

Scenarios for Transformation toward Climate-Neutral Society

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Nebojsa Nakicenovic

Group of Chief Scientific Advisers



European
Commission

Former Deputy Director General



International Institute for
Applied Systems Analysis
www.iiasa.ac.at

Former Tenured Professor



The World is at “Crossroads”

Explosive development also led to transgressing planetary boundaries and many are left behind

- ➔ Since 1800 global economy increased 100-fold, energy 50 times and CO₂ 30 times bringing multiple benefits
- ➔ During the same period temperature increased over 1°C, about 8 million die annually due to indoor and regional air pollution
- ➔ Achievement of 2030 Agenda and Paris Agreement would bring multiple co-benefits for people and the planet

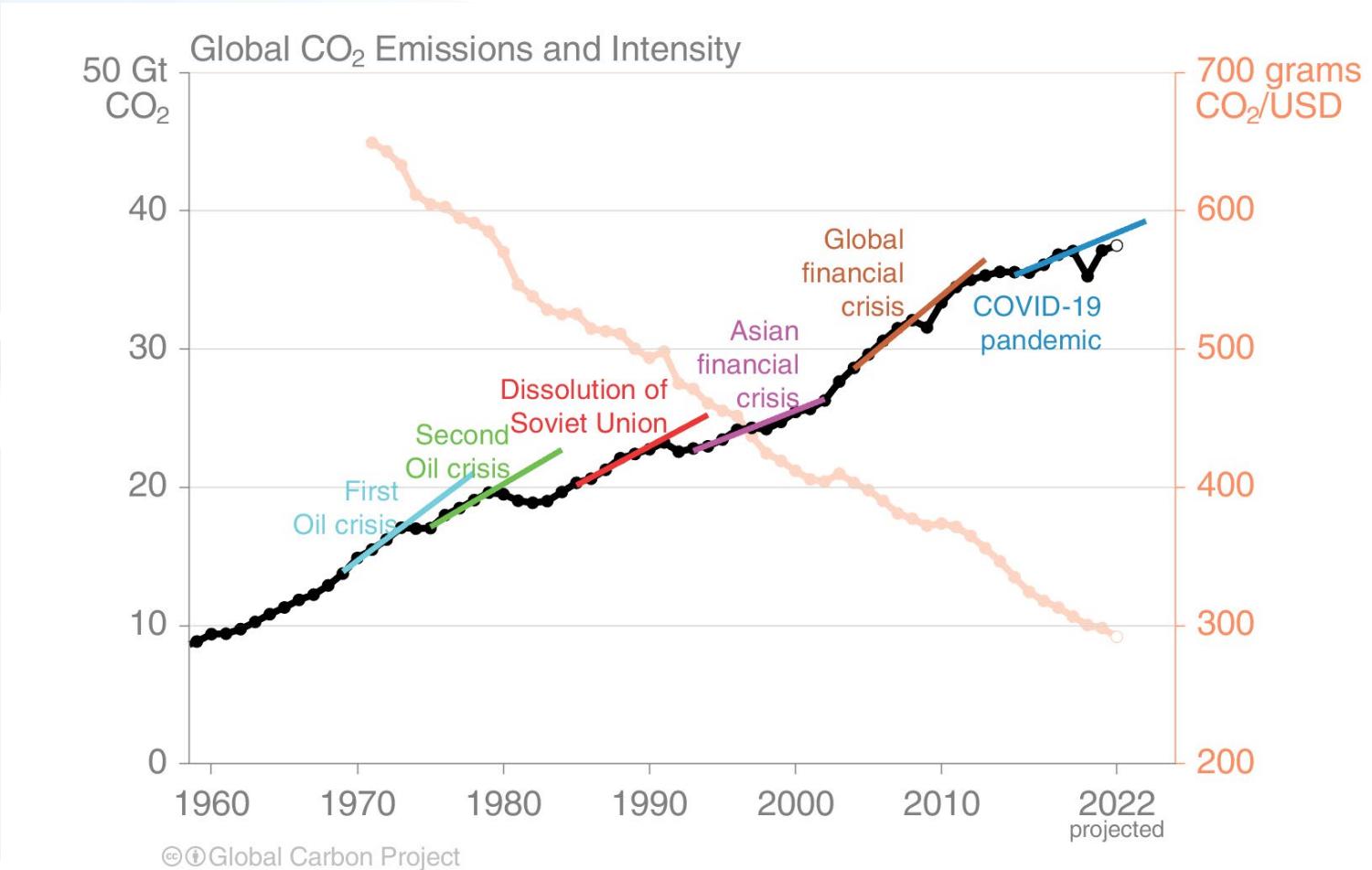
Four Raiders of the Apocalypse Death, Famine, War, and Conquest



A metaphor depicting the end of times in the Christian scriptures

Fossil CO₂ emission intensity

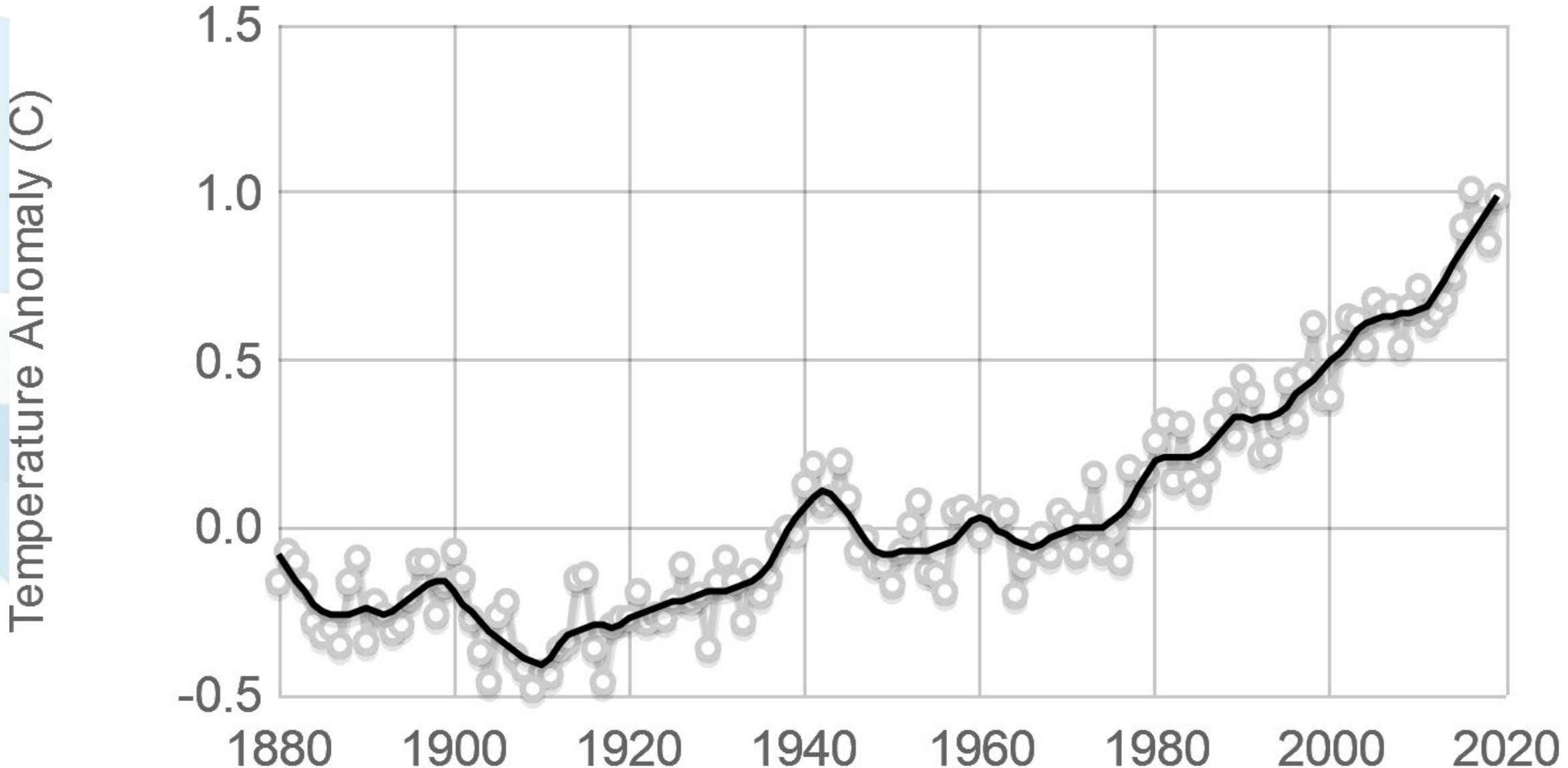
Global CO₂ emissions growth has generally resumed quickly from global crises.
Emission intensity has steadily declined but not sufficiently to offset economic growth.



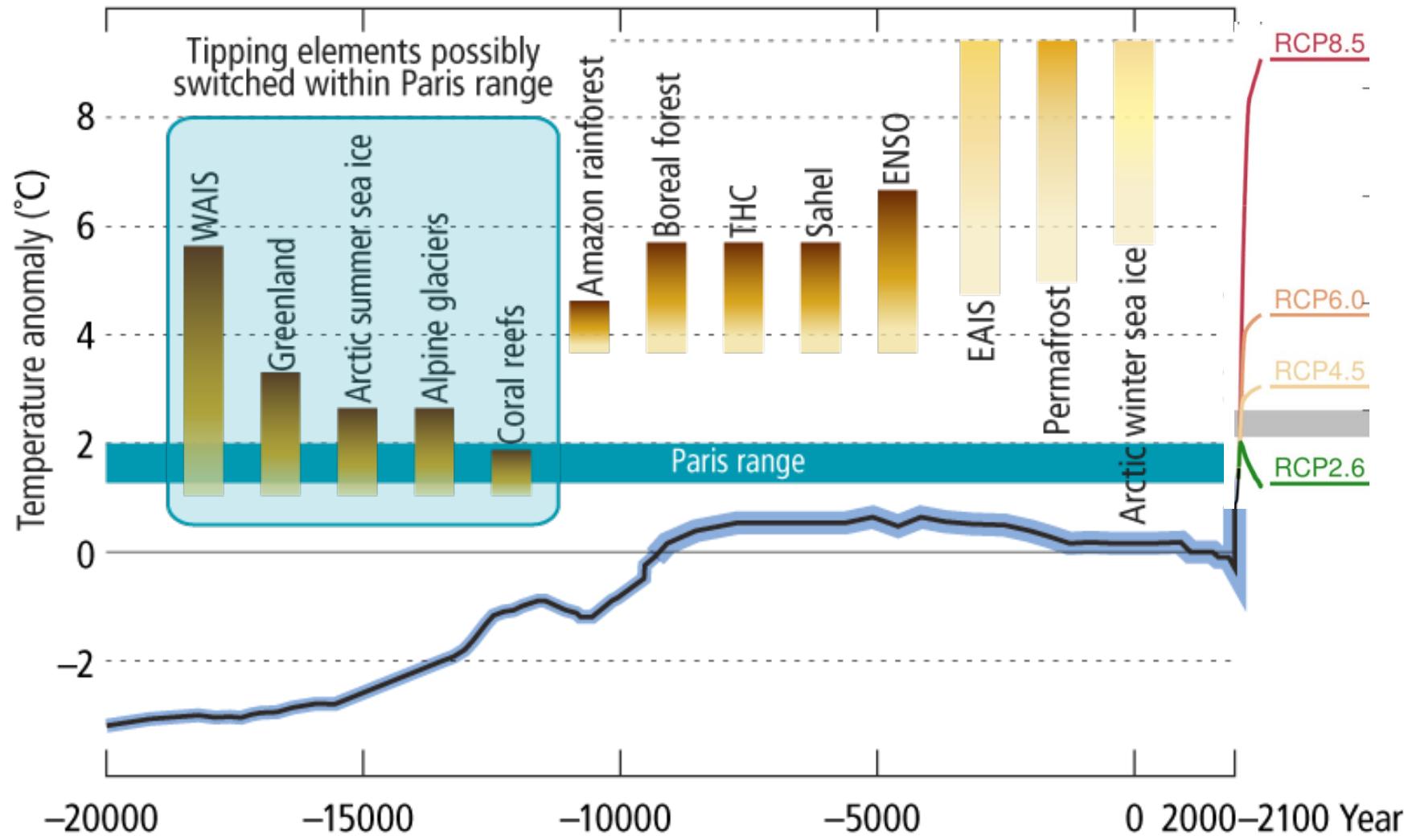
Each trend line is based on the five years before the crisis and extended to five years after.
Economic activity is measured in purchasing power parity (PPP) terms in 2010 US dollars.

Source: [Friedlingstein et al 2022](#); [Global Carbon Project 2022](#)

Global Mean Temperature Change



Holocene, Paris & Tipping Elements



Reassessment of Climate Tipping Points – Results

Thresholds

- Now:
5 CTPs
possible
(but not
yet *likely*)
- 1.5°C :
4 likely,
6 possible
- $\leq 2^{\circ}\text{C}$:
6 likely,
4 possible
- $\approx 2.6^{\circ}\text{C}$:
7 likely,
6 possible

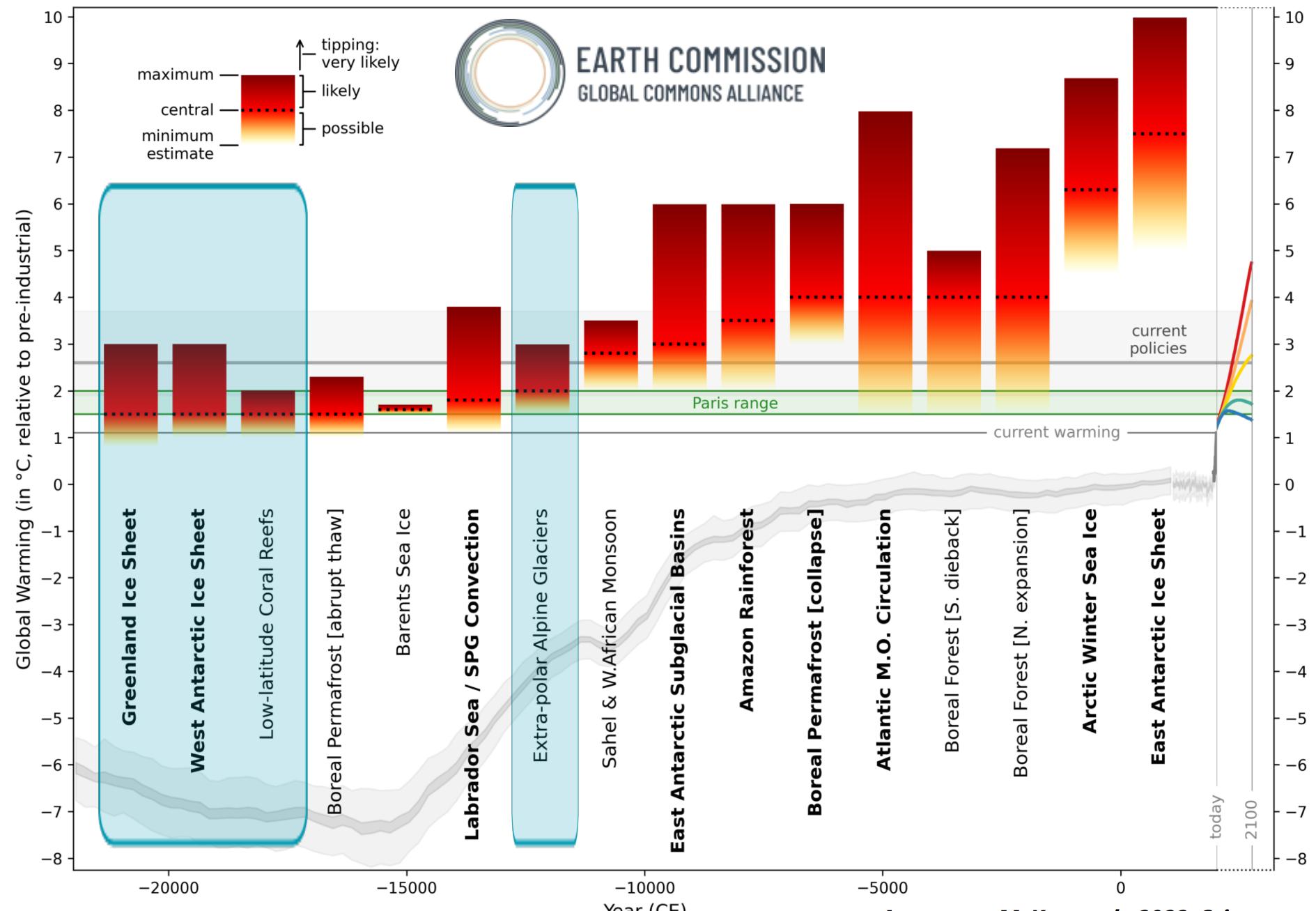
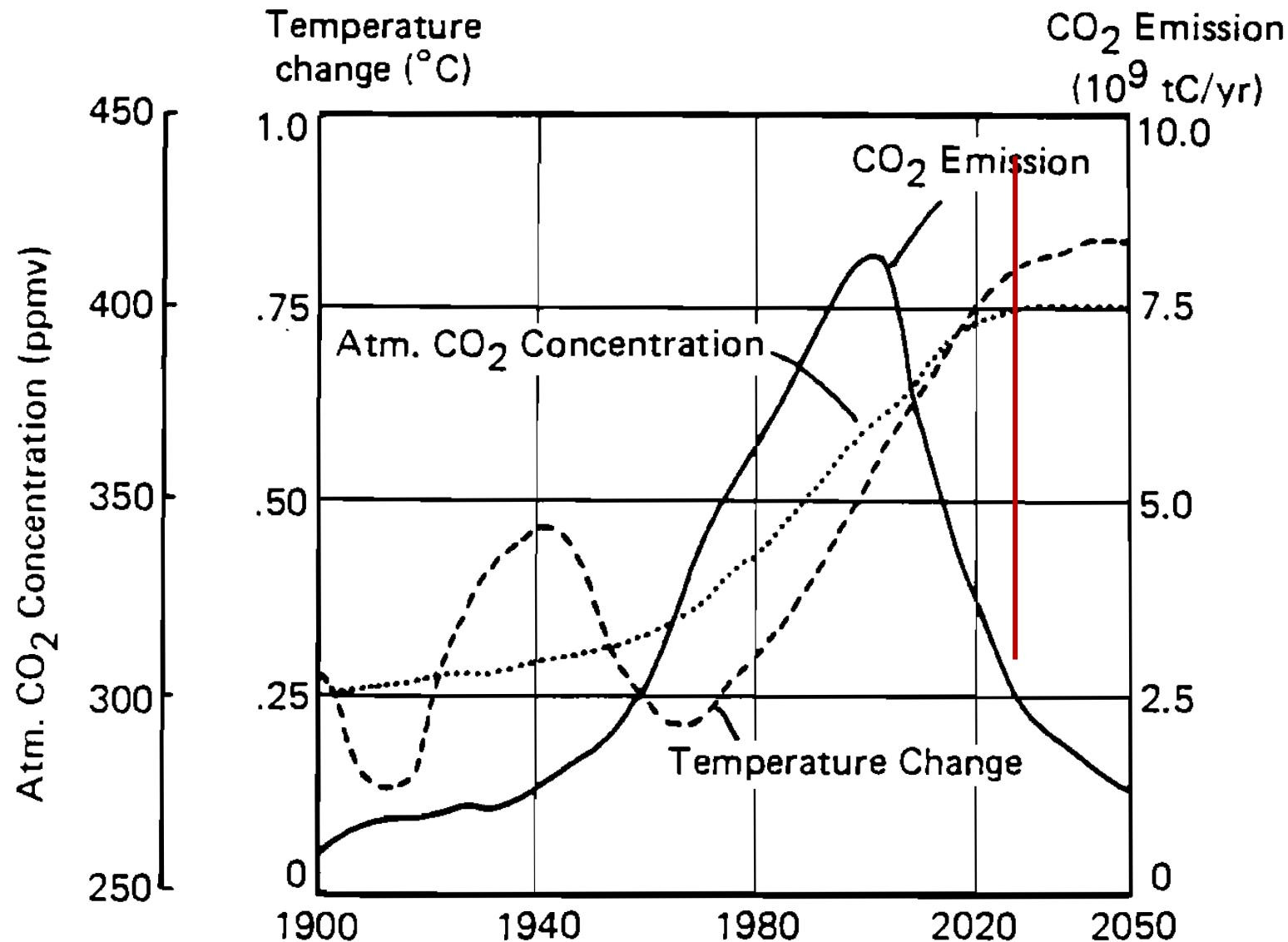
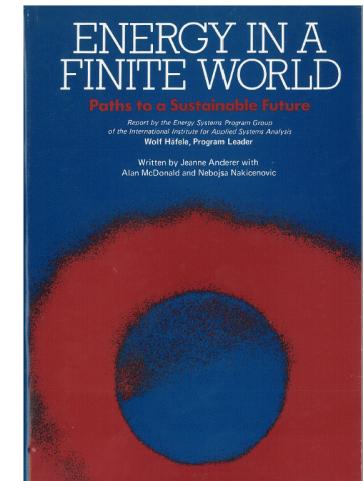


Figure 7-8. CO₂ emissions, atmospheric CO₂ concentration, and temperature change for 30 TWyr/yr solar and nuclear strategy. Source: Niehaus and Williams (1979).

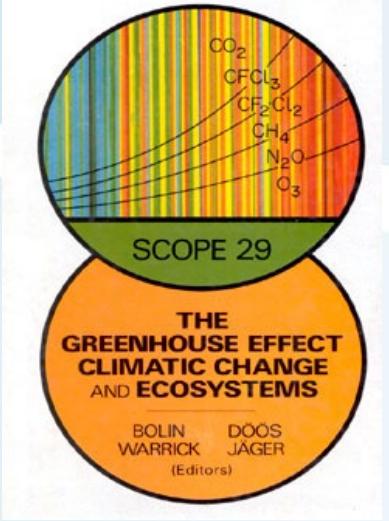


11 GtCO₂
400 ppmv
760 EJ

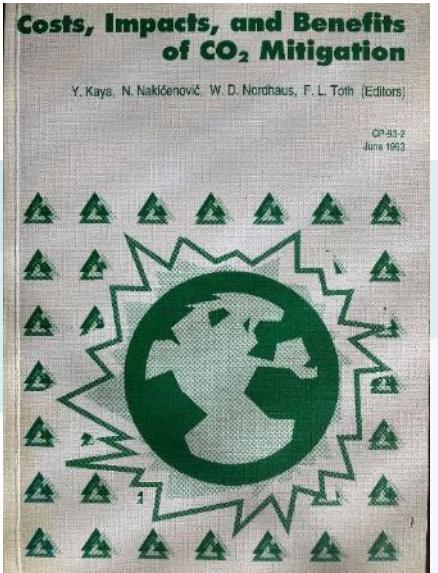


1981

2022 #8



1986



1993

the IPCC/RSWG
Energy and Industry Subgroup

Geneva: May 8-9, 1989

Impact of Carbon Dioxide Emission Control on GNP Growth
-Interpretation of Proposed Scenarios-

Y.Kaya (Japan)
May 8,1989

For the illustrative purpose I try to interpret the scenarios proposed by U.S./Netherlands delegates in the following way.

1. Basic Concept

C: CO₂ emission(C-ton)
X: Energy/GNP(Oil-equivalent ton/US\$)
Y: C/Energy(C-ton/Oil-equivalent ton)
Z: GNP(US\$)

From the above definition eq.(1) holds.

$$C = X Y Z \quad (1)$$

Therefore

$$\frac{dC}{C} = dX/X + dY/Y + dZ/Z \quad (2)$$

Based on the past trends of X, Y and Z, we easily understand the seriousness of proposed scenarios if those are expressed in terms of average changes in these variables.

The rates of change of X and Y in future are uncertain, but taking the past trends of X and Y into account as seen in Fig.1 and 2, we assume the values as shown in Table 2.

2. Past Trends of Energy/GNP and C/Energy

Past trends of Energy/GNP (X) and C/Energy (Y) of principal OECD countries are shown in Table 1 and Fig.1 and 2. It is seen that both X and Y have been

The Kaya identity states that the total emission level of the greenhouse gas carbon dioxide can be expressed as the product of four factors: human population, GDP per capita, energy intensity (per unit of GDP), and carbon intensity (emissions per unit of energy consumed).

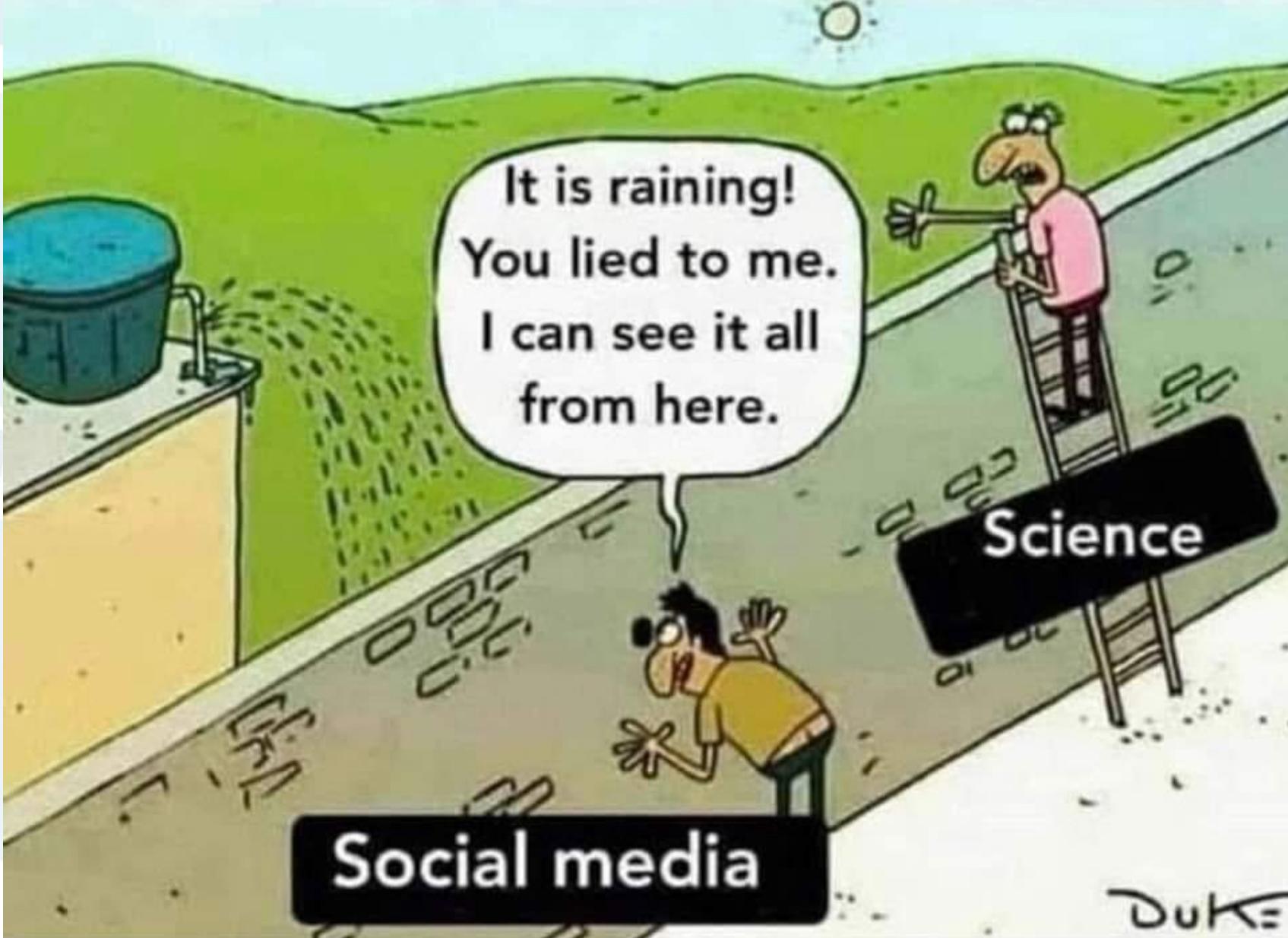




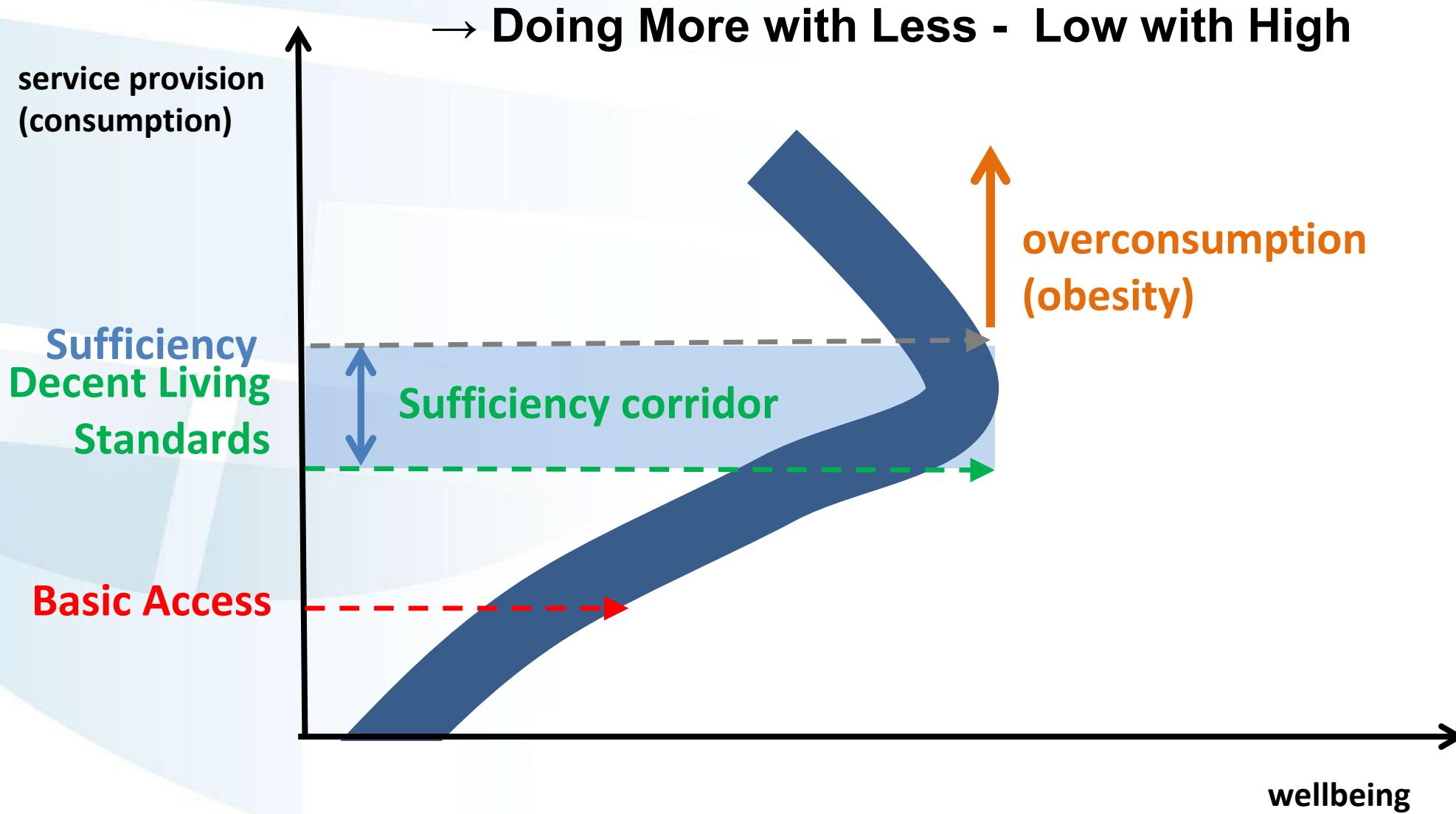
Distinguished Visiting Fellow Award Ceremony for Prof. Yoichi Kaya at IIASA on 23 May 2019



Evidence-based Scientific Advice is called for



Energy (Demand) Decent Living and Sufficiency



→ New values and norms; new morality and ethics
for a just, safe and beautiful future for all

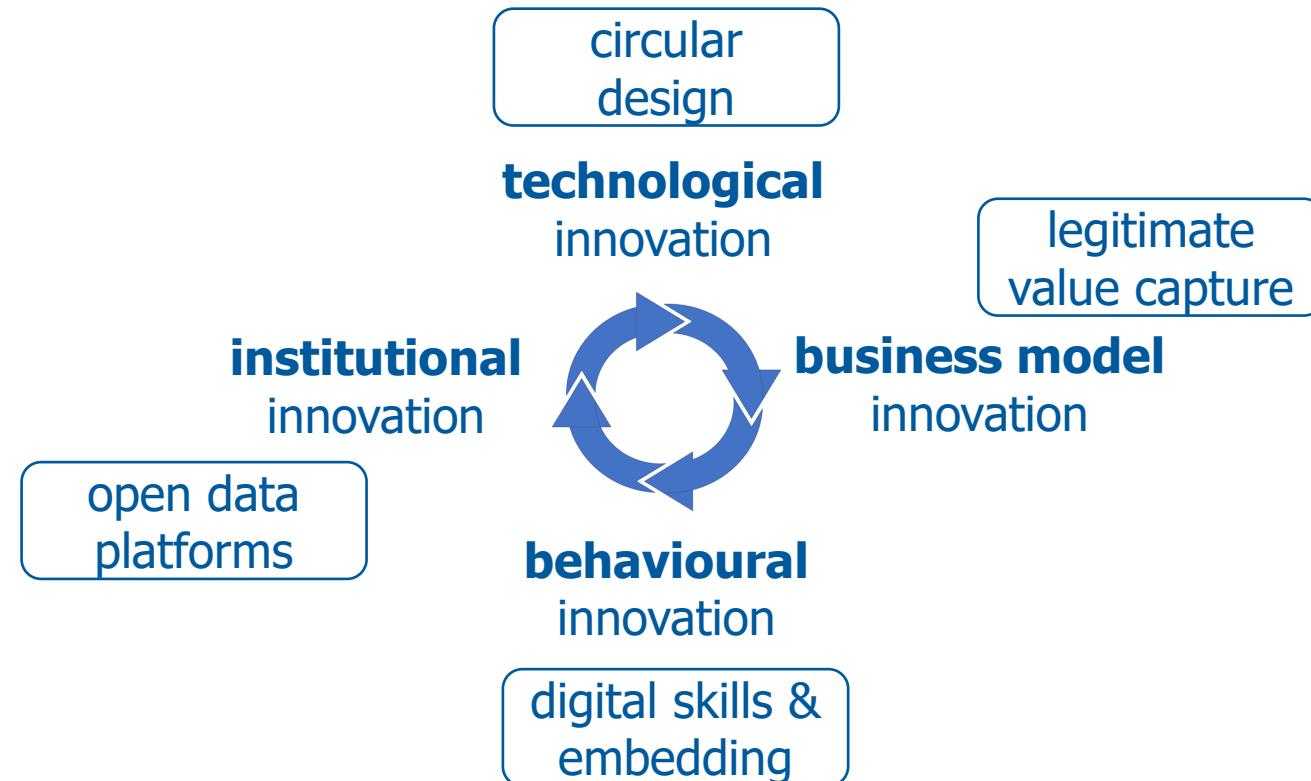
conversion efficiency

e.g., devices



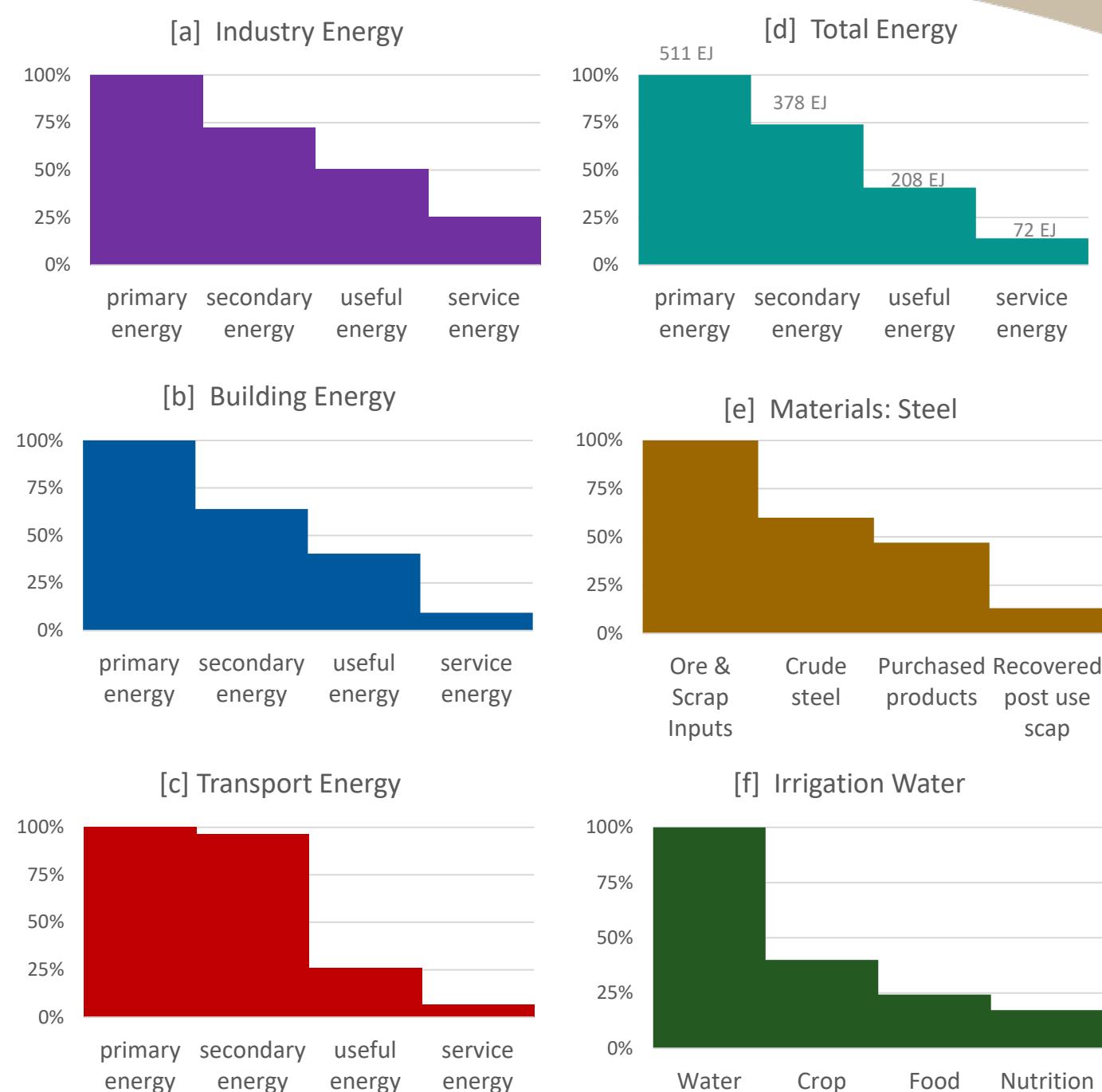
service efficiency

e.g., device convergence



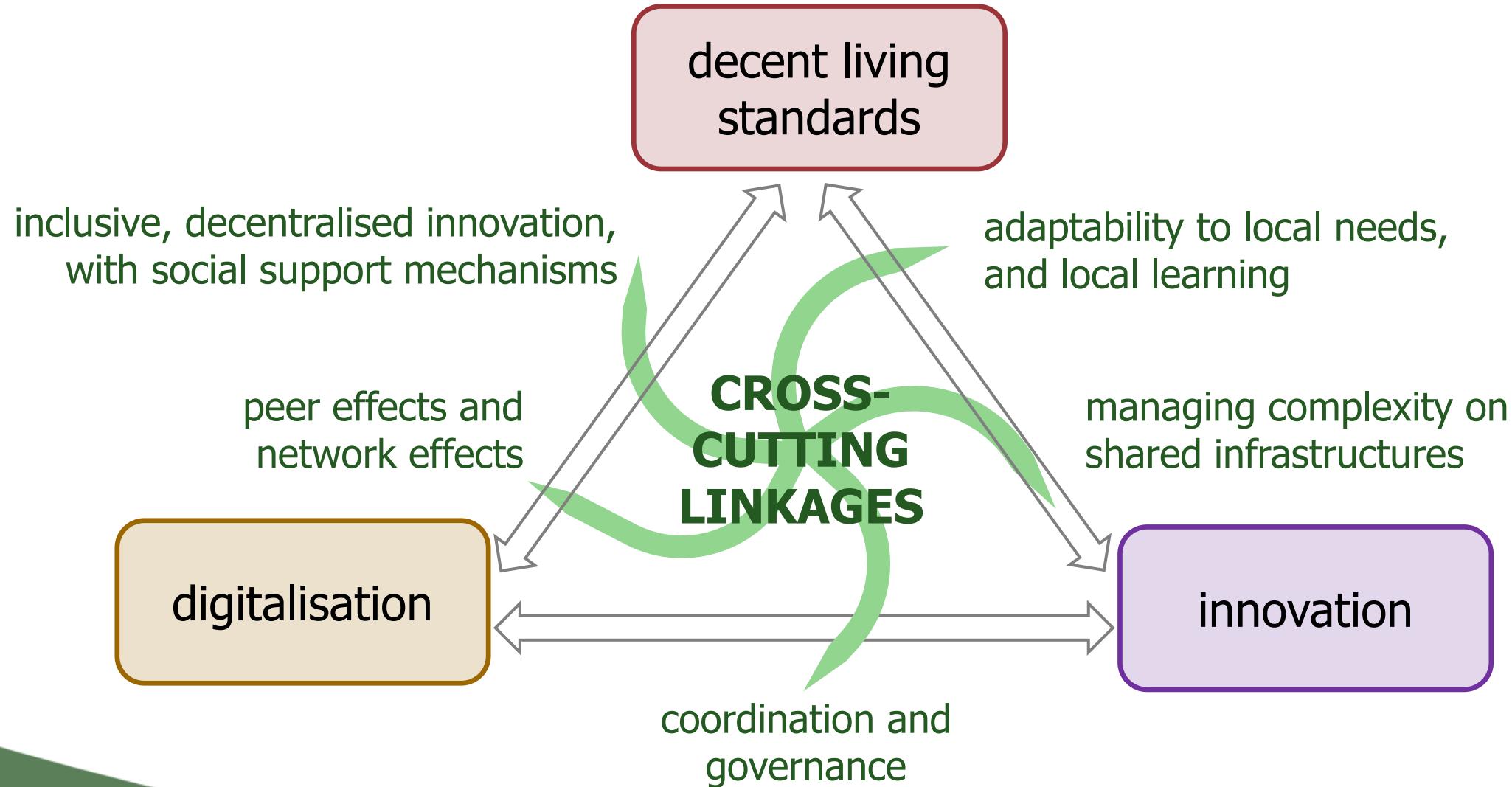
Tapping the enormous potential for services-led transformation

Source: Wilson, Grubler, and Zimm (2022). Energy-Services Led Transformation. In: *Routledge Handbook of Energy Transitions* (Ed: Araujo).
 Data from: Grubler et al. (2018), De Stercke (2014), Nakicenovic et al. (1993), Nakicenovic (1990).



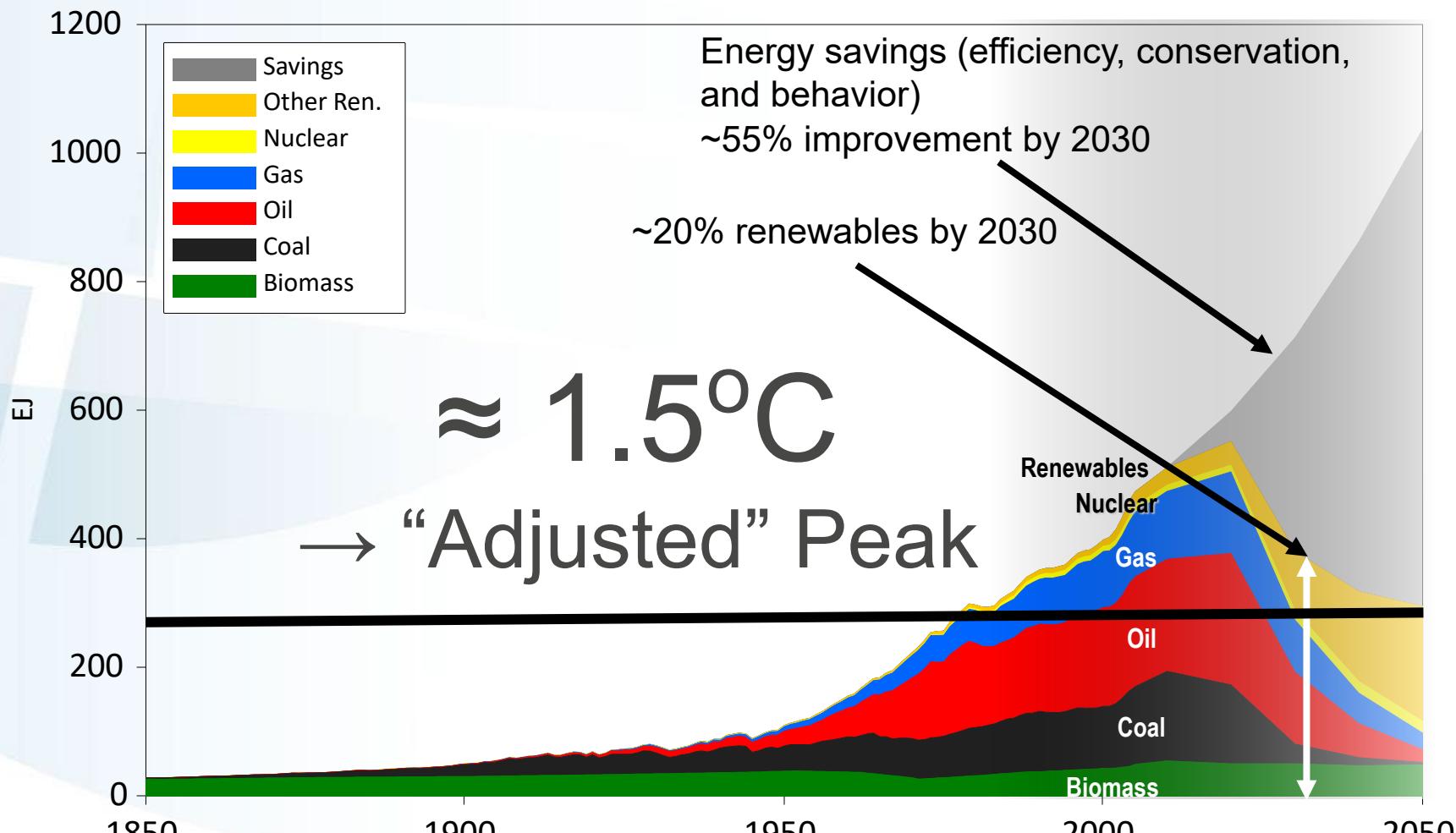
 savings
 amplify back up through resource conversion cascade
 and provide more flexibility and resilience in resource conversion and provision of services.

'High-with-Low' scenario further develops 3 key themes from LED ... and cross-cutting linkages

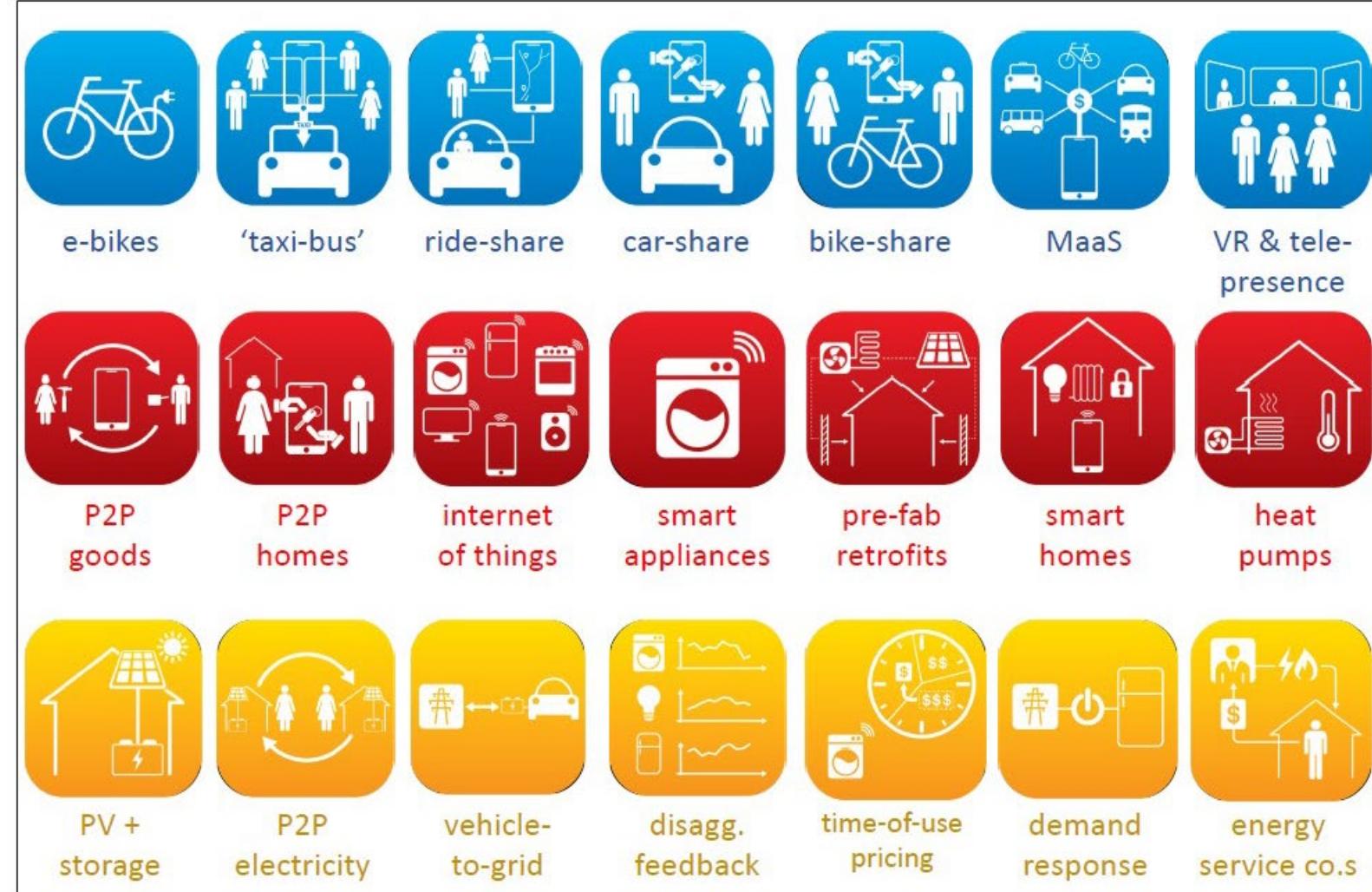


Global Primary Energy

Low Energy Demand (LED) – High Services

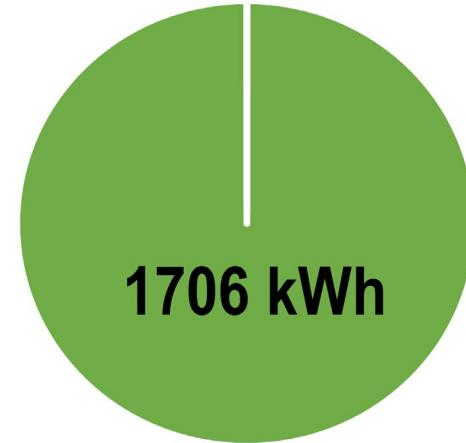


Disruptive End-user Innovations

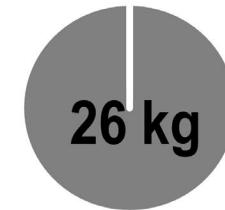


(1) From ownership to usership – (2) Sharing Economy – (3) From atomized to connected

Impact of IC Technology Convergence

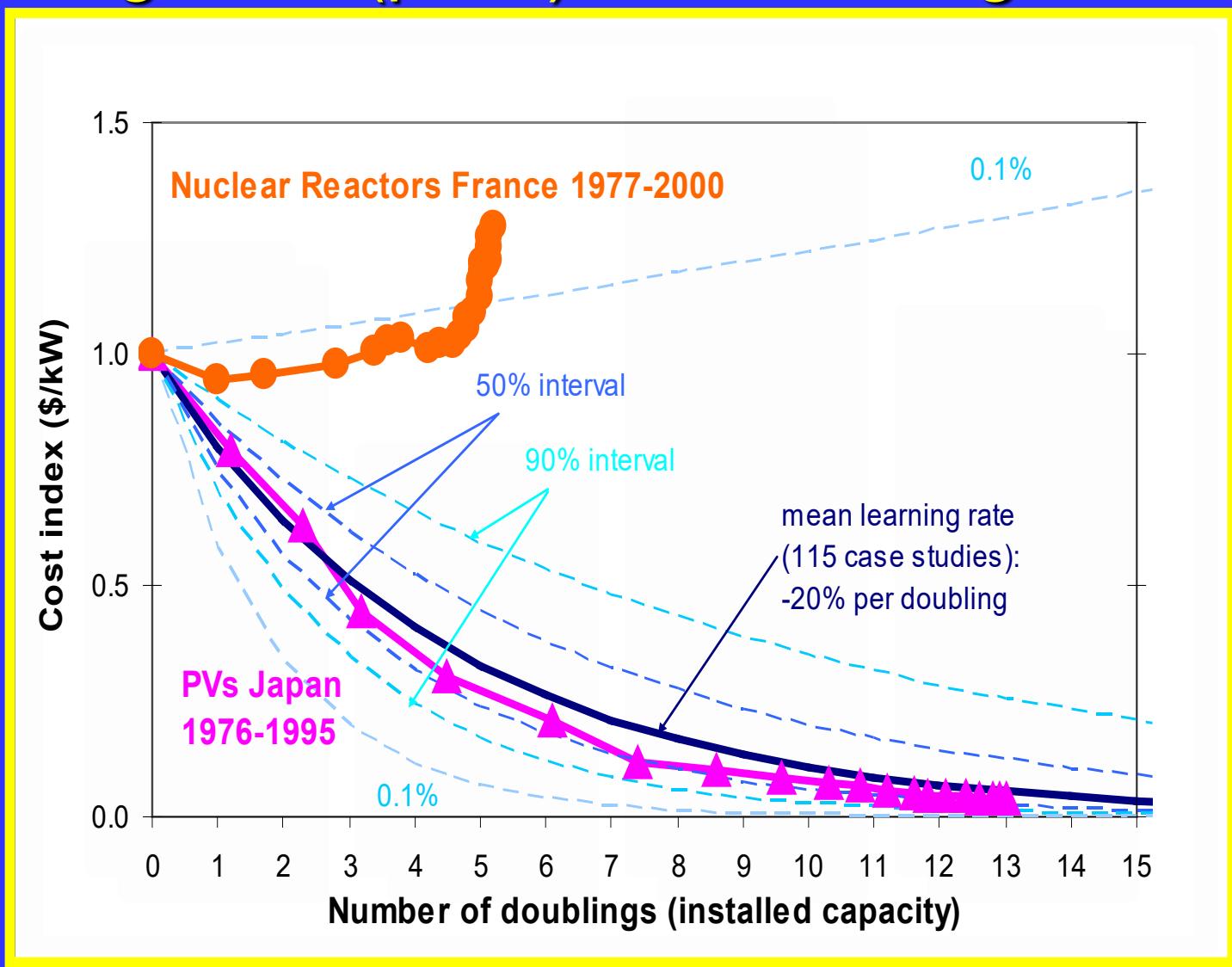


Embodied energy

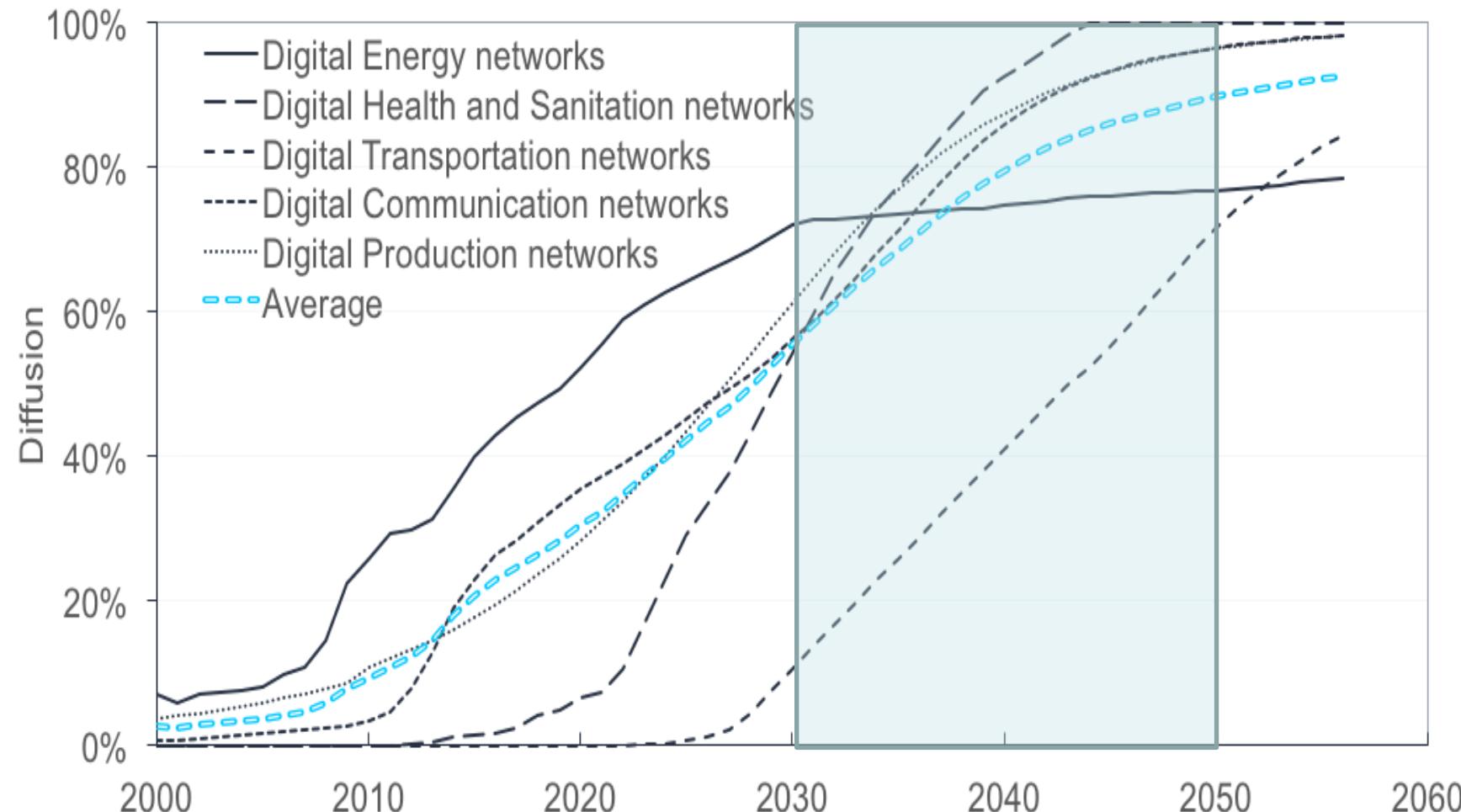


Weight

Technological Uncertainties: Learning rates (push) and market growth (pull)



Technology Diffusion Compared Digital Revolution



Six Major Transformations (TWI2050.org)

Digital
Revolution



Smart Cities
& Mobility



Food, Biosphere
& Water



Human capacity
Demography &
Health



Consumption
& Production



Decarbonization
& Energy



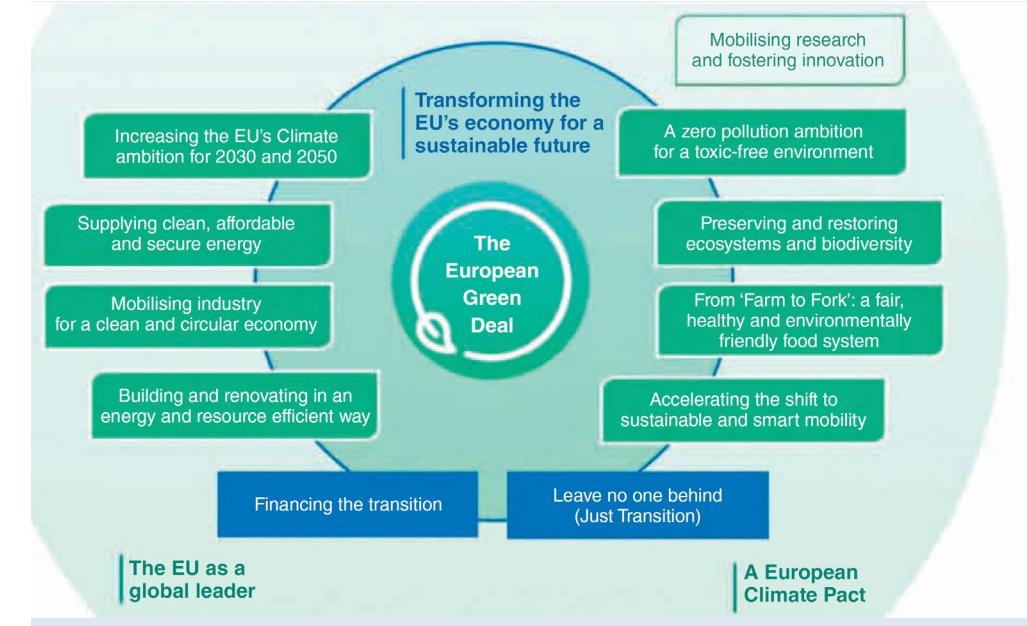
SDGs:
Prosperity
Social Inclusion
Sustainability



www.twi2050.org

The New Bauhaus World

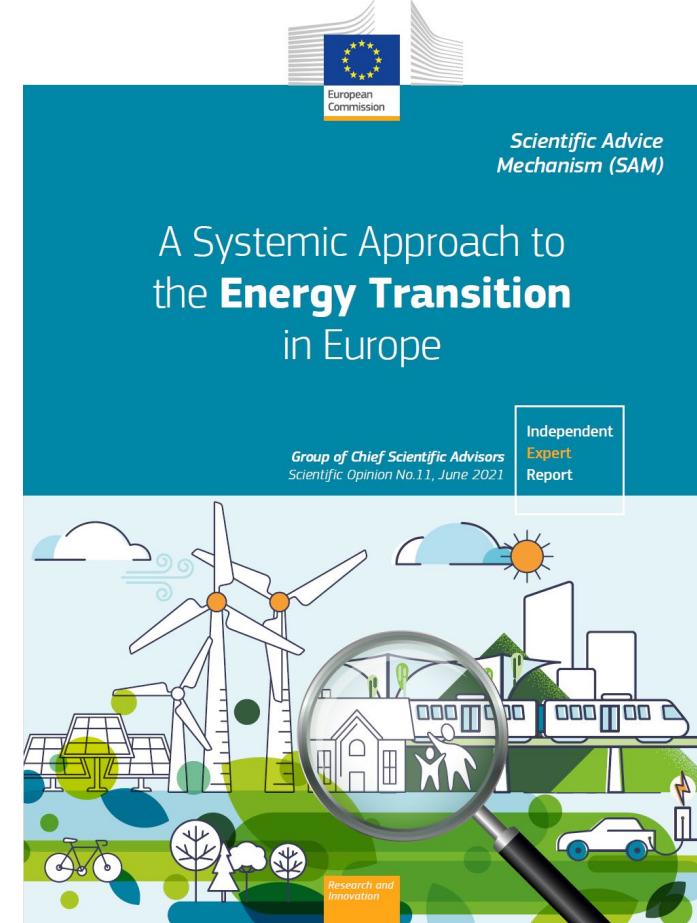
- The New European Bauhaus translates the European Green Deal into a tangible, positive experience in which all Europeans can participate and progress together.
- It inspires a movement to facilitate and steer the transformation of our societies along three inseparable values:
 - Sustainability, from climate goals to circularity and biodiversity
 - Inclusion, from valorizing diversity to accessibility and affordability
 - Beauty, from aesthetics of experience to style beyond functionality
- The approach is multi-level from global to local, participatory and transdisciplinary.



Social and Technological Change

- ➔ Changing consumer preferences (e.g. diets)
- ➔ Generational change in materialism
(service rather than ownership)
- ➔ New business models and behaviors
(sharing & circular economy)
- ➔ Digital Revolution and ICT convergence
toward climate-neutral society (Society 5.0)
- ➔ Rapid innovation in granular technologies
and integrated (e.g. P2P) digital services

ありがとう



www.TWI2050.org SAM
naki@eeg.tuwien.ac.at