清華大學环境学院
SCHOOL OF ENVIRONMENT, TSINGHUA UNIVERSITY

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GEO 6 for Industry in Asia-Pacific and Circular Economy

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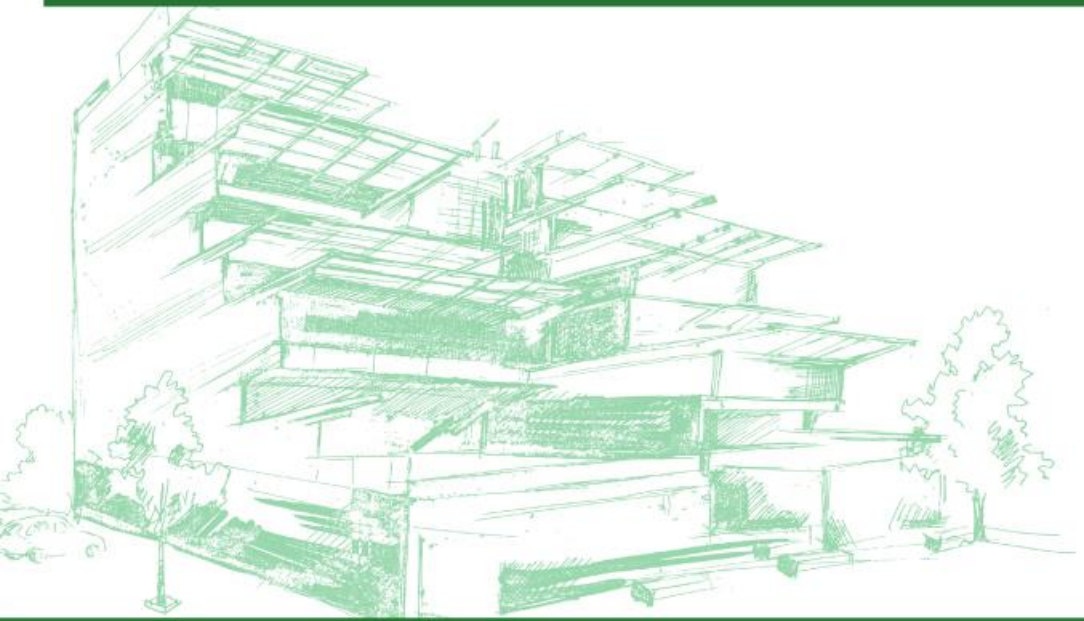
GEO 6 for Industry in Asia-Pacific



GEO 6 for Industry in Asia-Pacific

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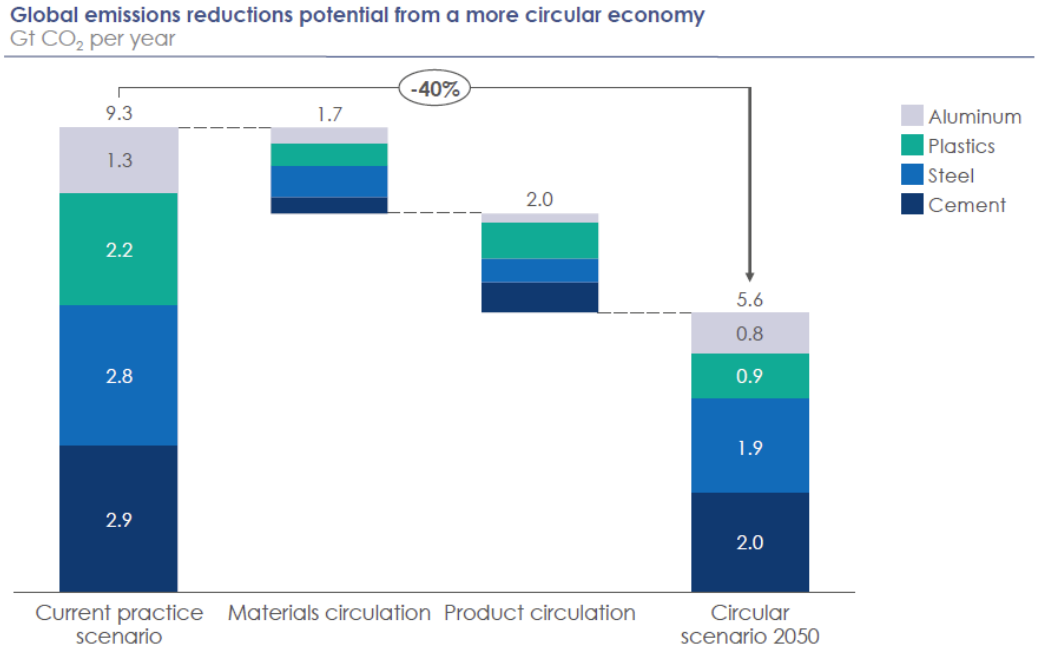
Chapter 1: Climate and Energy Efficiency

Key messages

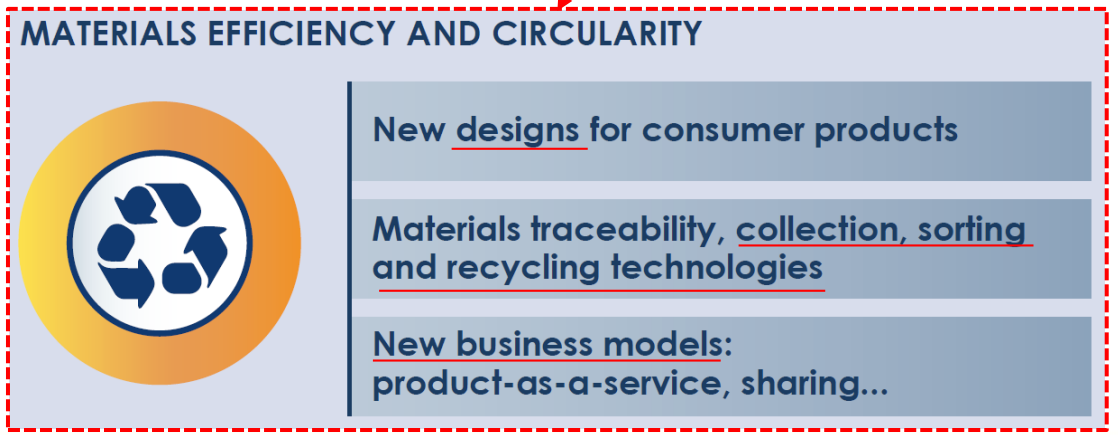
- Industry may have the highest potential of all sectors for energy end-use efficiency.
- Small-scale industry, however, is a unique sector requiring an out-of-the-box approach to make a difference.
- Energy auditing is a key tool for delivering energy efficiency in industry. But **more attention is needed to address hard-to-abate sectors**.
- The design of new industrial plants should incorporate the highest efficiency standards.
- Reusing waste heat is often a missed opportunity.

Chapter 1: Climate and Energy Efficiency



six innovation areas to fully decarbonize harder-to-abate sectors of the economy

A more circular economy can cut emissions from the harder-to-abate sectors in industry by 40% by 2050.



Source: Material Economics analysis for the Energy Transitions Commission (2018)

Chapter 2: Managing Air Pollution in Asia: Towards a Multi-Benefit, Multi-Source Strategy

Key Messages

- Despite many well proven solutions, air pollution has re-emerged as a serious threat to the health and well-being of much of Asia-Pacific.
- This chapter demonstrates how different sets of air pollution solutions from various industries can be implemented in the region.
- Open burning primarily from inadequate waste collection, treatment and disposal is an underrated source of air pollution. Another emerging source is poor manure management.
- The multiple co-benefits of clean energy hold promise to accelerate the transition to renewable energy and cleaner air that is already underway in some countries in the region.
- Governments need to build support for multi-sector and multi-solution strategies by working directly with the public, including in air quality monitoring.

Chapter 2: Managing Air Pollution in Asia: Towards a Multi-Benefit, Multi-Source Strategy

WASTE

- **Residential waste burning:** Strictly enforce bans on open burning of household waste
- **Solid waste management:** Encourage centralized waste collection with source separation and treatment, including gas utilisation
- **Wastewater treatment:** Introduce well-managed two-stage treatment with biogas recovery

SOLVENTS, OIL AND GAS

- **Oil and gas production:** Encourage recovery of associated petroleum gas; stop routine flaring; improve leakage control
- **Solvent use and refineries:** Introduce low-solvent paints for industrial and do-it-yourself applications; leak detection; inceneration and recovery
- **Coal mining:** Encourage pre-mining recovery of coal mine gas

Emerging industries that can help control and reduce waste burning through improved waste management is expected as governments work relevant solutions into their air pollution strategies.

Chapter 3: Water Scarcity and Quality

Key Messages

- Rapid changes in Asia and the Pacific are putting huge pressures on the region's water resources, especially in the industry and agriculture sectors.
- Intensive livestock production is polluting surface and groundwater, including with antibiotic resistant microbes.
- Water pollution from industrial-scale aquaculture operations is also increasing.
- Industry needs to be held responsible for implementing technological innovations that protect the environment, complementing a comprehensive mix of regulatory and other policy instruments.
- Industrial scale agriculture and aquaculture need to be treated like other industries, as a potentially serious source of environmental pollutants and hidden health impacts.

Chapter 4: Biodiversity and Industry

Key Messages

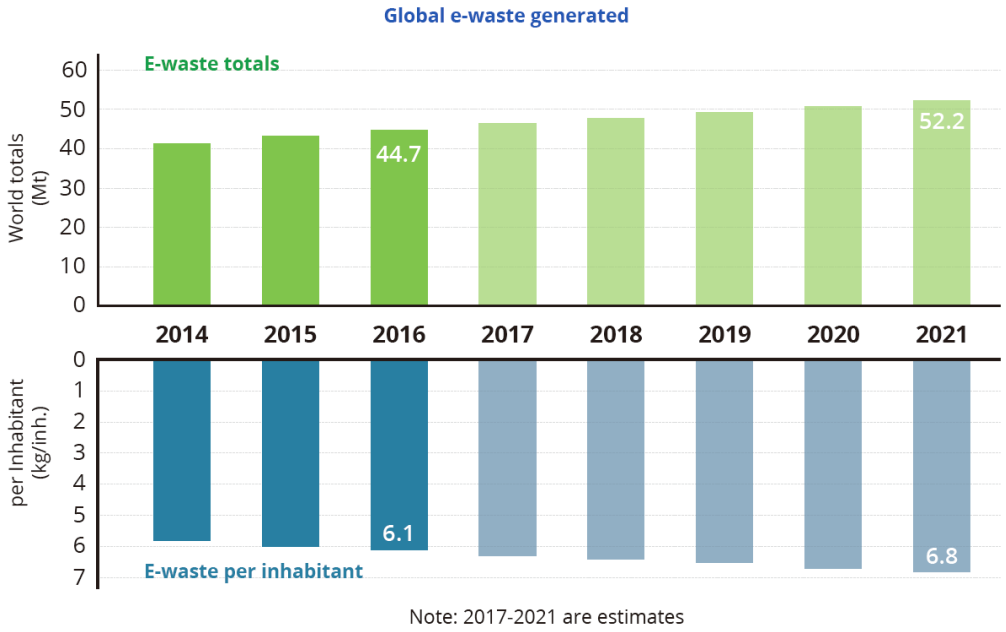
- Industry is a main driver of biodiversity loss and new threats are constantly emerging.
- Biodiversity and ecosystem services are being lost at an alarming rate. Without transformational changes in industrial production systems and consumption patterns, the basic functioning of vulnerable ecosystems will continue to break down.
- Biodiversity includes the genetic resources that constantly fuel the pharmaceutical industry's quest for more and better medicines.
- Synthetic biology, such as lab-grown "meat" is also developing rapidly and becoming available commercially, but cannot replace biodiversity.
- While industry is a driver of both biodiversity loss and of innovation that may contribute to conserving biodiversity, biodiversity is a driver of industrial innovation and a resource base for industry.

Chapter 5: Electrical and Electronic Waste

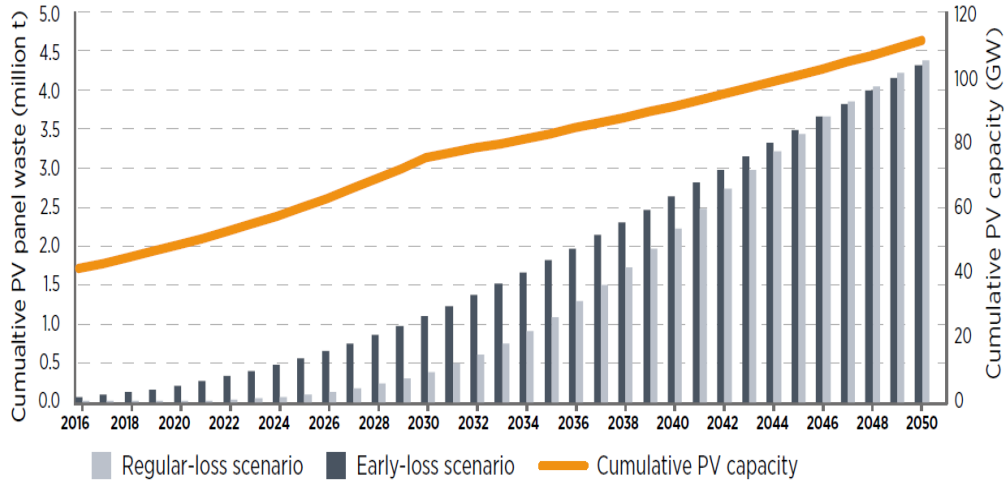
Key Messages

- Rapid industrialisation and middle-class population growth in Asia and the Pacific have led to increasing consumption of electrical and electronic equipment (EEE) and makes EEE life shorter.
- End-of-life solar photovoltaic panels and electric vehicle batteries will be emerging waste disposal issues in the next two decades.
- Electrical and electronic waste processing has toxic impacts on the environment and human health.
- Governments of developing countries in Asia and the Pacific should consider designing, promulgating and implementing legislation on e-waste management. New waste management facilities are needed for these emerging waste sources.

Chapter 5: Electrical and Electronic Waste



Source: Baldé et al. (2017)

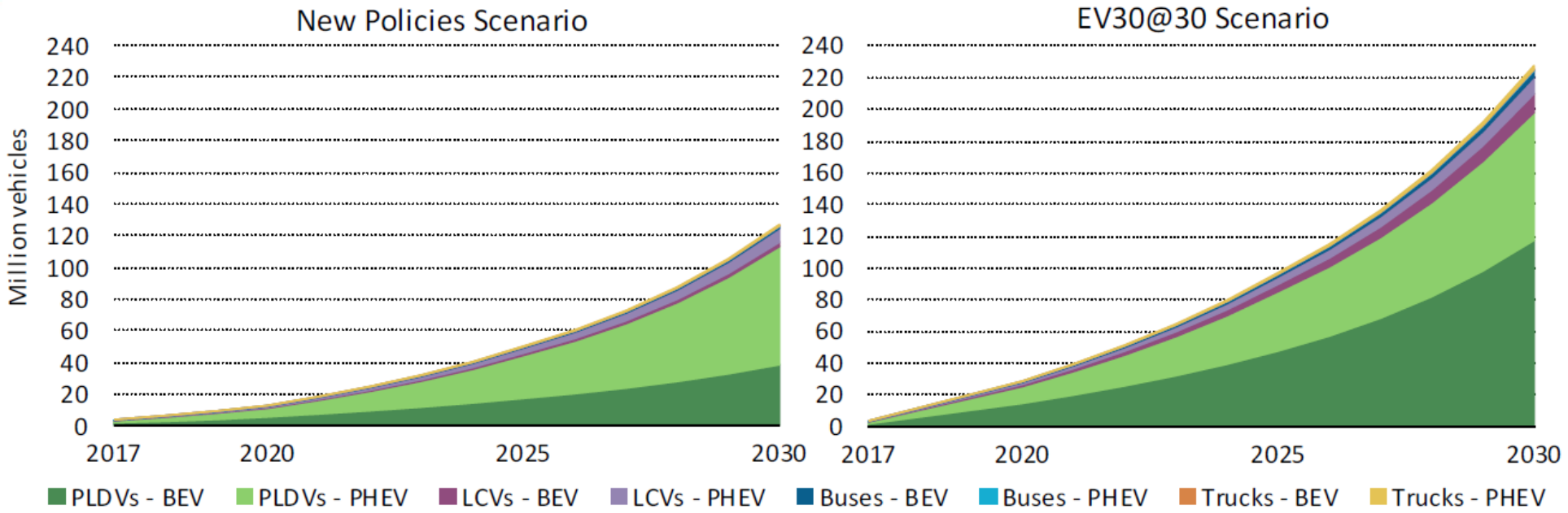


Source: IRENA and IEA-PVPS 2016

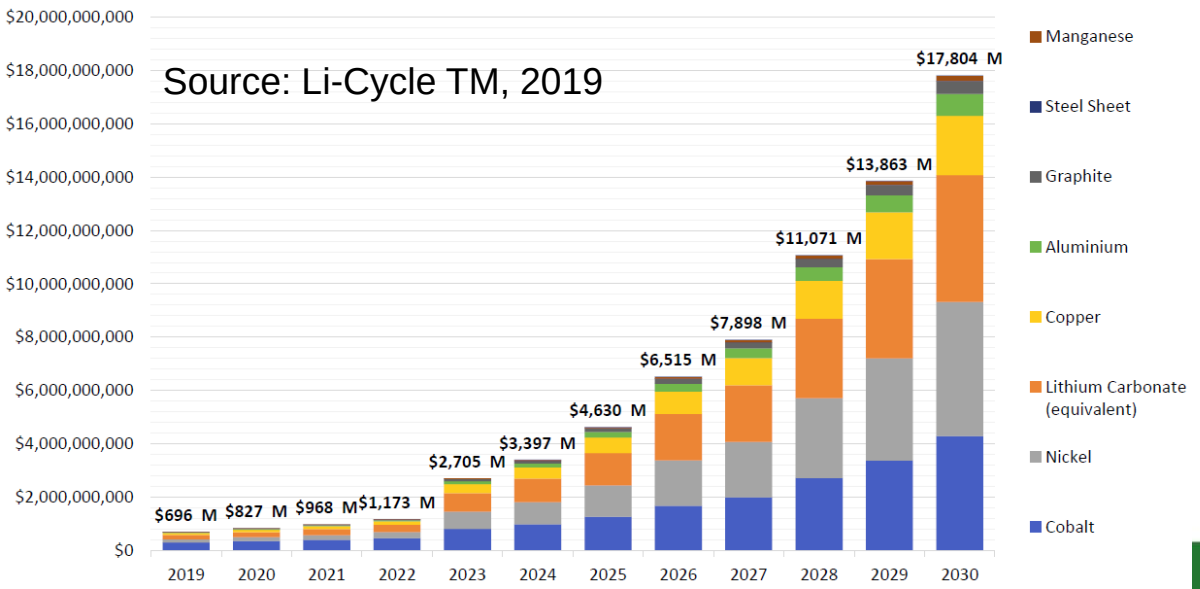
Resource recovery provides an incentive for effective recycling of WEEE:

- The total value of all raw materials in WEEE which have not been totally extracted and reused in the economy in 2016 was estimated at approximately EUR 55 billion (around US$ 60 billion) (Baldé et al. 2017).
- Material recovery from PV panels could cumulatively reach to US$ 450 million (in 2016 terms) by 2030, equivalent to the amount of raw materials currently needed for production of 60 per cent of new PV panels (IRENA and IEA-PVPS 2016).

Chapter 5: Electrical and Electronic Waste



Source: IEA analysis developed with the IEA Mobility Model (IEA, 2018)



- As the EV stock number is increasing rapidly, reaching around 120-220 million vehicles in 2030 .
- The reuse and recycling could reach to 17.80 billion USD.
- EV battery waste is also increasing fast. It is estimated that, by 2020, about 250,000 tons of batteries from EVs will have to be disposed of or recycled

Chapter 6: Microplastics and Nanomaterials

Key Messages

- Unfortunately, the main strength and durability features that make plastic so valuable also make it one of the world's most persistent pollutants, accumulating in landfills, agricultural fields, forests, streams and lakes and the oceans.
- Macro-plastics get most of the attention, through shocking deaths of marine mammals, but microplastics are an emerging concern.
- Microplastics adsorb toxic chemicals and potentially harmful effects are being increasingly revealed.
- Wastewater treatment systems do not capture all microplastics and they are found in nearly all bottled water.
- Nanomaterials are also raising concern but even less is known about their impact on the environment and on humans.

Chapter 7: Pharmaceuticals and Personal Care Products

Key Messages

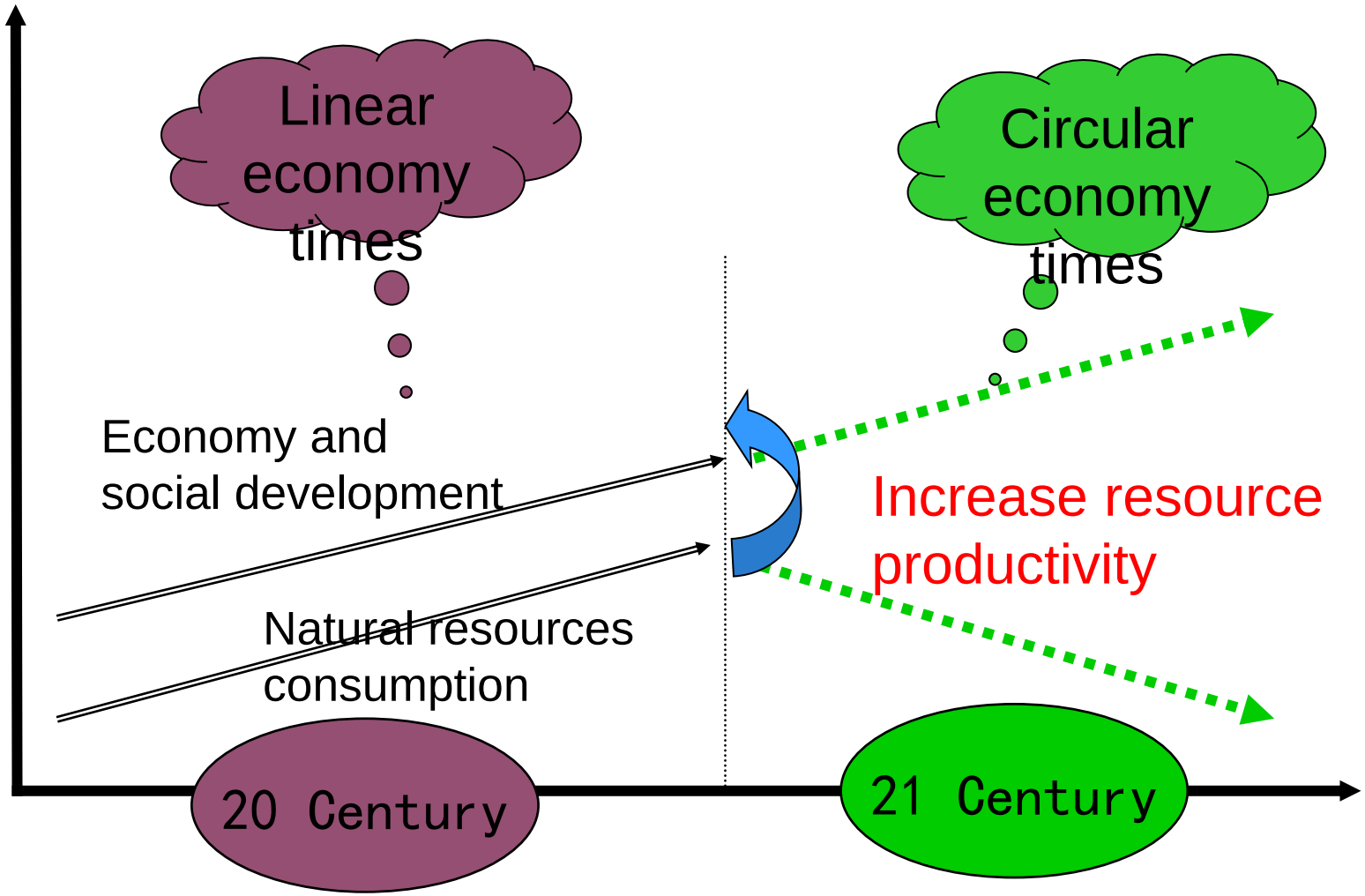
- Around 500 000 chemical products, including 4 000 pharmaceuticals, are used to make lives more fulfilling, easier and healthier.
- Pharmaceuticals, personal care products, hormones, pathogens and other chemical are now viewed as contaminants of emerging concern.
- Many of these contaminants are not removed in water treatment systems, and treated water may even contain illicit drugs and pharmaceuticals.
- Pharmaceuticals persistent in the environment, including synthetic hormones, anti-inflammatory drugs and anti-depressants, have been detected in soil, surface and groundwater, marine ecosystems and sediment.
- They may cause behavioural change, endocrine disruption, and even species extinction.

Chapter 8: Conclusions

Key Messages

- **Industrialisation is proceeding rapidly in Asia and the Pacific** and has been instrumental in lifting millions of people out of poverty. **The downside of that industrialisation has been air, water and land pollution, depletion of natural resources and its contribution to climate change.**
- As industrial production systems transition in advanced countries from the archaic steam engines and belt-and-pulley systems to robots, artificial intelligence and blockchain technologies, there are multiple opportunities to minimise the impact of industry on the environment.
- These opportunities won't emerge on their own. Governments and Industry need to work together to come up with **sustainable solutions** to the emerging environmental problems in the region.

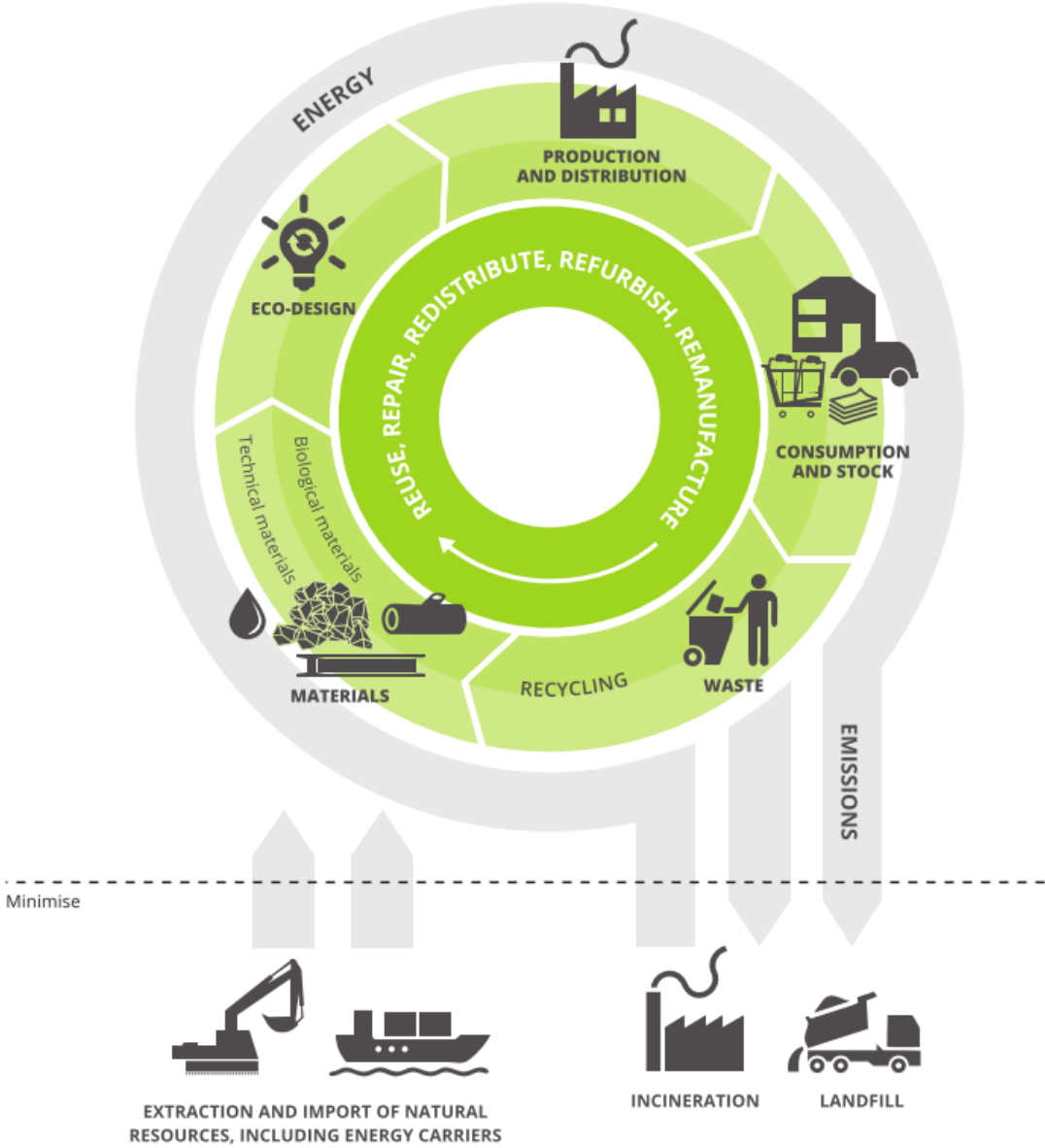
Circular economy: from strong materialization to dematerialization



Circular economy: solving the problems of economic and social development and resource consumption

In essence, a circular economy represents a fundamental alternative to the linear take-make-consume-dispose economic model that currently predominates.

Under the basic principles of technical feasibility and economic rationality. It takes reduction as the core, and reuse and recycling as key measures.



Source: EEA based on Eurostat, 2015b, 2015c.

History to recognize circular economy (1966-2016)

1960s

Prof. Boulding: The Economics of the Coming Spaceship Earth

1970s

Kneese & Ayres: Economics and the Environment: A Materials Balance Approach

1980s

New words for Circular Economy (1989)

1990s

Graedel & Allenby: Industry Ecology (1995)

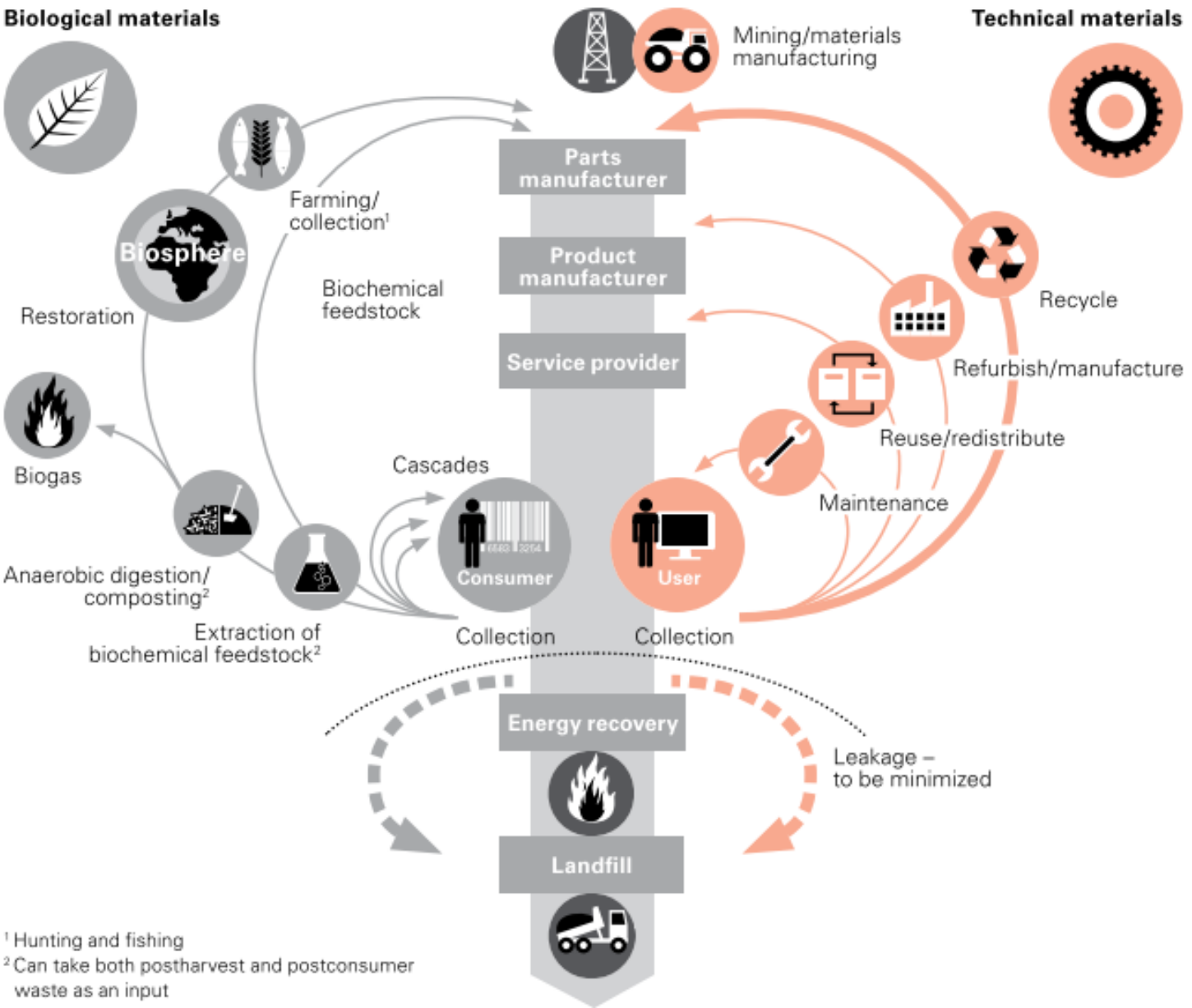
2000s

Multi branches under circular economy

2010s

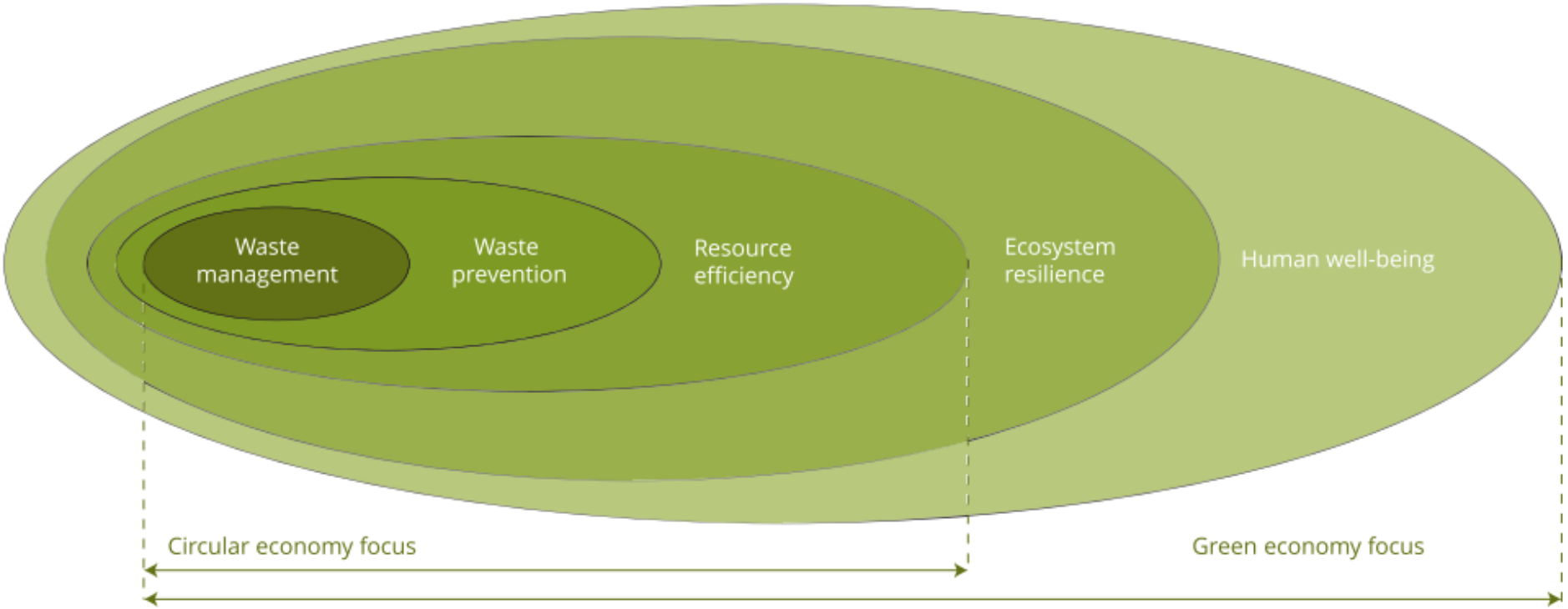
Ellen MacArthur Foundation: theory of circular economy

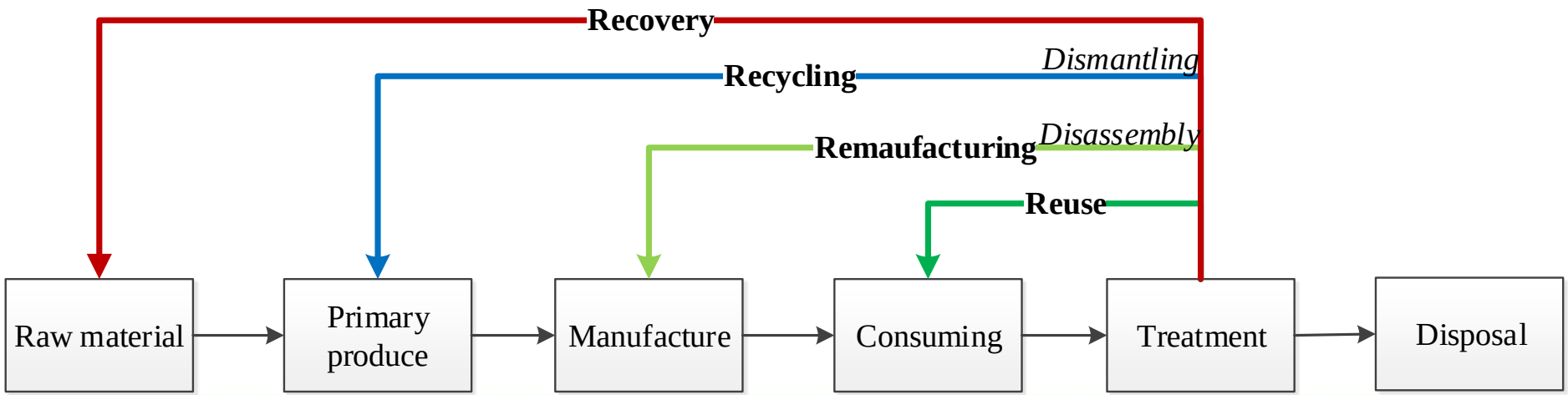
Ellen MacArthur Foundation: Theory of Circular Economy



Source: Ellen MacArthur Foundation

Scope of circular economy





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Thank You

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