2021 SWITCH-Asia Leadership Academy on Technology for A Circular Economy

Introduction to Circular Economy

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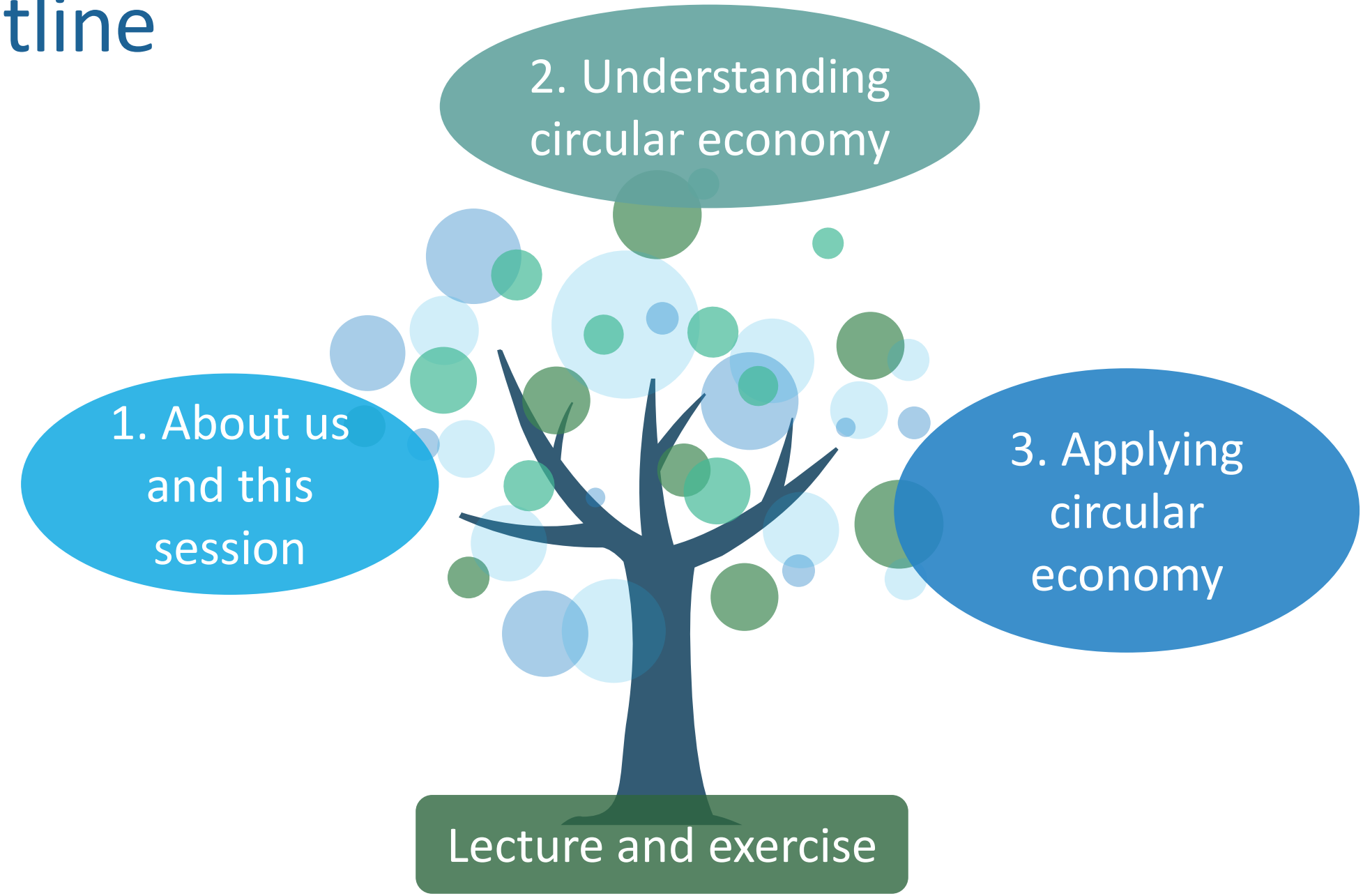
Outline


2. Understanding circular economy
1. About us and this session
3. Applying circular economy
Lecture and exercise

We are living in a

Material Cycling

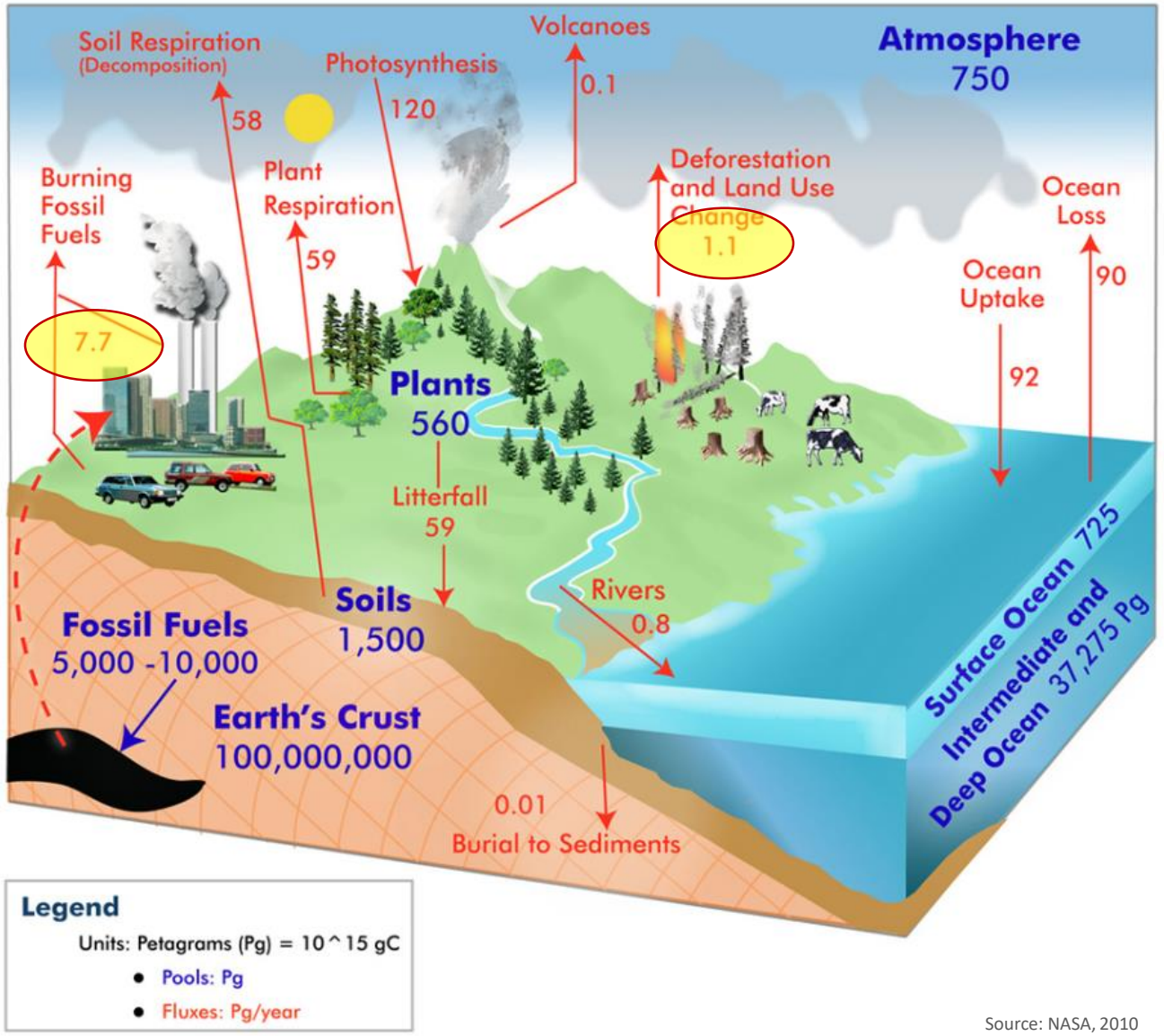
world!

Spaceship Earth

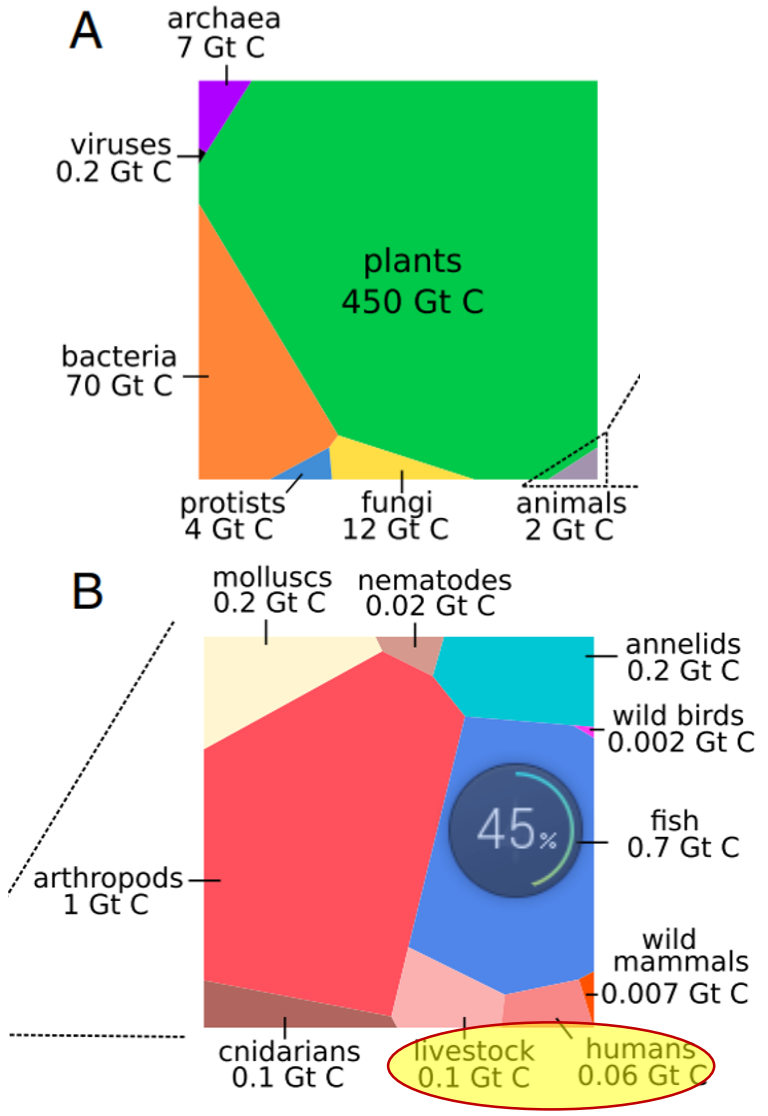
- K.E. Boulding (1966). *The Economics of the Coming Spaceship Earth*
- Transition from the **open unlimited 'cowboy' economy** to the 'spaceman' economy

- The closed economy of the future might similarly be called the **'spaceman' economy**, in which the Earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man must find his place in a **cyclical ecological system**

Biogeochemical cycle for Element Carbon



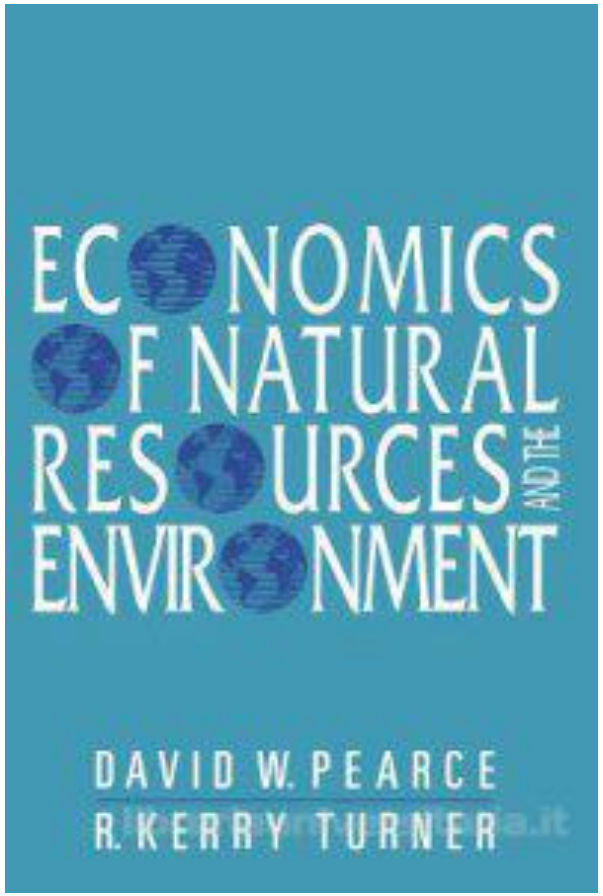
Source: NASA, 2010



Source: Bar-On et al., 2018

“Circular Economy” term created

D.W. Pearce and R.K. Turner (1989). ***Economics of Natural Resources and the Environment***. Johns Hopkins University Press

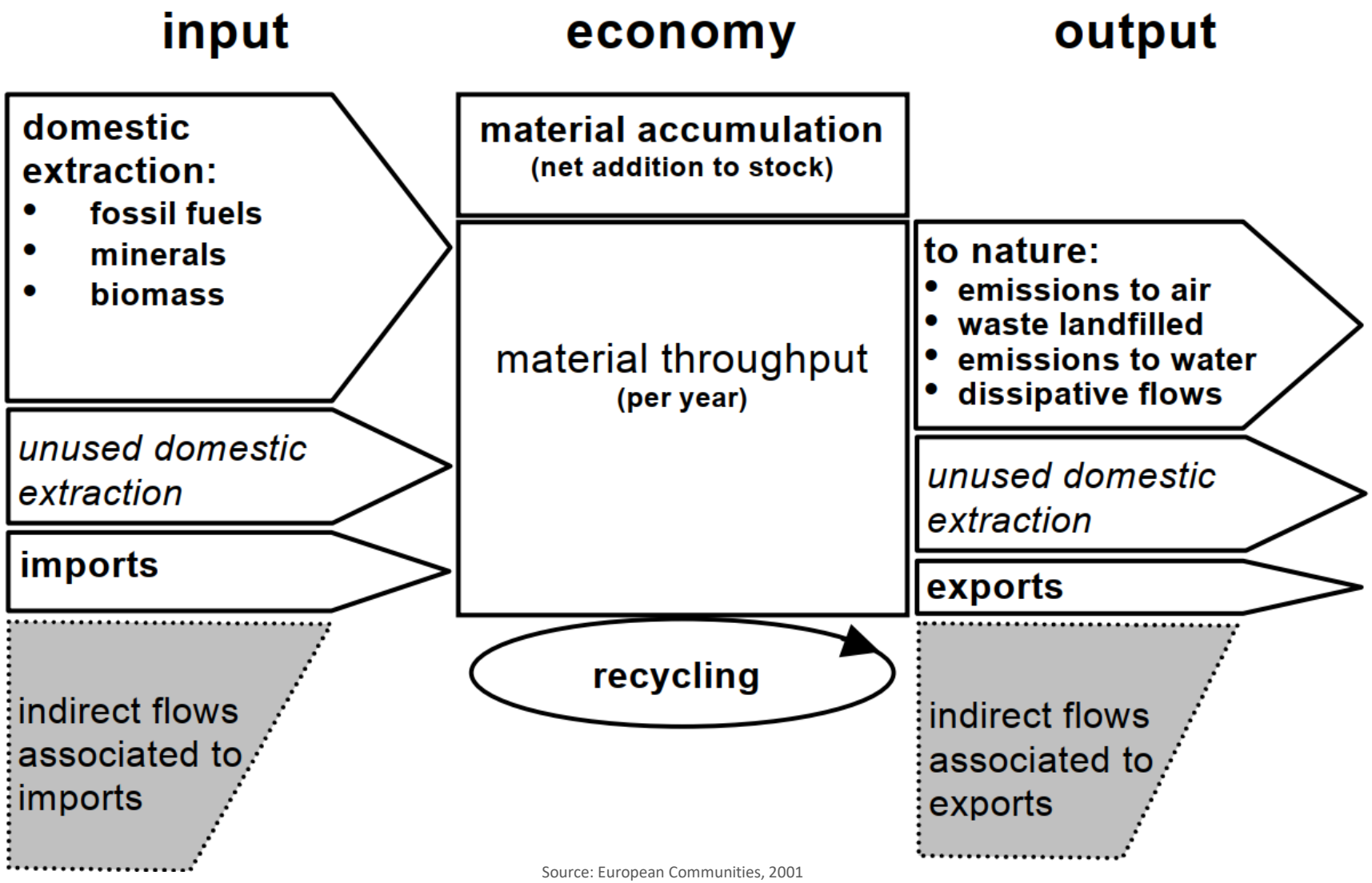


What is circular economy?

- Circular economy is an economic system aimed at minimizing waste and maintaining the value of products, materials and resources for as long as possible (*IRP and UNEP, 2019*)

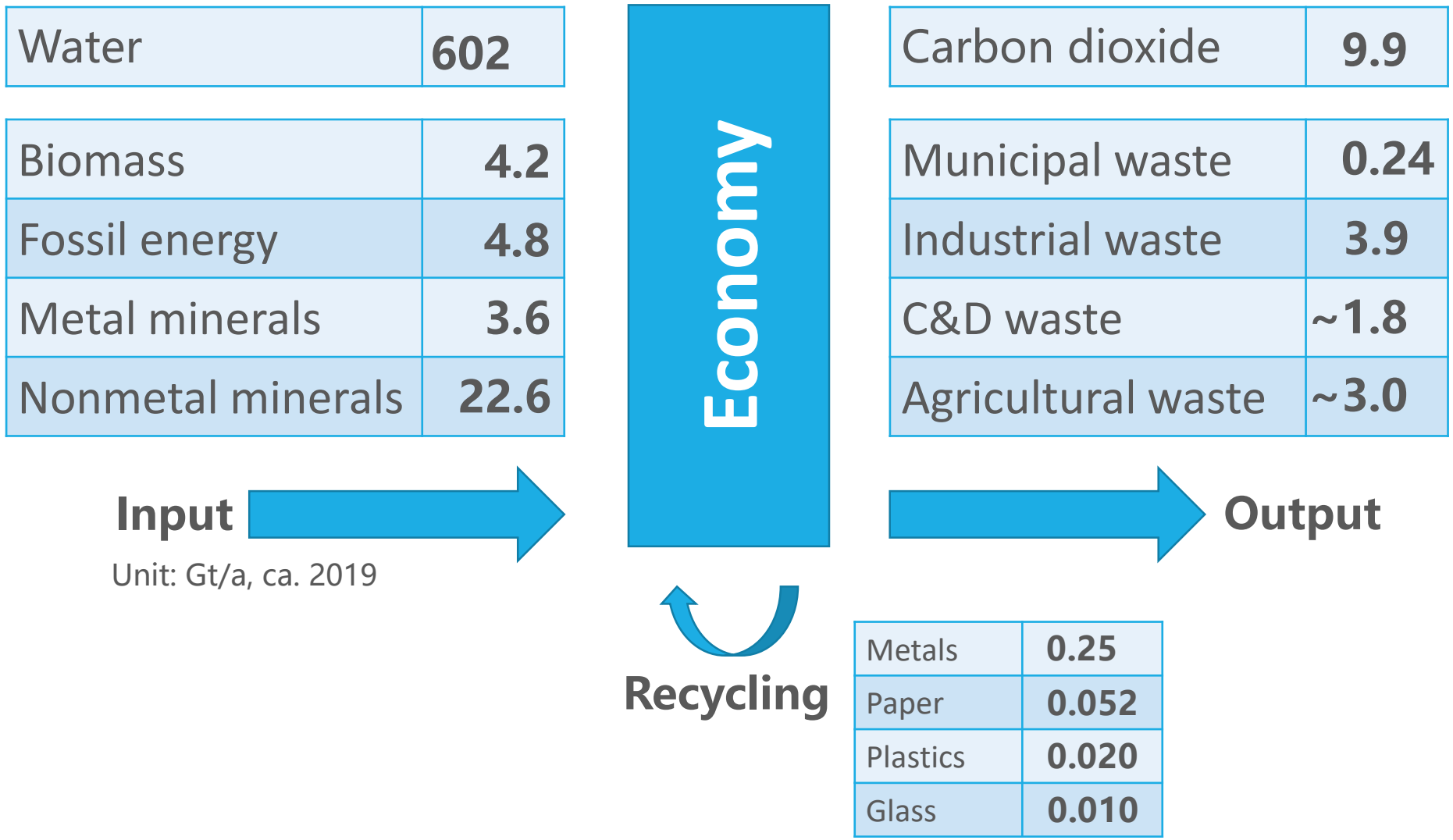
- Circular economy is a **revolution** to today's **linear economy** that vastly extracts and uses natural resources and vastly discharges wastes

Our economy today is largely linear

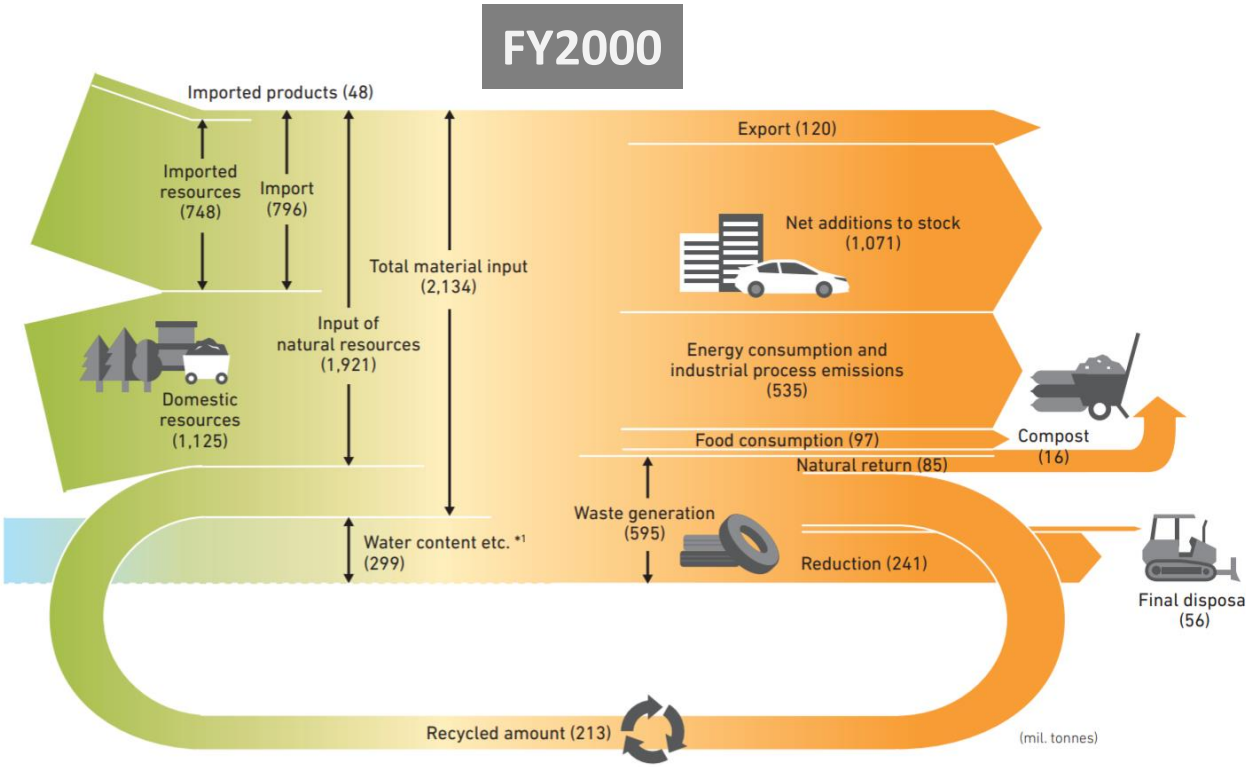


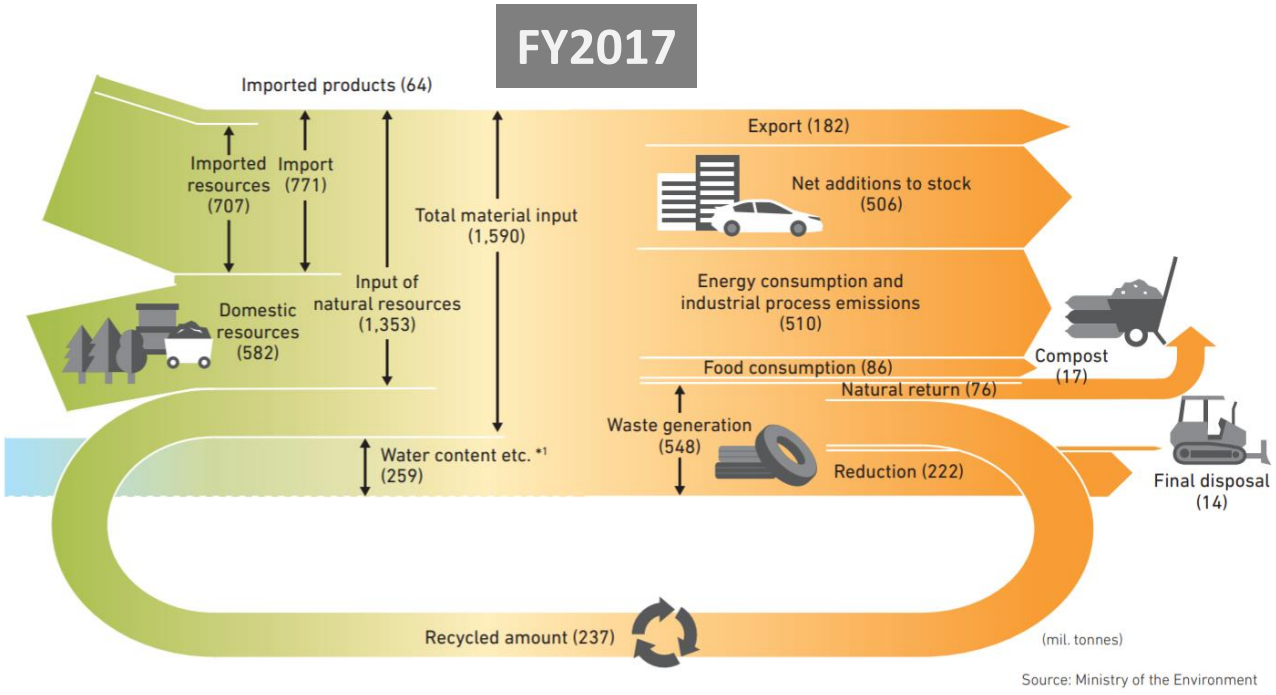
Source: European Communities, 2001

Case: the Chinese economy



Case: the Japanese economy

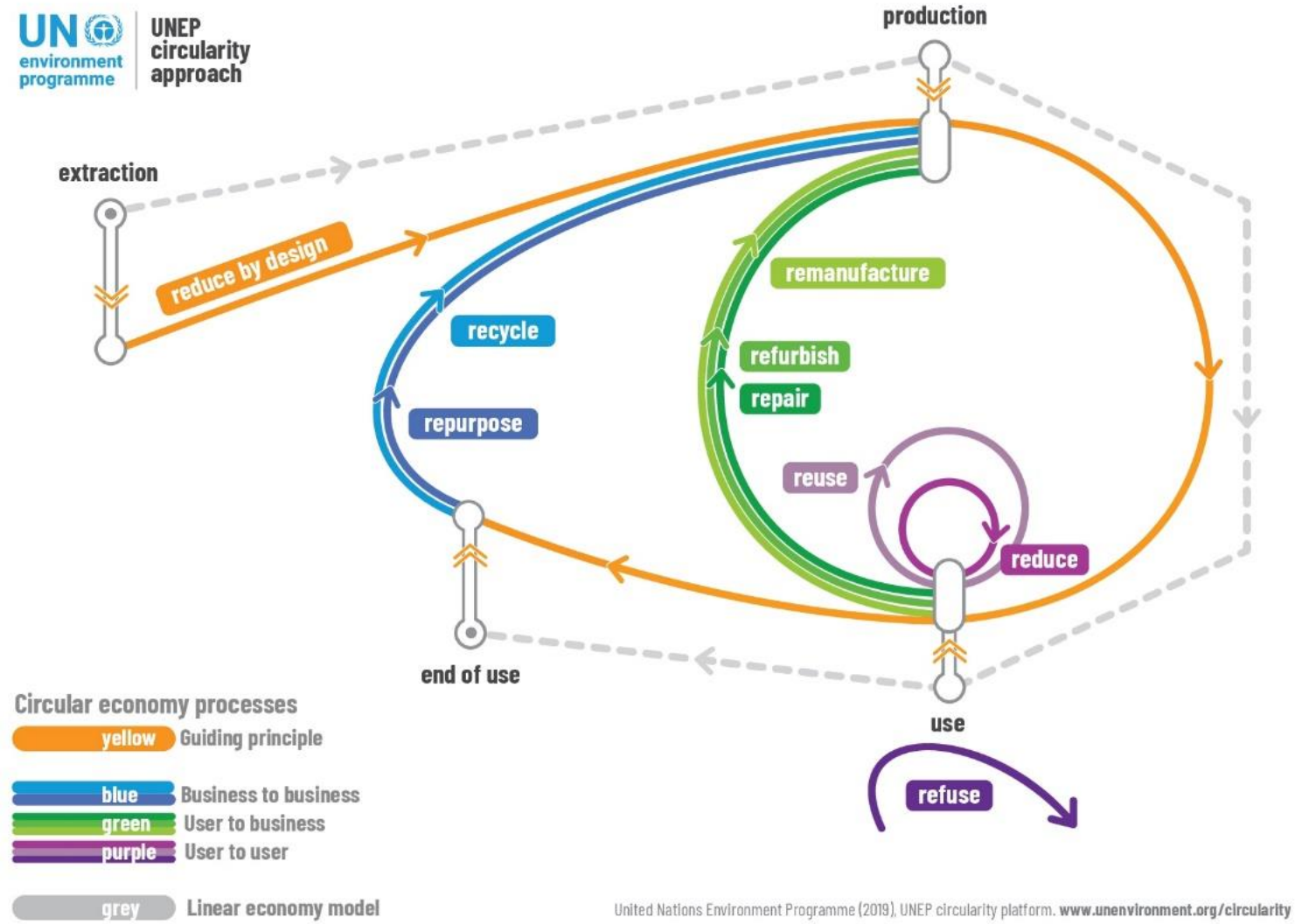




Source: Ministry of the Environment

CE approach: From 3R to 9R

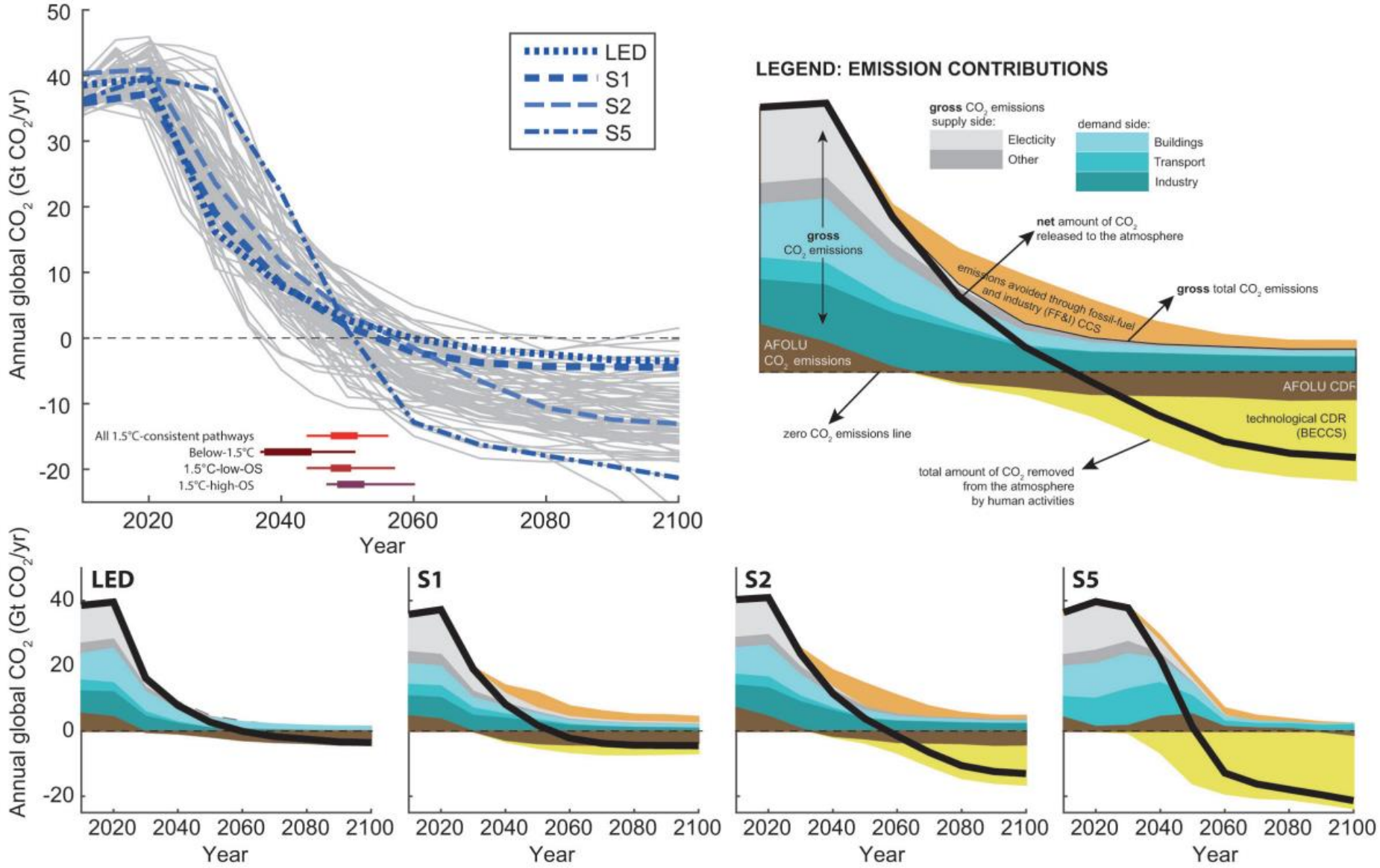
- System: Reduce by design
- User2user: Refuse, Reduce, Reuse
- User2business: Repair, Refurbish, Remanufacture
- B2B: Repurpose, Recycle



SDGs: CE can help

- **17** Sustainable Development **Goals** (SDGs), cover a broad range of development issues, in total **169 targets and 232 indictors**
- Heart of the *2030 Agenda for Sustainable Development* adopted by all UN members in 2015
- CE **directly relevant to many SDGs, including Goal 13** – Climate Action

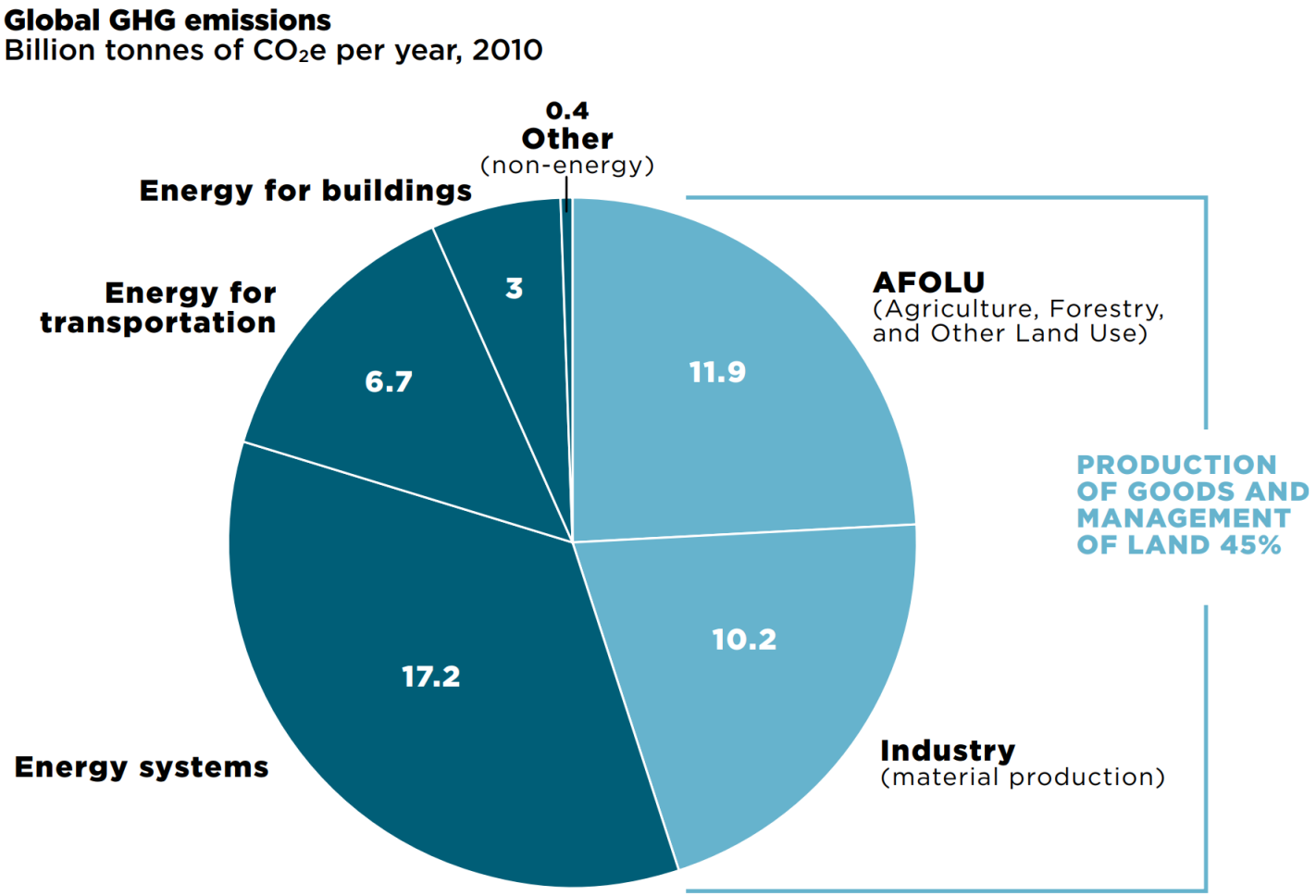
1.5˚ C climate action



Source: IPCC, 2018

CE contributes to climate action

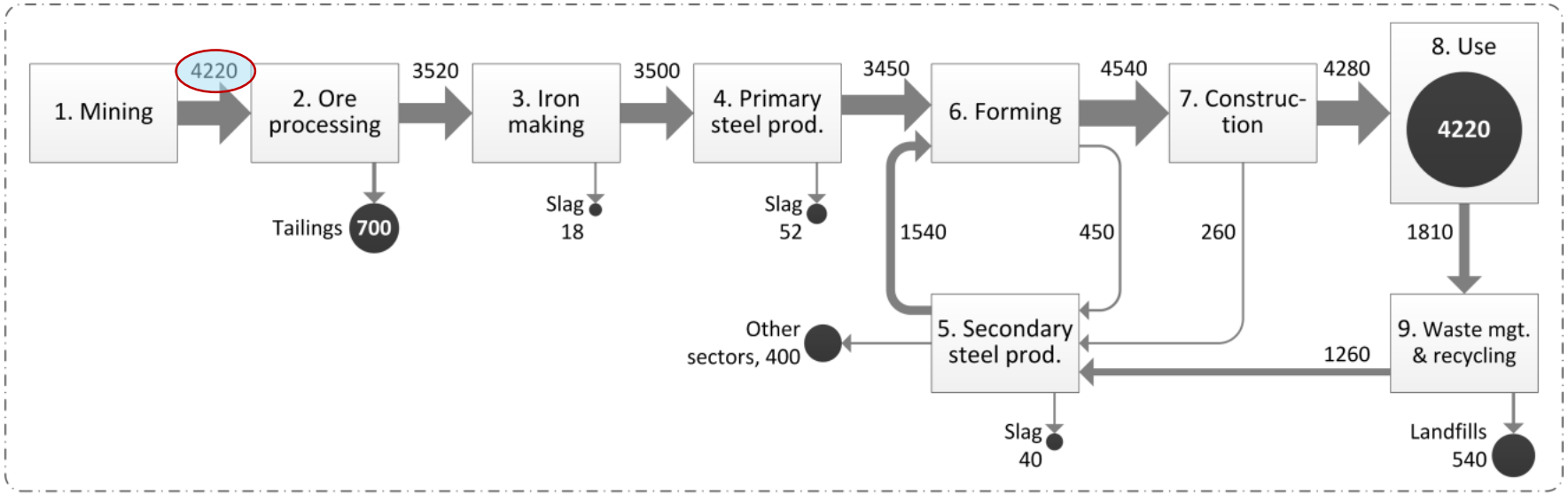
- **45%** GHG emissions from the products cycle where CE can work
- Renewable energy transition also needs **critical materials** (Si, Li, Cu, RE, …)



Source: Ellen Macarthur Foundation, 2019

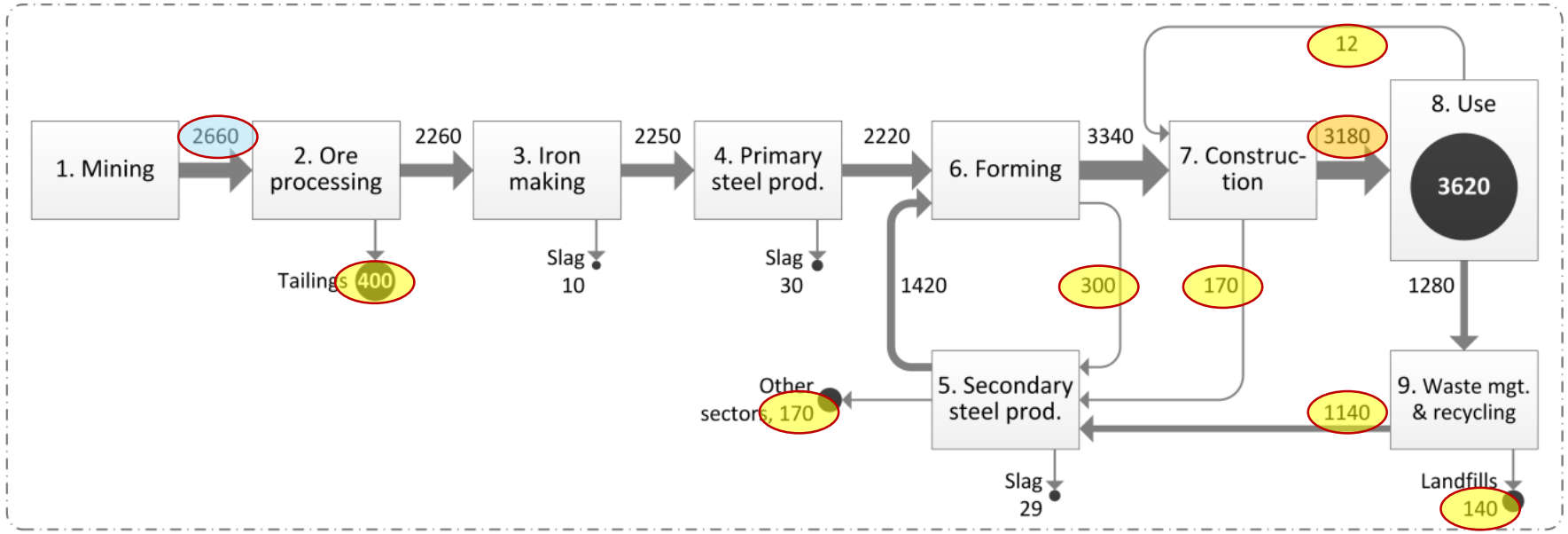
CE for building steel in China

Base scenario



System boundary: Steel cycle associated with buildings in China, 2013–2050, base scenario

CE scenario

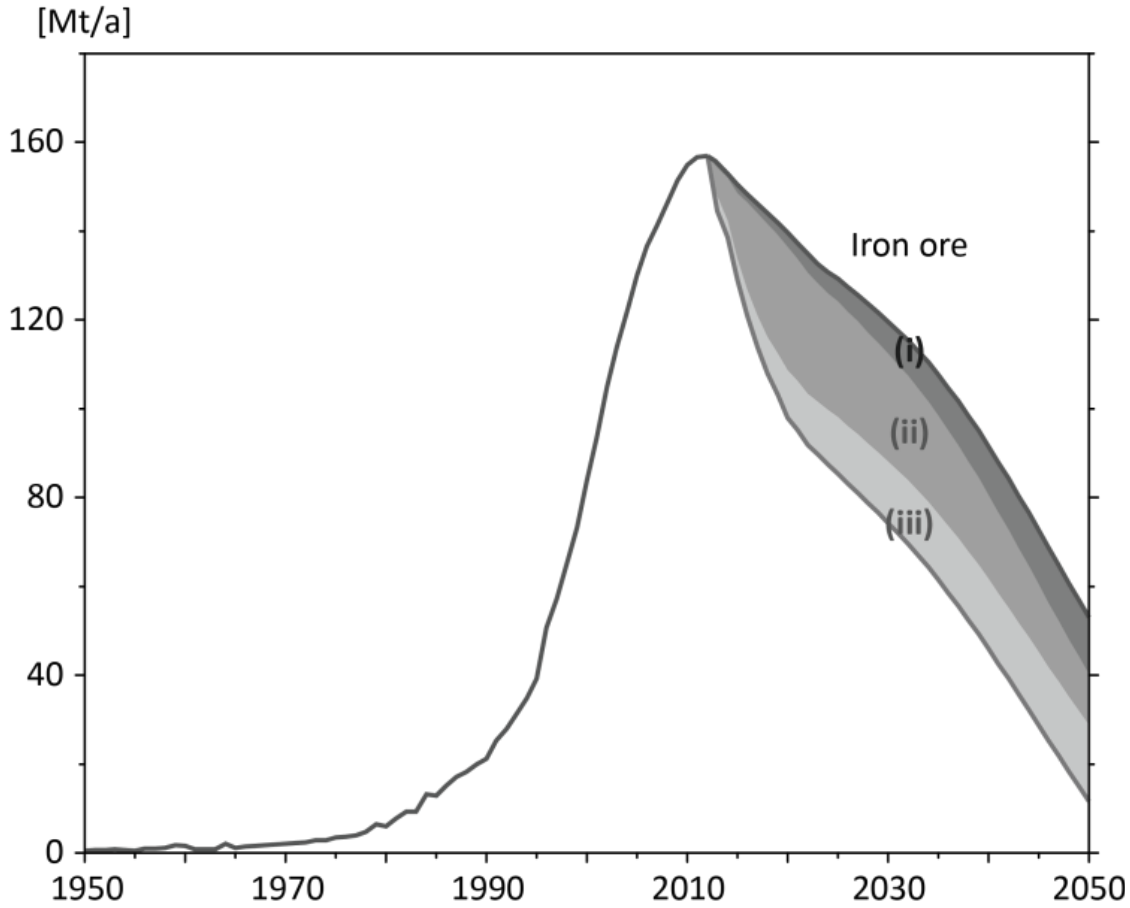


System boundary: Steel cycle associated with buildings in China, 2013–2050, conservation scenario

Source: Wang et al., 2015

CE for building steel in China

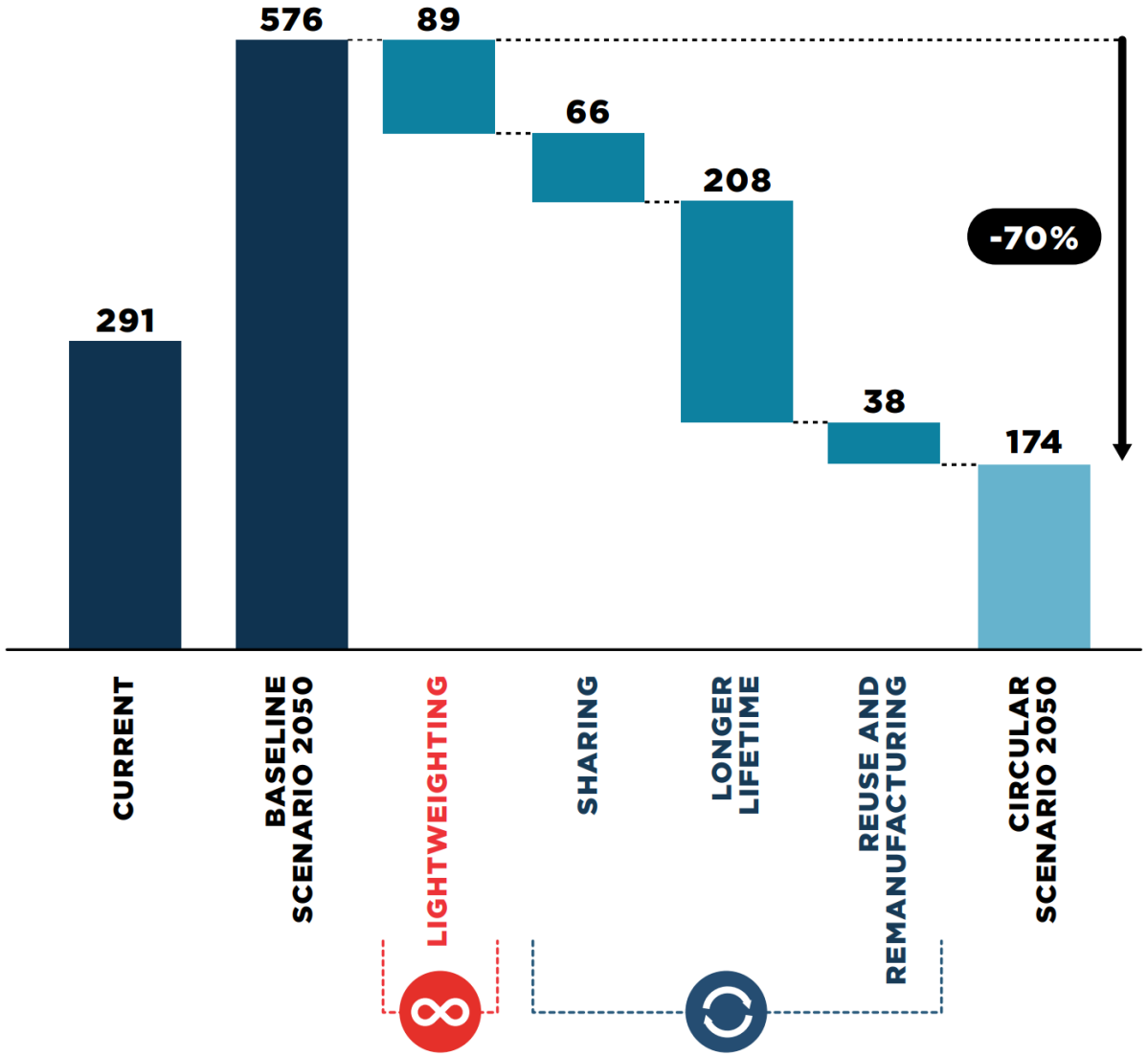
- 37% saving of iron ore via (i) longer building lifetime (7%), (ii) stronger but less steel use in buildings (18%), (iii) higher material efficiency in the steel cycle (12%)
- 27% reduction of GHG emissions from the steel



Source: Wang et al., 2015

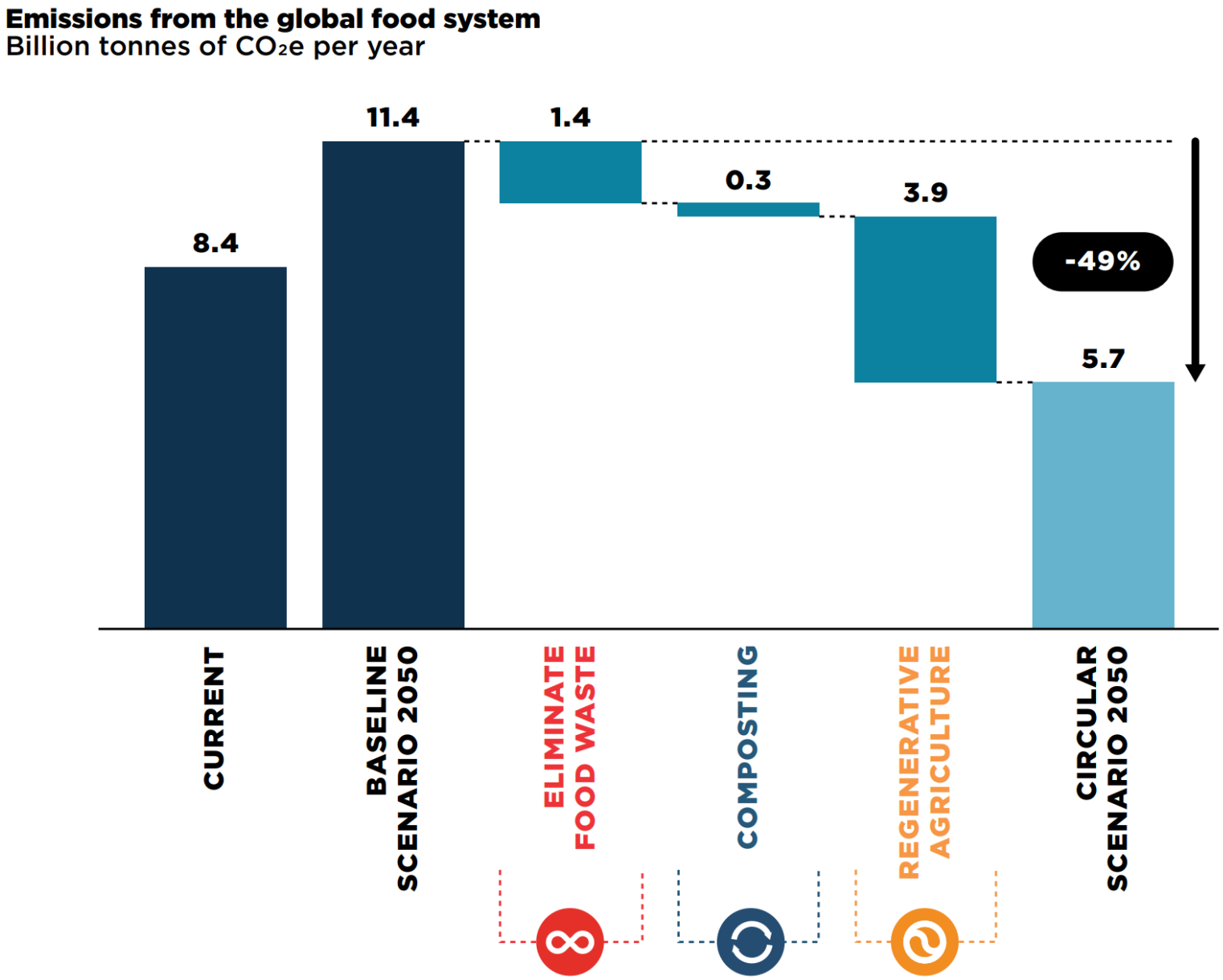
CE for passenger cars in the world

Emissions from all materials used in passenger cars
Million tonnes of CO_2 per year, globally



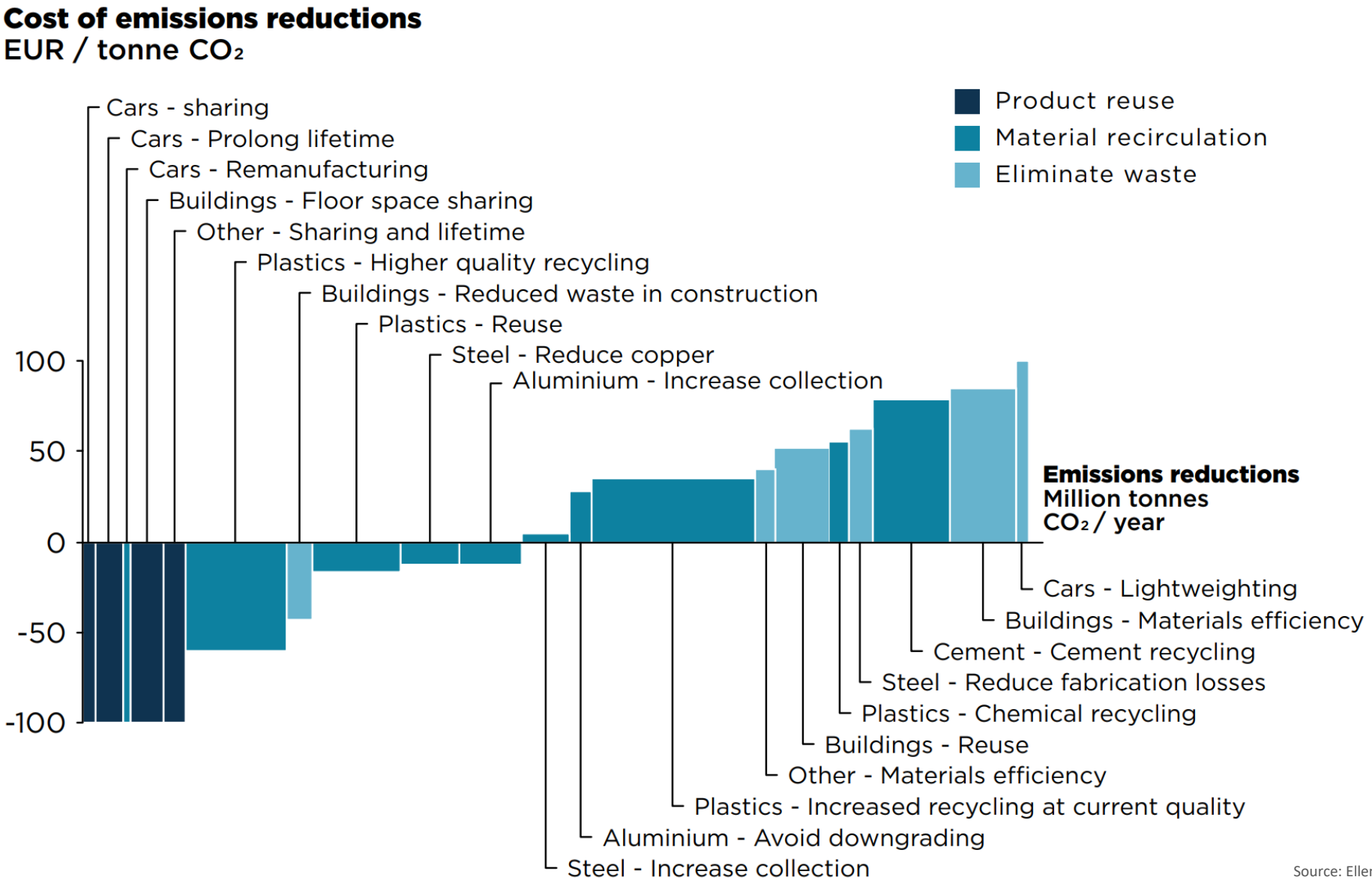
Source: Ellen Macarthur Foundation, 2019

CE for food system in the world



Source: Ellen Macarthur Foundation, 2019

CE is cost-effective and business-raising



Source: Ellen Macarthur Foundation, 2019

Tong Ji Da Xue

同 济 大 学

All in the same boat,
help each other!

Xun Huan Jing Ji

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Circularity

Thanks and see you again!

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