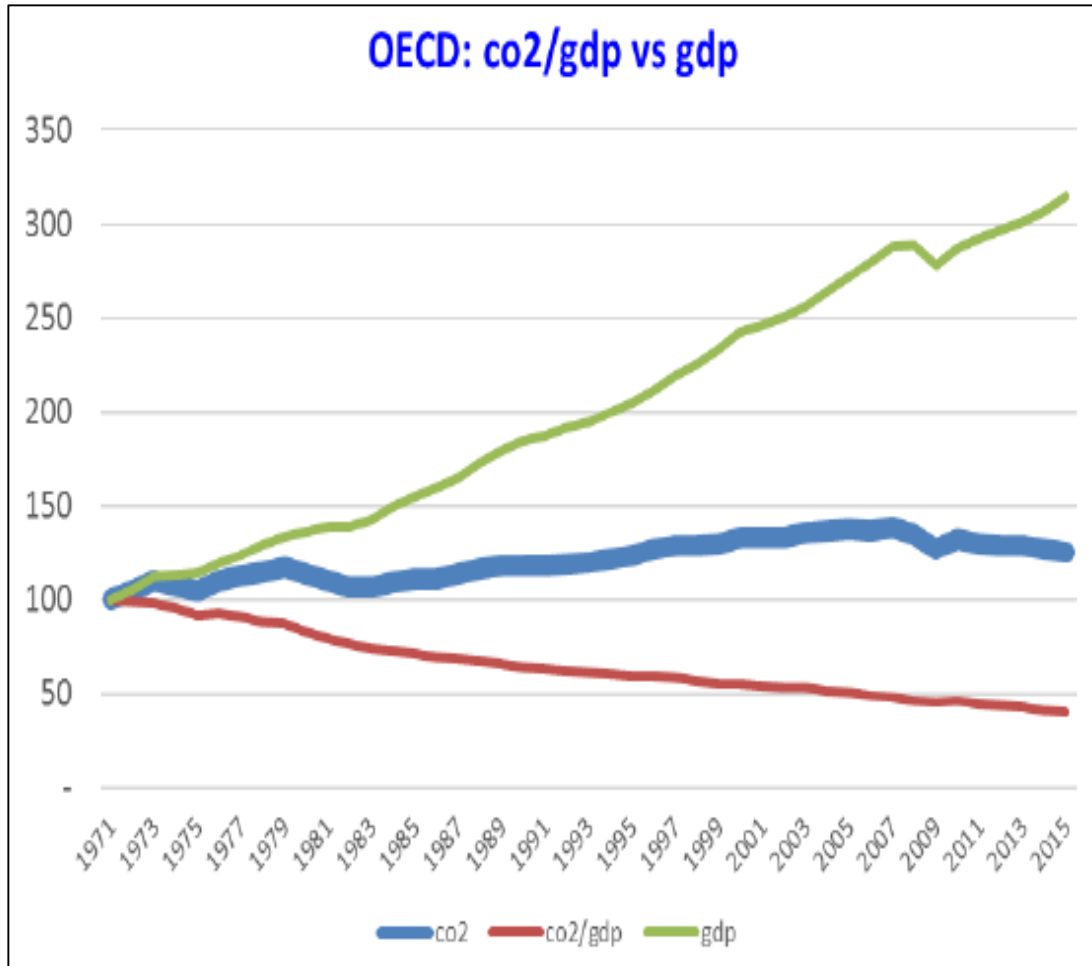
Energy Consumption by source, OECD (%)



How to keep our economy within a secure operating system?

OECD

- Absolute (but too slow) decoupling between economic growth and environmental impact
- Still very far from the ambitious carbon neutrality goal (2050) and from the 2030 intermediate goals
- need of a massive technological change, which required huge investments in infrastructures (not only plants)



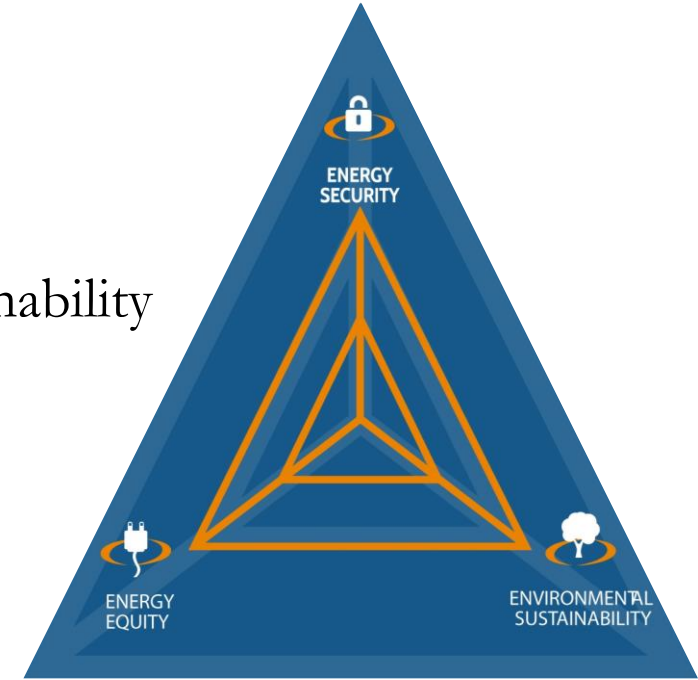
Which model to achieve ambitious political goal?

*A society that does not have access to **abundant, safe, cheap** and **clean** energy can hardly achieve social and economic development (Enel CEO, 2022)*

Energy Trilemma

The type of energy mix affects

- Prices, competitiveness of the industrial sector, households economic sustainability
- Emissions and environmental impact
- Dependence on primary import sources and energy security



- Our energy systems and the energy mix have serious political implications
- Which governance and energy organization model is more suitable to achieve these political priorities?

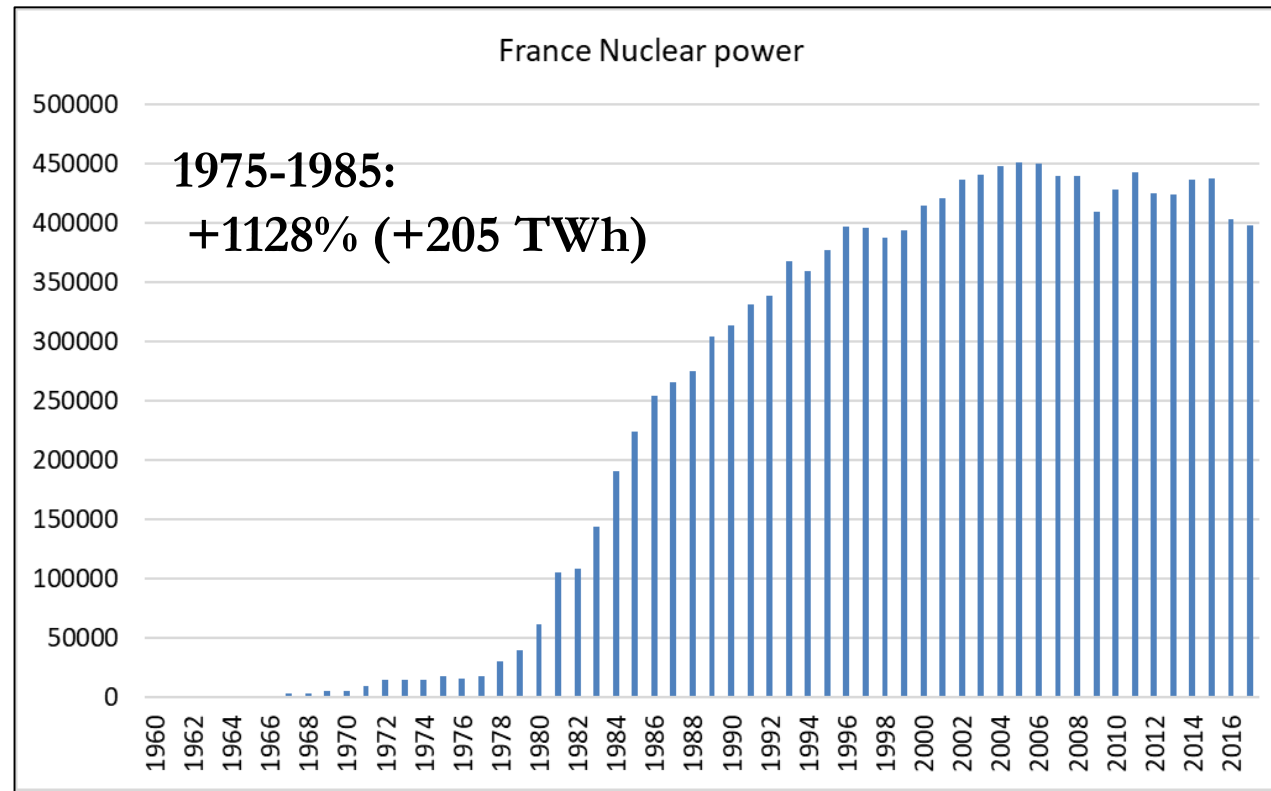
Which model to achieve ambitious political goal

Post-war Paradigm: Integrated Public Monopoly

Economic reasons: Natural monopoly

Socio-political reasons: Objectives that the market does not pursue spontaneously

- Universalization of public services, price accessibility of prices, continuity and security of supplies
- Divergence between public and private companies in their pricing and investment strategies
- Public enterprise as an industrial policy instrument which allow convergence and alignment between investments and political goals



Which model to achieve ambitious political goal

New paradigm: liberalization, privatization and unbundling

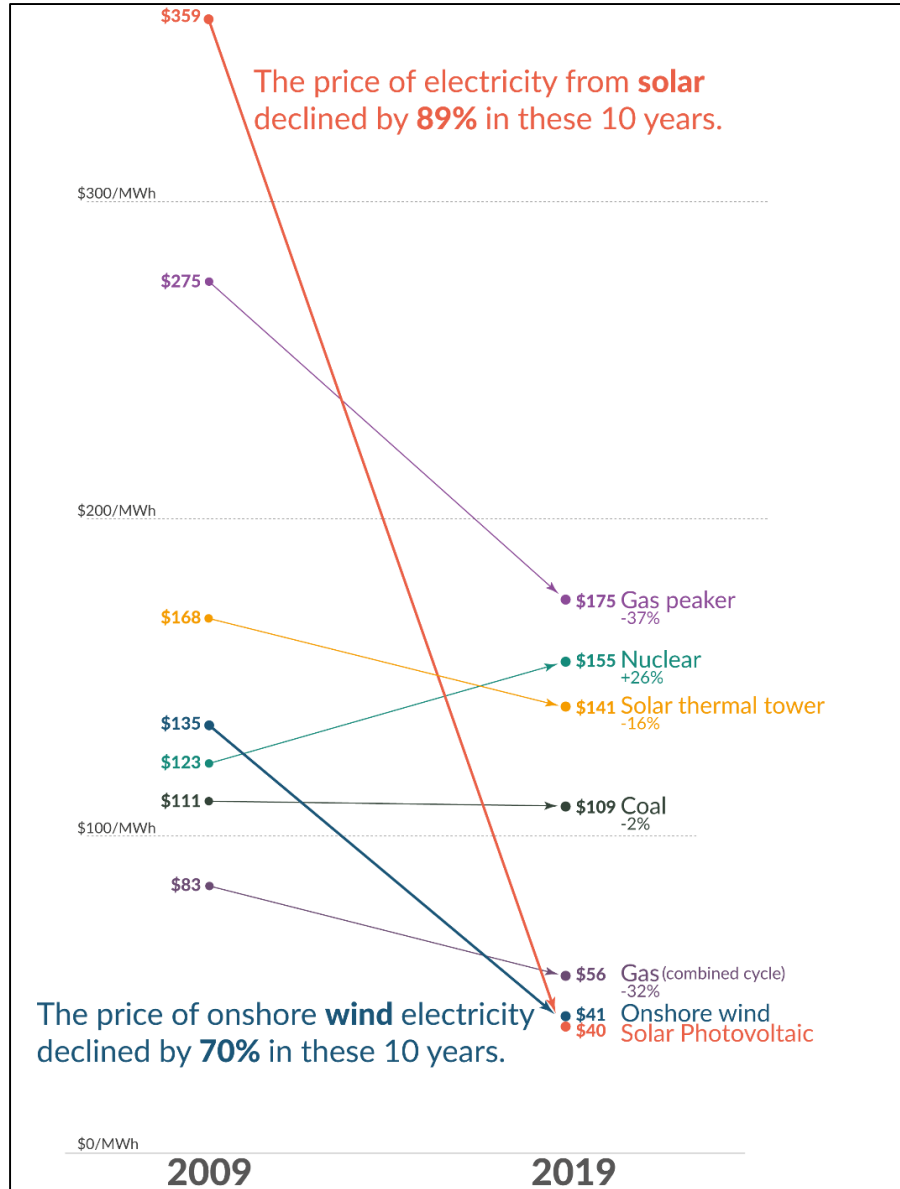
Decarbonization has to be achieved within a reformed market

Market reforms aimed at improving efficiency and bringing to price reduction....

...but are they designed to achieve other non-economic political goals, such as environmental sustainability and energy security?

- what is the compatibility between the new organizational model and socio-political objectives?
- Do markets have the intrinsic capacity to pursue socio-political objectives?
- Are firms' investment strategies oriented towards the pursuit of socio-political objectives, such as abundant, safe, cheap and clean energy?

Which model to achieve ambitious political goal



- Support mechanisms have promoted the diffusion of RES
- Economies of scale and technological learning curves have favored a drastic reduction in the RES technological costs

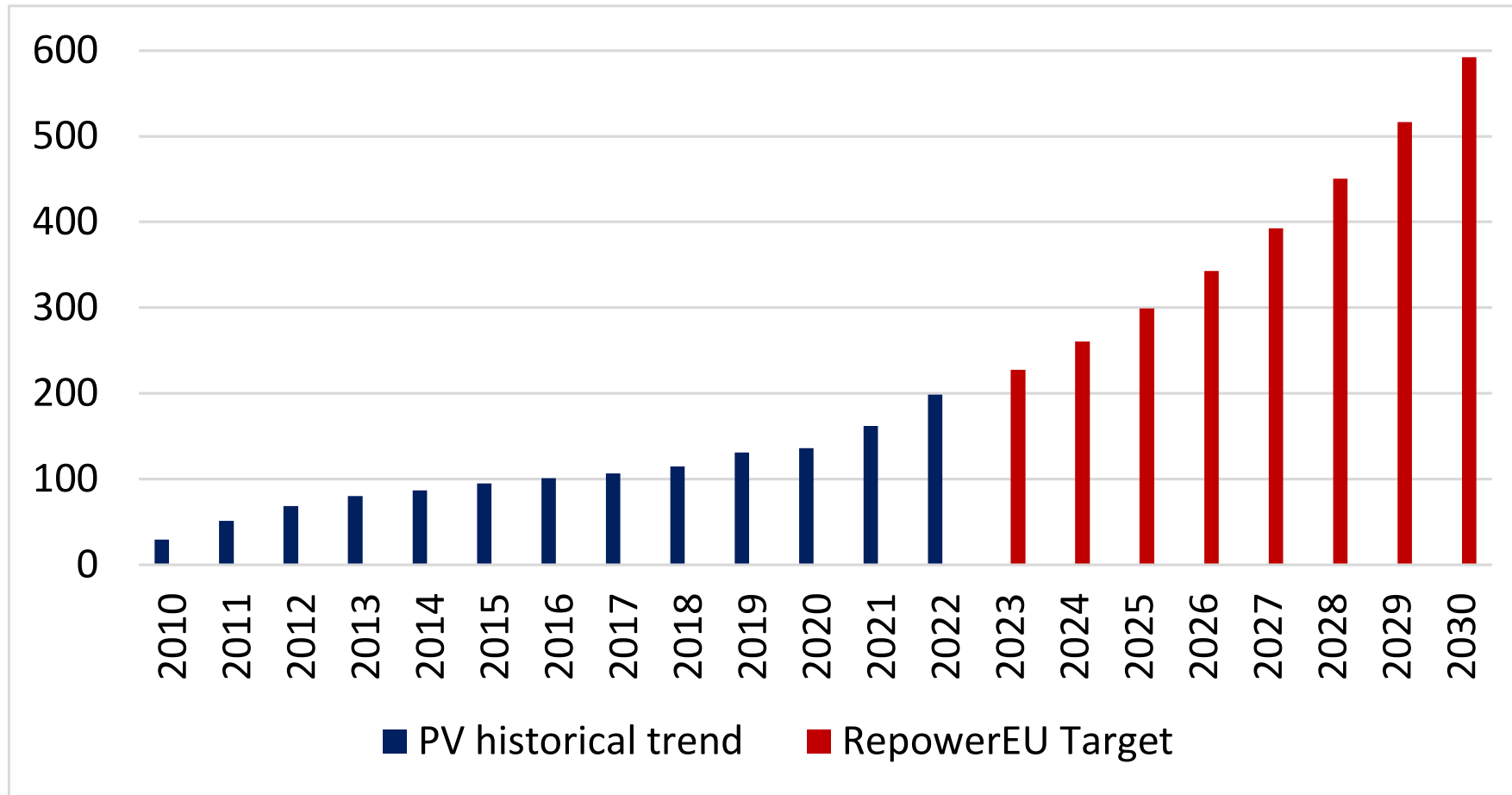
Fonte: Lazard LCOE analysis

Which model to achieve ambitious political goal

Still a significant gap

- To achieve the 2030 RepowerEU target, PV capacity must increase by 200%: from 198 GW to 592 GW (+394 GW)

EU PV CUMULATIVE capacity: past trend vs RepowerEU target

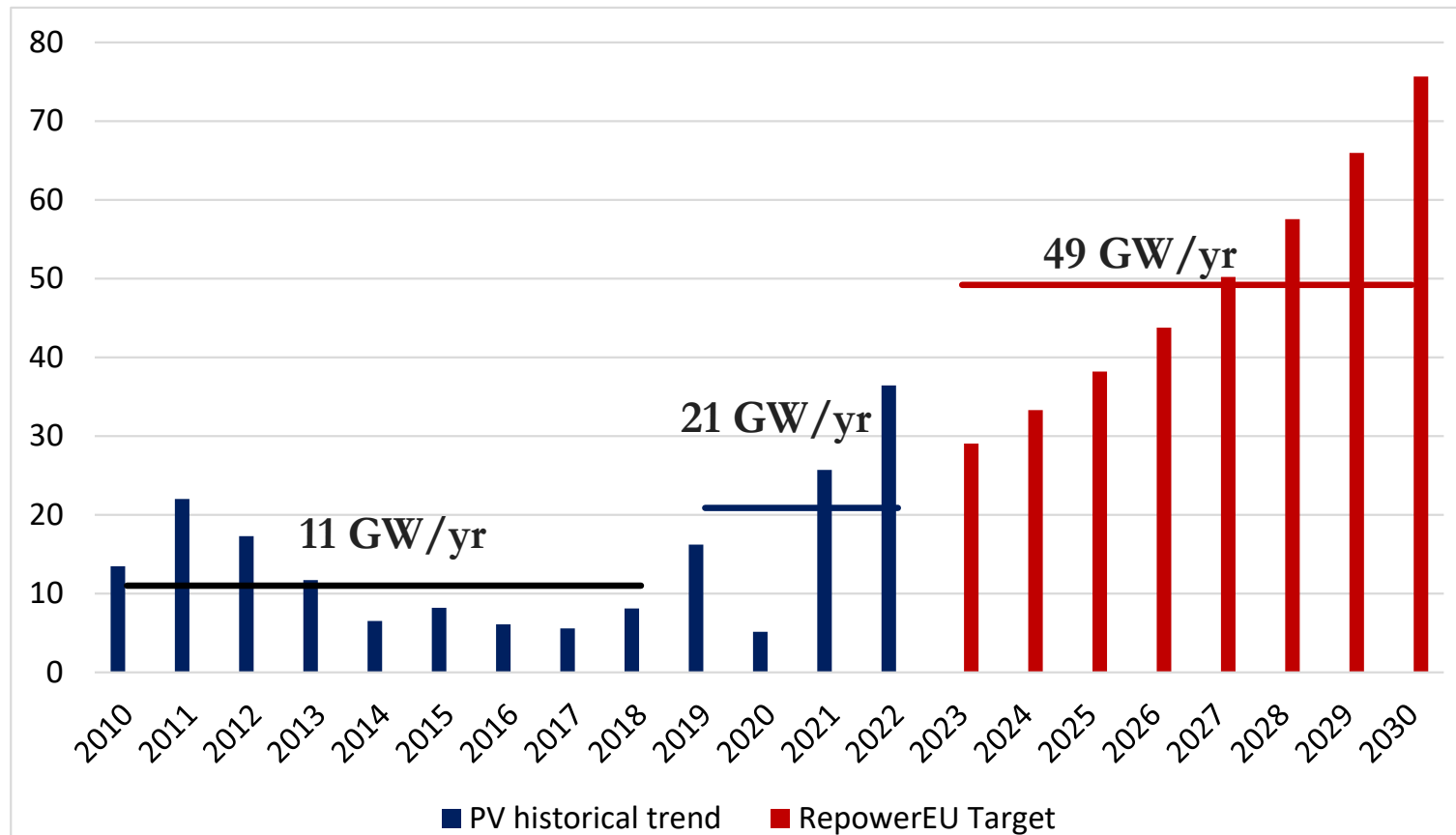


Which model to achieve ambitious political goal

Still a significant gap

- Divergence between market investments and investments required to achieve intermediate objectives
- 49 GW/year should be installed each year for 8 years, while 21 GW/year installed in the last years

EU PV yearly installed capacity: past trend vs RepowerEU target



Which model to achieve ambitious political goal

How to align market investments to political priorities?

Focus on the role of external regulation

Governments can influence market agents investments through:

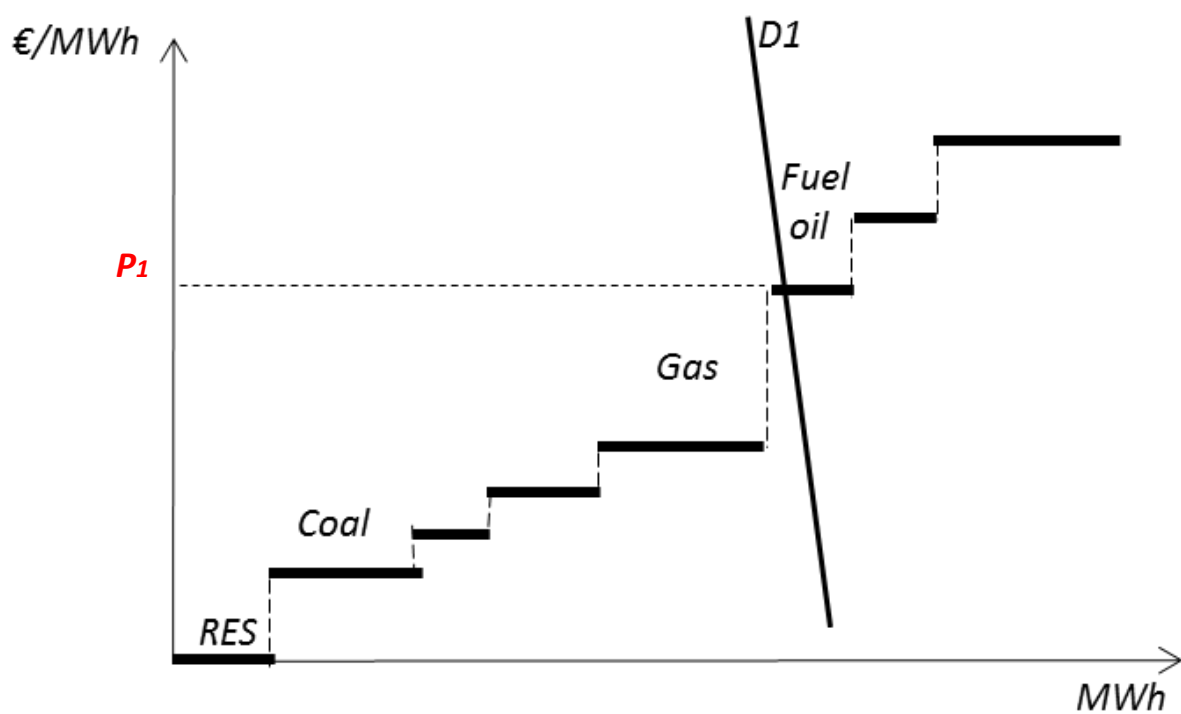
- Command and Control: Technological Standard Imposition
- Market based incentives: Pricing mechanisms which favour RES adoption by:
 - i) increasing the costs of fossil fuels (carbon tax or carbon pricing via ETS)
 - ii) lowering the costs of RES technologies (feed-in tariffs)

Some issues with traditional public intervention view

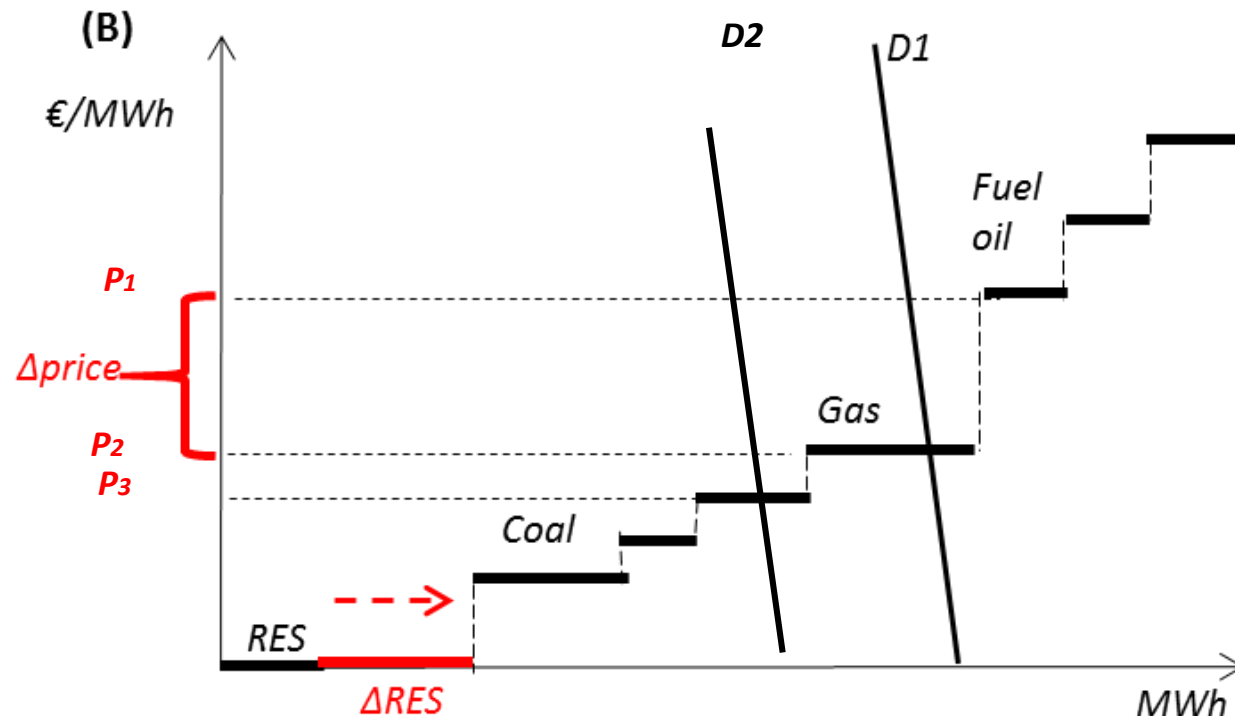
Are incentives to zero marginal cost RES technologies compatible with liberalized energy wholesale market based on marginal pricing systems?

- Renewables: fixed costs covered by incentives
- They enter the stock market at zero marginal cost
- Merit Order Effect: crowding out of the most expensive technologies and reduction of market prices

(A)



(B)

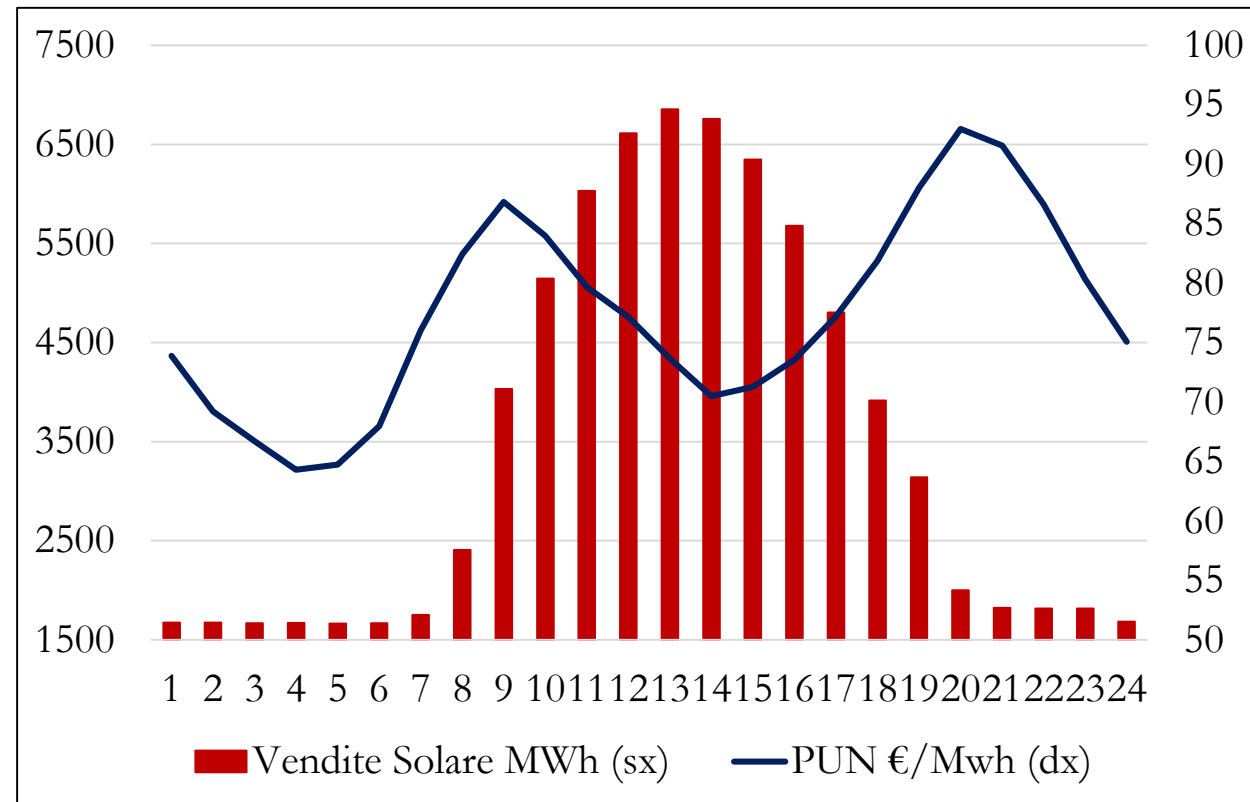


Some issues with traditional public intervention view

Cannibalization effect

- Price reduction not uniform over the day, concentrated during the PV production peak
- the more PV increases, the greater the reduction in prices and related PV unit revenues
- If at 2.00 pm all demand is covered by PV, price collapses to zero and so does PV unit revenue
- Structural problem for PV investments
- Need to decouple RES from marginal pricing systems and move towards long-term contracts

PV generation and market prices: hourly distribution



Some issues with traditional public intervention view

Are pricing mechanisms feasible? Are governments willing to implement them?

- Redistributive problems and political acceptability issues (yellow vests)
- After the war crisis, the main goal is to lower energy prices, not to increase them

Benoit strong argument:

MBIs designed for profit maximizing private companies, but energy markets still dominated by state-owned or state-controlled companies

SOEs may react to MBIs differently from POEs: but how?

Need to deepen the understanding on the effectiveness of traditional MBIs in mixed economies

- Cap and trade: if SOEs are already committed to reduce emissions, their abatement might decrease demand for allowances, thus depressing prices and the ETS effectiveness in promoting emissions reduction on POEs

Bringing SOEs into the picture allows to expand the potential channels governments dispose to favour decarbonization

SOEs role and potential

Government as ultimate owner of major energy companies over the world

- SOEs investment and pricing strategies are driven by motives different from profit maximization, typically improve welfare and increase consumer surplus
- Government can influence SOEs' ultimate goals inducing them to internalize sustainability and decarbonization goals into their mandate
- Benoit discusses how governments can influence the investment strategies of the companies they control
 - Government can appoint senior executives and members of the board of directors
 - Update mandates and formal objectives
 - Corporate culture
 - Enhance corporate capacity

SOEs role and potential

SOEs vs POEs - some empirical evidence on:

- Productivity (Florio et al. 2016, Oxford Bulletin of Economics and Statistics)
- M&As and internationalization strategies (Clò et al. 2017 European Journal of Political Economy; Clò et al. 2023 Structural Change and Economic Dynamics)
- Innovation (Clò et al. 2020; Research Policy)
- Environmental performance (Clò et al. 2017, Energy Economics)

Main findings:

- SOEs diverge from POEs in their goals and performance
- SOEs can be more productive, show higher innovative capacity, show better environmental performance; they diverge in their investment and internationalization strategies: they can be guided by social and political goals
- The intensity of this divergence crucially depends on two crucial factors

- 1. Institutional quality of the controlling government**
- 2. Degree of government control: there is a variety of SOEs**

1. Institutional quality of the controlling government

- The SOEs willingness and capacity to achieve social-valuable goals crucially depends on institutional quality and on the government's political priorities.
 - Institutional quality and SOEs are linked by a double relation
1. First channel is external to the SOEs
 - Institutions shape the external environment where firms operate: channel is common to both SOEs and POEs
 - Institutions as explanatory variables of economic performance, productivity growth, (Barro, 1991; Mauro, 1995; Hall & Jones, 1999; Acemoglu et al. 2005), knowledge accumulation and innovation (Rodrik, 2000; Sala-i-Martin, 2002; Gradstein, 2004)
 2. Second channel is internal to the SOE
 - Appointed manager, internal governance mechanisms, managers' objectives and mandates depend on the quality of the controlling government
 - This channel is relevant only for the SOE and does not affect POEs

1. Institutional quality of the controlling government (Research Policy 2020)

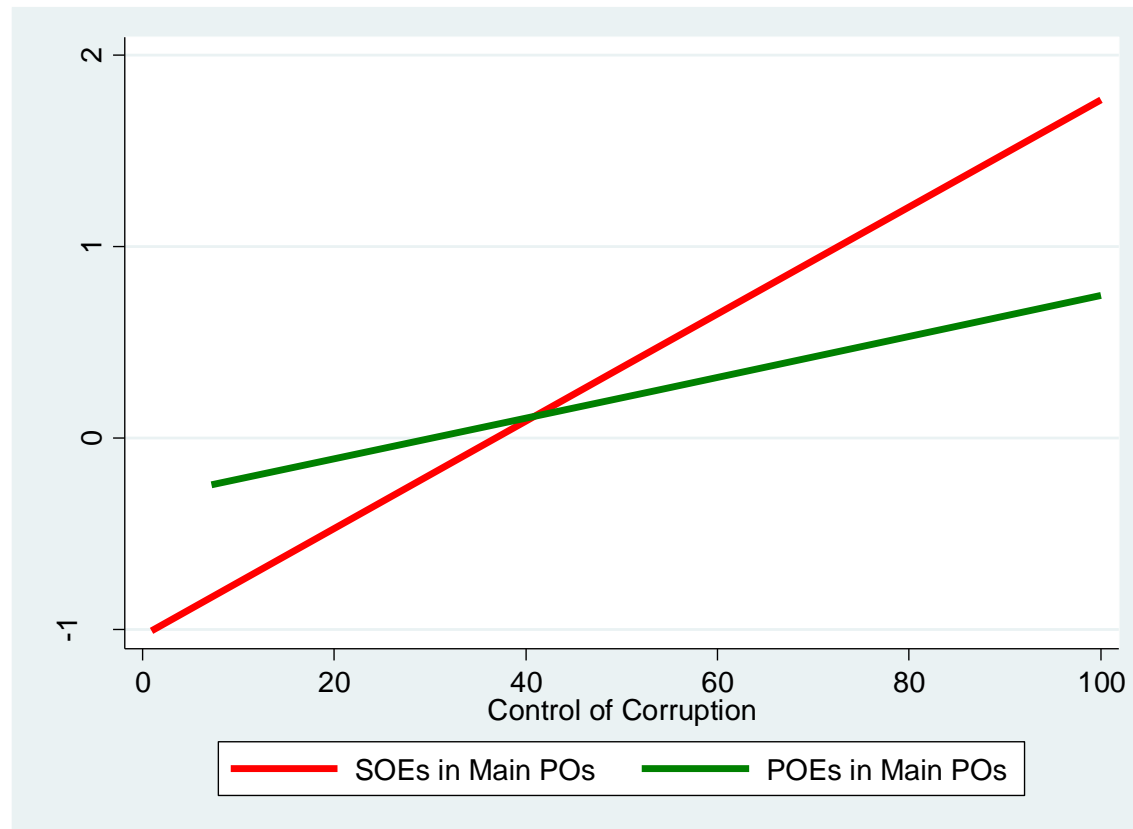
Innovation increases with institutional quality, and this effect is stronger for SOEs than for POEs

When institutional quality low, SOEs patent less than privates

Better institutional quality associated with increase in patenting, at a higher rate for SOEs

When institutional quality high, SOEs patent more than POEs

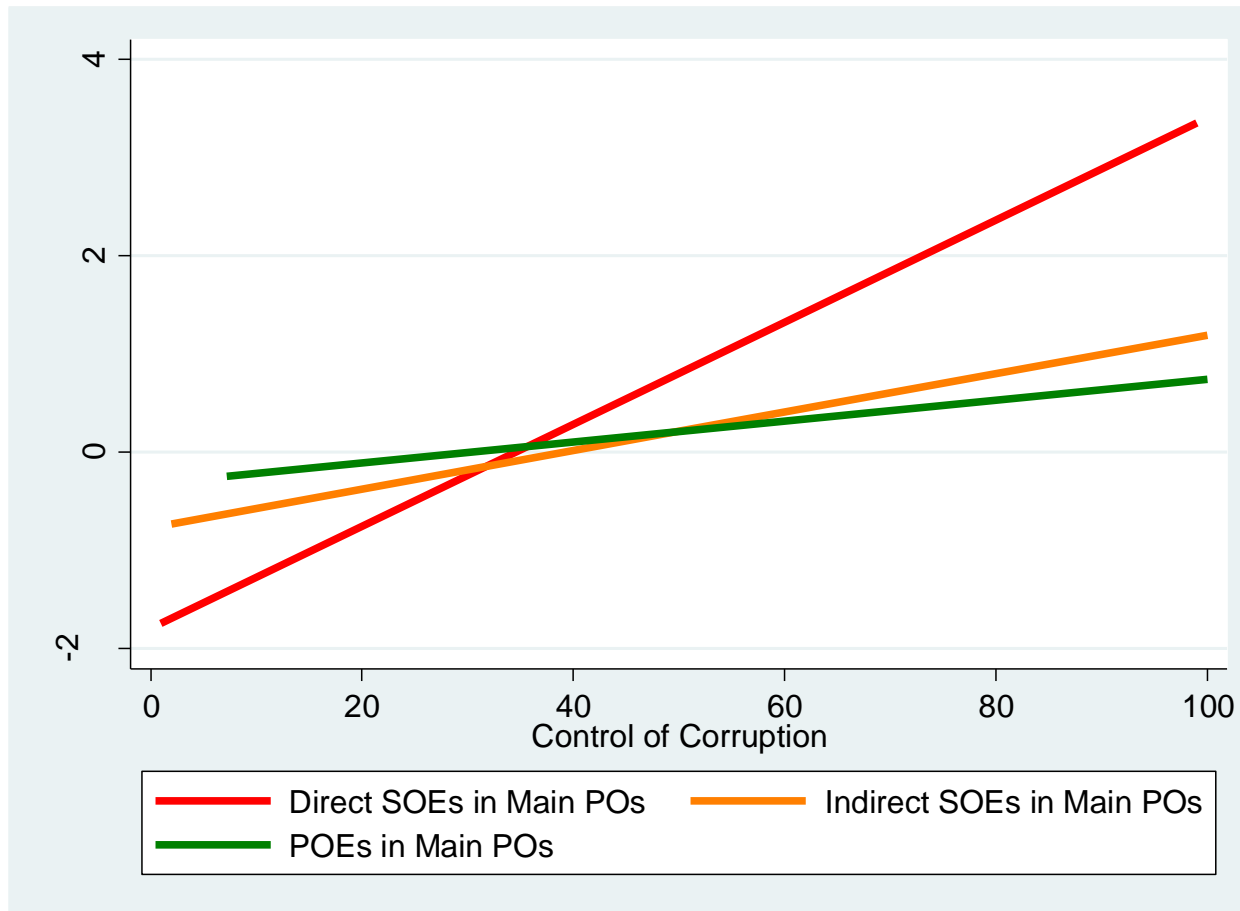
- Focus on long-term social valuable goals which depart from short-term private benefits



2. Degree of government control

Variety of SOEs depending on intensity of government control

- Direct Control: Unlisted companies with majority of control deviate from POEs strategies: clear and stringent influence of the government
- Indirect control: Listed SOEs with control lower than 50% are aligned to POEs: political influence diluted and SOEs do not differ strongly from private



Main difference between SOEs and POEs under direct control;

SOEs with indirect control aligned to POES

SOEs role and potential

IMPLICATION:

- decarbonization through SOEs requires increasing government control and unlisting strategic firms with crucial roles (TSO and firms in natural monopoly)
- SOEs as main driver of decarbonization: feasible under the condition of high institutional quality of the controlling government and strict political commitment to environmental goals
- In Asian and other developing countries SOEs more committed to ensure energy accessibility at low and affordable prices (through fossil fuels) than decarbonization through RES investments and reduction in energy consumption

Crucial role of breakthrough innovation

A trade-off still exists between environmental sustainability and energy equity

- RES have a lower environmental impact, but they are still non competitive compared to fossil fuels
- required rate of technological substitution implies a huge increase in the demand for PV panels, with relative prices increasing and lowering their convenience

The stone age and the fossil fuels age

- RES: intermittent and not programmable, do not grant the same performance of fossil-fuels based technologies
- RES combined with storage facilities are not competitive options

In order to commit SOEs to decarbonize also in developing countries RES must become the most convenient technological solution

- We should not subsidize at taxpayers' expenses the diffusion of low-performing technologies (PV)
- We need technological breakthrough innovation
- new technologies displacing fossil fuels because they are intrinsically more convenient

Crucial role of breakthrough innovation

Are Innovation designed to allow for technological leap and breakthrough?

- Innovation delegated to private subjects, whose objectives are not necessarily aligned with the public mission
- The system is not giving rise to projects that radically change scientific and technological knowledge

Benoit target indirect measures

- Other public channels to support innovation
- Government as financial provider
 - In EU development banks more oriented and more effective than private venture capital and private equity in supporting innovative enterprises (Clò et al. 2022; Research Policy)
- Government as public acquirer
 - Public procurement can significantly influence market demand of green-innovation products (Clò et al. 2023; Technovation)

Crucial role of breakthrough innovation

Florio: The privatization of Knowledge

In order to decarbonize we need a subject who internalizes a long-term scientific-technological mission and who acts as owner and manager in the collective interest

A CERN for climate

- Need to rediscover the idea of public enterprise and hybridize it with that of **research infrastructure**
- a new type of enterprise as a **hub for knowledge creation**.

This type of organization could manage the intangible capital deriving from public research, creating a portfolio of projects whose returns feed a fund intended both for reinvesting in the research itself and for social programs to promote universal access to knowledge creation.

Conclusions

- substantial divergence between market investments and political priorities
- Traditional **external** regulation might not be sufficient or feasible to ensure the achievement of the political goals
- Traditional external regulation might affect SOEs differently from POEs
- SOEs represent a powerful instrument to intervene **within** the market and to favour an alignment between market investments and political goals
- This solution requires direct government control over SOEs, clear political commitment to decarbonization and high institutional quality
- Decarbonization requires the introduction of breakthrough technologies, but can markets introduce disruptive innovation in a time consistent with our decarbonization goal?
- Opportunity to support innovation through public finance and public procurement (target indirect measures)
- Central role of SOEs and Research Infrastructures with a clear public scientific mandate