PBL Netherlands Environmental Assessment Agency

Applying Integrated Assessment Models to SDG planning

12-4-2016 | Paul Lucas

Quantitative modelling and assessment

- Sustainable Development Goals
  - Address a very broad set of issues
  - Many interrelations between the goals and targets
  - Underlying long-term dynamics of fast and slow moving processes

- Integrated Assessment Models (IAMs)
  - Model different sub-systems and their interactions
  - Assess impacts / trade-offs of social, econ. and ecological developments
  - Support public decision-making with a coherent framework

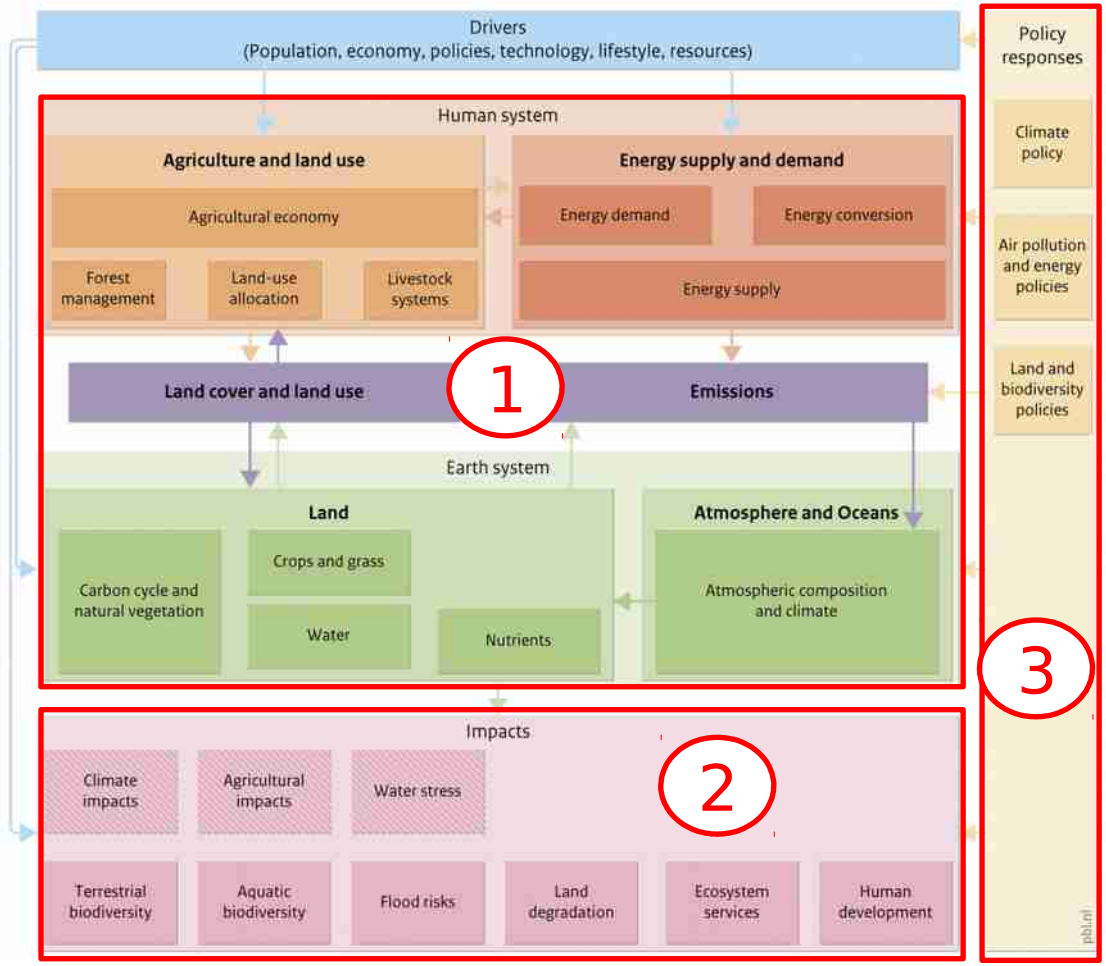
- Scenario analysis
  - Map out possible futures and explore uncertainty
  - They thereby indicate boundaries, difficulties, synergies and trade-offs
  - Explorative vs normative scenarios

IMAGE3.0: Integrated Assessment Model

- Strong earth system focus
- Describes HD and GEC and their interlinkages

1. Focus on integrated land and climate system
2. Impacts on human development, water, biodiversity, N and P cycle
3. Possible response strategies

- Used for many international scenario studies: IPCC, GEO, MEA, OECD-EO, …



http://www.pbl.nl/IMAGE

Three example studies

1. Beyond 2015: Long-term development and the MDGs (2009)

2. Roads from Rio+20: Pathways to achieve global sustainability goals by 2050 (2012)

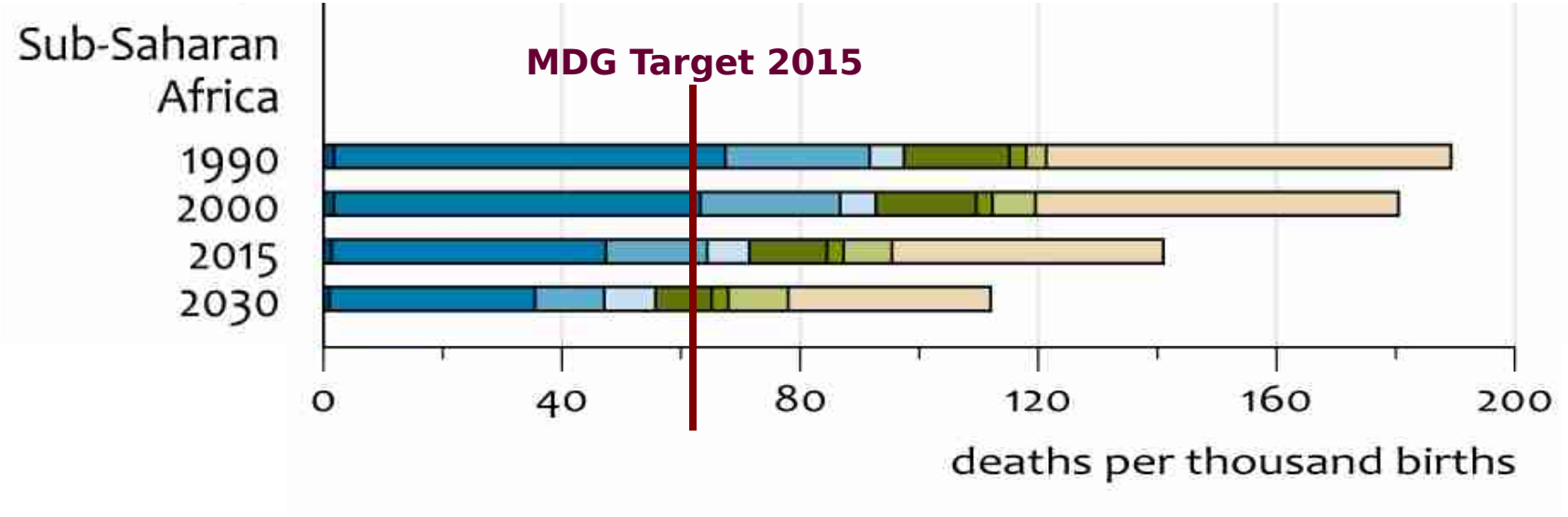
3. Planetary Boundaries and SDGs: an energy-system perspective (work in progress)

1) Beyond 2015: Long-term development trends and the implication for the MDGs

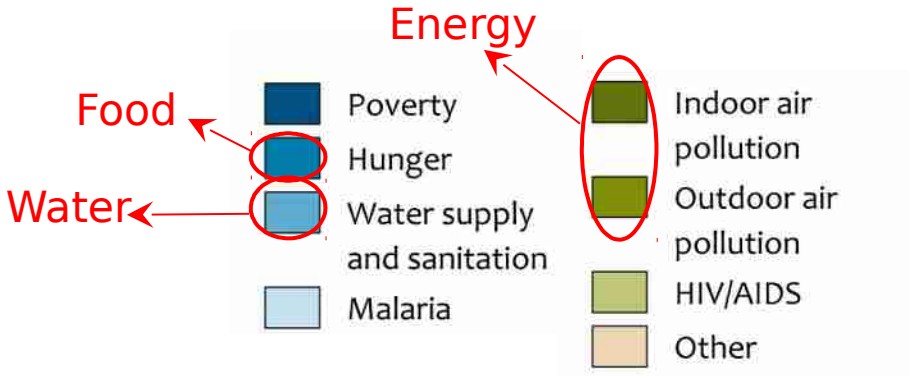
- Model-based analysis of long-term trends and dynamics relevant for HD
- Links GEC and socio-economic developments to MDG achievement up to and beyond 2015

- Various regions/countries are off-track
  - Especially health and environment targets
- Inertia matter, especially for volume
  - For example population, education
- Environment remains important
  - For example health (food, water, energy)

Implications for Child Mortality (MDG4)



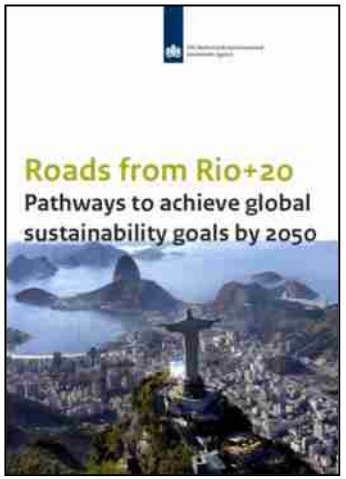
- Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate



2) “Roads from Rio+20”: Do pathways exist that achieve a set of SD goals and how do they look like?

- Model-based analysis of pathways that simultaneously achieve a broad set of long-term sustainable development targets

- Targets based on existing international agreements
  - Sustainable Development Goals *avant la lettre*
  - Targeted at Rio+20, but even more relevant now



- Focus on two key clusters of related challenges
  - Food (SDG2) and biodiversity loss (SDG15)
  - Energy (SDG7) and climate change (SDG13)

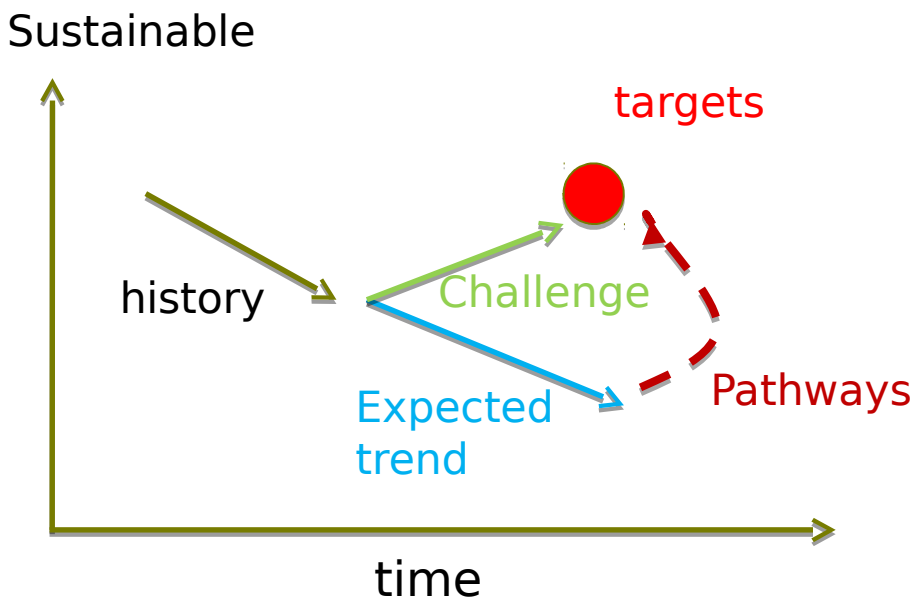
- Trade-offs and synergies with
  - Water (SDG6), nutrients (SDG2) and health (SDG3)

Methodology

- Internationally agreed upon targets (2012)
  - Eradicate hunger by 2050
  - Slow rate of biodiversity loss by 2030 and bring to zero by 2050
  - Achieve universal access to modern energy by 2030
  - Avoid temperature increases above 2 °C

- Expected trends without targeted policies

- Three alternative pathways that achieve the targets

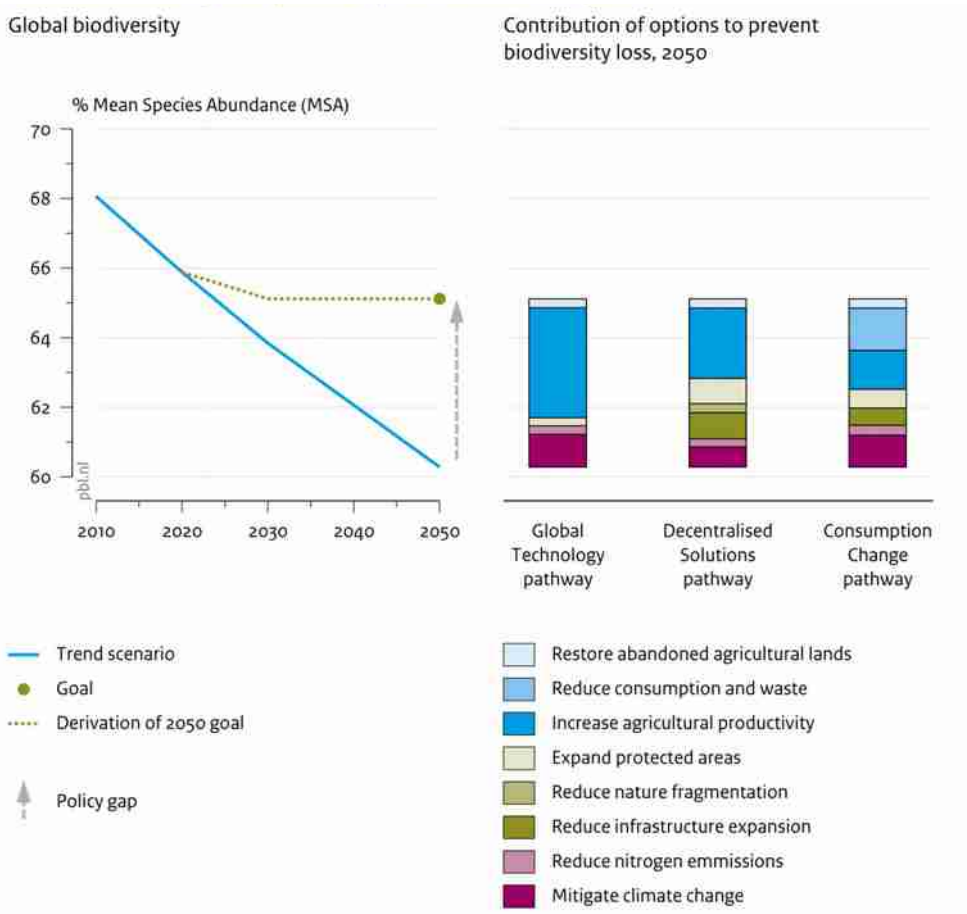


Three pathways that achieve the targets

Different combinations of technological and consumption measures

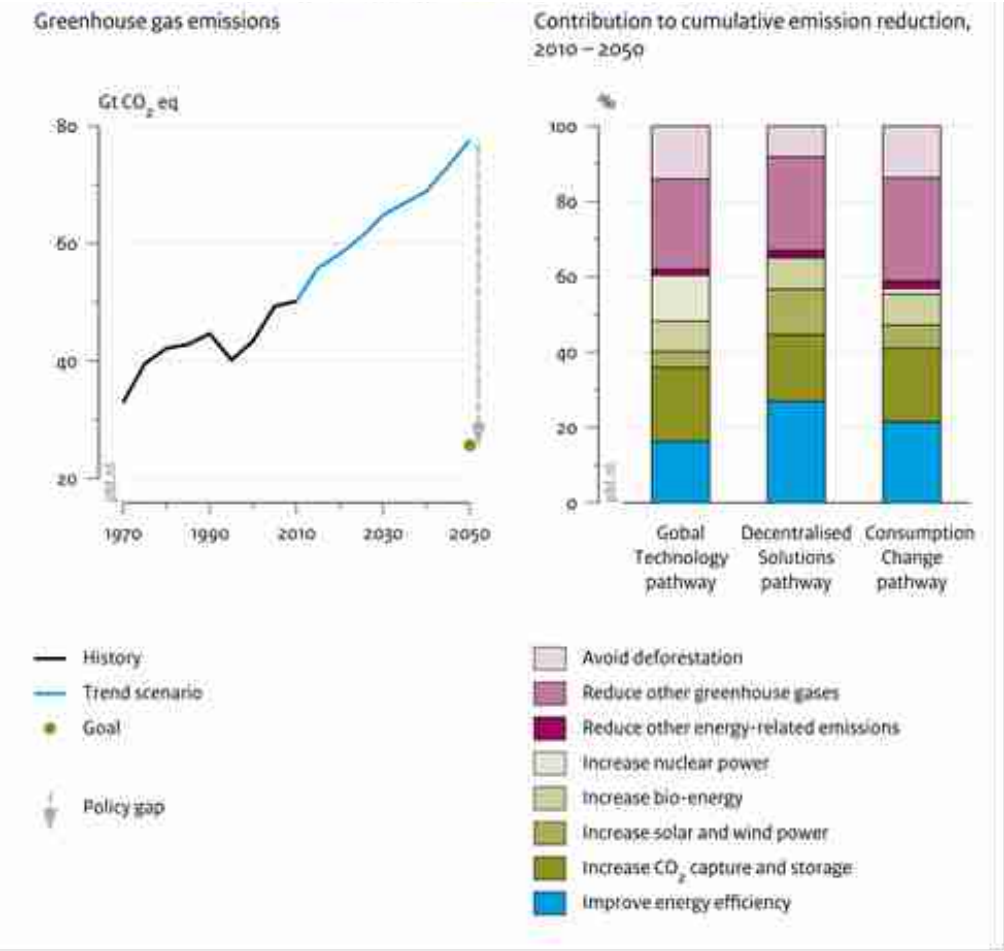
Pathway	Main assumption
Global Technology	Achieves the 2050 targets, with a focus on large-scale technologically optimal solutions, such as intensive agriculture and a high level of international coordination; for instance, though trade liberalisation
Decentralised Solutions	Achieves the 2050 targets, with a focus on decentralised solutions, such as local energy production, agriculture that is interwoven with natural corridors and national policies that regulate equitable access to food
Consumption Change	Achieves the 2050 targets, with a focus on changes in human consumption patterns, most notably by limiting meat intake per capita, by ambitious efforts to reduce waste in the agricultural production chain and through the choice of a less energy-intensive lifestyle

Food and biodiversity loss



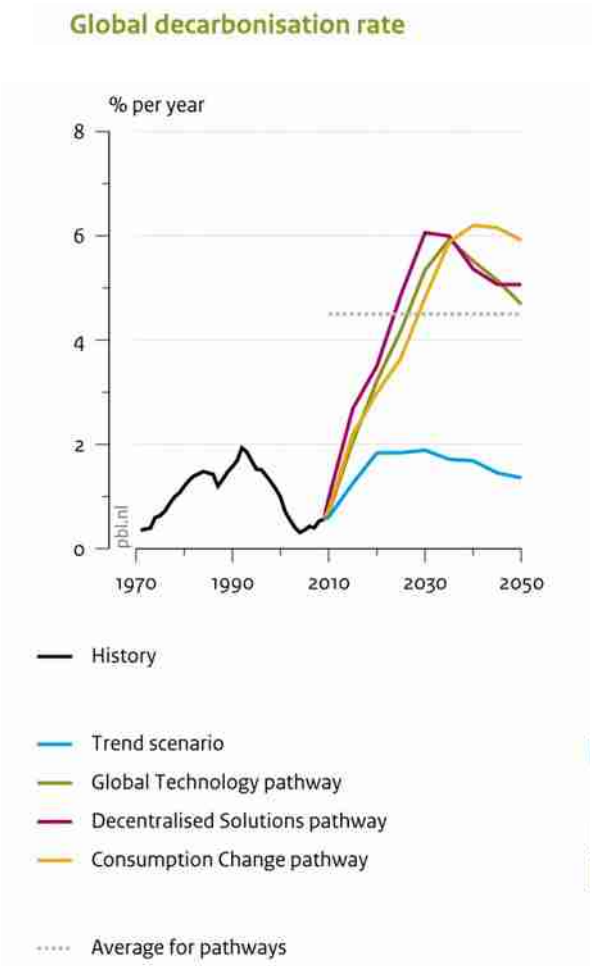
- Improve access to food
- Control consumption
- Sustainable intensification of agriculture
- Address ecosystem fragmentation
- Protect ecological hotspots
- Mitigate climate change

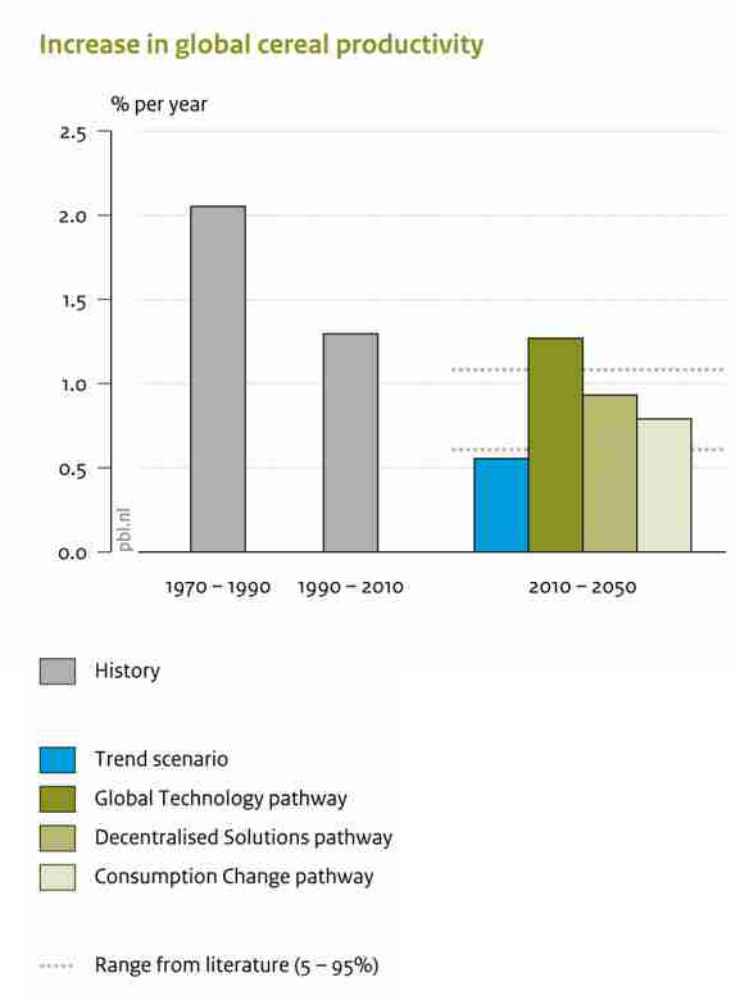
Energy and climate change



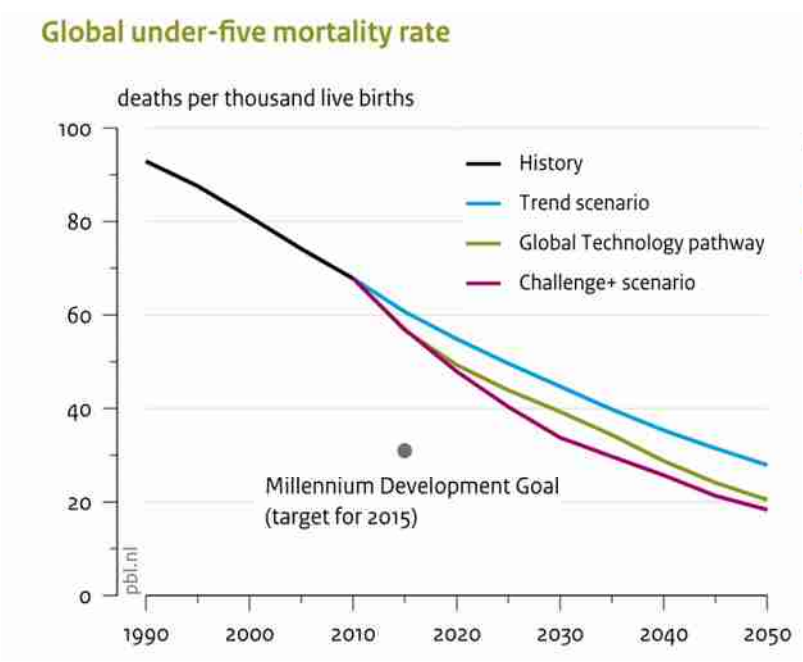
- Improve access to energy
- Avoid deforestation
- Increase energy efficiency
- Reduce non-CO_2 GHGs
- Invest in low- to zero-carbon technologies

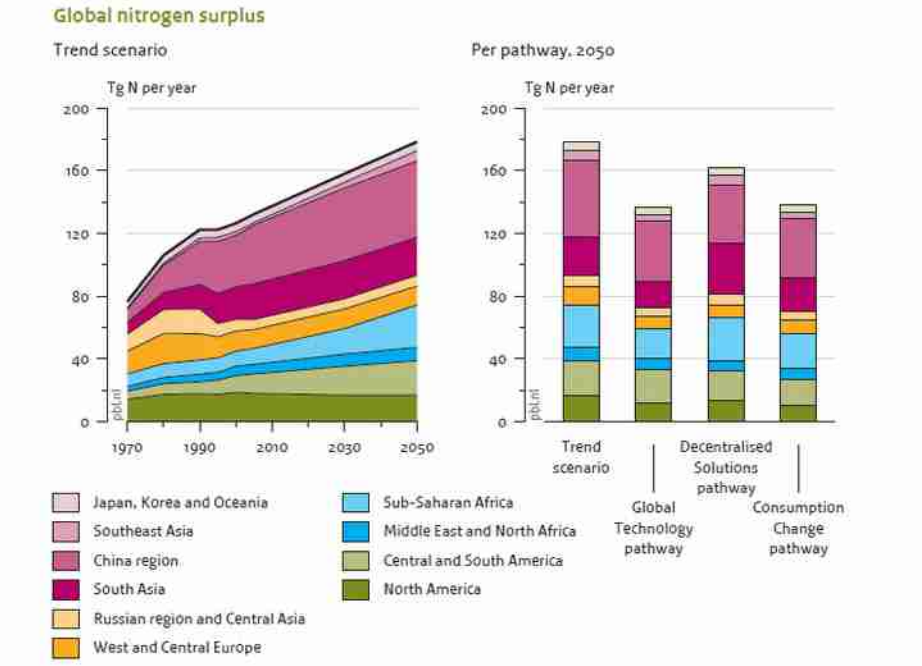
Transformative action is required, with technological change greater than or similar to historic rates





Important synergies and trade-offs exist

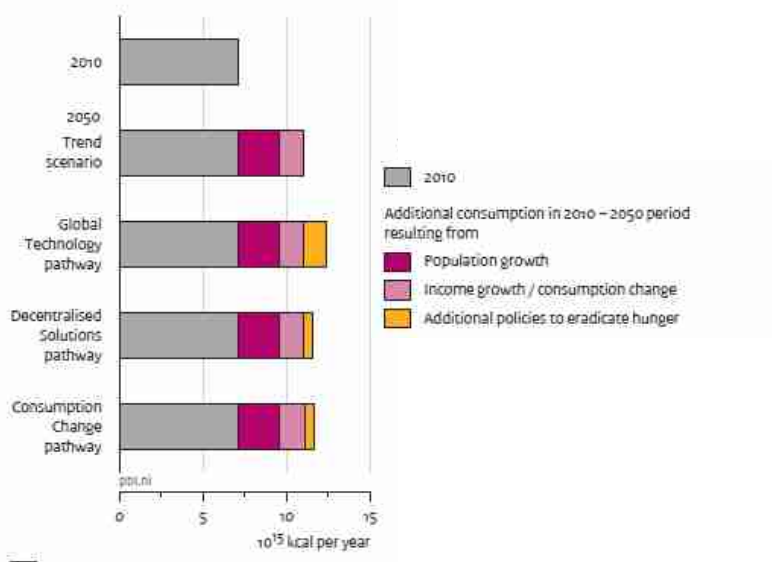


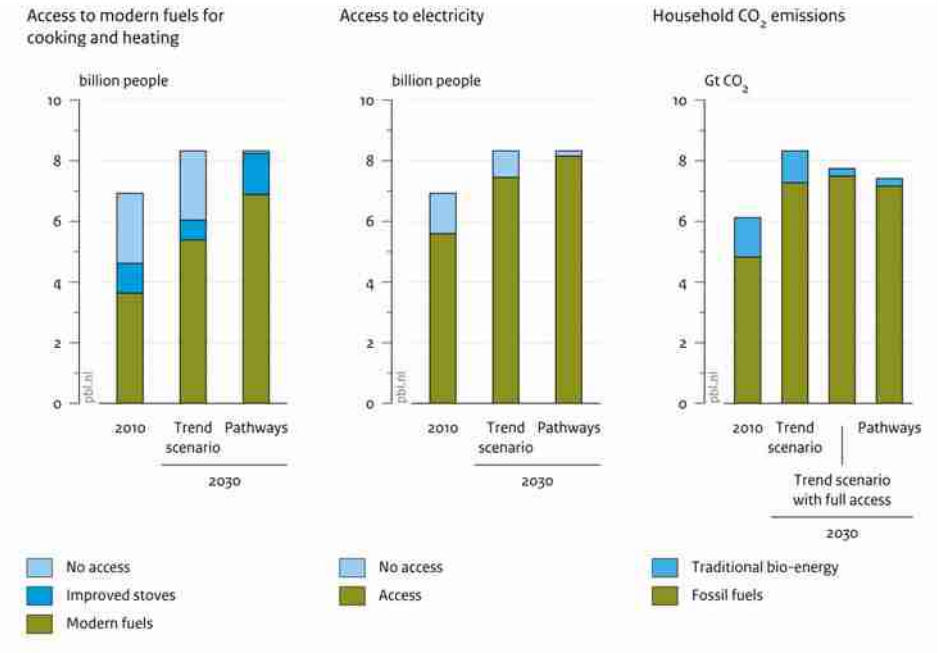


Eradicating hunger and ending energy poverty could avoid significant child deaths

Increasing crop yields inevitably pushes up phosphorus and nitrogen use

No fundamental trade-off between poverty eradication and environmental sustainability

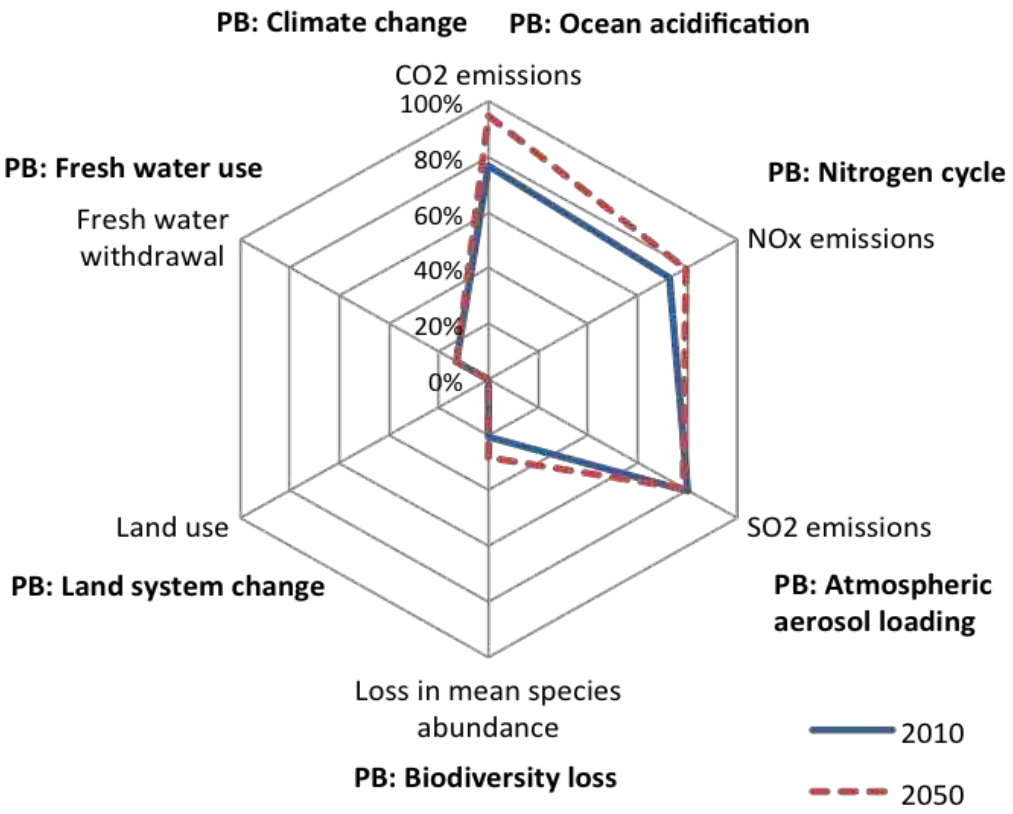




Increase in food demand is primarily driven by population and income growth

Full access to modern sources of energy has only little effect on CO_2 emissions

3) Planetary Boundaries and SDGs: an energy-system perspective (work in progress)

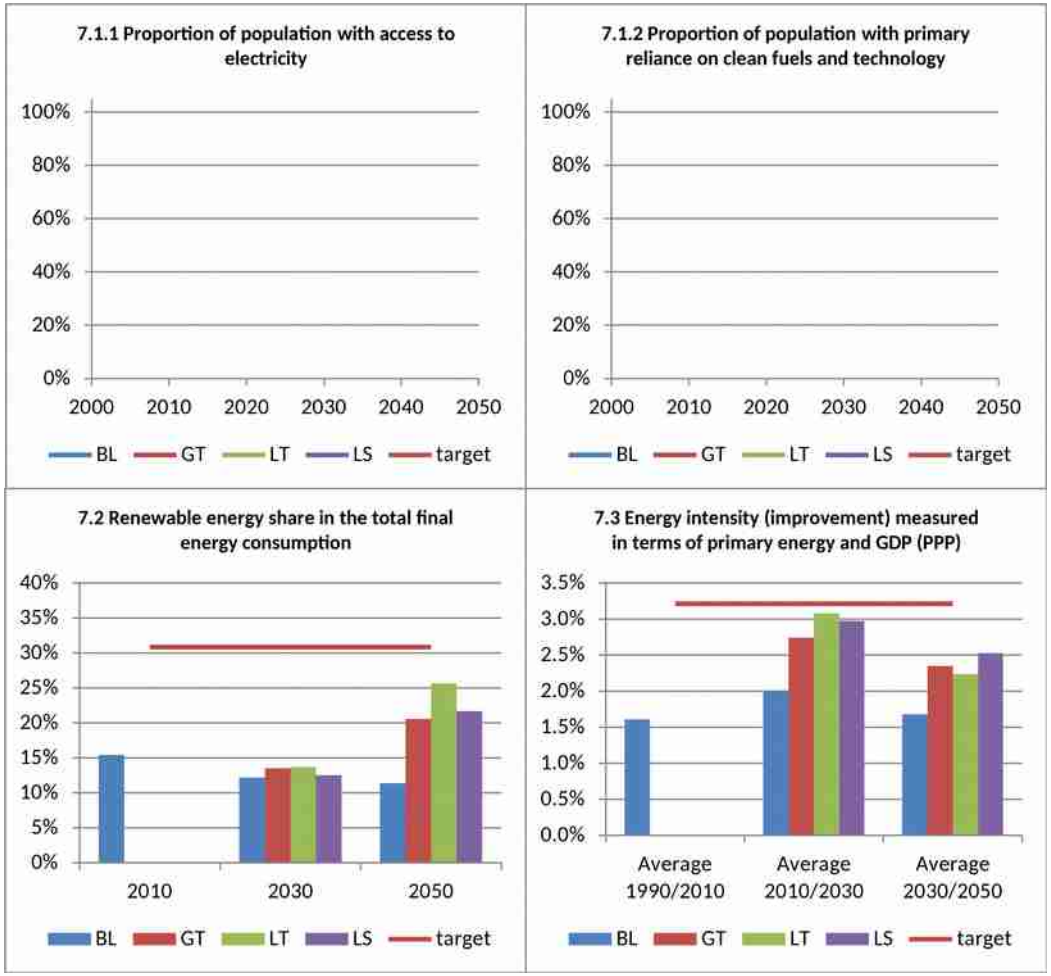


Energy-system challenges

1. Increasing consumption
2. Lack of energy access
3. Environmental risks
4. Energy security
5. Need for long-term investments

- SDG achievement increases energy demand
- PBs environmental constraint to energy developments
- SDG7 to address challenges

SDG7: Reinforcement or constraint



- Energy access
  - Constraints renewable target
- Renewable energy
  - Reinforces climate and air pollution targets
  - Constraints water and biodiversity targets
- Energy efficiency
  - Reinforces agriculture and decoupling targets

Main messages

Conclusions from the studies

- Achieving GEC and HD goals is challenging
- Objectives can be reached (given the assumptions made), but…
- Transformative changes required
- Important synergies and trade-offs

IAMs and model-based scenario analysis are effective tools for

- Linking across issues, time and scale
- Addressing feasibility, trade-offs / co-benefits, inertia, required effort
- Making goals and targets transparent and track progress

4) The World in 2050 (upcoming project)

"Develop integrated pathways for achieving sustainable development and attain the Sustainable Development Goals"

- Multi-institute / multi-model study
- Under the flag of SDSN
- Moreover resembles "Roads from Rio+20"

- Back-casting from the SDGs as desired outcome
- Co-benefits and/or trade-offs of addressing multiple SDGs at the same time
- Goal achievement until 2030 and beyond

Links and references

- IMAGE: http://www.pbl.nl/IMAGE

- Beyond 2015
  - http://www.pbl.nl/en/publications/2009/Beyond-2015_-Long-term-development-and-the-Millennium-Development-Goals

- Roads from Rio+20
  - Summary report /Full report: http://www.pbl.nl/en/node/55488
  - Interactive website (app): http://roadsfromrio.pbl.nl/
  - Scientific paper: http://dx.doi.org/10.1016/j.techfore.2015.03.005

- Planetary Boundaries Research network: http://www.pb-net.org/

- The World in 2050:
  - http://www.iiasa.ac.at/web/home/research/researchProjects/TWI2050.html