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

science for global insight

Disruptive technologies and sustainable lifestyles toward net-zero emissions

SDGs:
Prosperity
Social Inclusion
Sustainability

TWI2050
The World in 2050
www.twi2050.org

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ALPS International Symposium, Tokyo – 19 February 2019

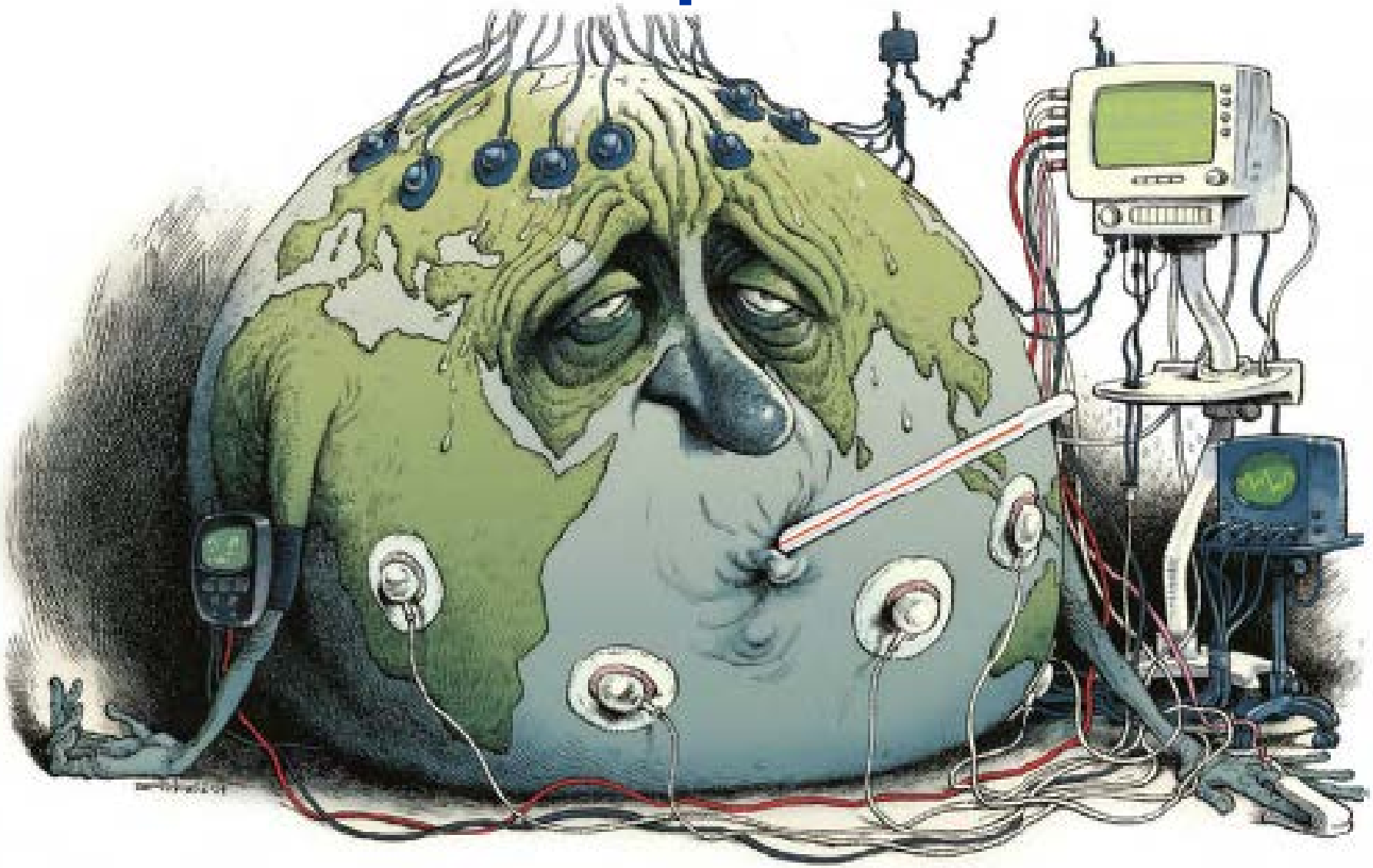
Four Great Achievements since the Beginning of Industrial Revolution

- Life expectancy has doubled in a century
- One billion are obese while less go hungry
- More die by suicide than war and violence
- Everyone in the world has a mobile phone

Mobile Phones Charging

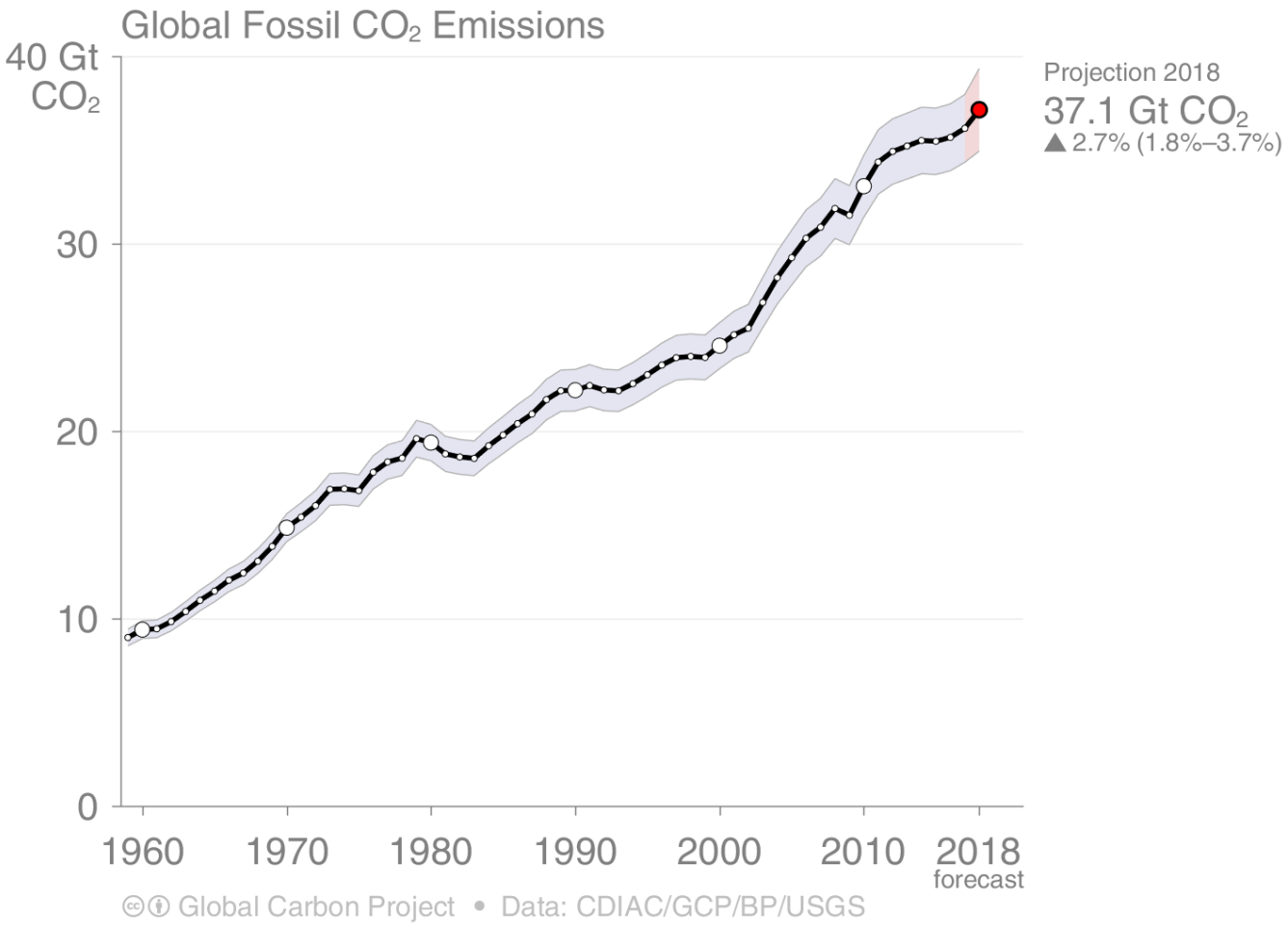
Source: Modi, 2011

Collective Responsibility in the Anthropocene



Global Fossil CO_2 Emissions

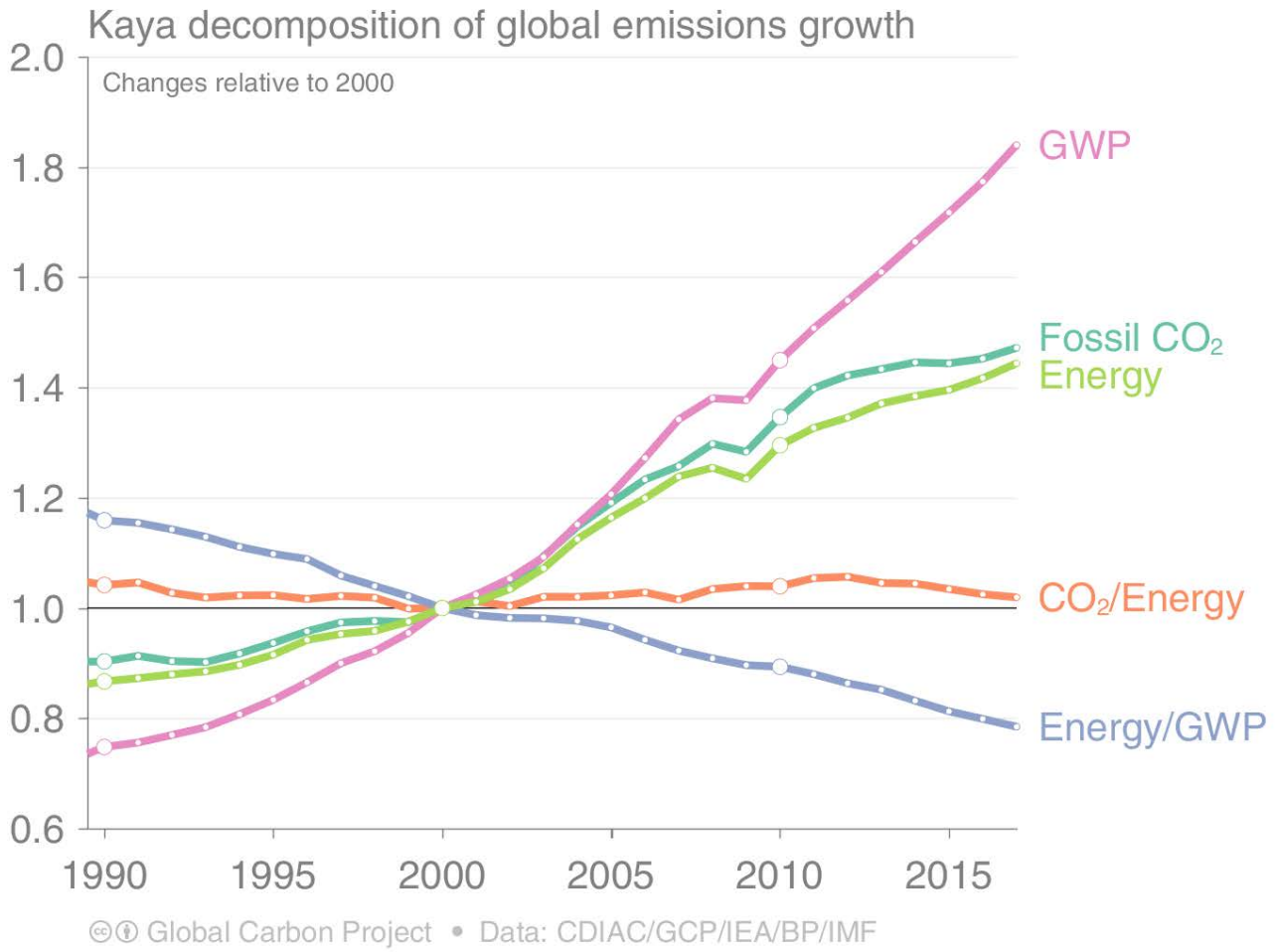
Global fossil CO_2 emissions have risen steadily over the last decades.
The peak in global emissions is not yet in sight.



Estimates for 2015, 2016 and 2017 are preliminary ; 2018 is a projection based on partial data.

Kaya Identity

The Kaya decomposition illustrates that relative decoupling of economic growth from CO_2 emissions is driven by improved energy intensity (Energy/GWP)

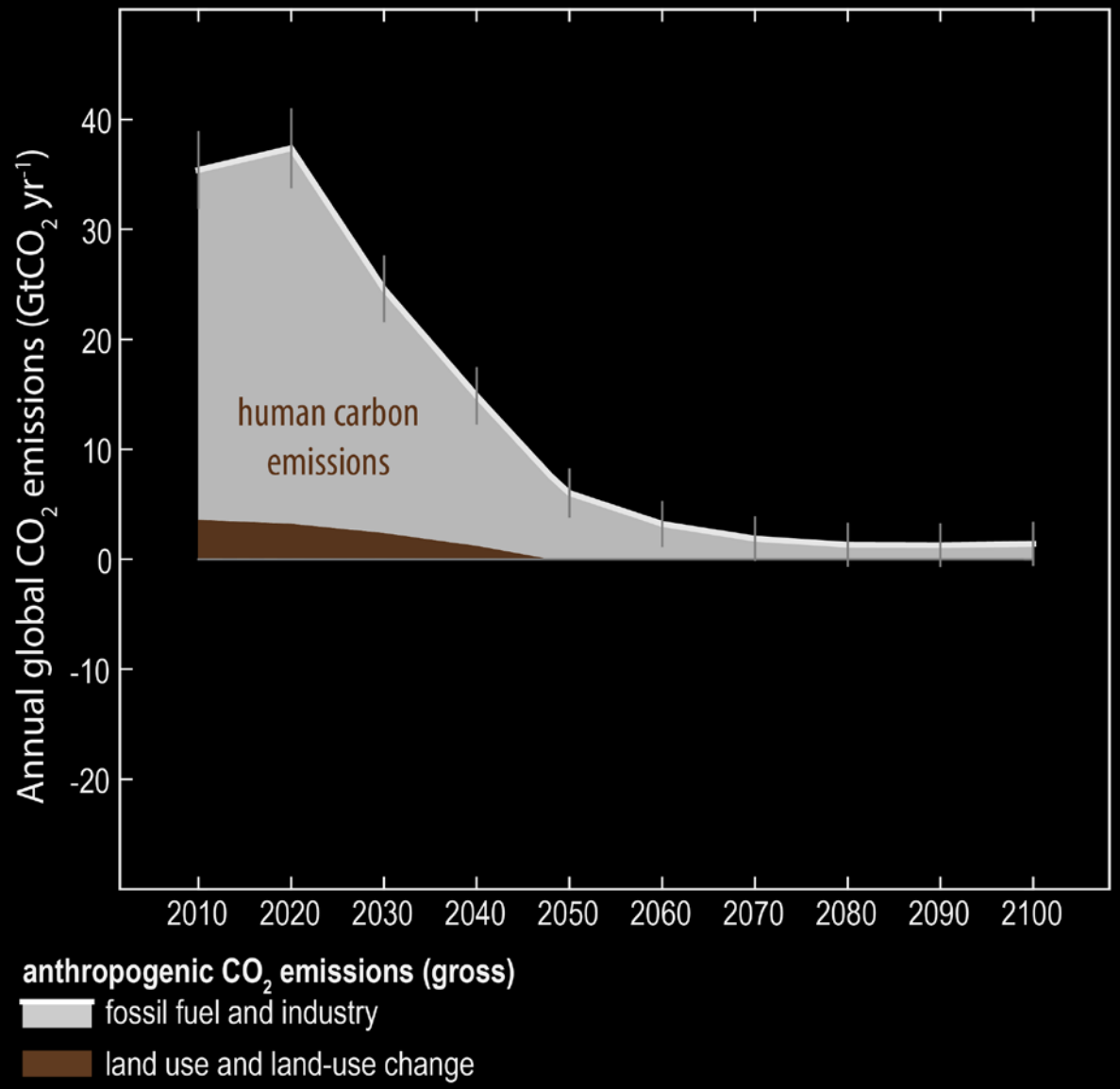


GWP: Gross World Product (economic activity)

Energy is Primary Energy from BP statistics using the substitution accounting method

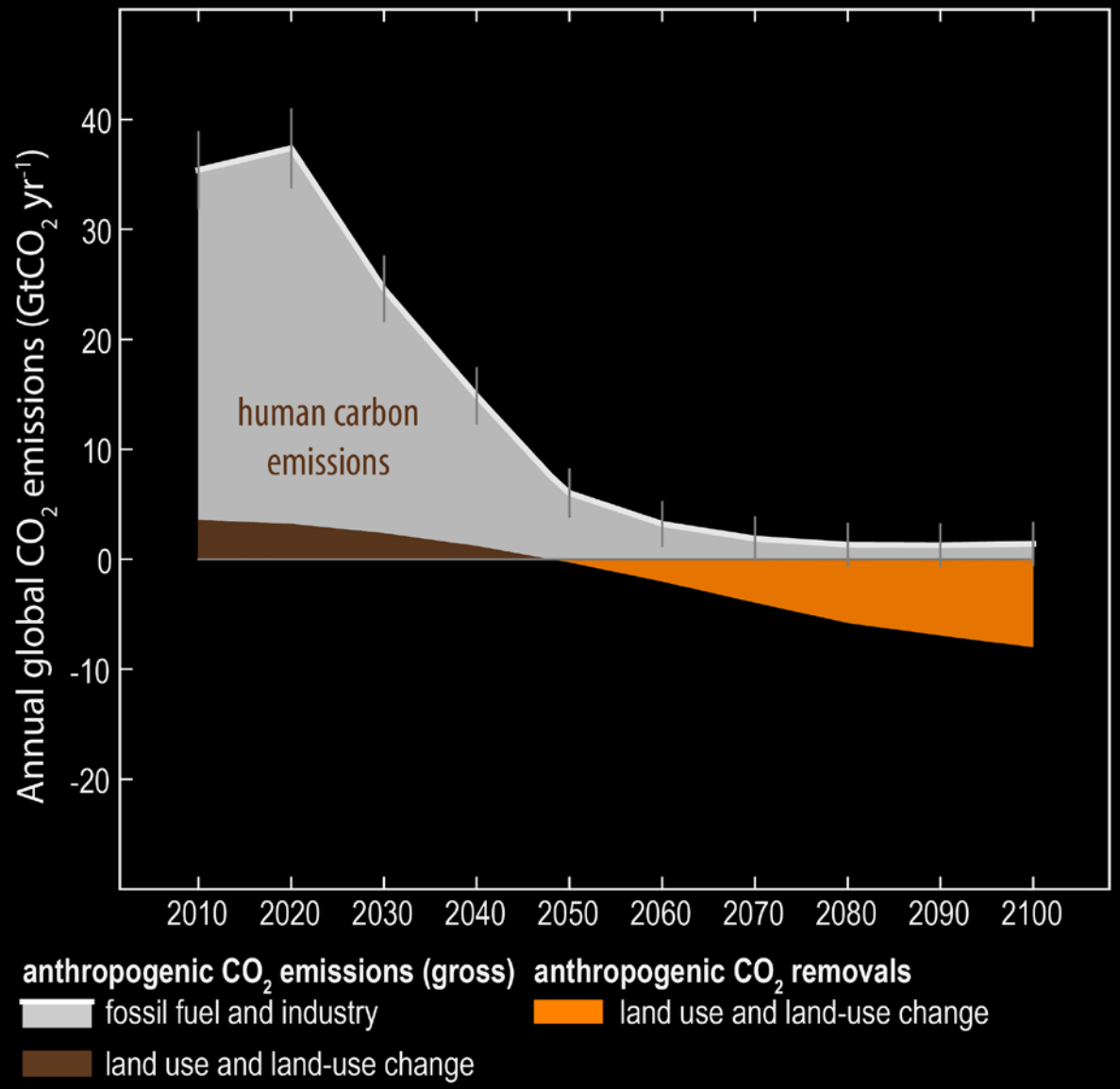
Source: Jackson et al 2018; Global Carbon Budget 2018

“Carbon Law”



Rockström, Gaffney, Rogelj, Meinshausen, Nakicenovic, Schellnhuber. *Science* 24 March 2017

“Carbon Law”



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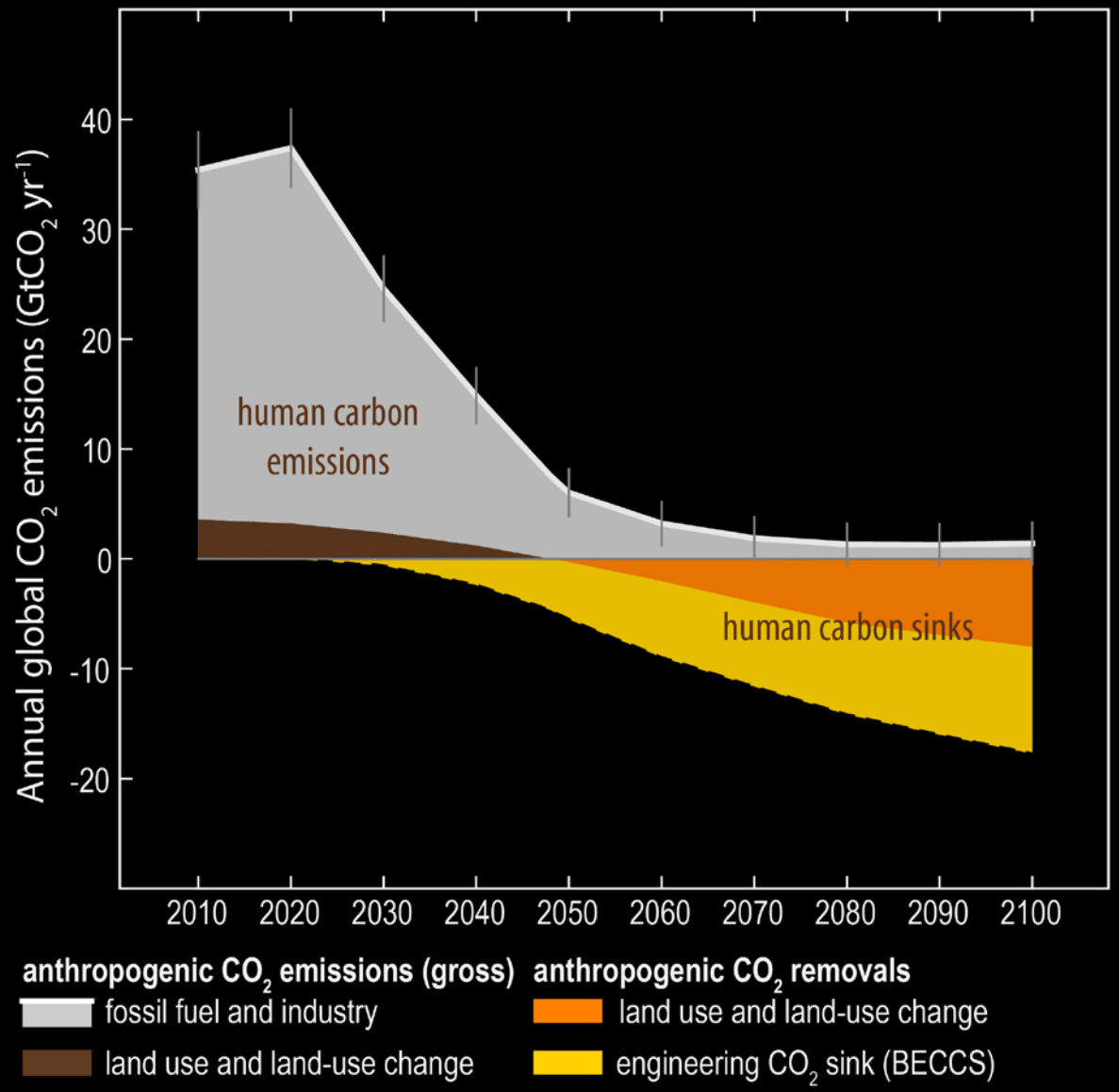

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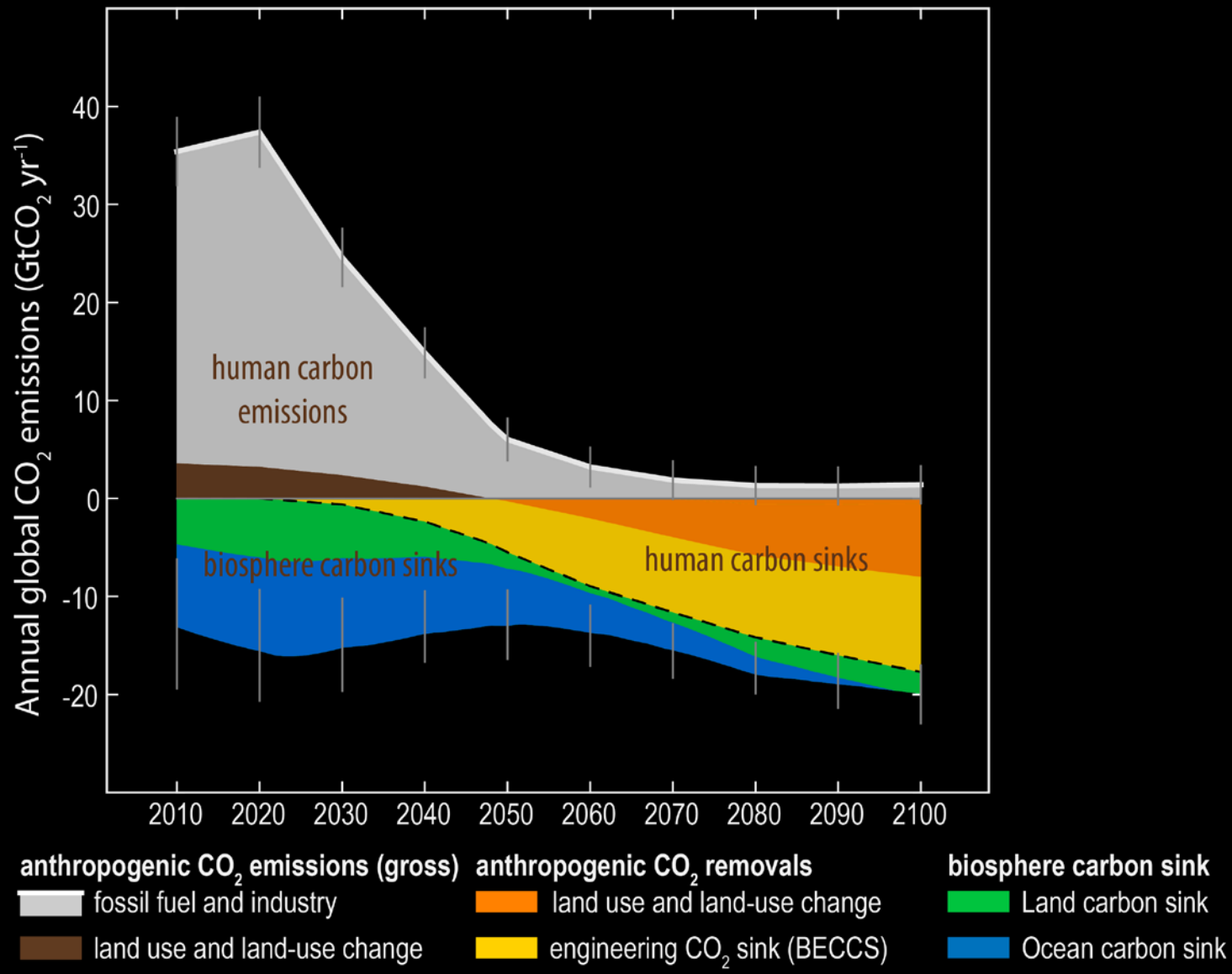
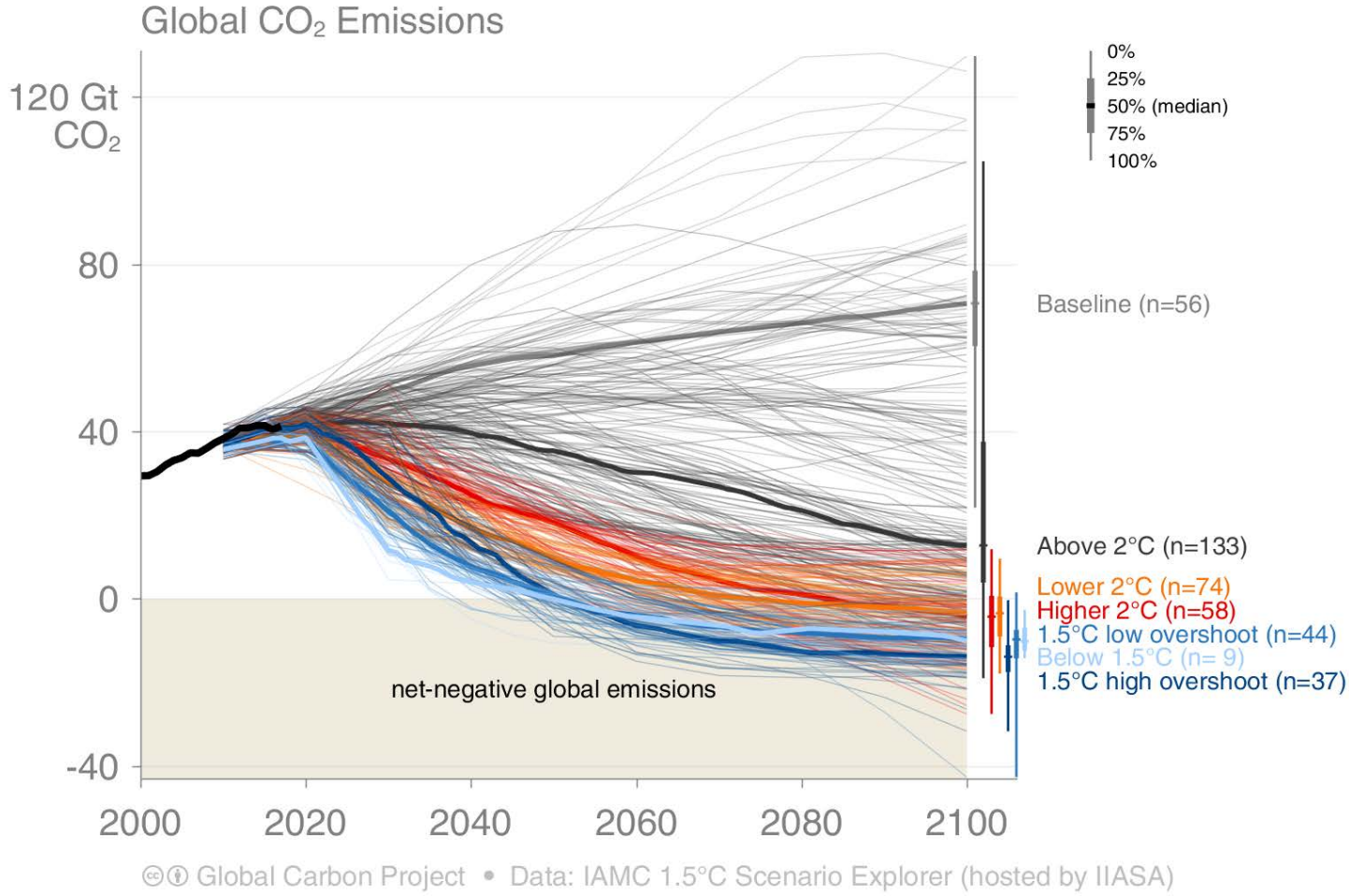


Rockström, Gaffney, Rogelj, Meinshausen, Nakicenovic, Schellnhuber. *Science* 24 March 2017

The IPCC Special Report on "Global Warming of 1.5°C"

The IPCC Special Report on "Global Warming of 1.5°C" presented new scenarios:
1.5°C scenarios require halving emissions by ~2030, net-zero by ~2050, and negative thereafter



Net emissions include those from land-use change and bioenergy with CCS.

Source: Huppmann et al 2018; IAMC 1.5C Scenario Database; IPCC SR15; Global Carbon Budget 2018

Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
- To limit warming to 1.5°C, CO2 emissions would need to reach 'net zero' around 2050
- Reducing non-CO2 emissions would have direct and immediate health benefits

SDGs:
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Social Inclusion
Sustainability

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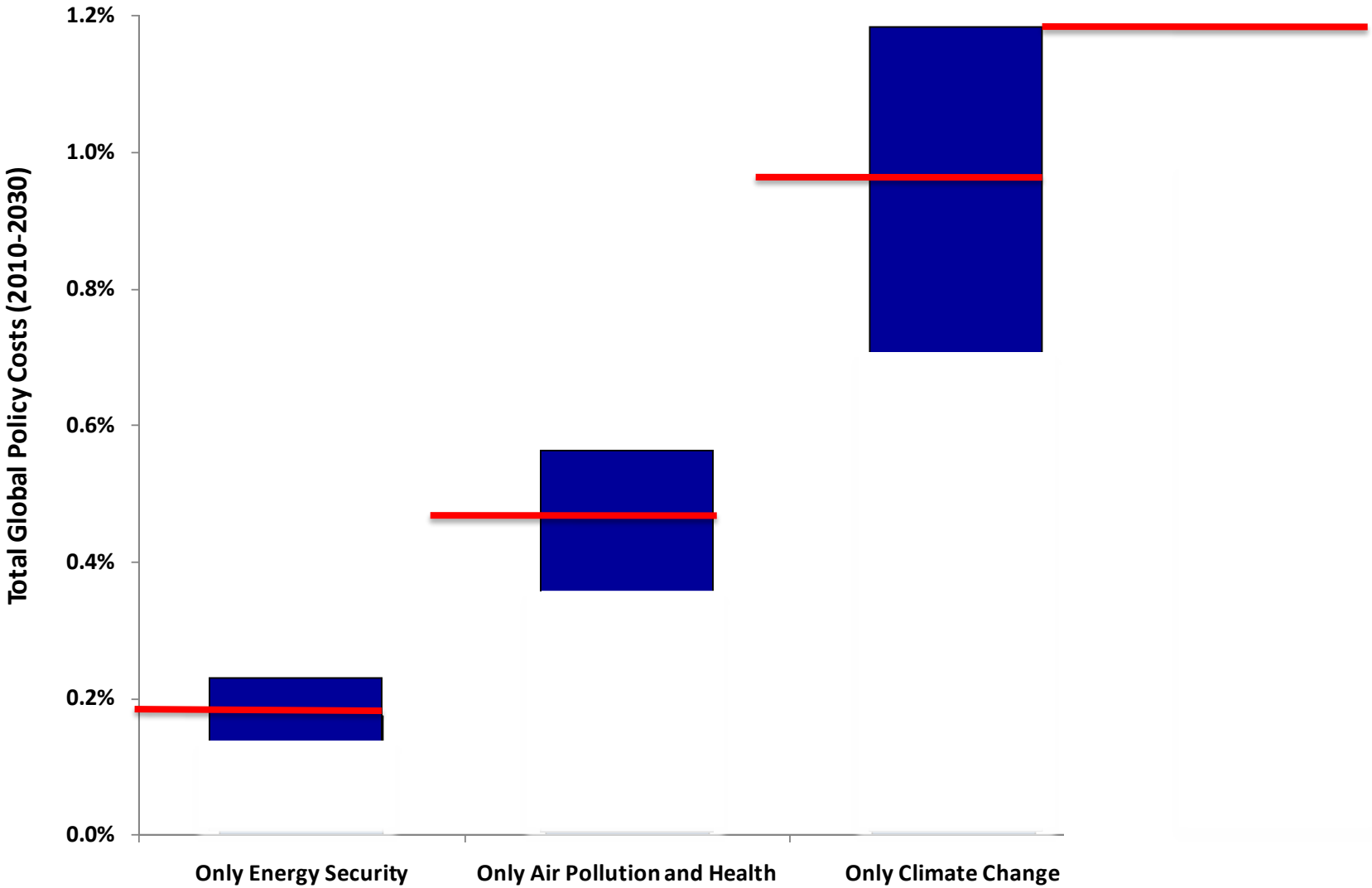
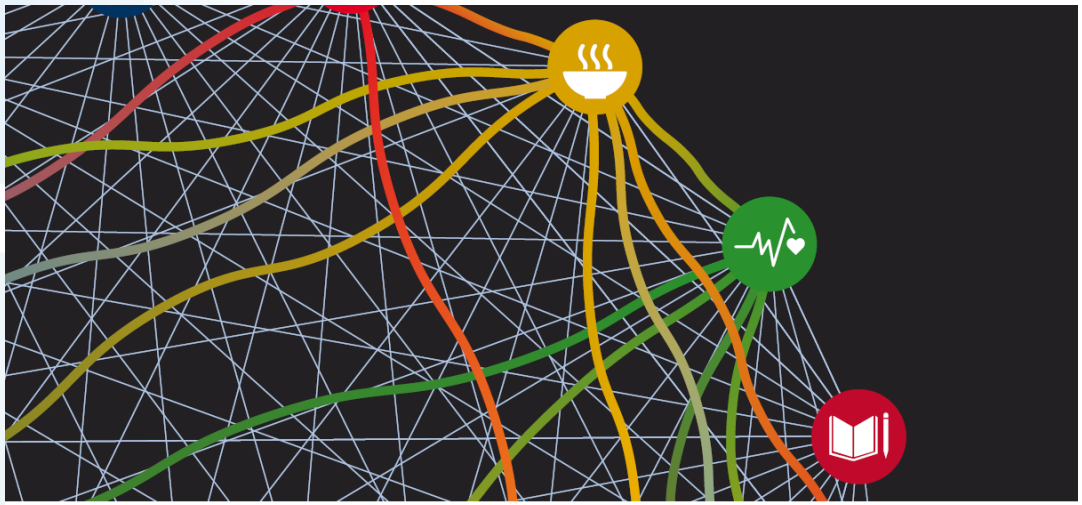
SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

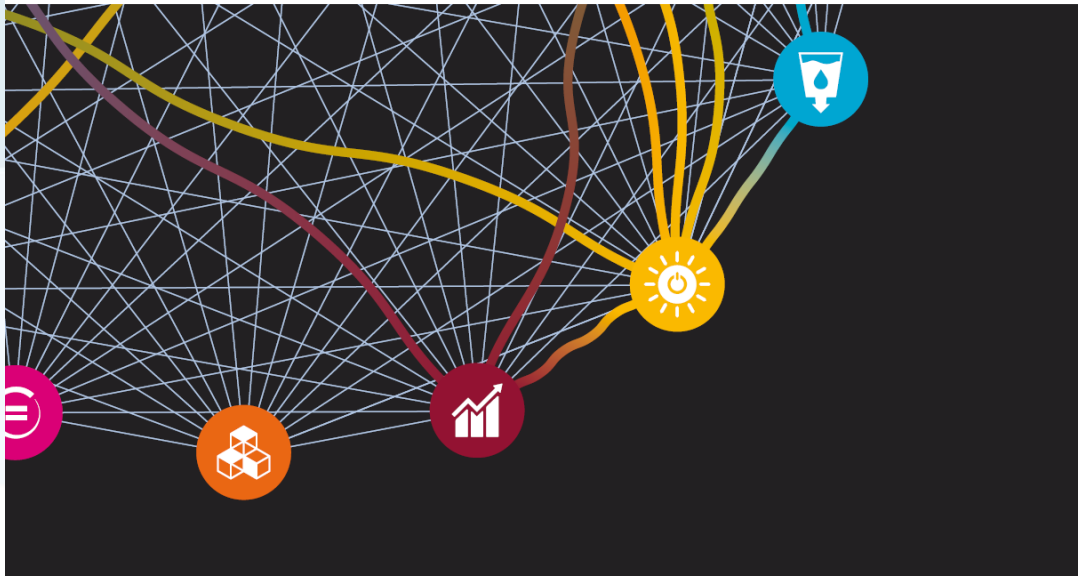
Multiple Benefits of Integrated Policies





A GUIDE TO
SDG INTERACTIONS:
FROM SCIENCE
TO IMPLEMENTATION

INTERNATIONAL
COUNCIL
FOR SCIENCE



Interactions between SDG 7 & other SDGs

Sustainable Development Goals

1 – No Poverty
2 – Zero Hunger
3 – Good Health and Well-being
4 – Quality Education
5 – Gender Equality
6 – Clean Water and Sanitation
7 – Affordable and Clean Energy
8 – Decent Work and Economic Growth
9 – Industry, Innovation and Infrastructure
10 – Reduced Inequalities
11 – Sustainable Cities and Communities
12 – Responsible Consumption and Production
13 – Climate Action
14 – Life below Water
15 – Life on Land
16 – Peace, Justice and Strong Institutions
17 – Partnerships for the Goals

TWI2050 Report (www.TWI2050.org)

Key Messages

Synthesis

1. Framing and Introduction
2. The Challenges Ahead
3. Sustainable Development Pathways
4. Governing the Transformation

- >60 authors from ~20 organizations
- >150 contributors and participants

TWI2050 Writing Meeting
5-7 March 2018, IIASA

TWI2050 Report (www.TWI2050.org)

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TWI2050 Launch HLPF
11 July 2018, UN

Some Key Messages

- Attaining the SDGs in a resilient and lasting way, requires vigorous action now, and a people and planet focus beyond 2030!
- As everything is integrated in the connected world, the grand transformation requires a holistic perspective!
- Transformational change is needed but to succeed we must take along winners and losers!
- The world is at crossroads as we are currently experiencing signs of a counter-transformation!
- A central element of the sustainability transformation is effective and inclusive governance!
- Think globally, act locally! Think long-term, act now!

The World in 2050 (TWI2050.org)

"Doing More with Less" within Planetary Boundaries

Target space 2050+ →

Vision: Sustainable Future

One "backcasting" storyline and many transformational pathways

← Target space 2030

Transformation Diffusion

Legitimacy of BAU erodin

2030

2050

Six Major Transformations (TWI2050.org)

Digital revolution
Artificial intelligence, big data, biotech, nanotech, autonomous systems

Human capacity & demography
Education, health, ageing, labor markets, gender, inequalities

Smart cities
Decent housing, mobility, sustainable infrastructure, pollution

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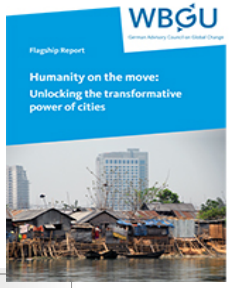
Consumption & production
Resource use, circular economy, sufficiency, pollution

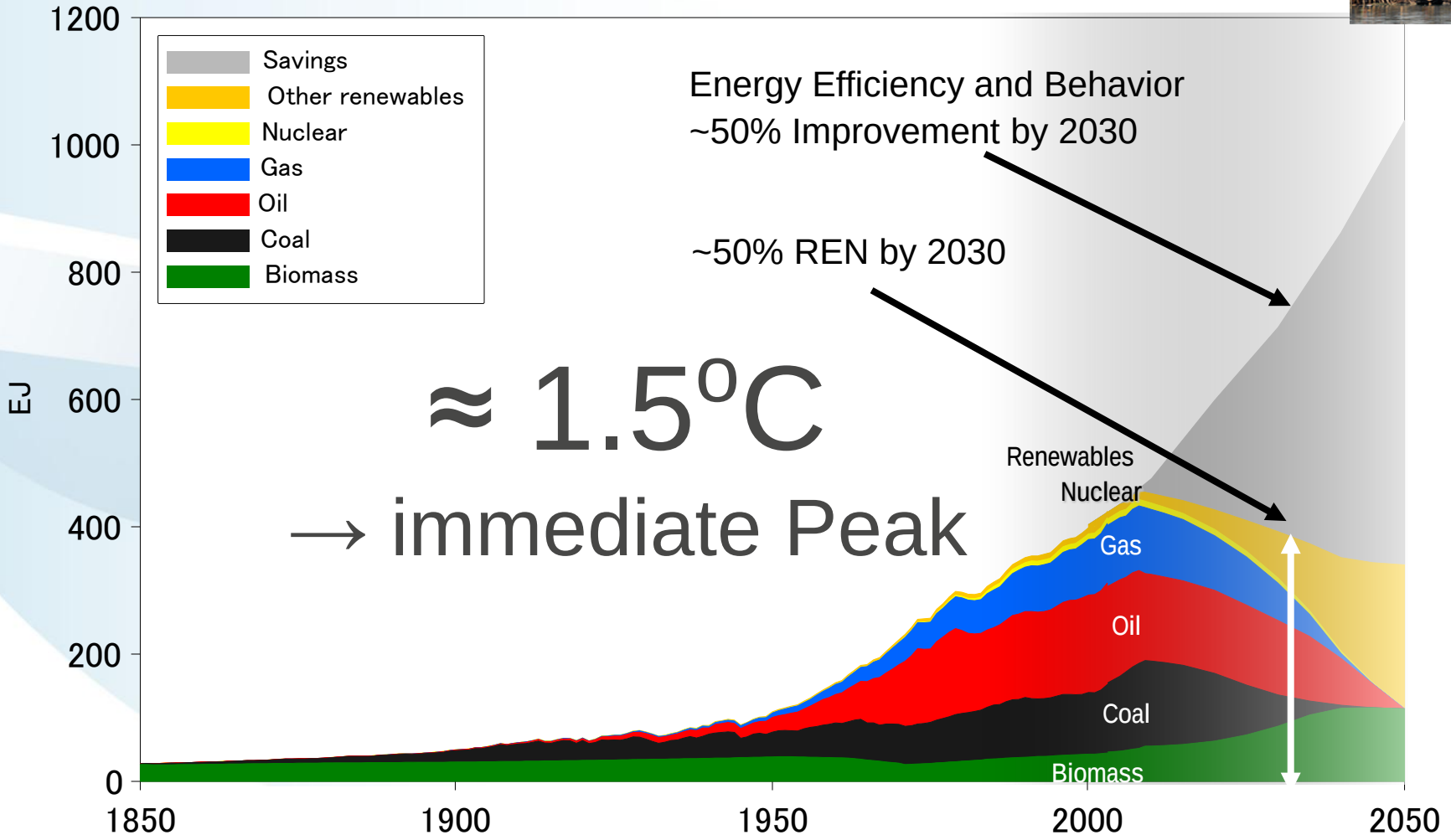
Food, biosphere & water
Sustainable intensification, biodiversity, forests, oceans, healthy diets, nutrients

Decarbonization & energy
Energy access, efficiency, electrification, decent services

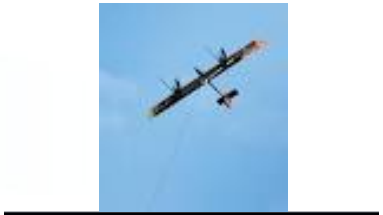
Global Primary Energy

Zero Emissions by 2050

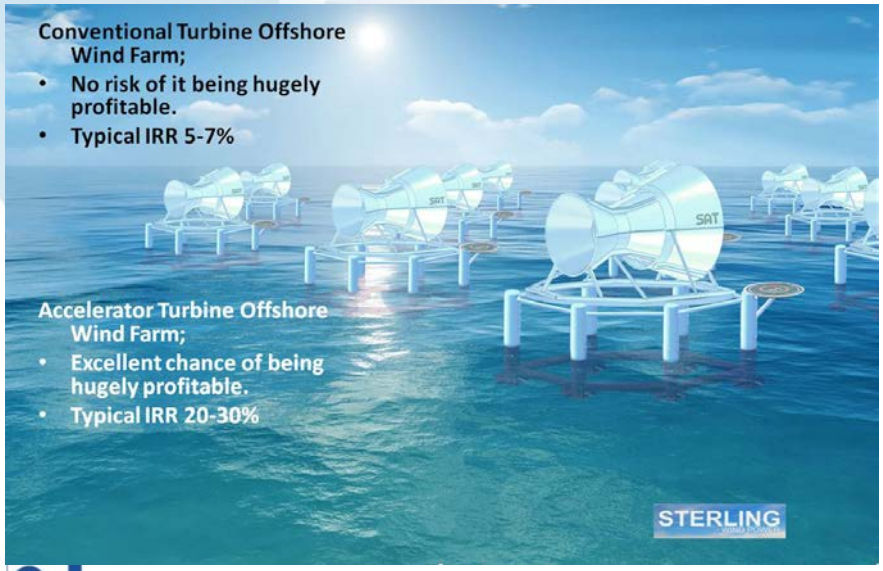


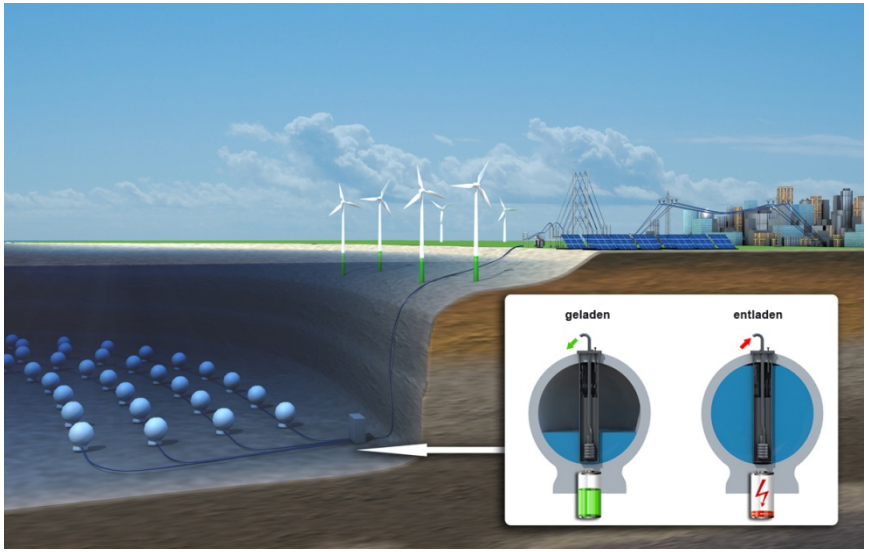


Possible Transformational Technologies

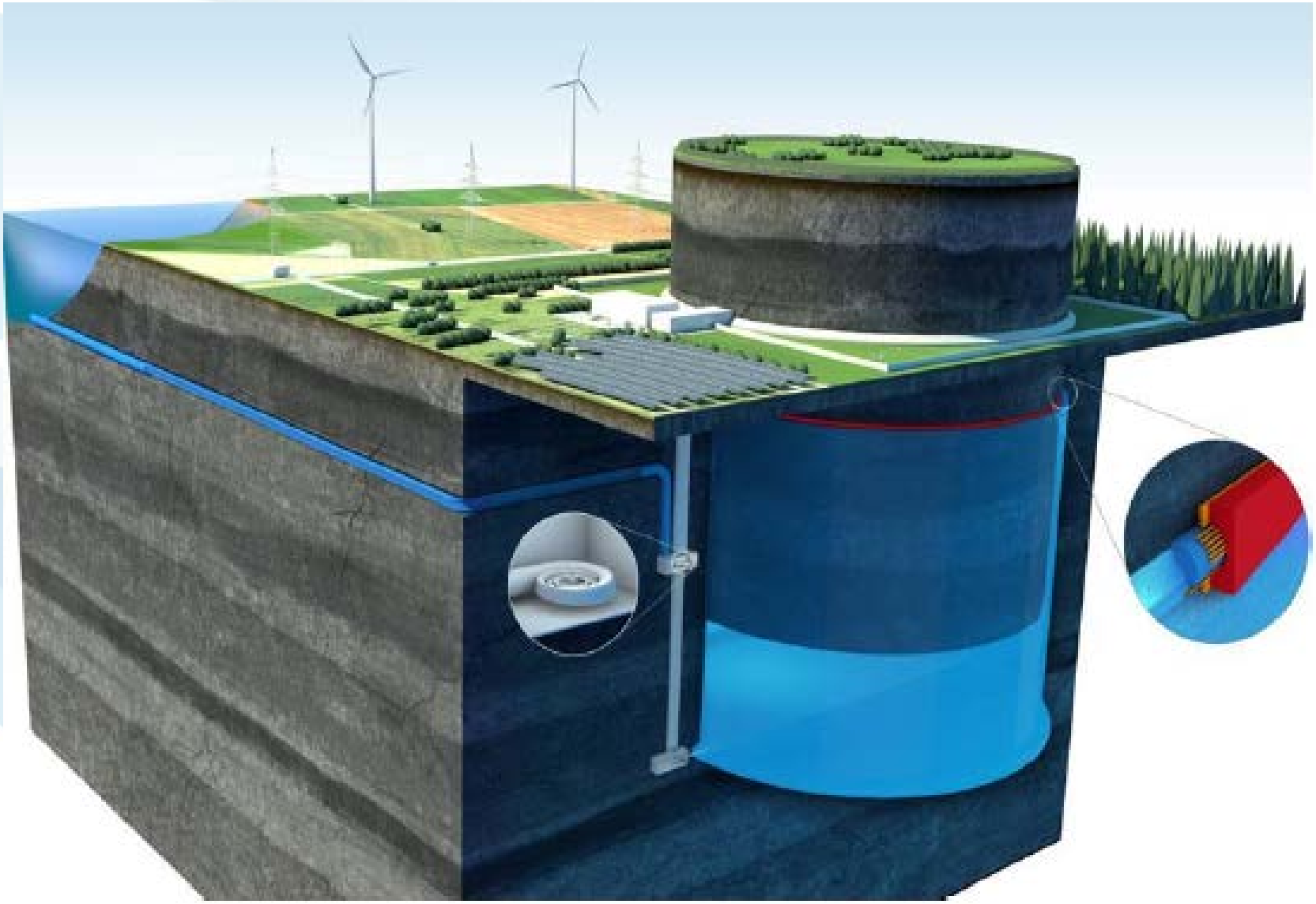


Google X

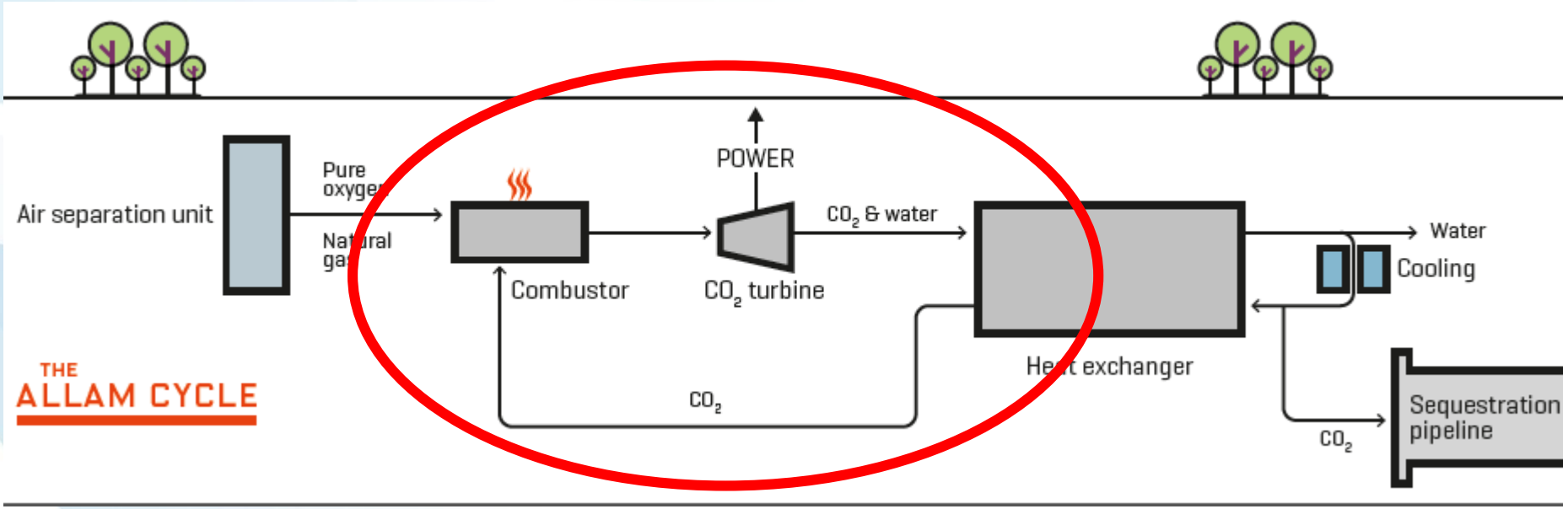




Hydraulic Electricity Storage

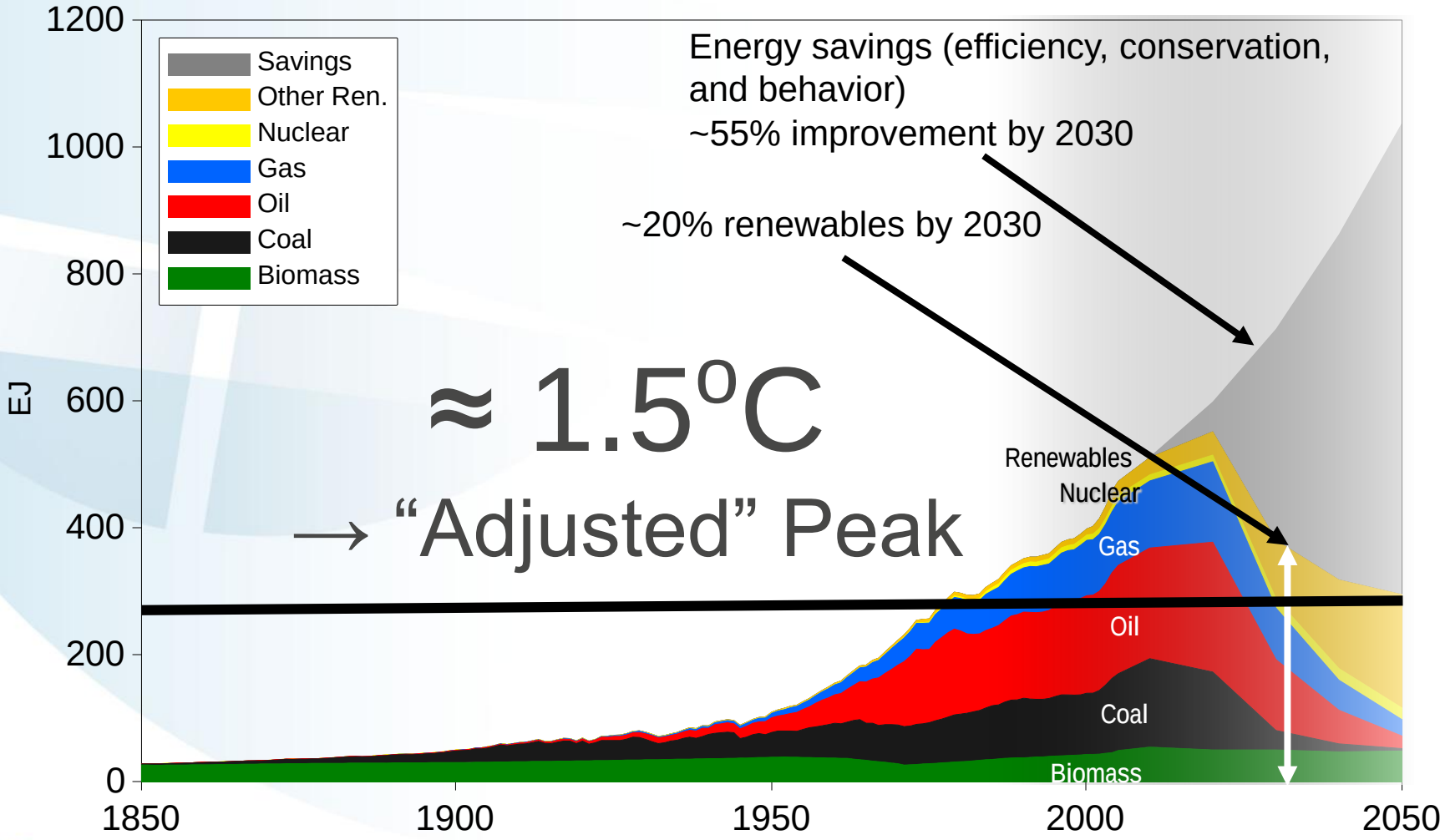


NET POWER Breaks Ground on Demonstration Plant for Oxyfuel, Nantural Gas ZEP, La Porte, Texas

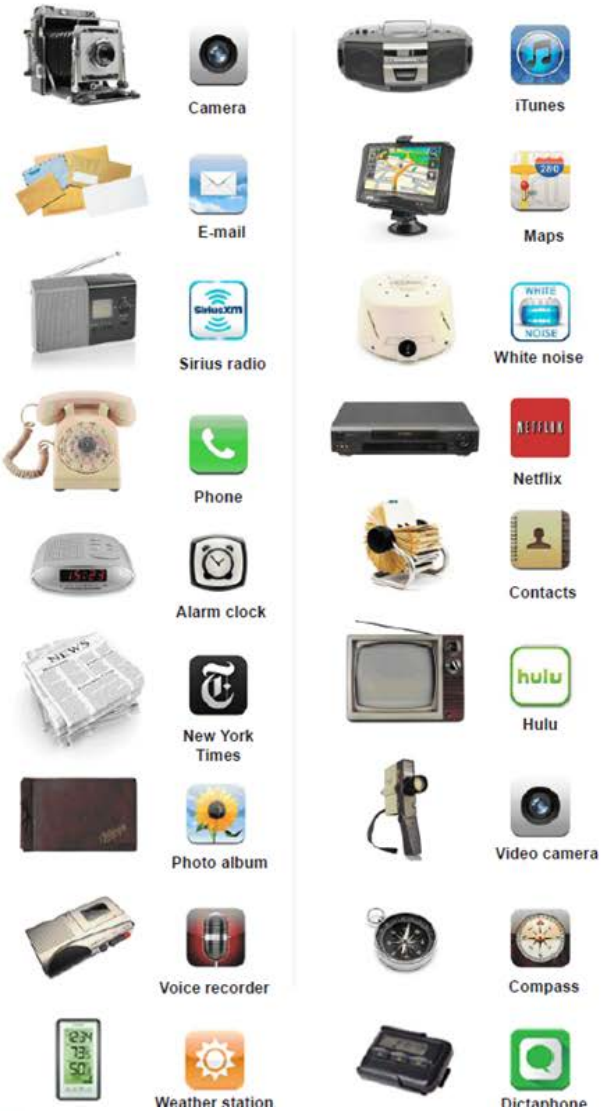


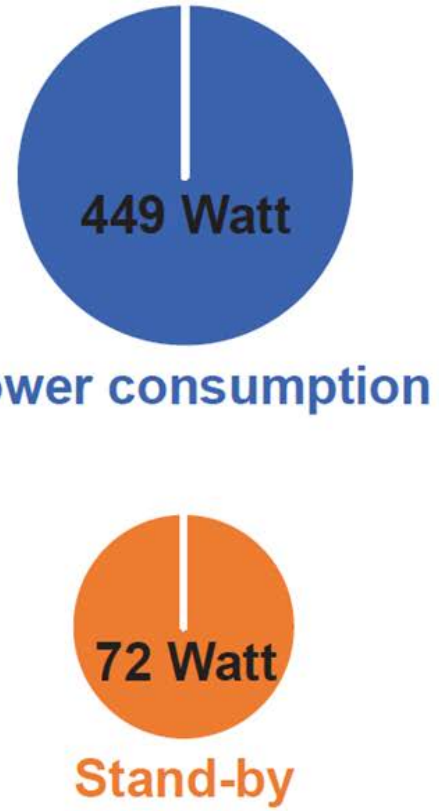
Global Primary Energy

ALPS Low Energy Demand (LED)



Impact of IC Technology Convergence

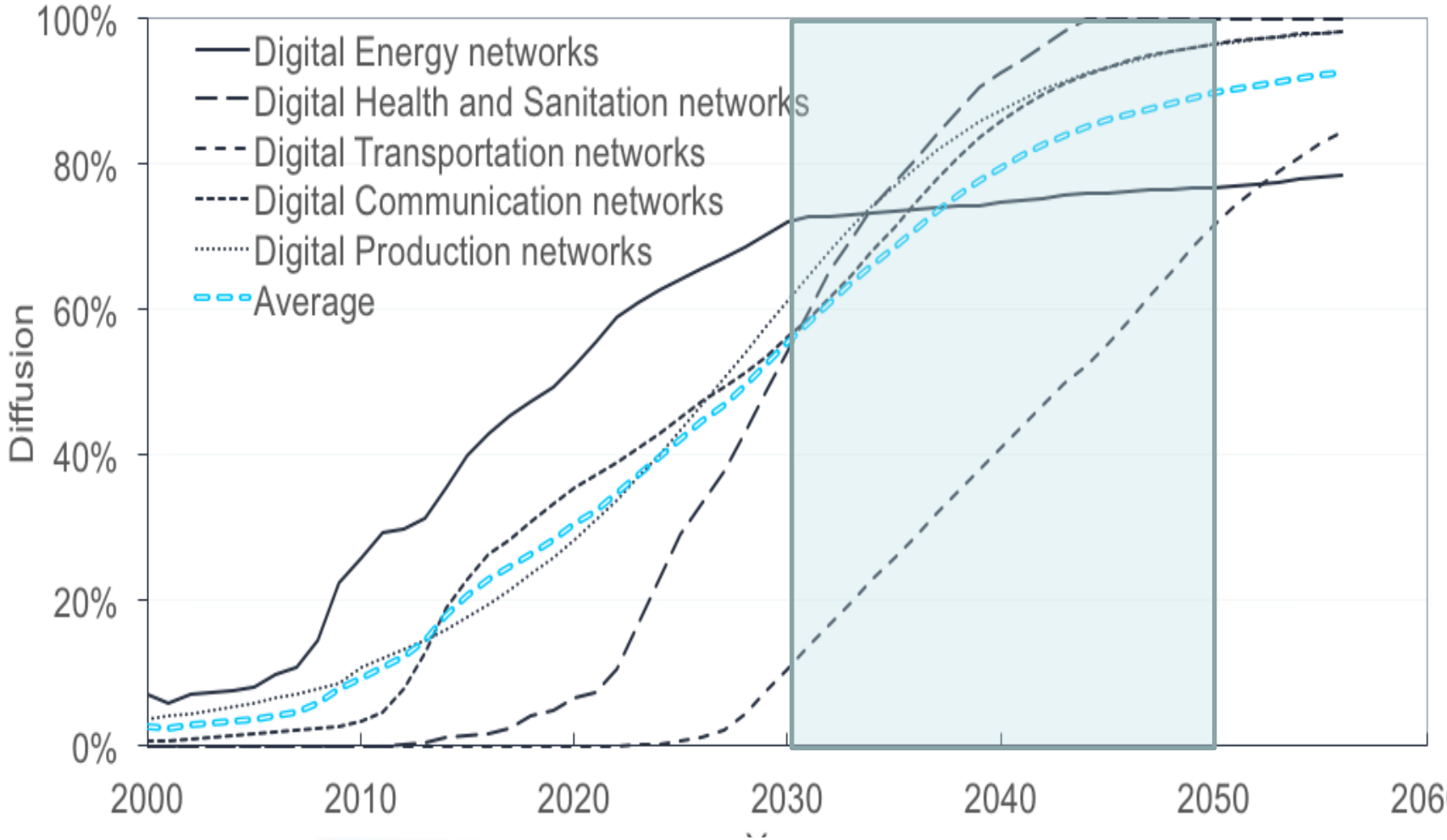




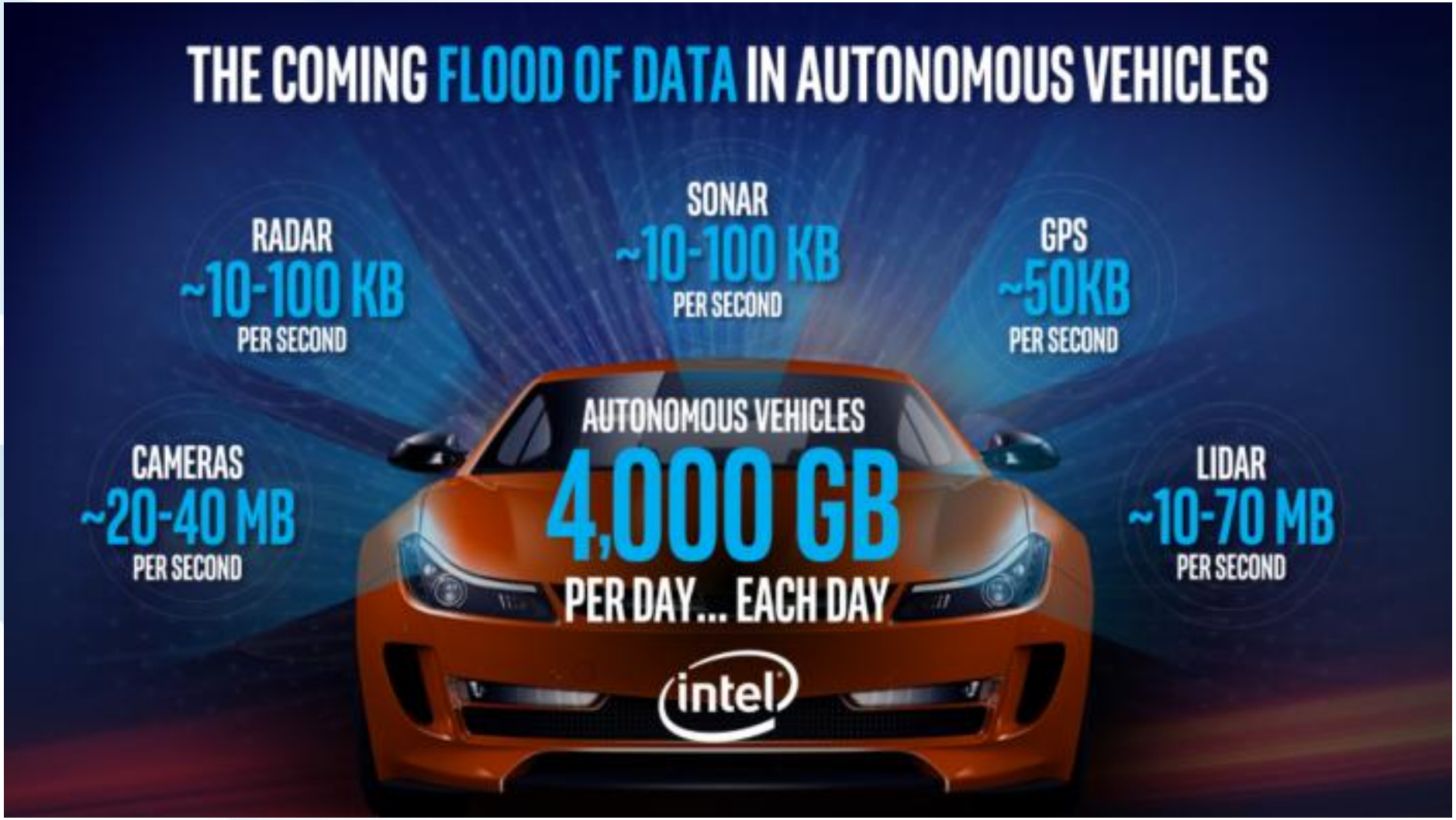
Impact of Digital Technology

Source: httpshappykids.huuncategorizeddigitalization-the-most-powerful-force-in-the-21st-century-digital-tech-1080x675

Technology Diffusion Compared
digital revolution



Social and Technological Learning



“Autonomous” Feature of Tesla S

Disruptive Change

Easter Parade on Fifth Avenue, New York, 13 years apart

1900: where's the car?

1913: where's the horse?

Images: L, National Archive, www.archives.gov/research/american-cities/images/american-cities-101.jpg
R, shorpy.com/node/204.
Inspiration: Tona Seba's keynote lecture at AltCar, Santa Monica CA, 28 Oct 2014,
http://tonyseba.com/keynote-at-altcar-expo-100-electric-transportation-100-solar-by-2030/

Pipistrel electric aircarft

Urban mobility FRA airport

Progress Eagle

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ありがとう

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