



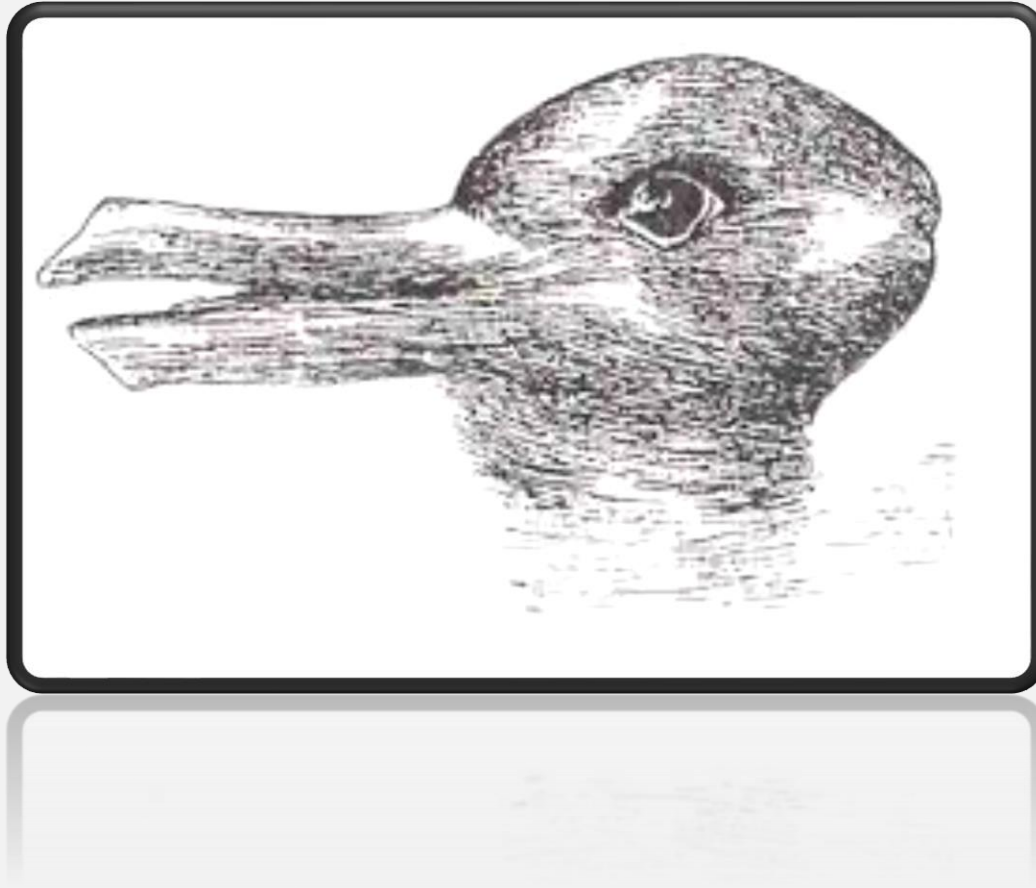
A Good Disruption – Redefining growth in the 21st century

DAKOFA

Prof. Dr. Martin R. Stuchtey
Nyborg , September 20th 2018

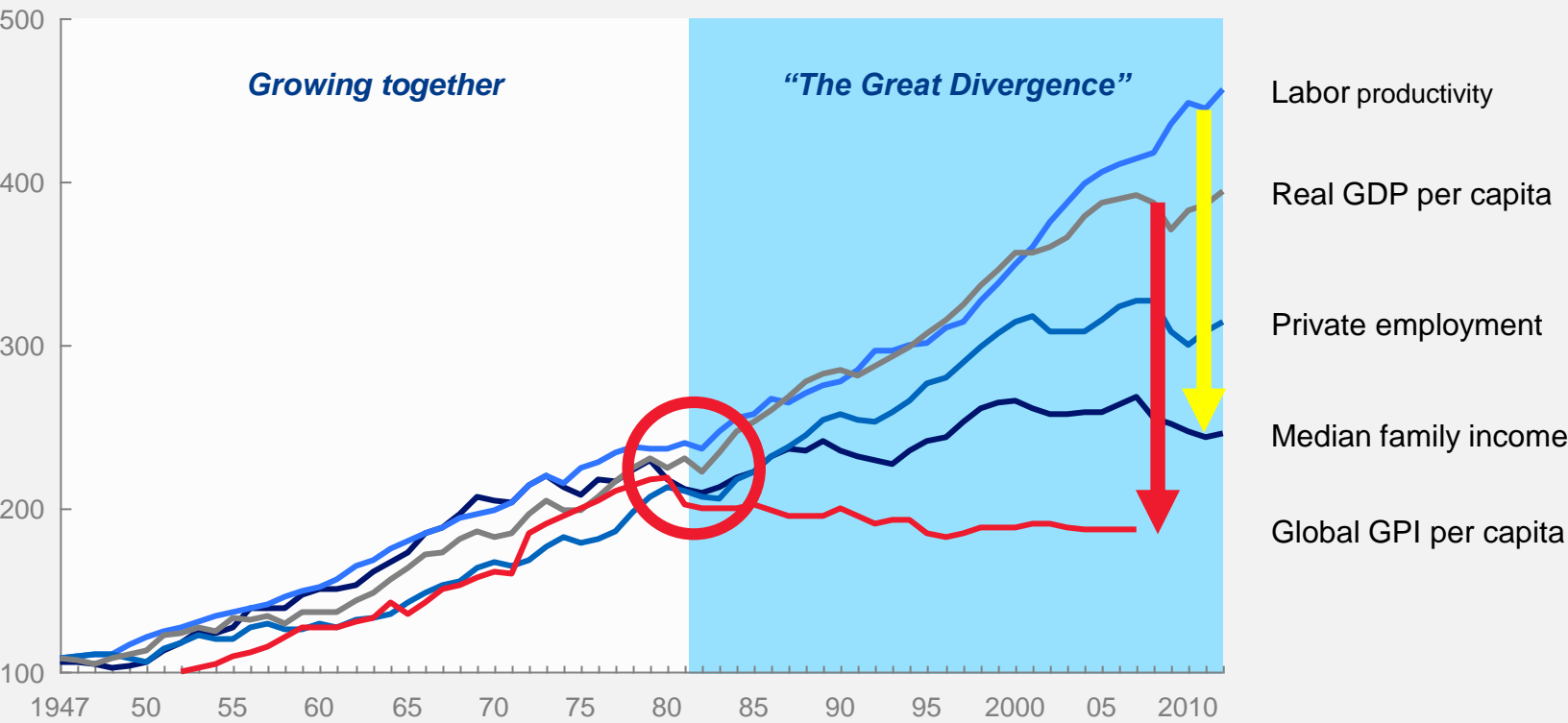
S Y S T E M I Q

Congruence, anomaly, or new paradigm?



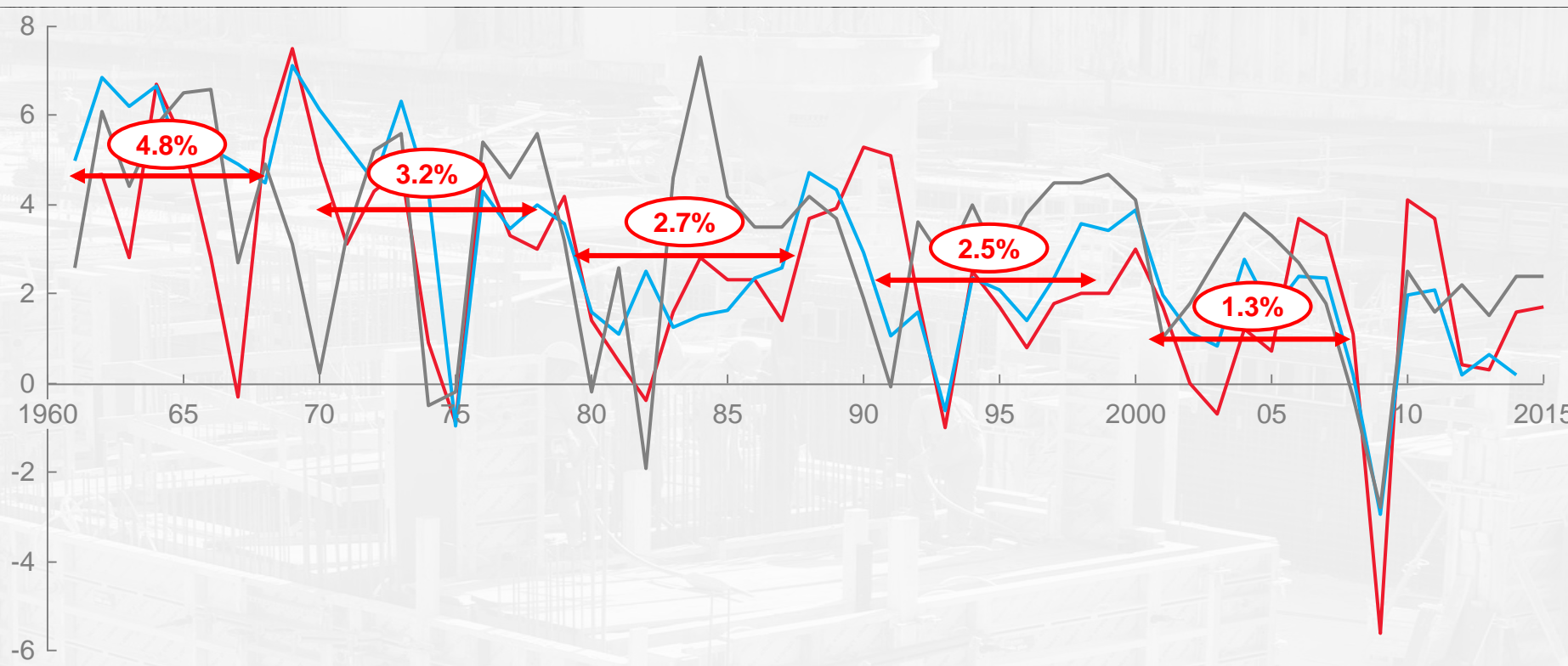
We are seeing a “great divergence”

U.S. labor productivity, GDP per capita, employment, median income, and Global GPI per capita
Indexed to 1947



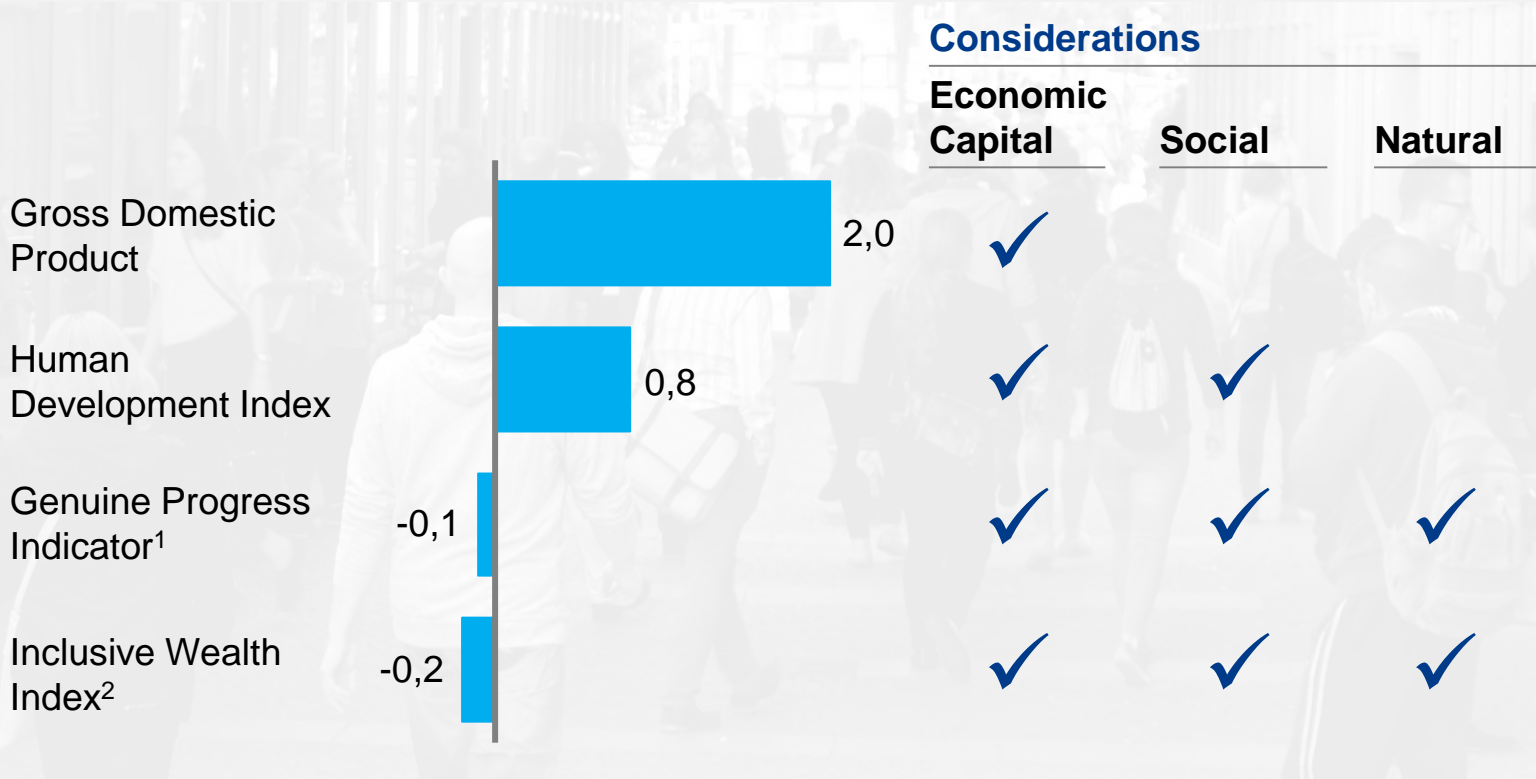
Annual GDP Growth rates in Germany, France, and the USA

- Germany
- France
- USA



Measures of societal development that include natural capital depletion grow much slower than GDP

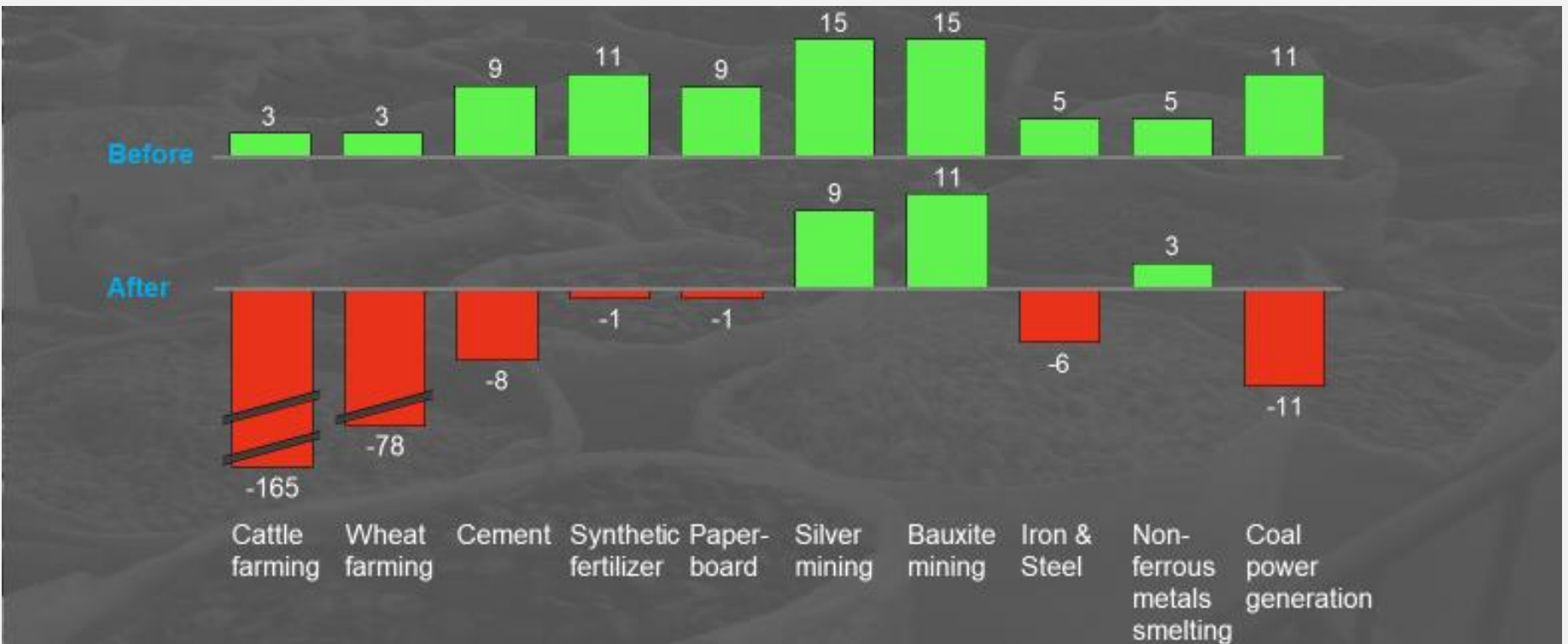
Progress per capita³, globally, 1990-2010, real terms



1 1990-2005, as later data not available globally,
2 IWI exists in two versions, one unadjusted, and one where adjustments are made for environmental damage, oil capital gains, and total factor productivity. The adjusted version is shown here,
3 Global population growth was 1.6 percent per year during the period

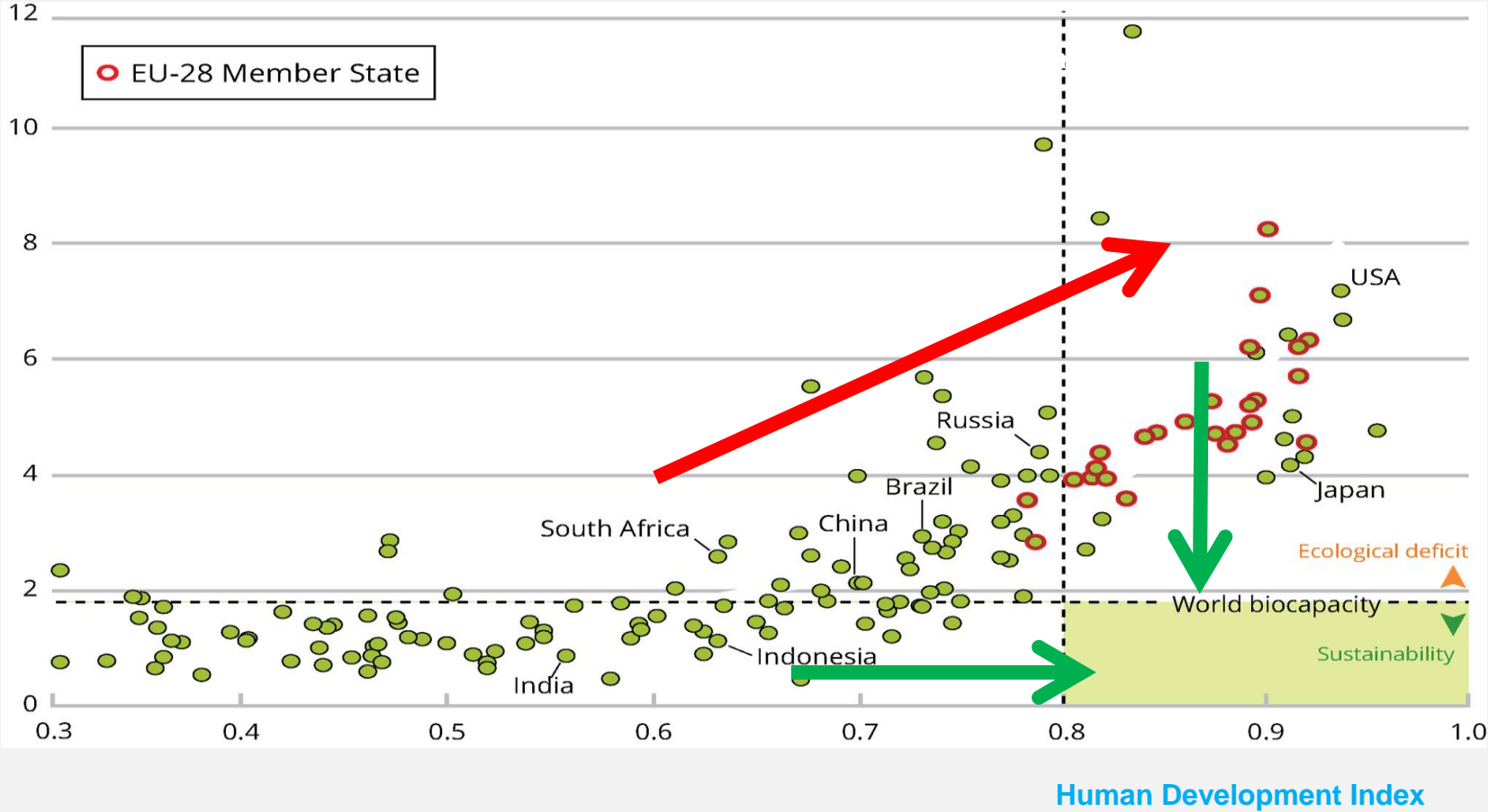
Paradigm shift: Most of the world's resource-using industries are negative

Profit margin (EBIT) before and after natural capital costs, based on top-2 companies in each Morgan Stanley Composite Index category, Percent, 2012



Our future operating space – uncharted

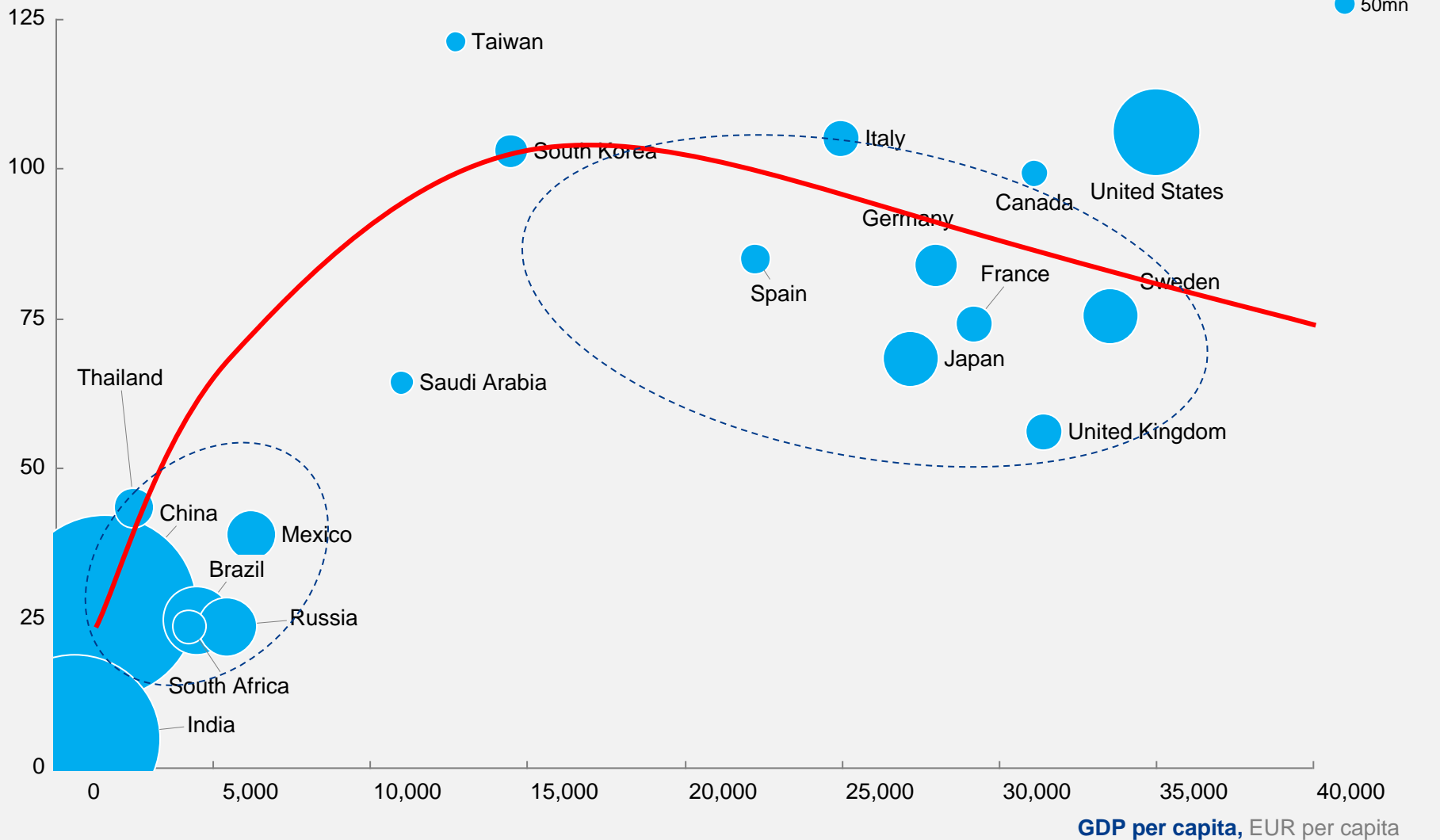
, hectares per person per year



Waiting for Kuznets – example commodity plastics

COMMODITY PLASTICS

Plastic consumption, Kg per capita

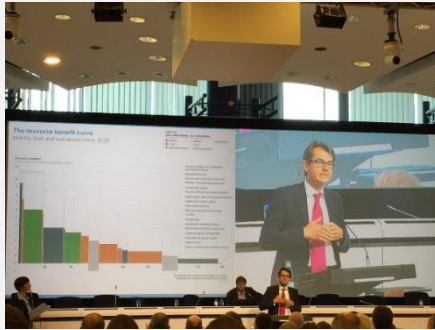


1 Includes EPS, HDPE, LDPE, LLDPE, PET Resins, PP, PS, and PVC

The vision of a decoupled, net positive industry model

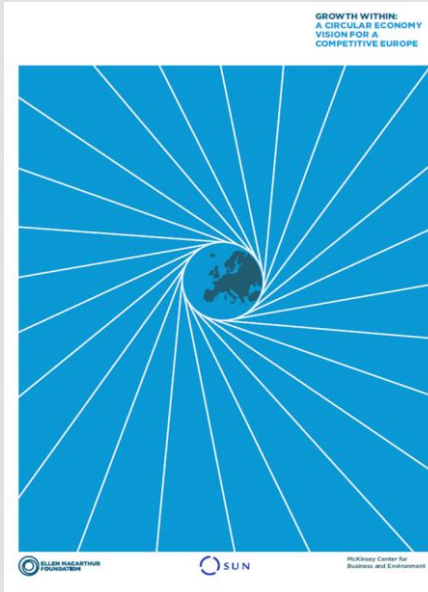


2016, at the European Commission in Brussels



"Circular economy will be a similar mega trend in economy as globalisation. I'm convinced that the circular economy can enable a triple win: economic, environmental and social."

Jyrki Katainen - EU Vice President Jobs, Growth, Investment and Competitiveness



"I am very impressed by the findings of Growth Within report, looking forward to developing our shared agenda"

Karmenu Vella, EU Commissioner Environment, Maritime Affairs and Fisheries

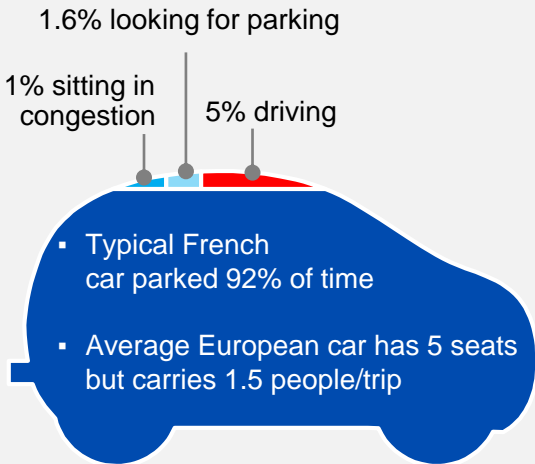


"I passionately believe in the opportunities of the circular economy. The future is not making things with finite components."

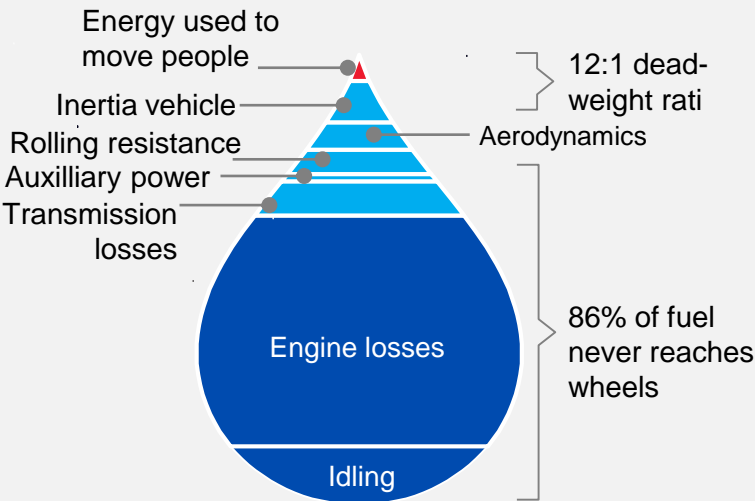
Frans Timmermans, EU Commission First Vice President

Major structural waste in the mobility system

Car utilisation

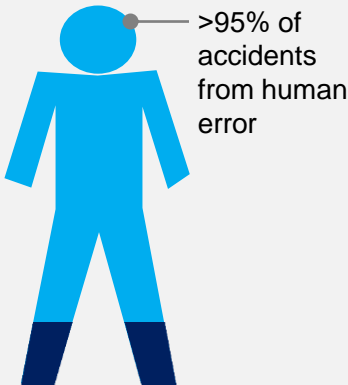


Tank-to-wheel energy flow - gasoline



Deaths and injuries/year on road

30,000 deaths in accidents and 4x as many disabling injuries

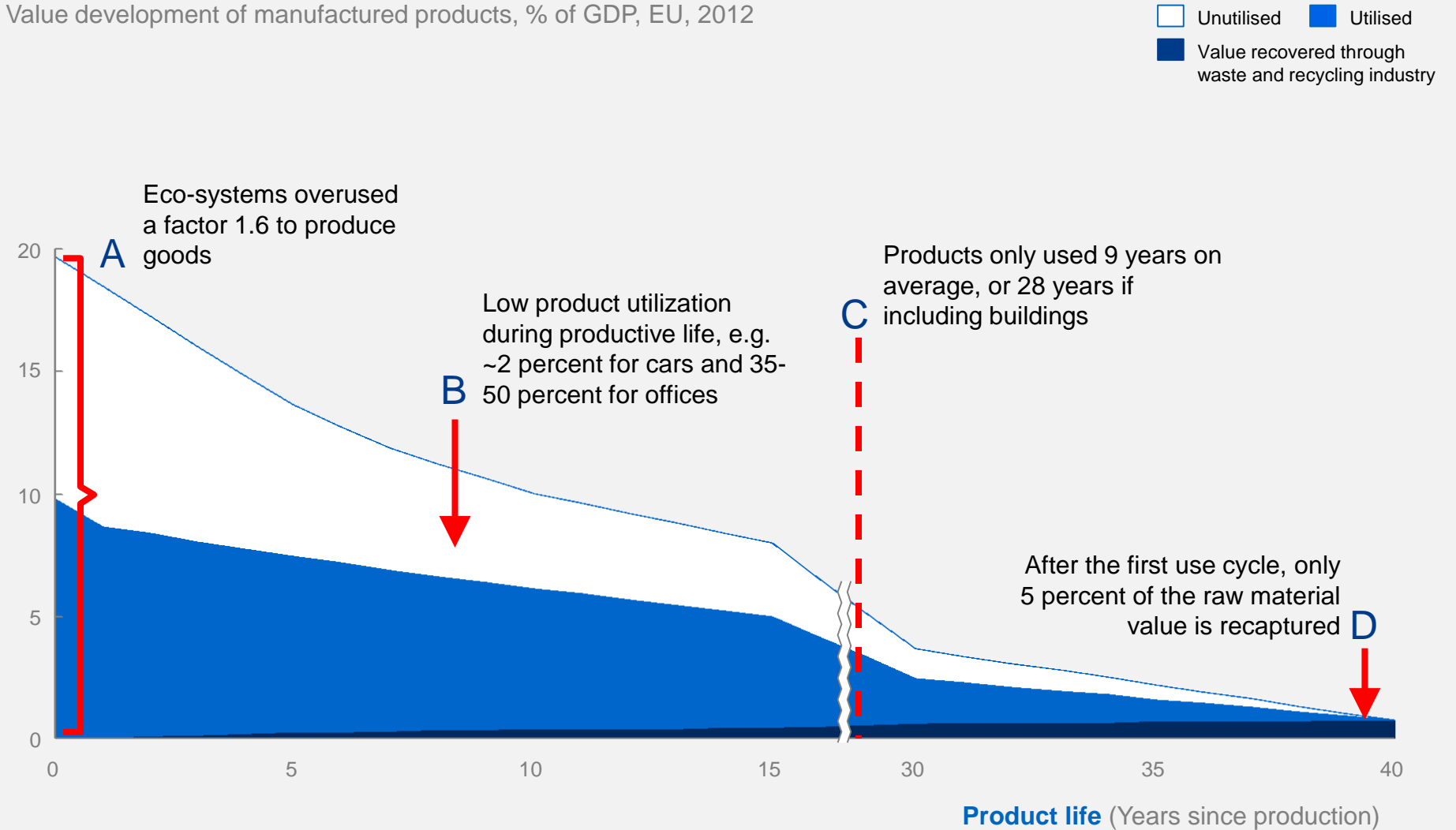


Land utilisation

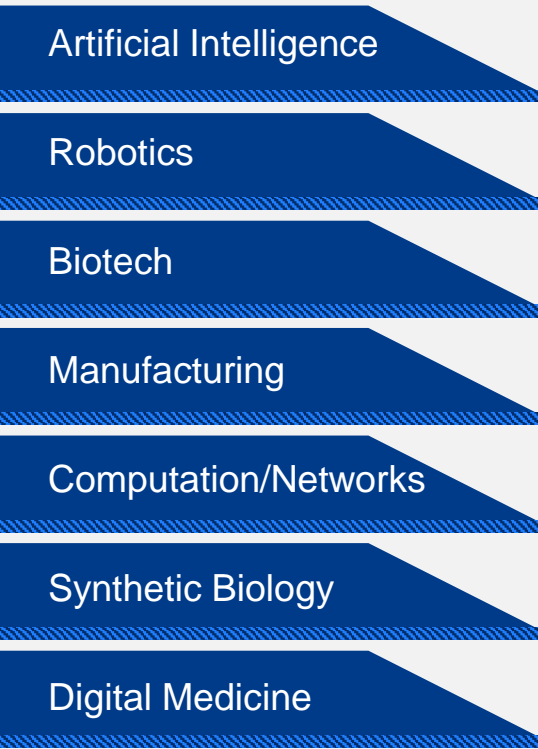
- Road reaches peak throughput only 5% of time and only 10% covered with cars then
- 50% of most city land dedicated to streets and roads, parking, service stations, driveways, signals, and traffic signs

Waste, waste, everywhere – example Europe

Value development of manufactured products, % of GDP, EU, 2012



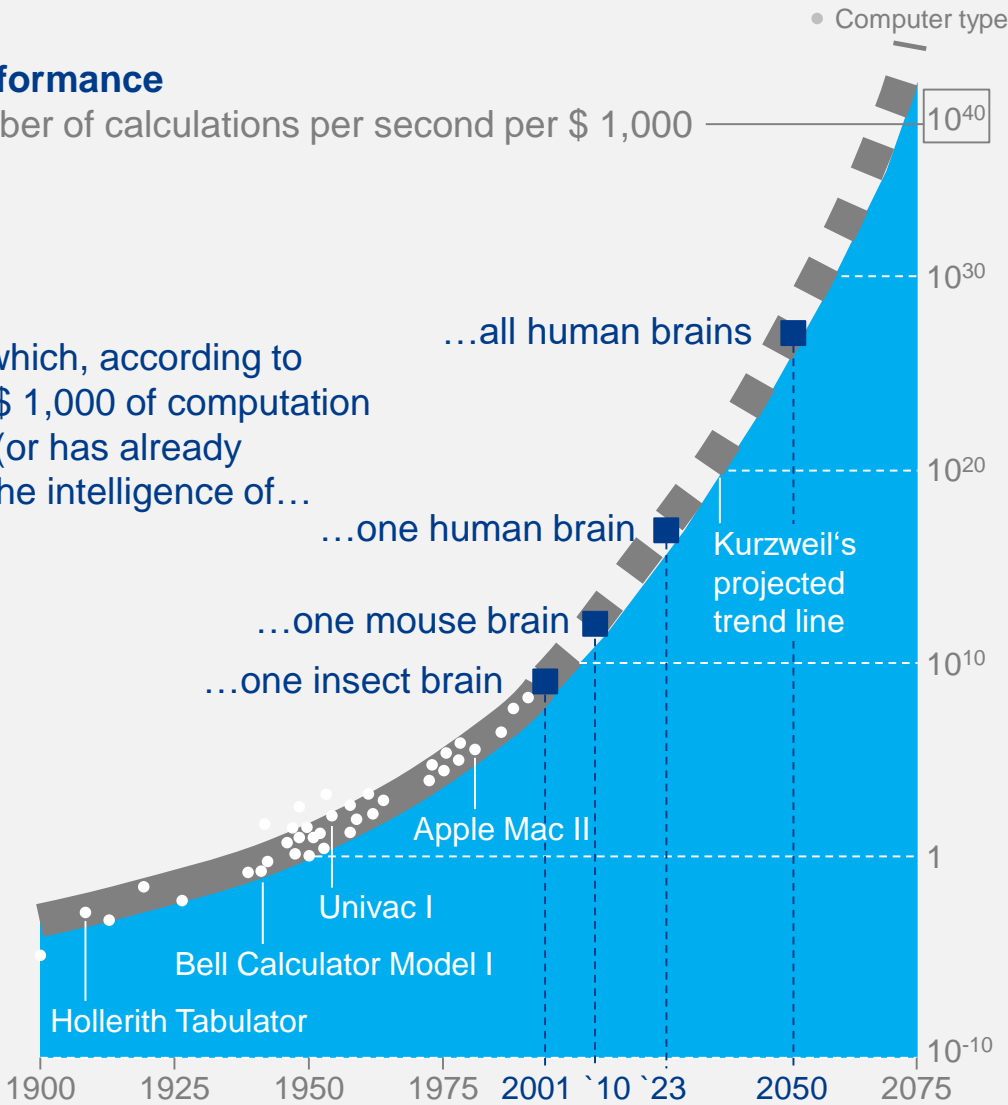
Entering, exponential technology



Computer performance

Plotted by number of calculations per second per \$ 1,000

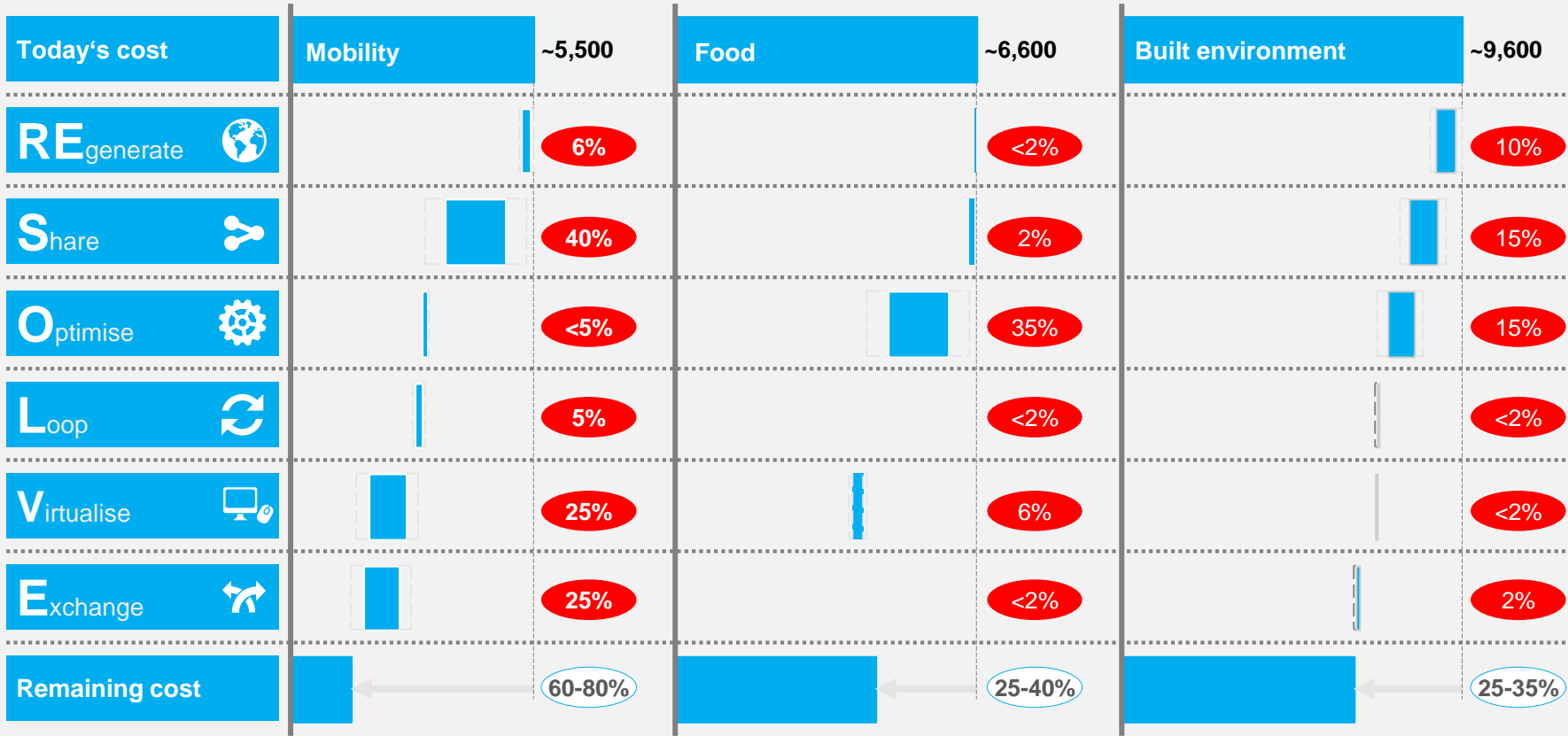
Years by which, according to Kurzweil, \$ 1,000 of computation will equal (or has already equaled) the intelligence of...



Cost-reduction potential in the three real life systems

Total annual cash-out costs per household; EU average 2012, EUR
Improvement potential for 2050

X Total savings



ReSOLVE – a menu of business actions for a better economy

Examples

REgenerate



- Shift to renewable energy and materials
- Reclaim, retain, and restore health of ecosystems
- Return recovered biological resources to the biosphere

NESPRESSO

SLM



Share



- Share assets (e.g. cars, rooms, appliances)
- Reuse/secondhand
- Prolong life: maintenance, design for durability, upgradability, etc.



Optimise



- Increase performance/efficiency of product
- Remove waste in production and supply chain
- Leverage big data, automation, remote sensing and steering



Loop



- Remanufacture products or components
- Recycle materials
- Digest anaerobic
- Extract biochemicals from organic waste



Virtualise



- Books, music, travel, online shopping, autonomous vehicles etc.



Exchange



- Replace old with advanced non-renewable materials
- Apply new technologies (e.g. 3D printing)
- Choose new product/service (e.g. multimodal transport)



In search of a superior design - outline of a circular economy system (75 million downloads)

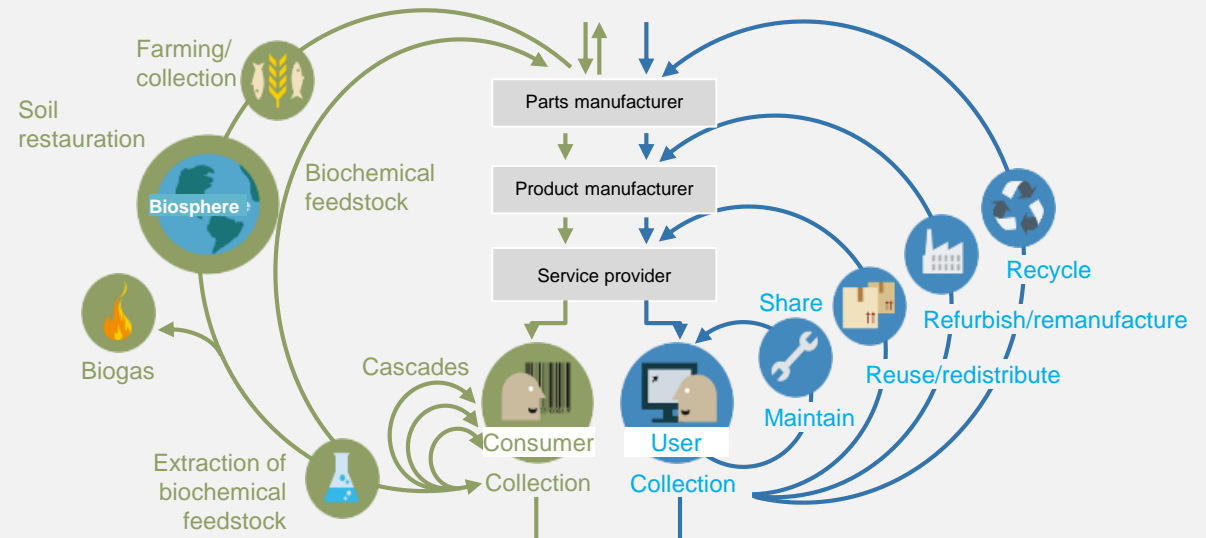
Principle 1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows



Principle 2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles



Principle 3

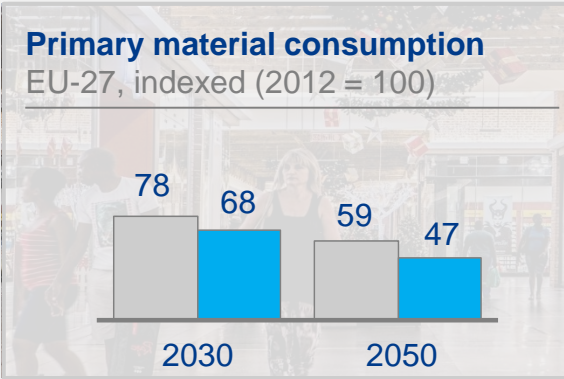
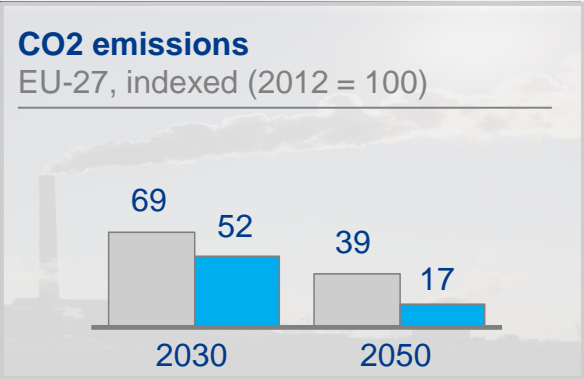
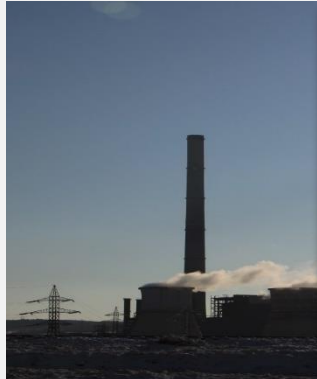
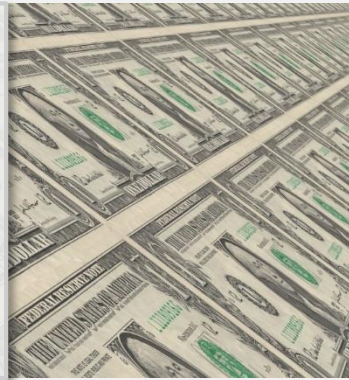
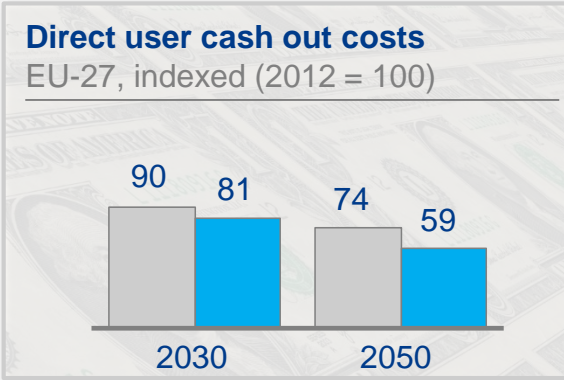
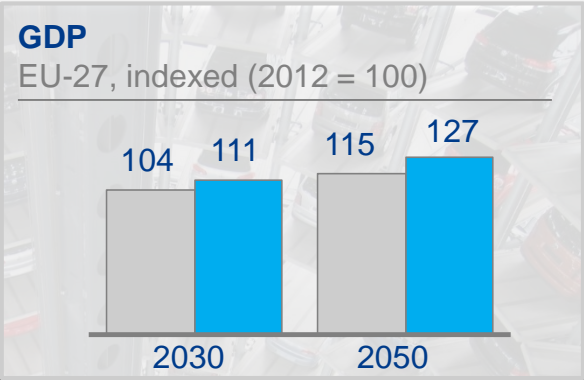
Foster system effectiveness by revealing and designing out negative externalities

Minimise systematic leakage and negative externalities

It delivers both better economic and environmental outcomes

Indexed (2012 = 100)

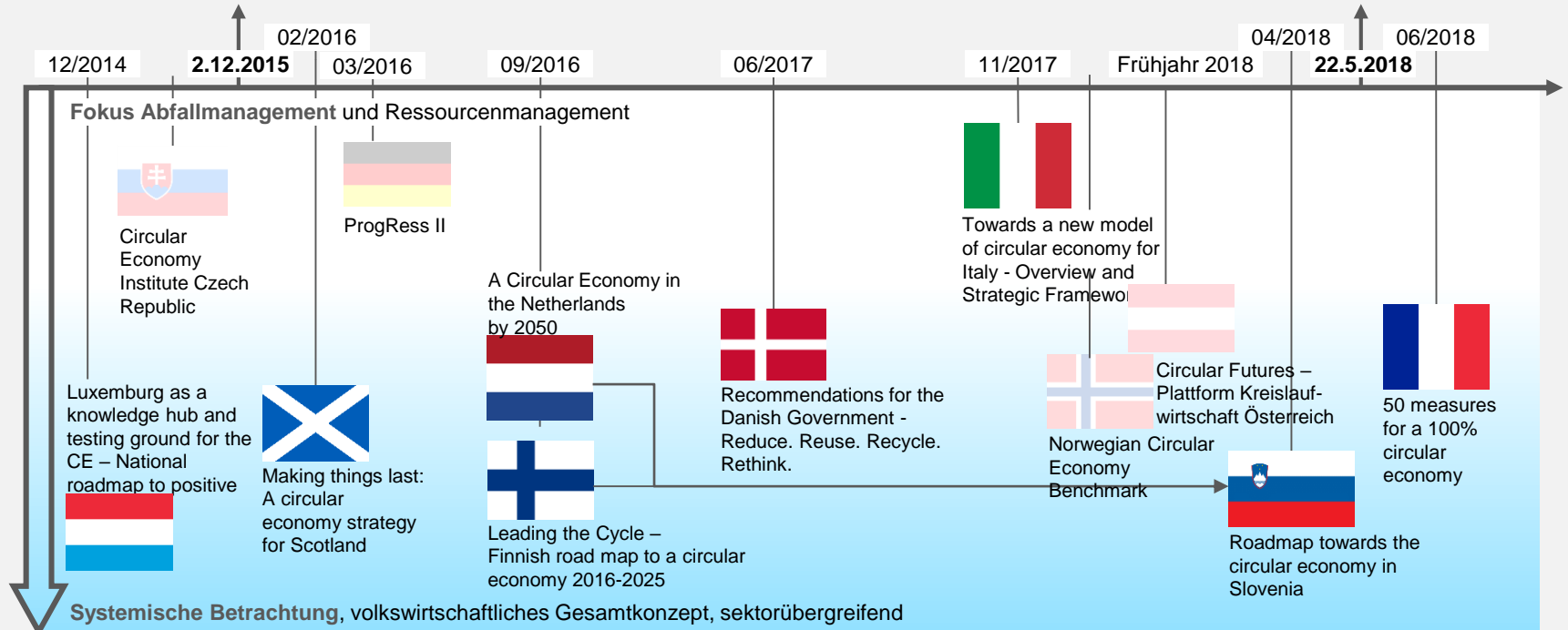
■ Current development scenario
■ Circular scenario



The Circular Economy Action Plan of the EU Commission sparked more than 10 national strategies

EC submits CE package

EC endorses Action Plan



Global developments: CHINA Introduction into 12th 5-year plan 2000 (Fokus 3R), 2017 Circular Economy Policy Portfolio (Fokus Upstream: Ecodesign and EPR) JAPAN Resource efficiency and recycling CANADA ("Smart prosperity"); CE als Lösungsansatz

What's (really) new?

1

A political framework, the „**20-20-20**“ of resources

- EU CE Action Plan (2015)
- DK CE Strategy (8/2018)
- DK plastic, waste strategy (TBD)

2

The emergence of a **global agenda**

- G7/G20, EU presidencies
- International Resource Panel

3

The recognition of the **climate link**

- Plastic, cement, steel with BAU 800 Gtons until 2100 (equals total 2°C budget)

4

An emerging **ReSOLVE industry**

- Some MNC strategic bets
- Vibrant startup community
- Creator, „re“-sector

5

Inescapable **pressure points** and evident strategic „blanks“ within core industries

- The GHG automotive standards trap
- Plastic crisis
- EV material supply gap

6

The end of the **material identity** crisis

- Materials, their source, use and ownership history can be traced
- Transactions are safeguarded (block chain)

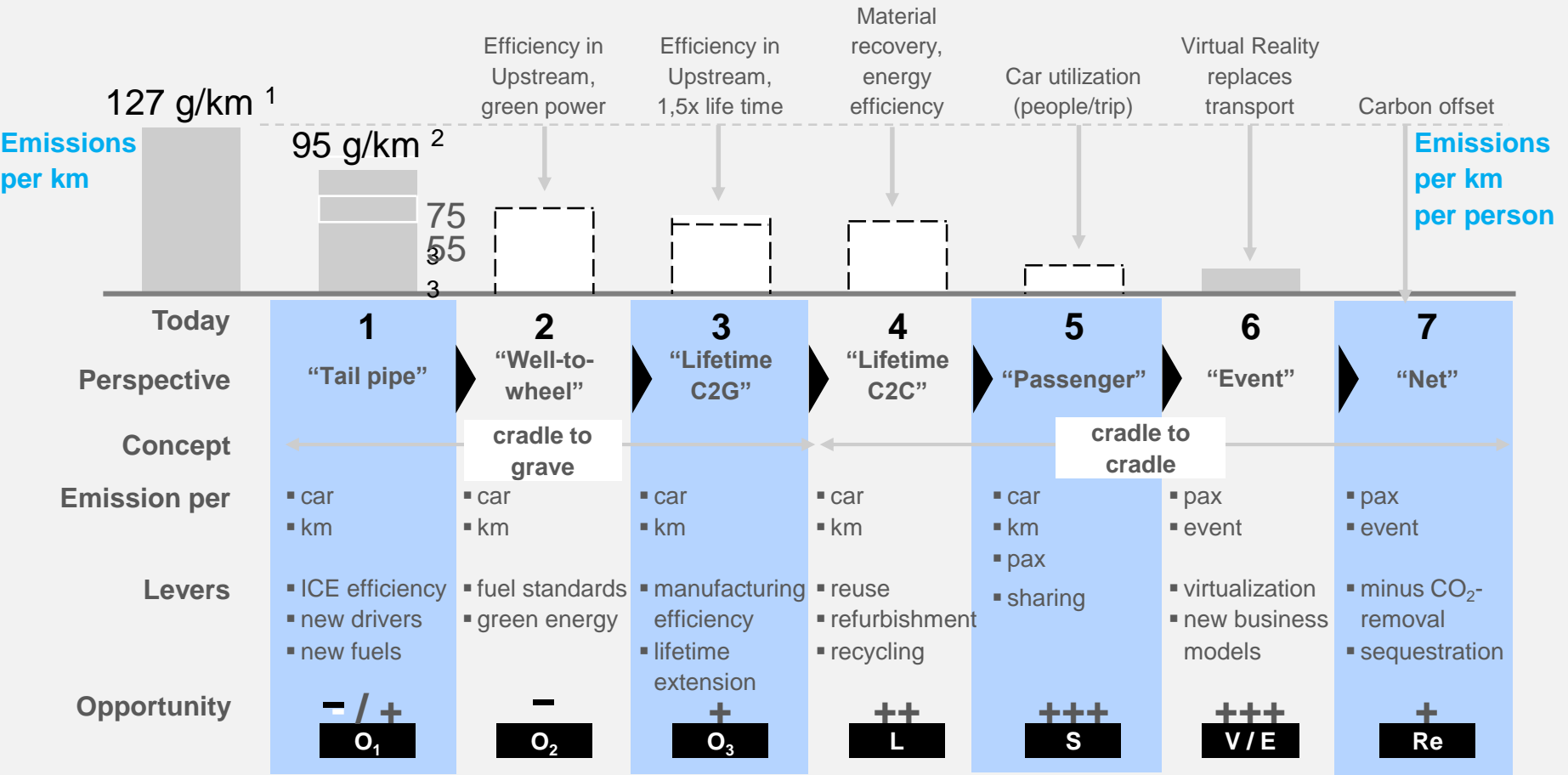
7

The **EPR renaissance** and EPR's new friends

- Broadening into new products
- Internationalization
- Differentiated fees for recycled/recyclable

Circularity in rescue of an automotive industry with a back to the wall

Indicative



1 Average CO₂-emissions of new cars sold in Germany in 2017 (UBA); 2 target for fleet average for 2021; 3 potential target for fleet average 2030 / 2050...

Plastic packaging – the emblematic environmental crisis



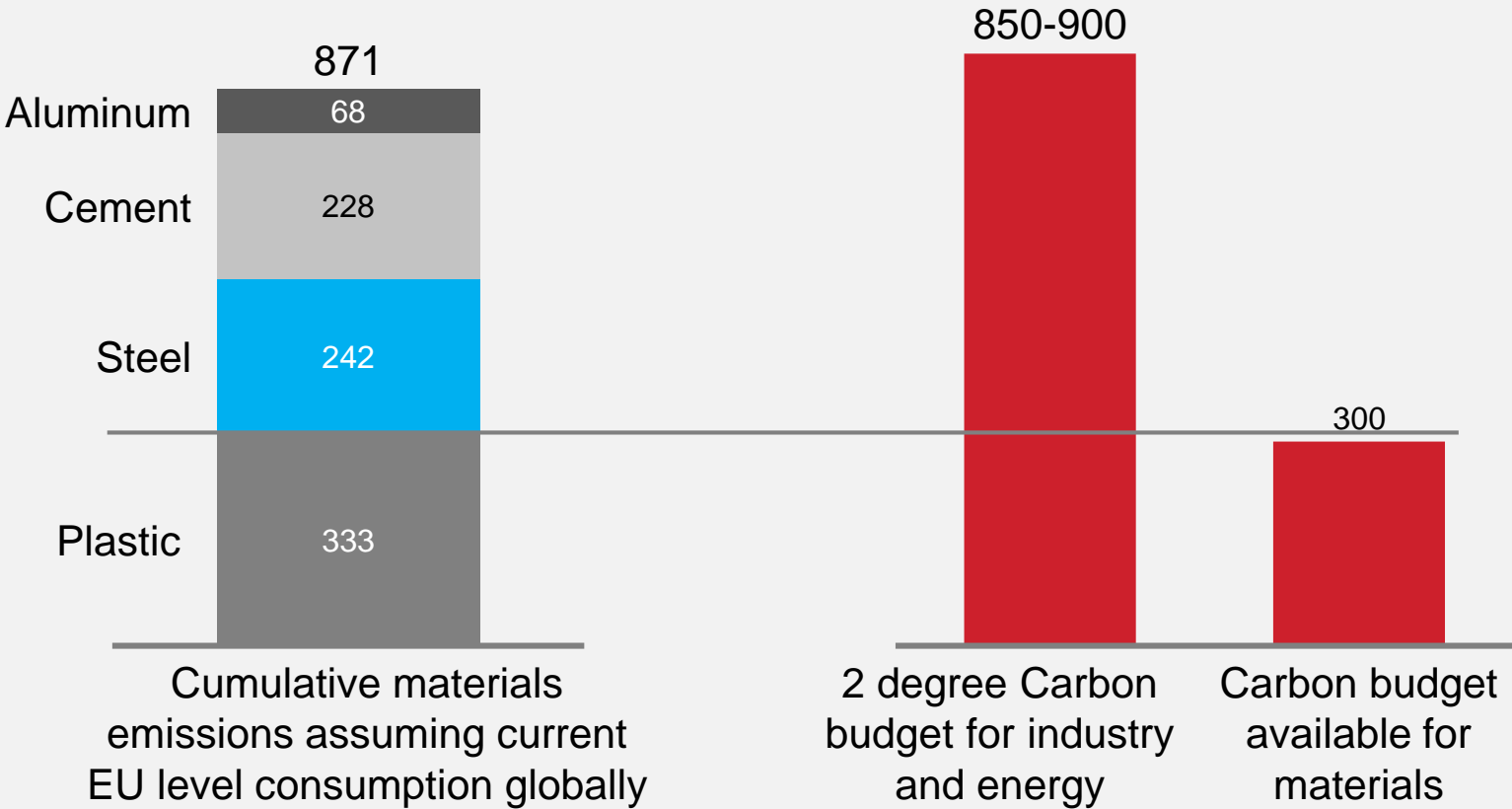
Plastic alone may well consume this century's carbon emission budget for materials

Cumulative emissions to 2100

GtCO₂, global, 2015-2100

Projected CO₂ emissions from materials

Carbon budget to 2100

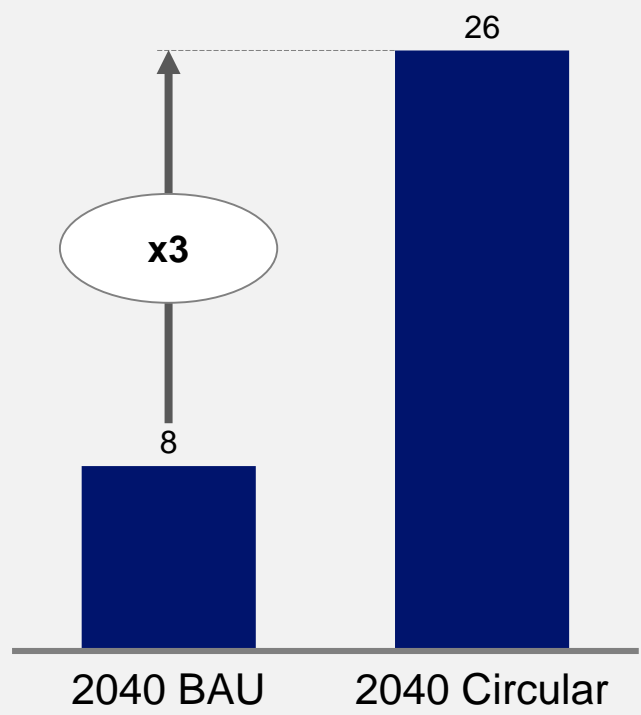


SOURCE: Material Economics 2018

Implementing a circular plastics scenario can triple value and reduce 2040 emissions by 50%

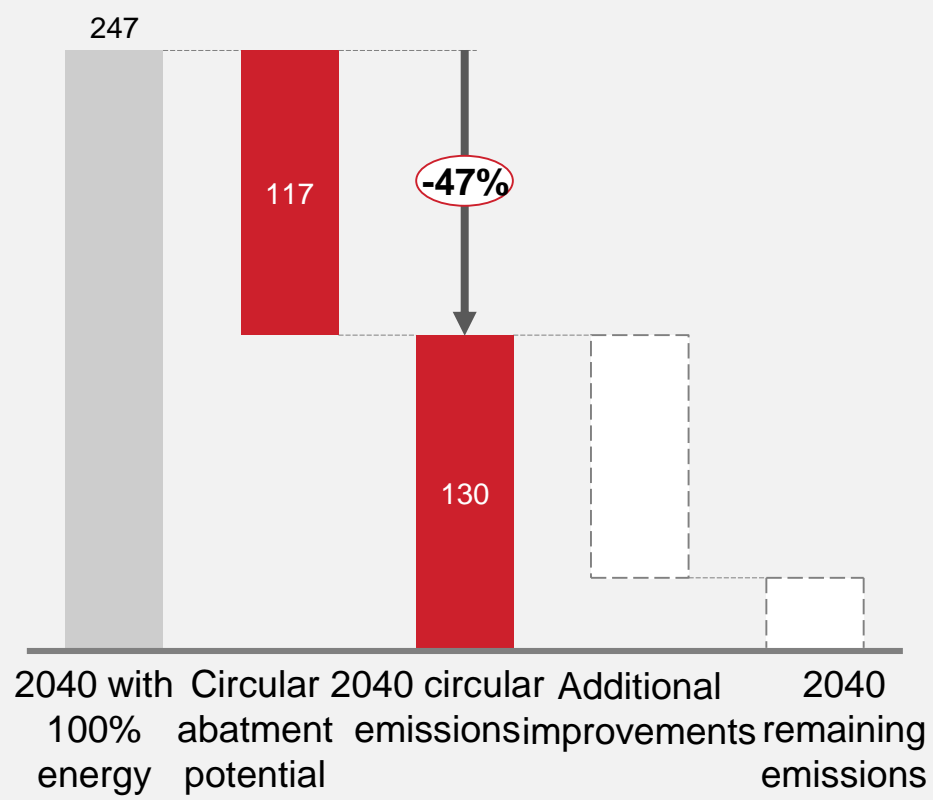
Circularity can triple the size of industry, unlocking value to fund the investment and processing required...

Remaining material value after one use cycle, 2040
Billion EUR/ year



... as well as reduce net emissions from plastic production and EOU treatment by 50%

Annual emissions, Europe, 2040
Mton CO₂e



SOURCE: Material Economics 2018

A storm of creative destruction – how can the waste and resource sector benefit?

First economy
(1820 – 2017)



Second economy
(2018 – 2038)



Winners and losers – five (cautious) considerations for a winning waste and recycling industry

First economy (1820 – 2017)



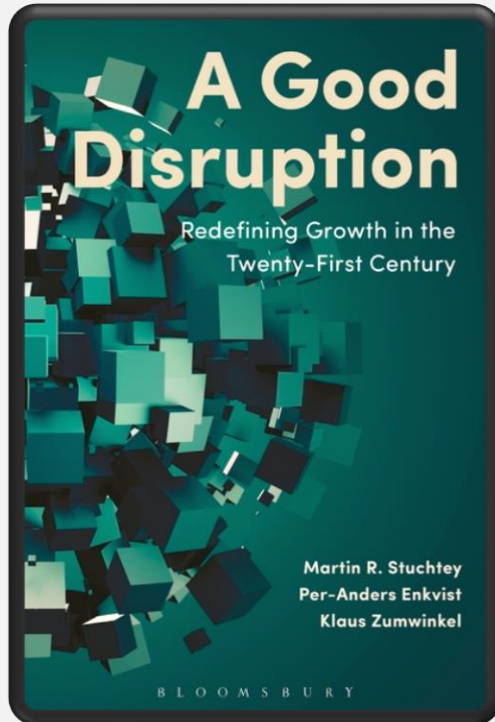
75 Trillion USD

1. **Decoupled:** Decouple the economy and decouple your business model
2. **Golden:** Don't sell materials – be the central bank, not the gold mine
3. **Linked:** Seek the intersect between new energy and material loops
4. **Digital:** Add information (and trust) to every traded unit of materials
5. **Global:** Go global and consider system know how as critical

Second economy (2018 – 2038)



75 Trillion USD



Thank you!

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