UNIVERSITÀ DEGLI STUDI DI TRIESTE

SOCIETÁ, TERRITORIO E TRANSIZIONE ENERGETICA
Dipartimento di Scienze Politiche e Sociali

SOCIETÁ, TERRITORI, TRANSIZIONI

SOCIETÁ, TERRITORI, TRANSIZIONI I
L'ENERGIA COME SISTEMA SOCIO-TECNICO

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LEZIONE 10
11 APRILE 2024

CENTRALE IDROELETTRICA DI BARGI, BACINO DI SUVIANA

RIPRENDIAMO IL FILO

ENERGIA E SCIENZE SOCIALI

L'ENERGIA IN EPOCA MODERNA:
SISTEMI SOCIO-TECNICI INTERDIPENDENTI DI PRODUZIONE E CONSUMO

METABOLISMO URBANO

METABOLISMO URBANO

urban metabolism, teorizzato da Abel Wolman nel 1965*,
è un concetto fondamentale per lo sviluppo di città e comunità sostenibili.

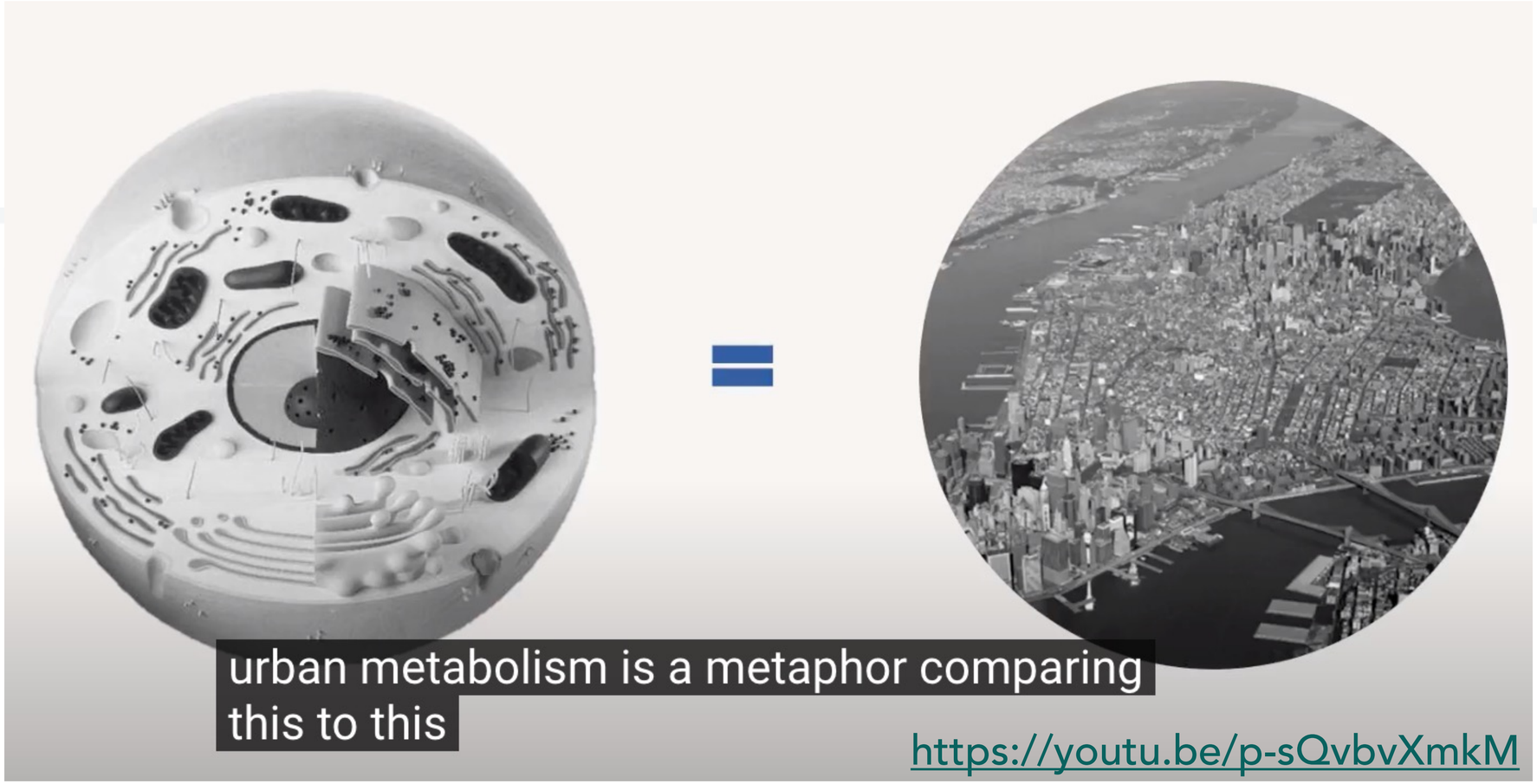
«The sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste» (Kennedy et al., 2007)**

*A. Wolman (1965), The metabolism of cities, *Scientific American, 213* (3), pp. 179-190

**C.A. Kennedy, J. Cuddihy, J. Engel Yan (2007), The changing metabolism of cities Journal of Industrial Ecology, 2007 (11), pp. 43-59

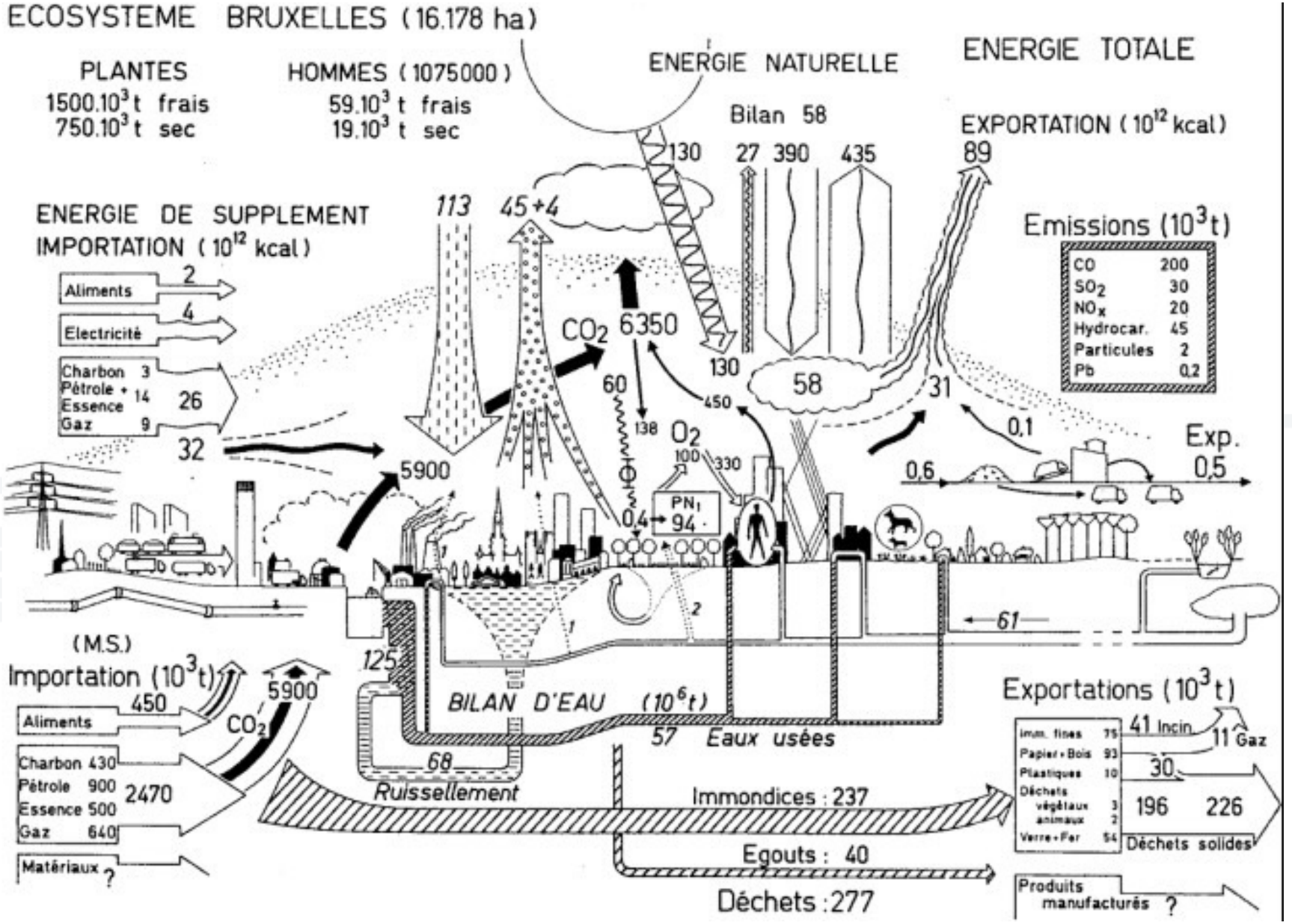
METABOLISMO URBANO

Urban Metabolism for Policy Makers



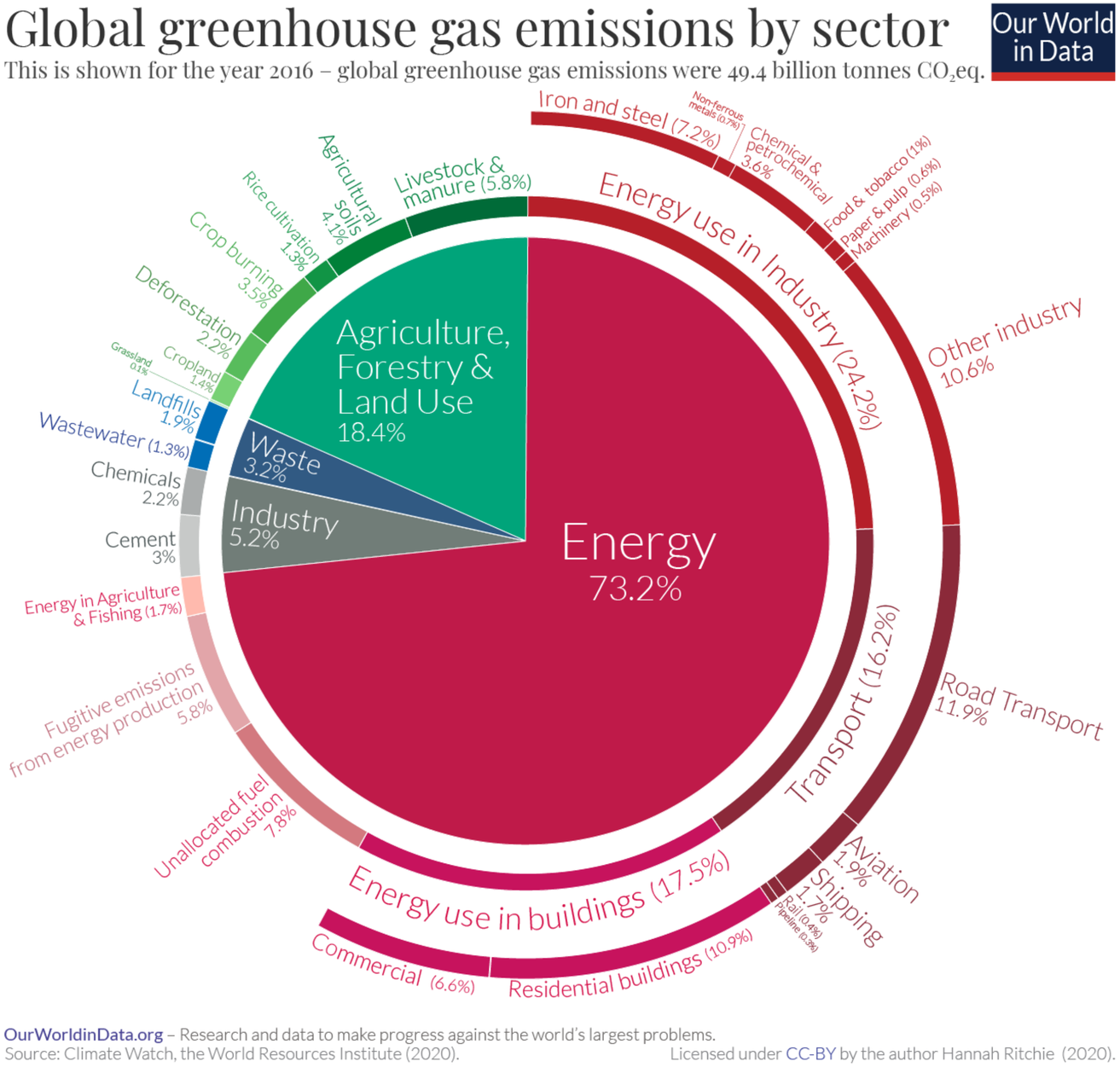
METABOLISMO URBANO DI BRUXELLES, ANNI ‘70

DUVIGNEAUD E DENEYEYER-DE SMET (1977)



ENERGIA ED ECOSISTEMI URBANI

EMISSIONI DI GAS SERRA PER SETTORE (2020)

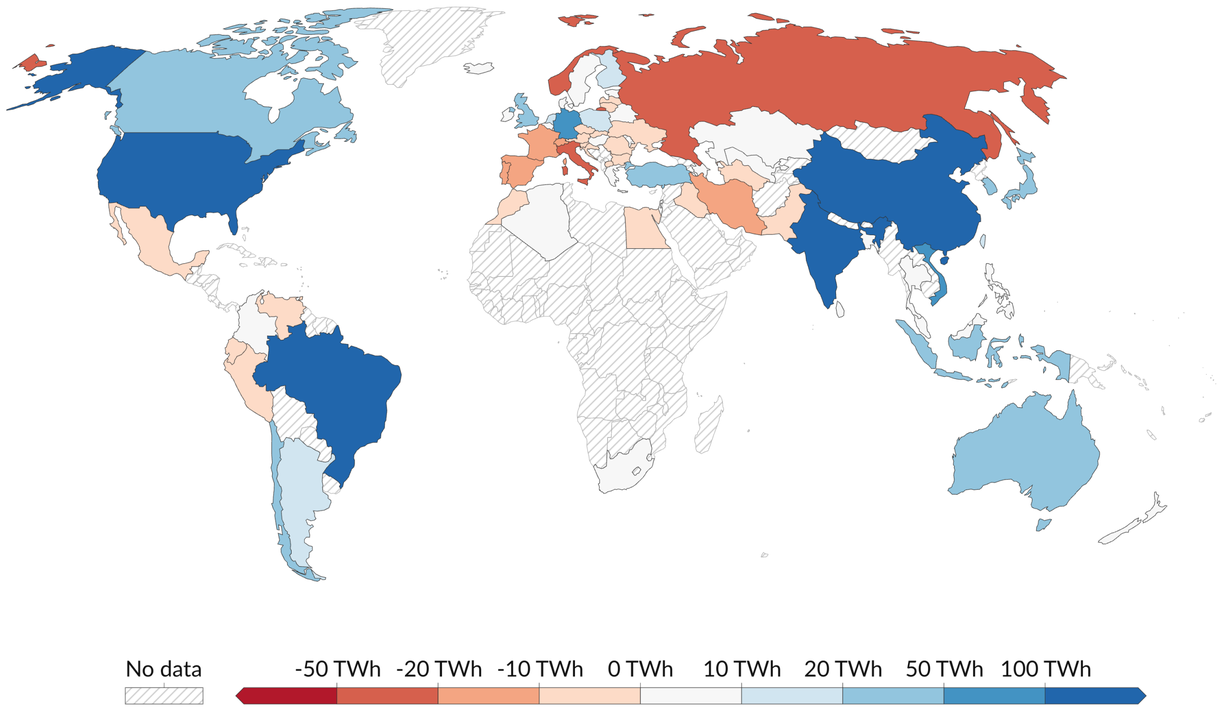


ENERGIA, SOCIETÀ, TRANSIZIONE

Annual change in renewable energy generation, 2022

Our World in Data

Change in renewable energy generation relative to the previous year, measured in terawatt-hours[1] and using the substitution method[2]. It includes energy from hydropower, solar, wind, geothermal, wave and tidal, and bioenergy.



Data source: Energy Institute - Statistical Review of World Energy (2023)

OurWorldInData.org/energy | CC BY

1. Watt-hour: A watt-hour is the energy delivered by one watt of power for one hour. Since one watt is equivalent to one Joule per second, a watt-hour is equivalent to 3600 Joules of energy. Metric prefixes are used for multiples of the unit, usually: - kilowatt-hours (kWh), or a thousand watt-hours. - Megawatt-hours (MWh), or a million watt-hours. - Gigawatt-hours (GWh), or a billion watt-hours. - Terawatt-hours (TWh), or a trillion watt-hours.

2. Substitution method: The 'substitution method' is used by researchers to correct primary energy consumption for efficiency losses experienced by fossil fuels. It tries to adjust non-fossil energy sources to the inputs that would be needed if it was generated from fossil fuels. It assumes that wind and solar electricity is as inefficient as coal or gas. To do this, energy generation from non-fossil sources are divided by a standard 'thermal efficiency factor' – typically around 0.4 Nuclear power is also adjusted despite it also experiencing thermal losses in a power plant. Since it's reported in terms of electricity output, we need to do this adjustment to calculate its equivalent input value. You can read more about this adjustment in our article.

ENERGIA, SOCIETÀ, TRANSIZIONE

Annual change in renewable energy generation

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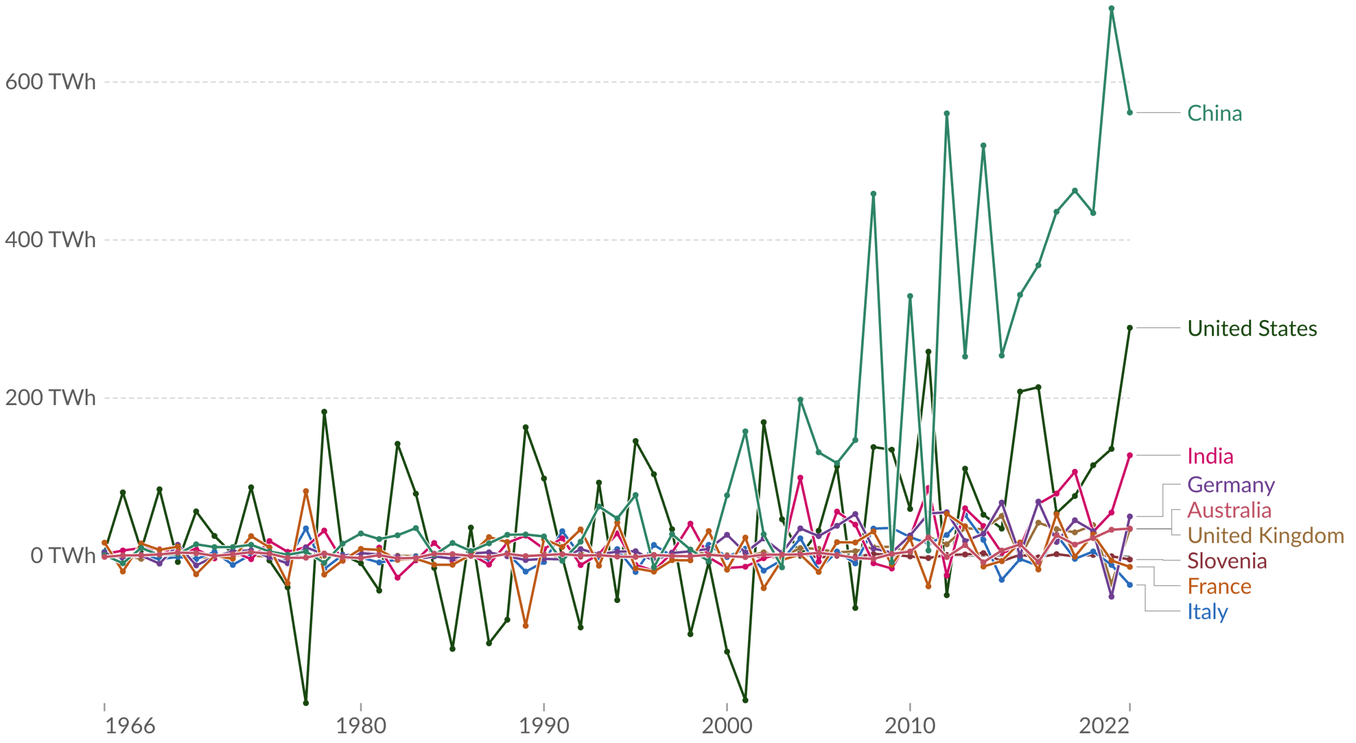

Data source: Energy Institute - Statistical Review of World Energy (2023)

OurWorldInData.org/energy | CC BY

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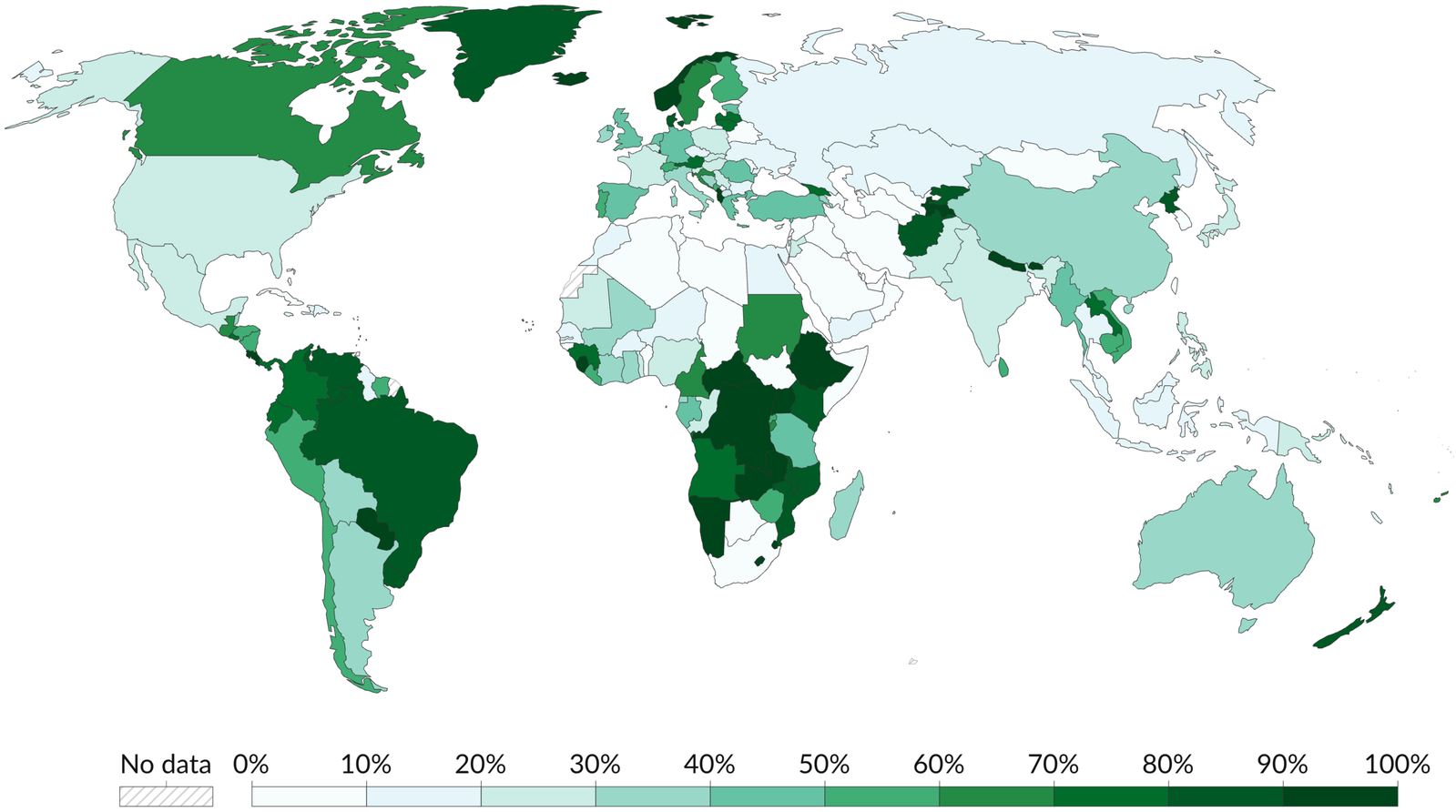
https://ourworldindata.org/grapher/annual-change-renewables?tab=chart&country=CHN~IND~USA~FRA~DEU~AUS~ITA~SVN~GBR

ENERGIA, SOCIETÀ, TRANSIZIONE

Share of electricity production from renewables, 2022

Our World in Data

Renewables include electricity production from hydropower, solar, wind, biomass & waste, geothermal, wave, and tidal sources.



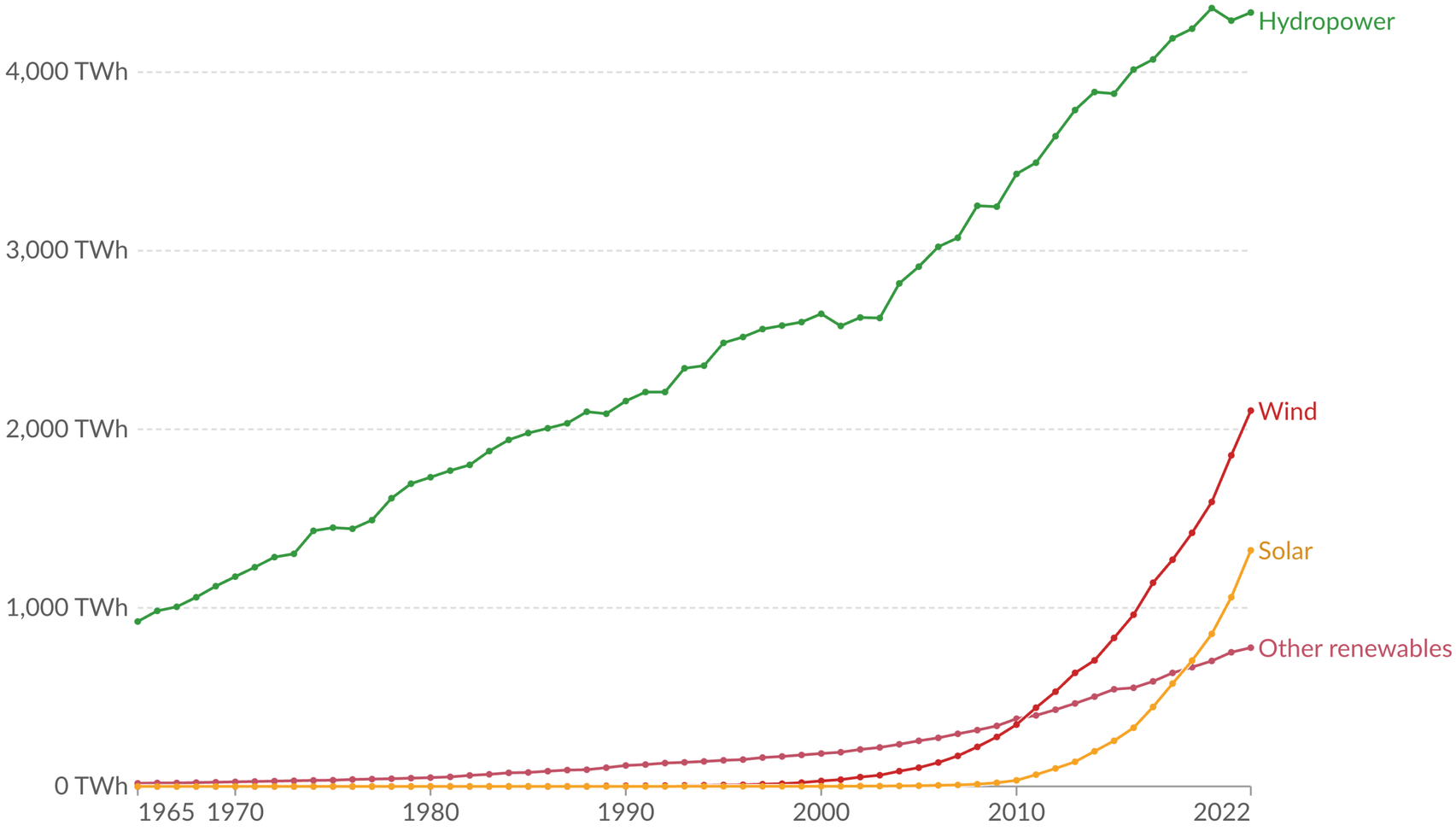
Data source: Ember - Yearly Electricity Data (2023); Ember - European Electricity Review (2022); Energy Institute - Statistical Review of World Energy (2023)

OurWorldInData.org/energy | CC BY

ENERGIA, SOCIETÀ, TRANSIZIONE

Renewable energy generation, World

Our World in Data

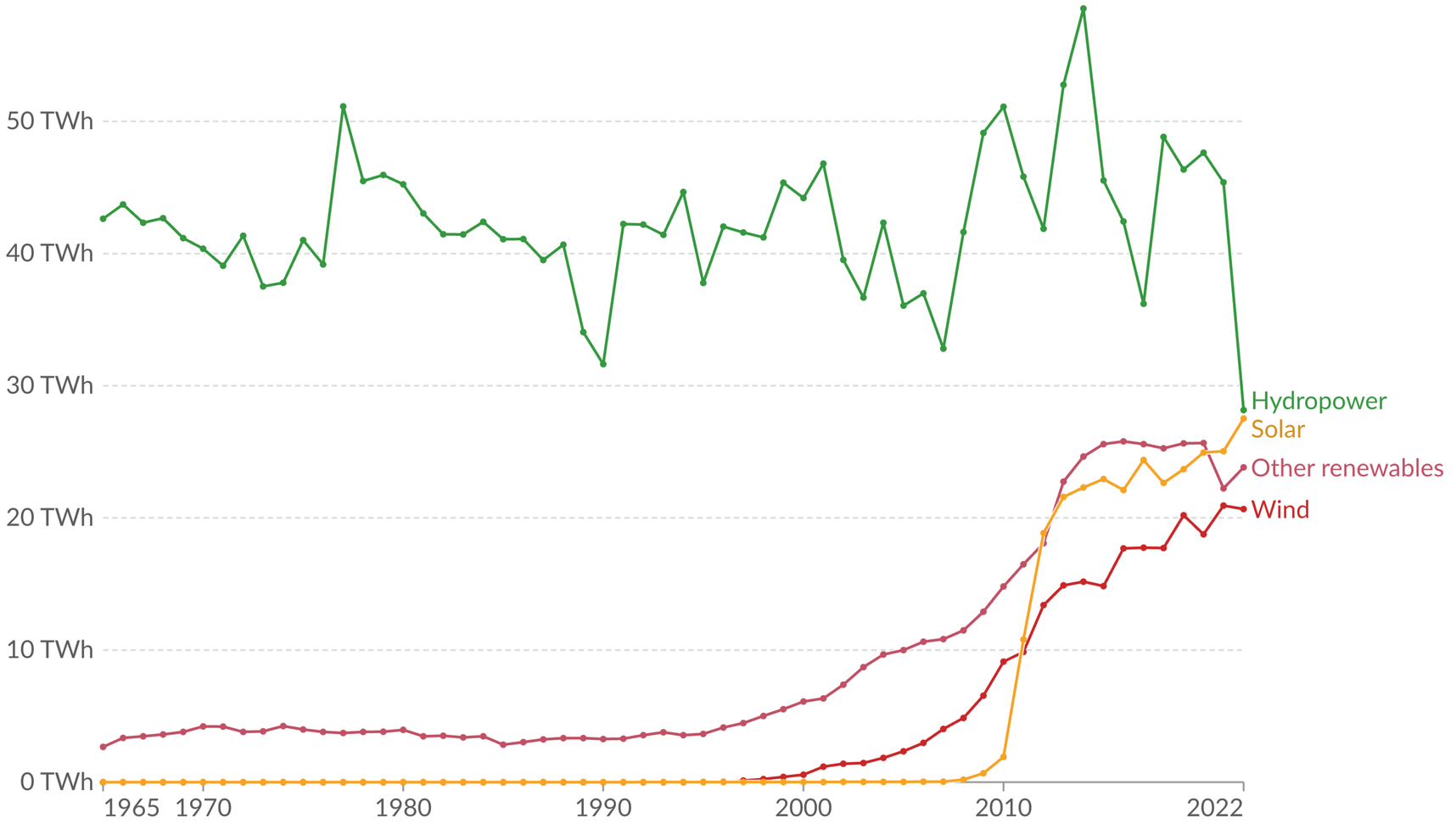


Data source: Energy Institute - Statistical Review of World Energy (2023) OurWorldInData.org/renewable-energy | CC BY

Note: 'Other renewables' refers to renewable sources including geothermal, biomass, waste, wave and tidal. Traditional biomass is not included.

ENERGIA, SOCIETÀ, TRANSIZIONE [ITALIA]

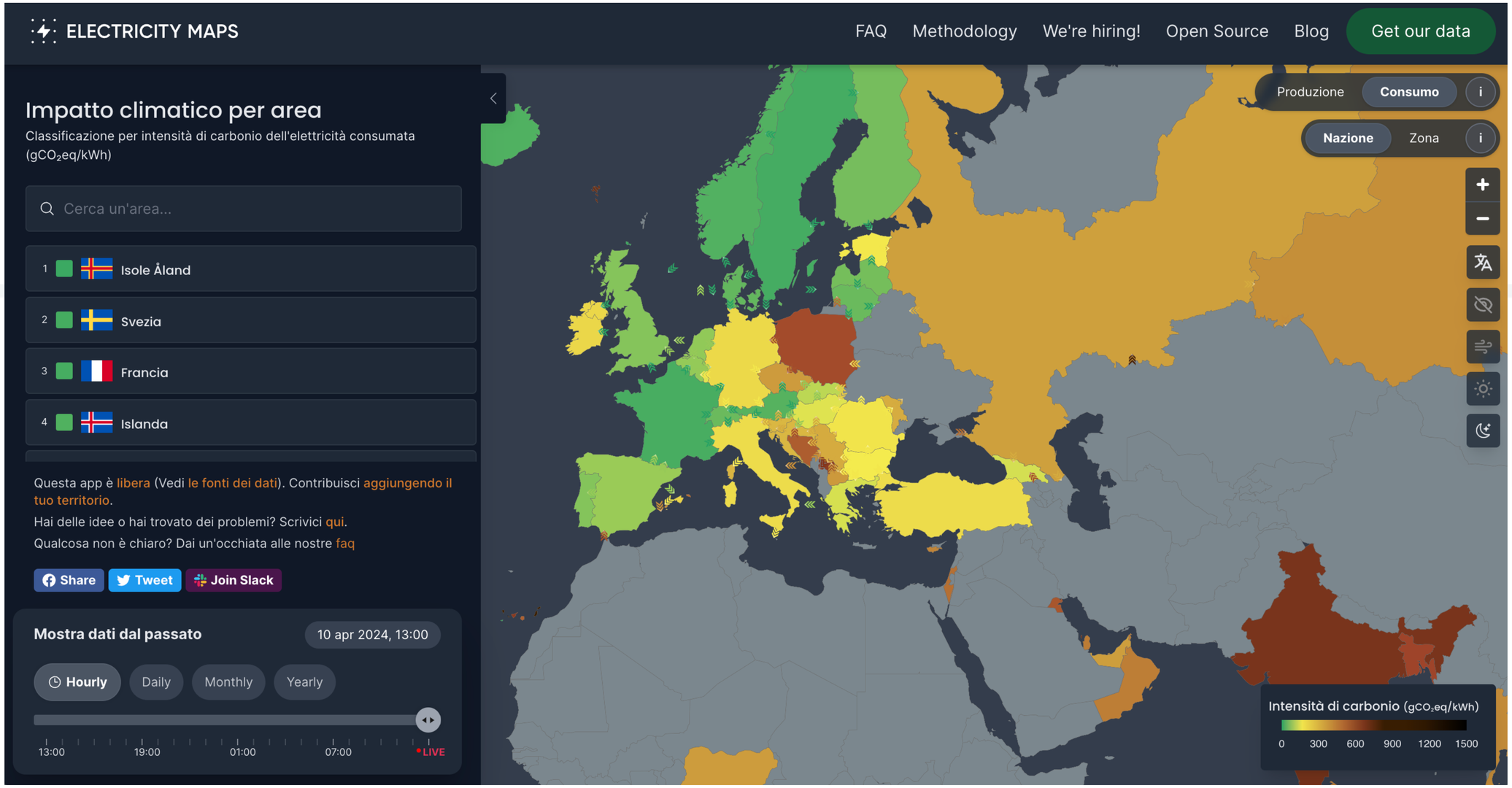
Renewable energy generation, Italy



Data source: Energy Institute - Statistical Review of World Energy (2023) OurWorldInData.org/renewable-energy | CC BY

Note: 'Other renewables' refers to renewable sources including geothermal, biomass, waste, wave and tidal. Traditional biomass is not included.

FREE APP: ELECTRICITY MAP



UNIVERSITÀ
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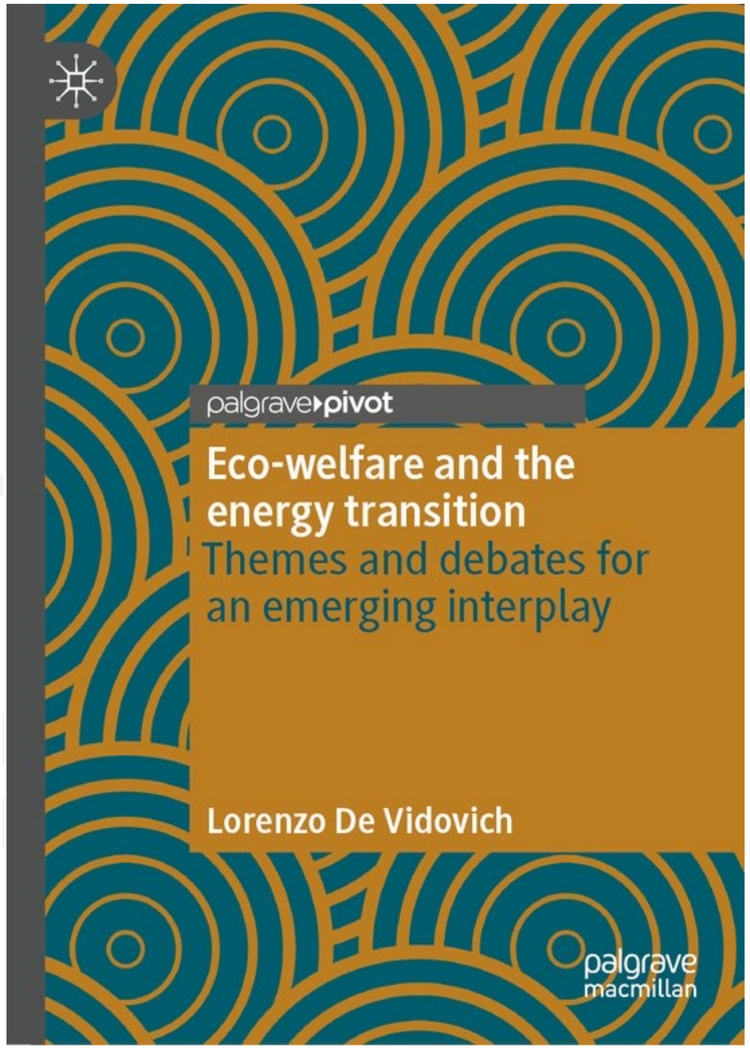
L'ENERGIA
COME SISTEMA SOCIO-TECNICO

DIMENSIONE SOCIO-TECNICA E TRANSIZIONE ENERGETICA

INTRO

Le nostre scelte nella vita quotidiana sono ormai sistematicamente orientate verso scelte che comportano l'esaurimento delle risorse e le emissioni di gas serra

Leuser e Pellerin-Carlin, 2022
da un ragionamento sul concetto di «sufficienza energetica»



DIMENSIONE SOCIO-TECNICA E TRANSIZIONE ENERGETICA

INTRO

Concentrandosi sulla transizione verso una low-carbon society, l'energia è interpretata come un sistema socio-tecnico, concettualizzato come segue (Magnani, 2018):

- un network di diversi attori (individuali e collettivi), istituzioni (incluse norme e regole tecniche), artefatti tecnologici, e saperi

- una interazione fra elementi materiali e immateriali che, insieme, garantiscono la fornitura di energia

Rapid and deep decarbonisation requires the transformation of socio-technical systems, which are seen as "the interlinked mix of technologies, infrastructures, organizations, markets, regulations, and user practices that together deliver societal functions" (Geels et al., 2017, p. 1242)

STS: *SCIENCE AND TECHNOLOGY STUDIES*

UN IMPORTANTE FILONE DI STUDI

Nell'ambito delle scienze sociali, i *Science and Technology Studies* (STS) hanno avuto un ruolo chiave nel considerare la concettualizzazione multidimensionale dei ruoli, delle organizzazioni, e delle interazioni tra uomo e tecnologia, per affrontare la costruzione sociale dei sistemi tecnologici (Bijker et al., 1987; Callon, 1987; Law et al., 1992)

Le tecnologie non sono solo elementi materiali, ma anche «componenti incorporati» (embedded) di sistemi socio-tecnici in cui vengono utilizzati diversi produttori, infrastrutture, utenti, regolamenti e attori intermedi (Bijker & Law, 1992)

STS: *SCIENCE AND TECHNOLOGY STUDIES*

UN IMPORTANTE FILONE DI STUDI

L’innovazione tecnica (e tecnologica) e l’innovazione organizzativa sono condizionate da processi e pratiche di tipo sociale

(Cohen, 2012)

STS E MLP: *MULTI-LEVEL PERSPECTIVE*

UN IMPORTANTE FILONE DI STUDI

Diverse teorie hanno descritto i cambiamenti socio-tecnici dei sistemi energetici facendo riferimento ai processi associati alla tecnologia e ai percorsi di transizione

MLP [*Multi-level perspective*]

Prospettiva di analisi della transizione verso la sostenibilità:

- Per esaminare i meccanismi attraverso cui la transizione avviene in diversi settori influenzati dai sistemi socio-tecnici

- Transizione come una triplice interazione tra le innovazioni («niches»), la struttura («regime») e le tendenze esogene di lungo periodo («landscapes»)

Sovacool e Hess (2017), Geels e Schot (2007), Geels (2002), Gross e Mautz (2014), Grin et al. (2010)

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

https://youtu.be/12Q4fQrtwFo?si=93iO8dRVs2QnRD70&t=398

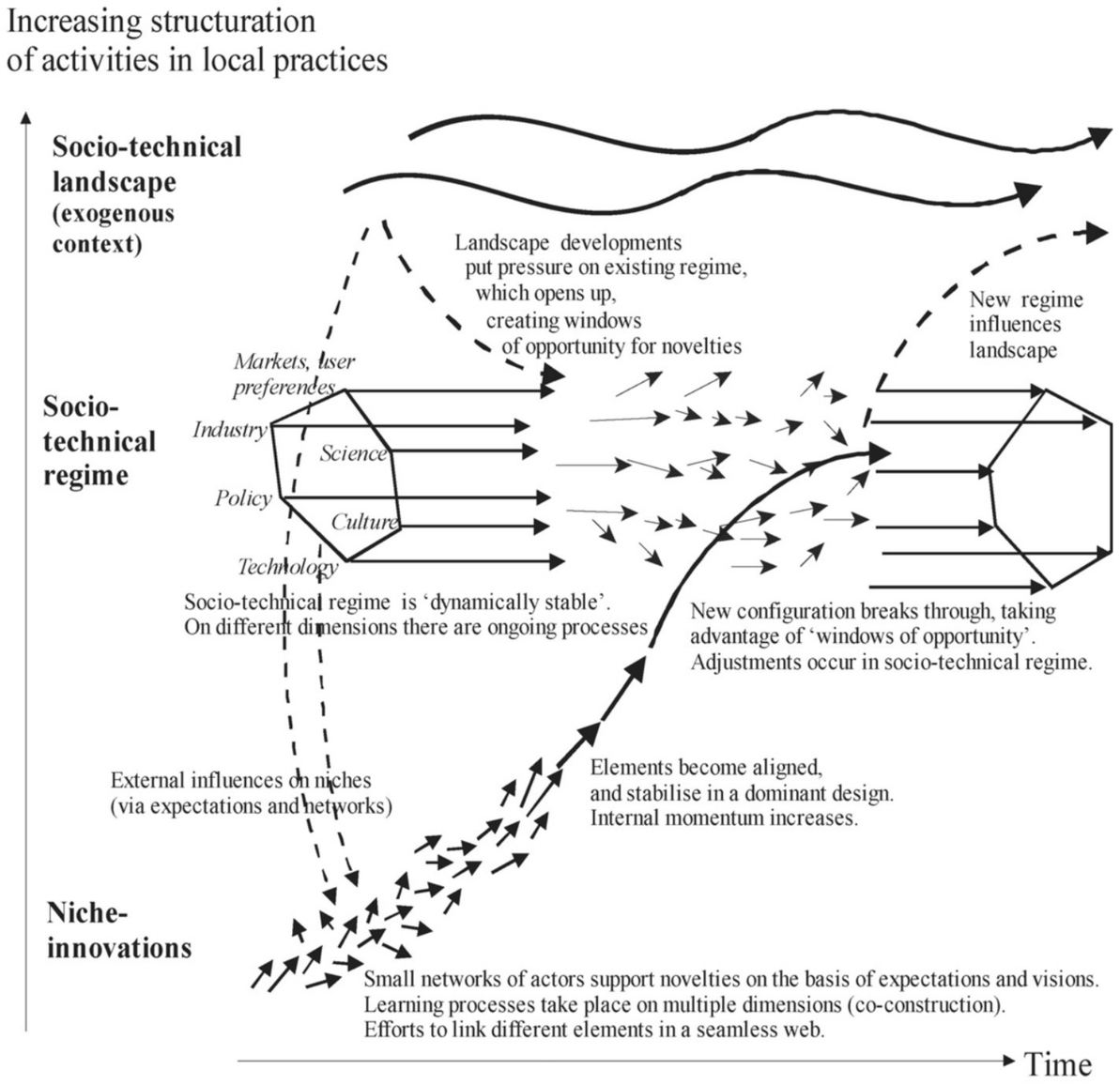


Fig. 1. Multi-level perspective on transitions (adapted from Geels, 2002, p. 1263).

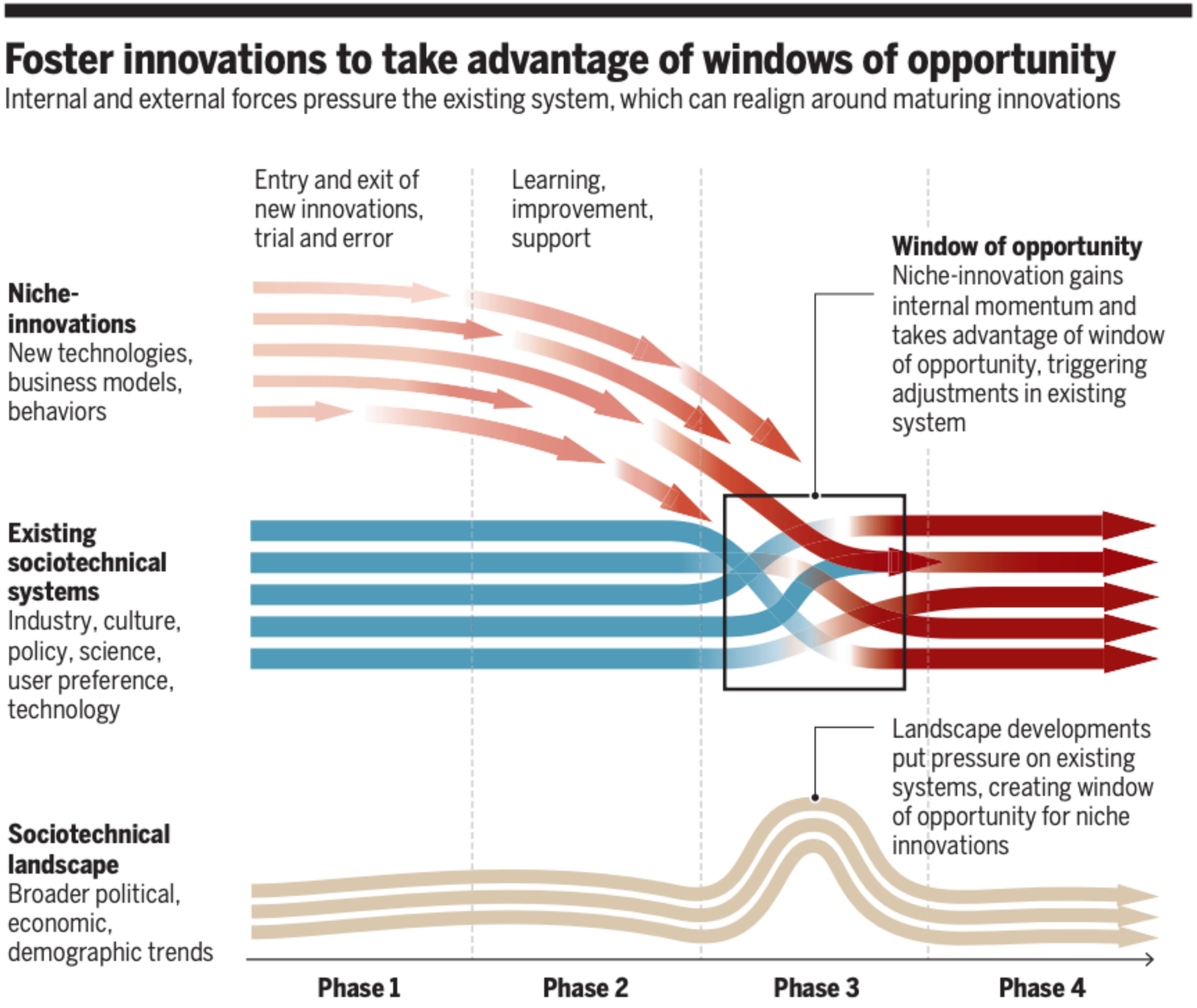
ENERGIA: VERSO UN SISTEMA ECO-SOCIO-TECNICO

POLICY FORUM

CLIMATE POLICY AND INNOVATION

Sociotechnical transitions for deep decarbonization

Accelerating innovation is as important as climate policy

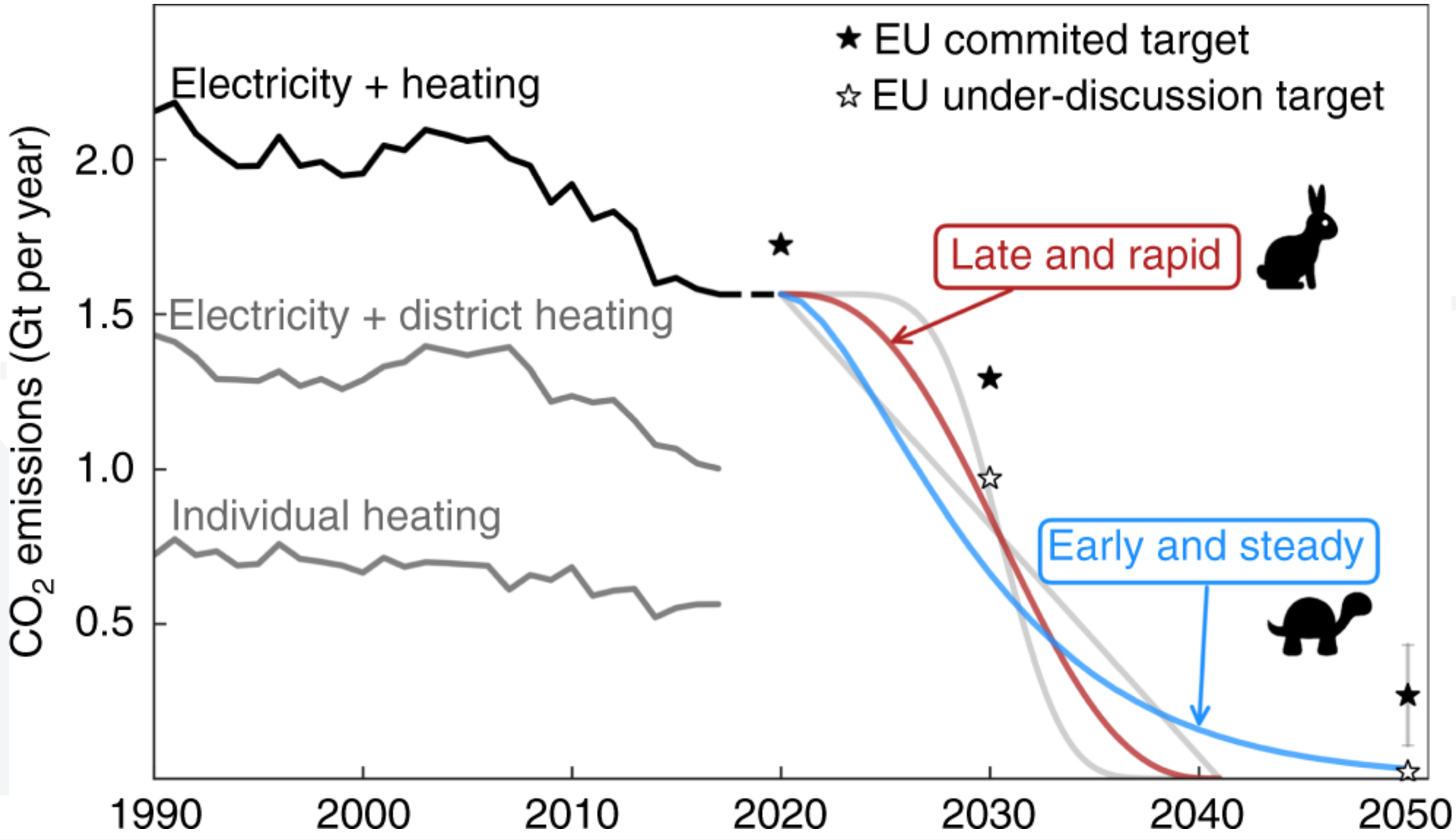


QUANTO TEMPO ABBIAMO?

IPOTESI E SCENARI

Victoria, M., Zhu, K., Brown, T., Andresen, G. B., & Greiner, M. (2020). Early decarbonisation of the European energy system pays off.

Nature Communications, 11(1), Article 1. https://doi.org/10.1038/s41467-020-20015-4



COME CAMBIAMO IL SISTEMA SOCIO-TECNICO?

Tipologie di cambiamento ambientale

© Suarez e Oliva (2005)
Estratto da Geels e Schot (2007)

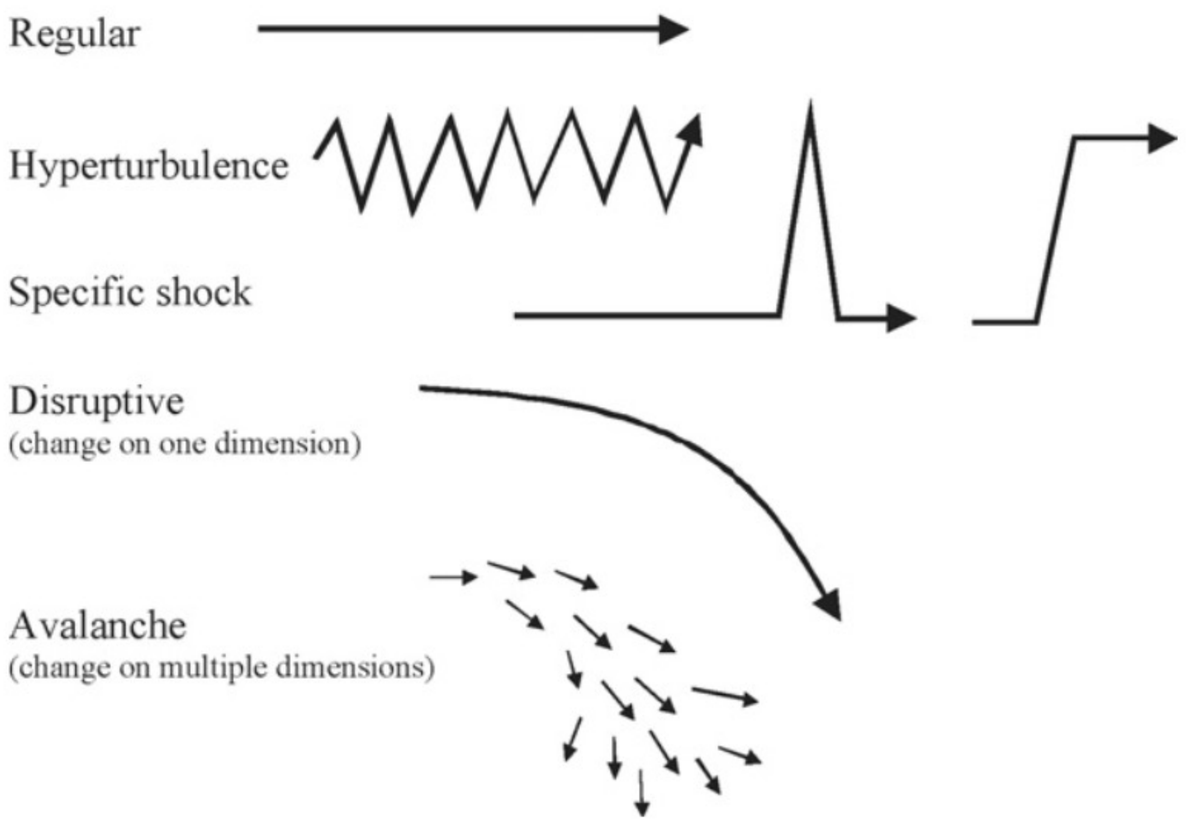


Fig. 4. Types of environmental change (based on Suarez and Oliva, 2005).

COSA OCCORRE PER CAMBIARE IL SISTEMA ENERGETICO SOCIO-TECNICO VERSO LA DECARBONIZZAZIONE?

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VERSO UNA DECARBONIZZAZIONE DELL'ENERGIA

- Cambiamento nella produzione di energia
- Cambiamento nei consumi energetica
- Analisi, comprensione e cambiamento del come consumiamo: pratiche energetiche

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