Beyond net zero to planet positive

Three transitions to return within the boundaries of a habitable earth

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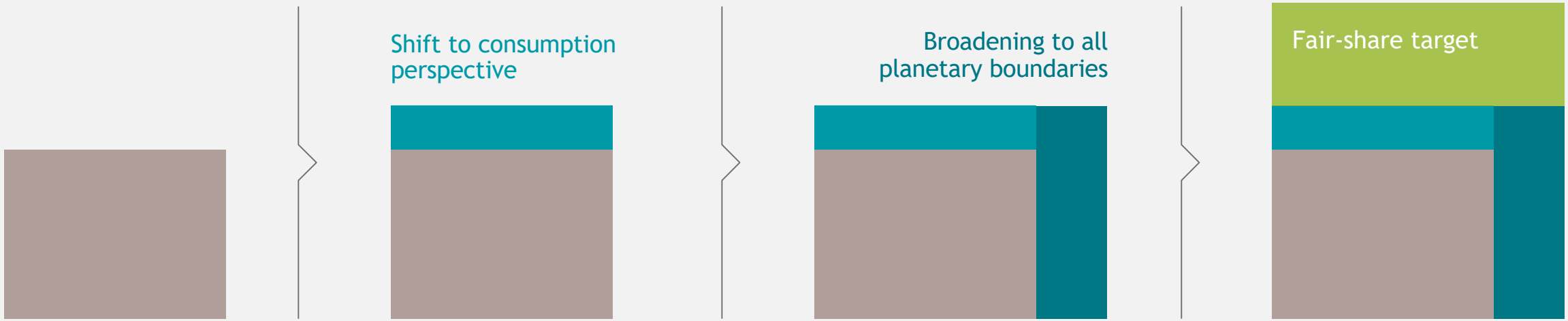
In our report we describe three perspective shifts that broaden the Dutch sustainability challenge



National target to address climate change from the production perspective

National target to address climate change from the consumption perspective

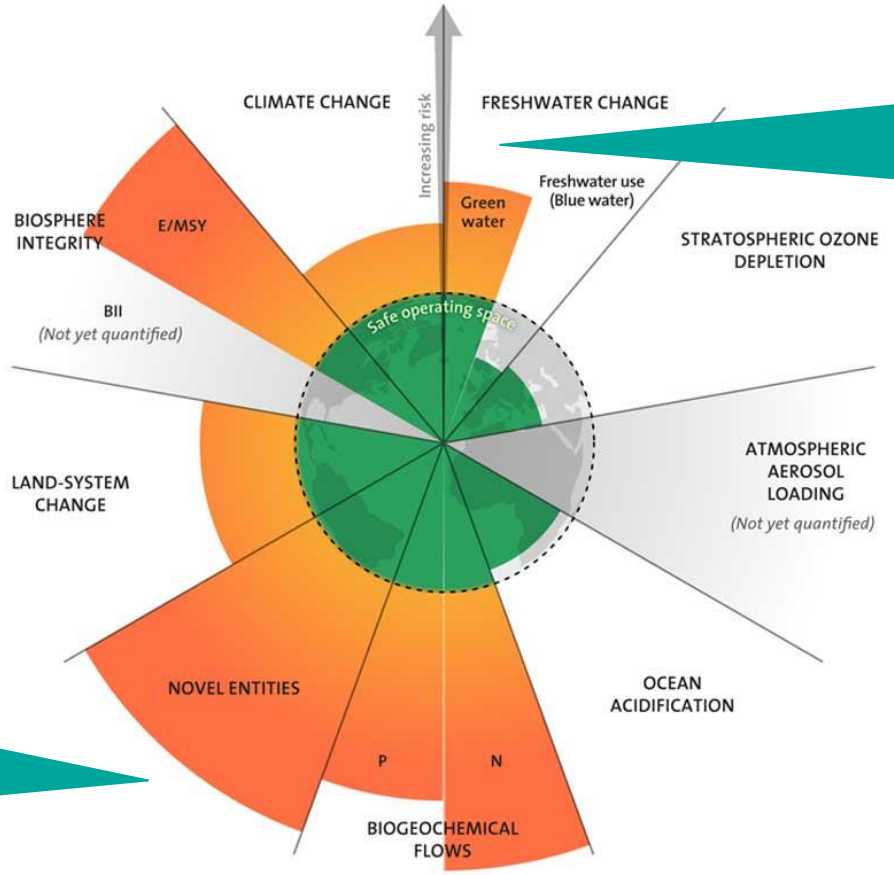
National target for all planetary boundaries from the consumption perspective

Fair-share target for all planetary boundaries from the consumption perspective

Sustainability is more than climate change: nine planetary boundaries define a safe operating space for humanity to retain a habitable earth

Note: blue is safe, yellow is increasing mid- and long-term risk, red is acute risk.
Source: Rockström & Gaffney, 2020, Breaking Boundaries; Steffen et al., 2015, Planetary Boundaries: Guiding human development on a changing planet, Science; Bernhardt et al. 2017, Synthetic chemicals as agents of global change; Mercator Research Institute on Global Commons and Climate Change, 2021, That's how fast the carbon clock is ticking; Lucas and Wilting 2018, Using planetary boundaries to support national implementation of environment-related Sustainable Development Goals, PBL Netherlands Environmental Assessment Agency, The Hague.

Since the publication of our report, two further exceedances of planetary boundaries have been quantified

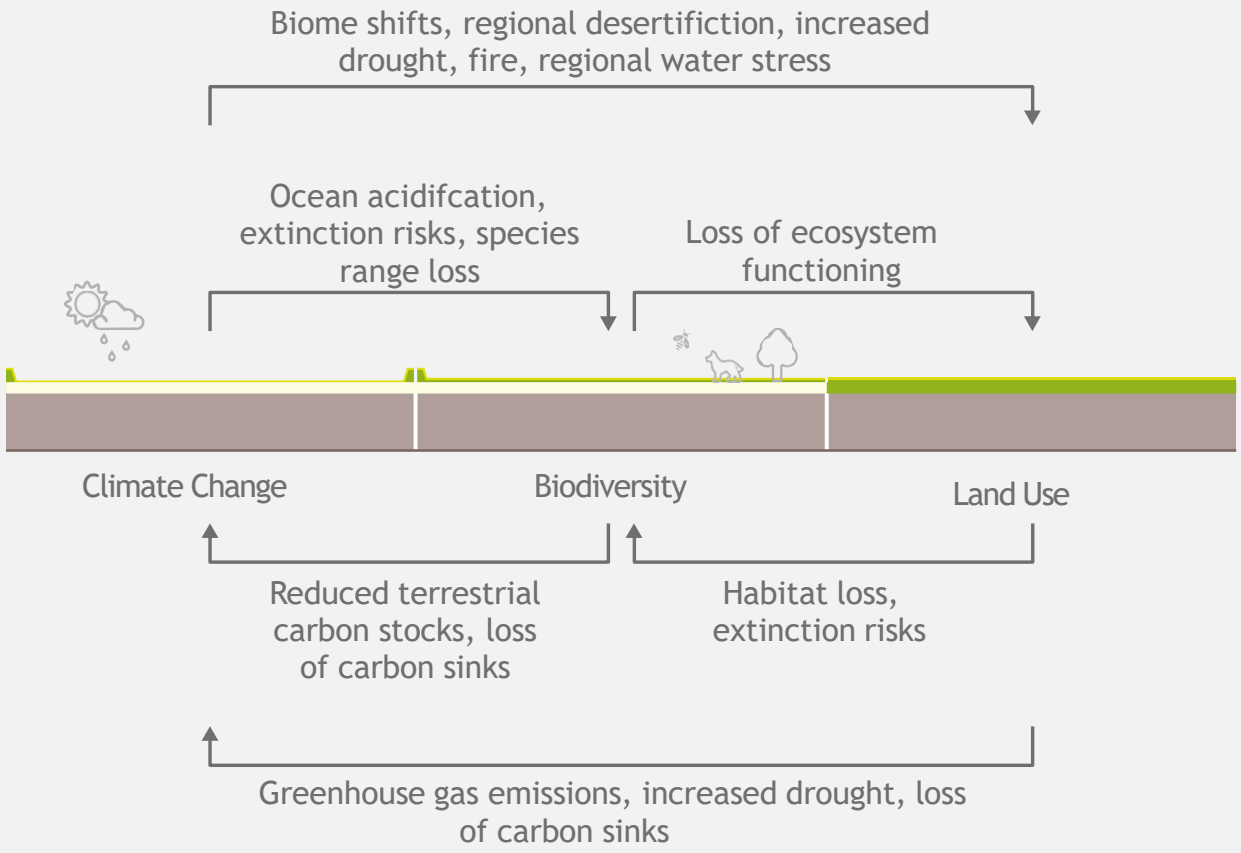


Abnormally dry or wet soils due to changing rainfall, evaporation and soil moisture threaten the survival of ecosystems – for example, the drying up of the Amazon

Strong increase in production and emissions from new entities – such as plastics, antibiotics and chemicals – exceeds the ability to assess and manage problems

Source: Persson et al., 2022, Outside the Safe Operating Space of the Planetary Boundary for Novel Entities.; Wang-Erlandsson, L., Tobian, A., van der Ent, R.J. et al., 2022, A planetary boundary for green water. Nat Rev Earth Environ.

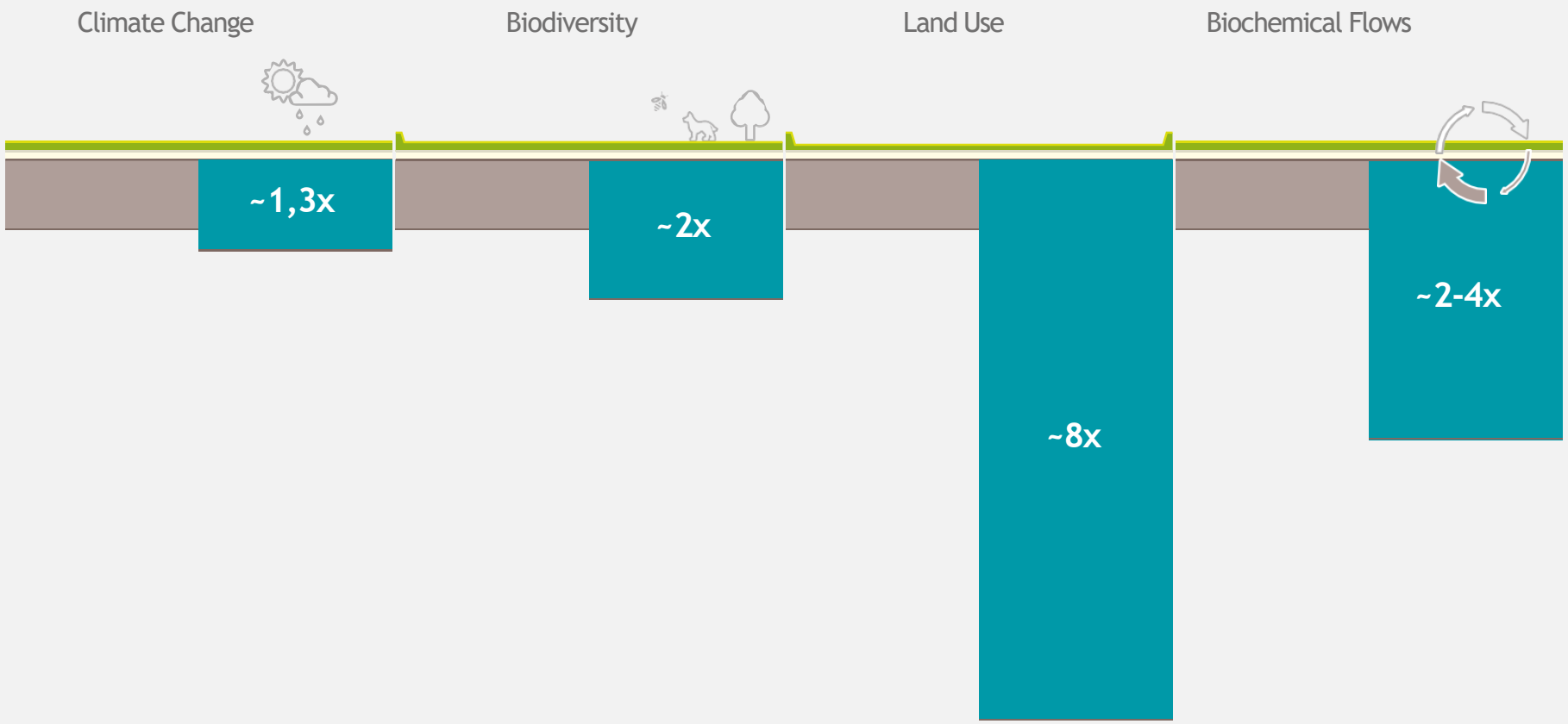
Ecological impacts on different planetary boundaries interact with each other and interventions can have both negative and positive spillover effects



The same spillover effects take place in the opposite case of positive effects on each boundary

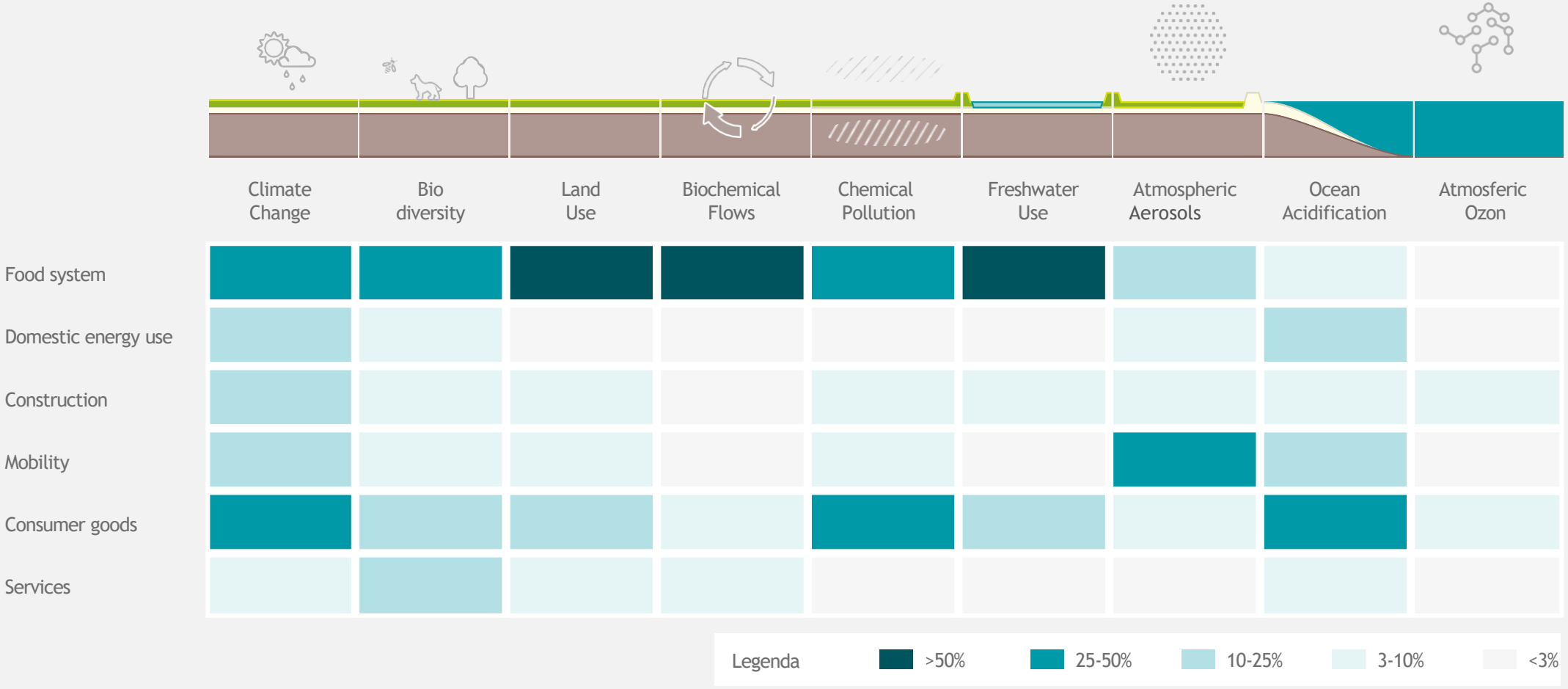
Source: UNEP, 2021, Making peace with nature, Steffen et al., 2015, Planetary Boundaries: Guiding human development on a changing planet, Science.

For four of the trangressed boundaries the Dutch consumption footprint is larger than the production footprint



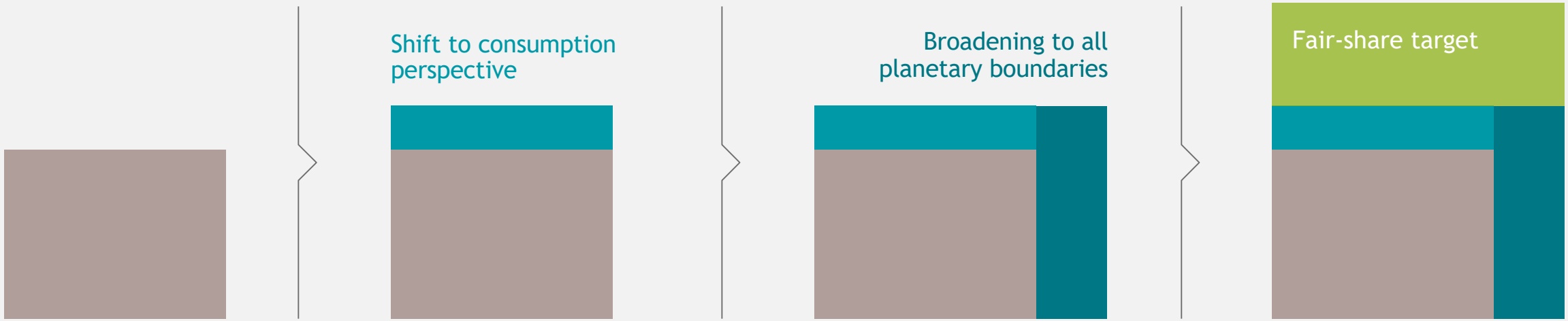
Source: Lucas and Wilting 2018, Using planetary boundaries to support national implementation of environment-related Sustainable Development Goals, PBL Netherlands Environmental Assessment Agency, The Hague.

The consumption footprint perspective shifts the distribution of impact between consumption categories



Note: Distributed impacts add up to 100% vertically for each boundary. For atmospheric ozon the sum of negative impact is <100% as the trend is positive
Source: Milieucentraal; PBL, Using planetary boundaries to support national implementation of environment-related Sustainable Development Goals, 2018; Metabolic, Global food system analysis, 2017; Wilting et al. Quantifying biodiversity losses due to human consumption: a global-scale footprint analysis, 2017; Ellen McArthur Foundation, The Big Food Redesign Study, 2021; IPCC, 2014;

Broadening the perspective to all planetary boundaries, the consumption footprint and the fair-share distribution increases the challenge considerably



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To reduce the consumption footprint three systems changes are needed in how food, energy and materials are produced and used

Food transition

Overhaul of the food system from the largest driver of transgression of diverse planetary boundaries to a net contributor to its restoration

Energy transition

Scaled phasing out of fossil fuels and replacing the energy supply with renewables, in order to excise the largest contributor of climate change

Materials transition

Shift of largely linear material extraction and waste to largely circular material use and re-use

A combination of all three transitions is needed to halt and reverse the transgressions of the planetary boundaries

These systems changes can be realised with technical changes, behavioural shifts and restoration measures

Technical change

Making processes more sustainable, such as shifting to renewable energy

Behavioural shift

Bending consumption patterns to reduce impact, such as cycling instead of driving or shifting to a plant-based diet

N.B. broader than individual action

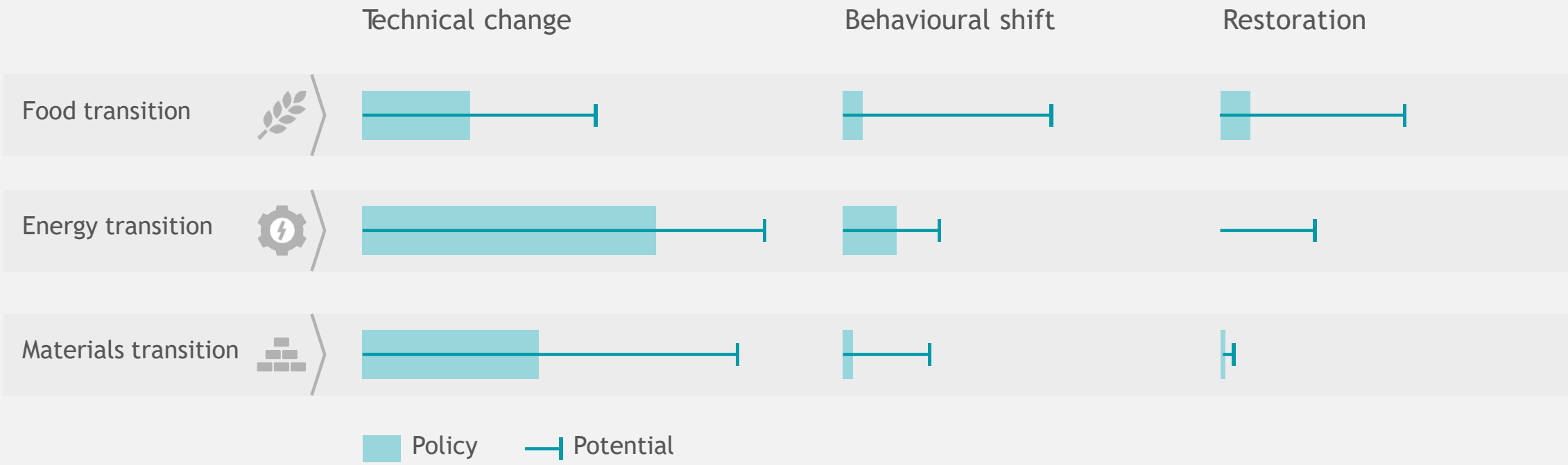
Restoration

Repairing the damage already done, such as reforestation and negative CO2 emissions

N.B. Moral hazard of betting on unproven technologies and future results

A combination of strategies is required, but ratios will differ between countries, industries and planetary boundary

Current policies lean heavily on technical changes, underutilising the potential of behavioural shifts and restoration



Despite the large impact of the food system, the food transition is currently not high on the agenda

The food systems drives a large ecological impact on multiple planetary boundaries

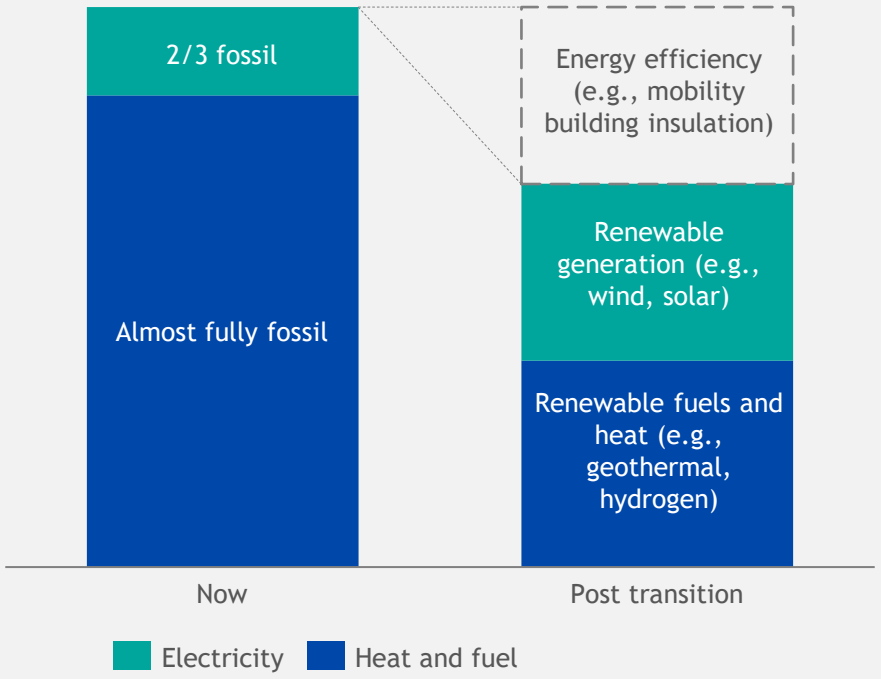
- Largest cause of biodiversity loss
- 25-30% of global greenhouse gas emissions
- Largest cause of transgression of nitrogen and phosphorus flows driven by fertilizers and intensive livestock farming
- Food production is the global driver of deforestation, specifically in tropical rain forests
- Among the largest sources of chemical pollution, e.g., from pesticides, antibiotics and plastic packaging
- Food production is responsible for ~70% of global freshwater use

Three interventions can turn the food system into a net contributor to recovery

1. Diet shift from animal proteins to plant-based proteins
2. Livestock reduction to reduce environmental impacts locally and globally
3. Sustainable farming methods, e.g., agroecology, and circular farming

Complexity, lead time and bottlenecks make the overhaul of the energy system within several decades a considerable challenge

There are various challenges in the Dutch energy transition



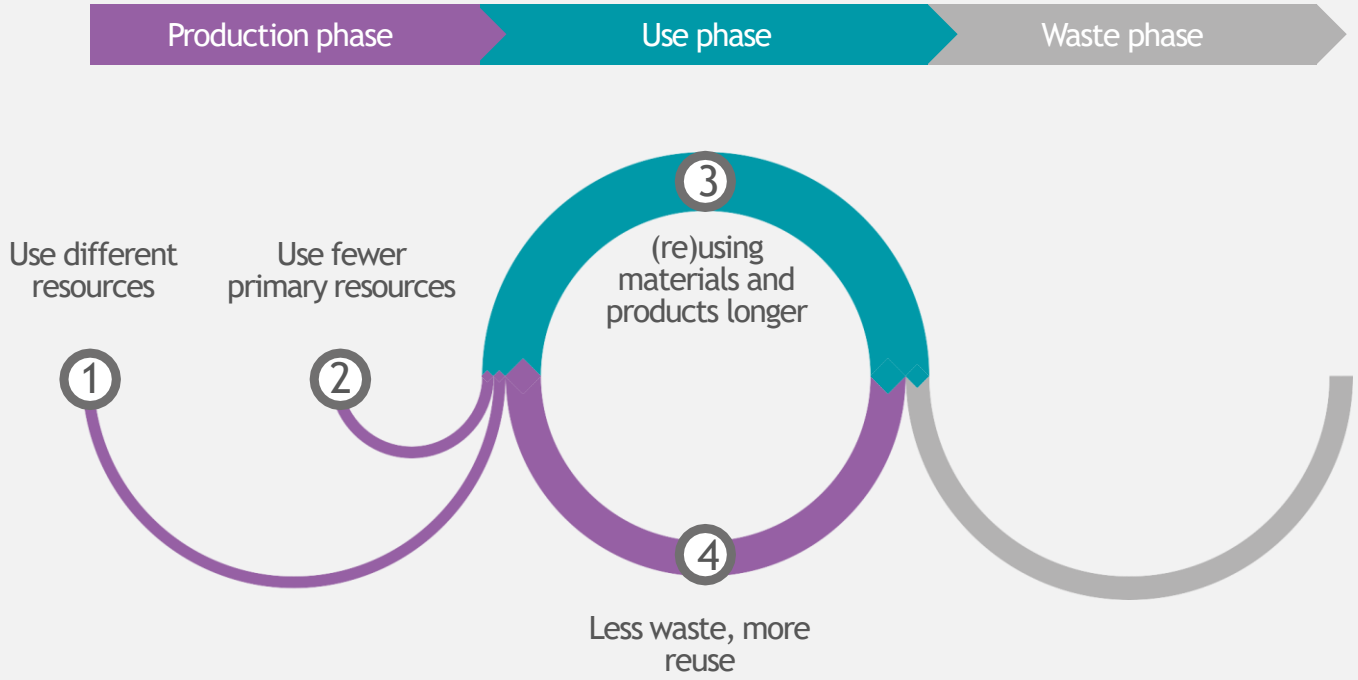
Several unlocks can remove the bottlenecks and accelerate the transition

- Clear system choices
- Investments in infrastructure
- Unlocking technical personnel
- Spatial integration
- Scarce metals strategy

Source: Blok, 2021, Perspective on the Energy Transition.

Hard plans and policy instruments are required to realise high Dutch ambitions on circular materials use

The materials transition is about using different, and fewer materials, for longer, and repetitively

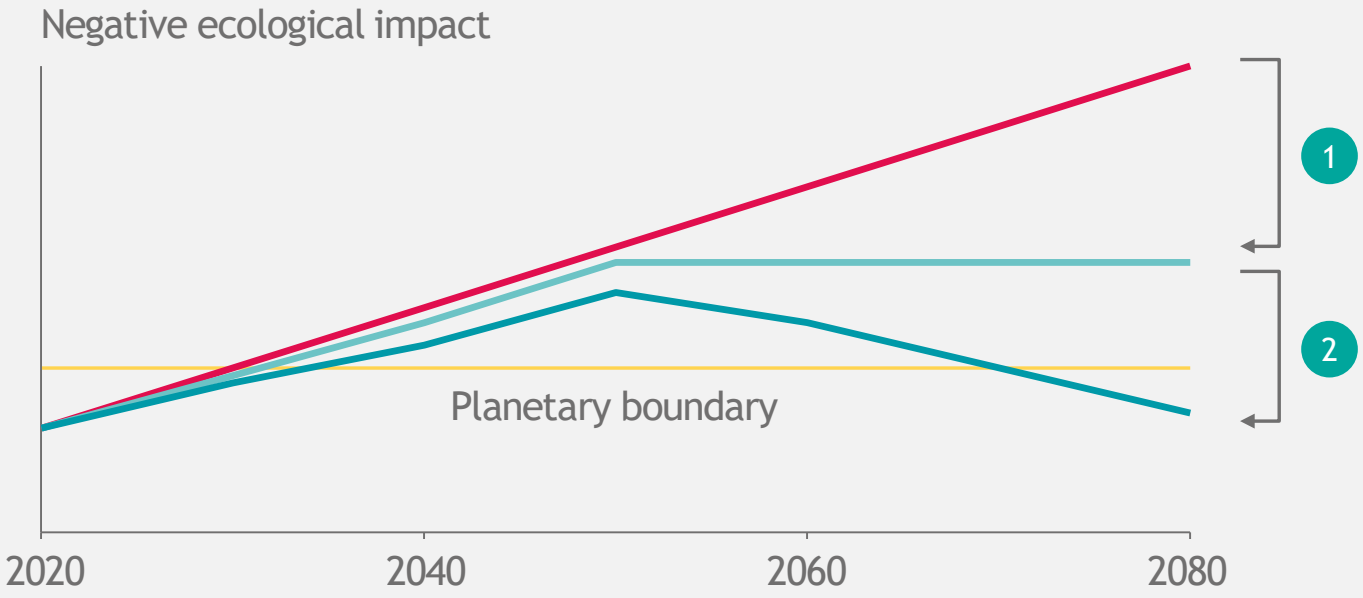


"Harder" policy instruments are needed to accelerate the transition

- Norms can pose requirements on e.g., the use of recyclate, modular design or reparability
- Internalising externalities into the price ensure that "the polluter pays"
- Sustainable procurement, subsidies, investments and financing can stimulate circular business models

When a planetary boundary has been transgressed, active restoration is required to return to within safe levels

The restoration task grows as a planetary boundary is transgressed further



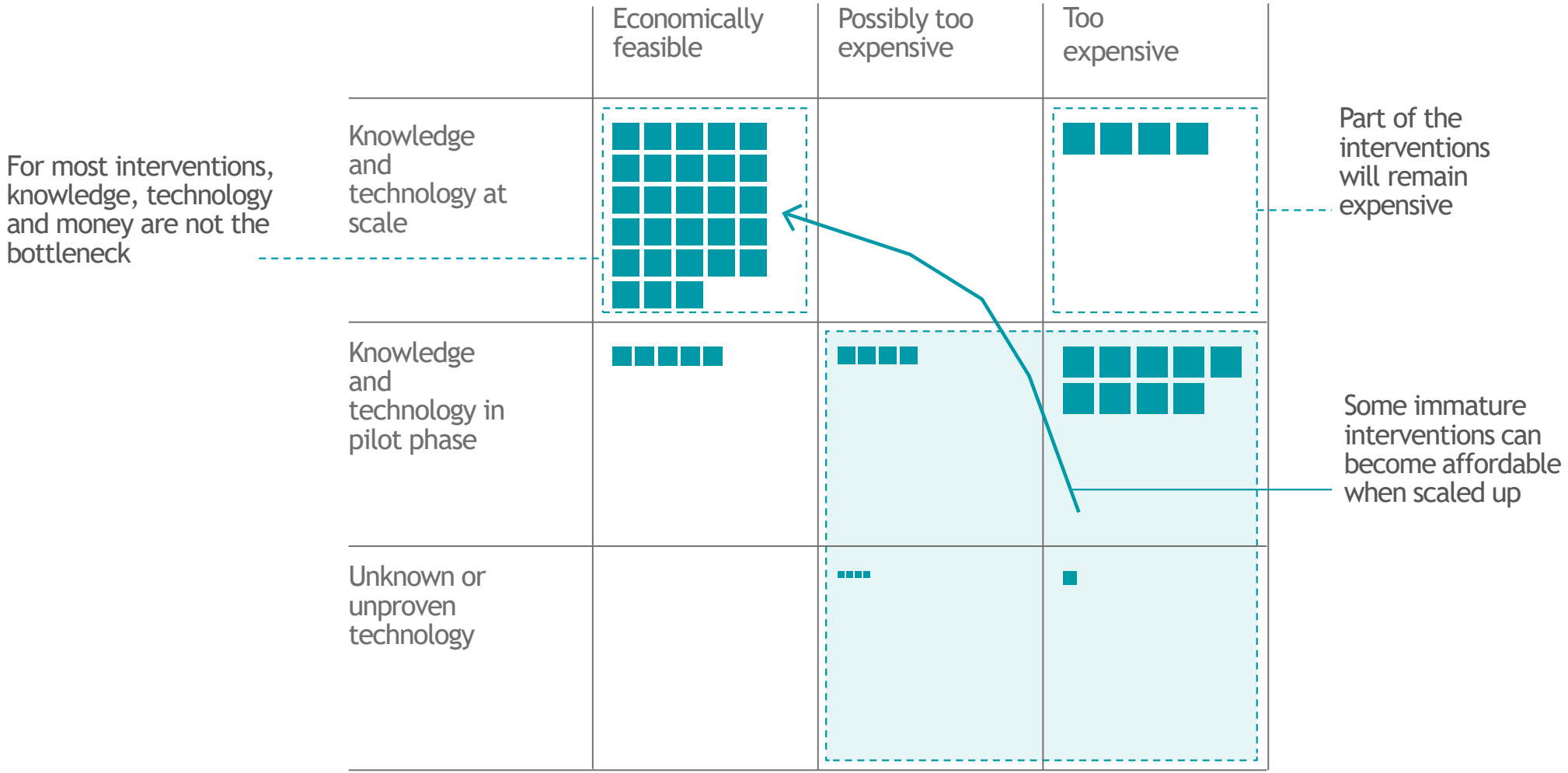
1 To halt further transgression, a reduction of new impact is required

2 Net zero is not enough: active restoration to realise recovery to within planetary boundary

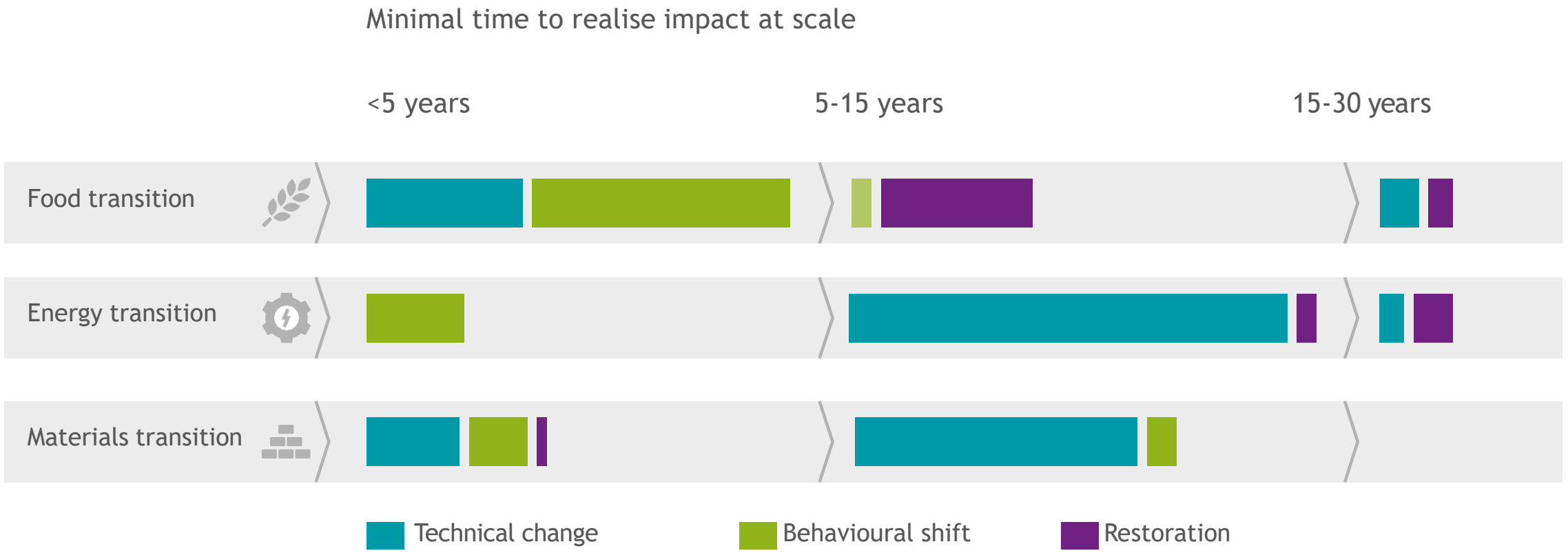
Key solutions

- Nature-based solutions can realise restoration of multiple planetary boundaries
- New negative emissions technologies require investment to go through cost- and scale curves

For most interventions, knowledge, technology and money are not the bottleneck



Impact in the energy transition mostly in the mid-term future, while short-term impact can be realised in the food transition

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