Integrated Assessment
Contribution to TWI 2050

Nebojsa Nakicenovic
Deputy Director General
International Institute for Applied Systems Analysis
Professor Emeritus of Energy Economics
Vienna University of Technology

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Strategic objective of TWI2050 initiative

The World in 2050 project will explore the design of sustainable development pathways at the global and regional scales that achieve convergent economic and social development within planetary boundaries.
Transformational and “BAU” Paradigms

“Safe Space”  \hspace{1cm} \textbf{Unsustainable Development}

Distribution of the Global Population

\textbf{Individual Planetary Boundaries (2-3 tCO}_2\text{ p.a. \\ & p. cap.)}

\textbf{Source: WBGU, 2014}

\textbf{CO}_2 – \textbf{Emissions p.a. \\ & p. cap.}

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Transformational and “BAU” Paradigms

“Safe Space”  Unsustainable Development

Distribution of the Global Population

Individual Planetary Boundaries
(2-3 tCO₂ p.a. & p. cap.)

Source: WBGU, 2014

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2015 #4
Transformational and “BAU” Paradigms

“Safe Space”
Unsustainable Development

Distribution of the Global Population

Individual Planetary Boundaries
(2-3 tCO₂ p.a. & p. cap.)

CO₂ – Emissions
p.a. & p. cap.

Source: WBGU, 2014

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Transformational and “BAU” Paradigms

Unsustainable Development

Distribution of the Global Population

“Safe Space”

Individual Planetary Boundaries
(2-3 tCO₂ p.a. & p. cap.)

CO₂ – Emisions
p.a. & p. cap.

Source: WBGU, 2014
The World in 2050

- How to secure global development within a safe and just operating space
- Planetary boundaries: e.g. Food; Water; Energy; Biodiversity; Climate Change
- “Safe Space” of interaction among SDGs: sustainability narratives to integrated models
- Transformational and BAU scenarios based on existing literature e.g. SSPs, GEA, DDPP
- Multiple-benefits of transformational pathways toward the “safe space” compared to BAU
Possible Unified Analytical Approach

**Proximate Drivers**
- Population
- Economy
- Technology
- Governance

**Ultimate Drivers**
- Values and Needs
- Knowledge and Understanding
- Power Structure
- Culture

Source: Paul Raskin, 2002
Urbanization World

Population

1850  1900  1950  2000  2050  2100

0%  20%  40%  60%  80%  100%

Historical (UN)

IIASA SRES B1 scenario

IIASA SRES B2 scenario

IIASA SRES A2r scenario

Source: Grubler et al. 2012

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Urbanization World, UK, BRICs

Population

Historical (UN)

IIASA SRES A2r scenario

IIASA SRES B1 scenario

IIASA SRES B2 scenario

BRICs

Source: Grubler et al. 2012

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Global Educational Attainment

Source: Lutz et al., 2007
Participatory Governance

Source: Modelski & Perry, 2008; 2010

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Source: Modelski & Perry, 2008; 2010
Participatory Governance
Slavery Abolishment

Source: Nakicenovic & Rogner, 2012;

Population

Abolishment

1863 United States of America

1906 China

1948 UN Declaration of Human Rights

2015 #13
Cumulative Carbon Emissions

RCP 2.6
Cumulative Carbon Emissions

RCP 2.6
Cumulative Carbon Emissions

Net-negative emissions

RCP 2.6
Sustainability Transformation

“Doing More with Less” within (Planetary) Boundaries

→ Growing number of actors of change:
  • green businesses
  • cities
  • civil society
  • science
  • IGOs (e.g., GEF, UNIDO)

→ Increasing problem perception
→ Values and norms
→ Policy regimes

Vision: Sustainable Future

Legitimacy of BAU eroding

Time

Transformation Diffusion

Source: WBGU, 2011
Co-benefits of GHG Mitigation

Policy Costs of Achieving Different Objectives

Global Energy Assessment Scenario Ensemble (n=624)

- Costs of Achieving Air Pollution Levels Shown in Panel (b)
- Costs of Achieving Stringent Mitigation Targets (430-530 ppm CO₂eq in 2100)
- Costs of Integrated Approaches that Achieve all Three Objectives Simultaneously; Highest Cost-Effectiveness

Source: IPCC, Figure 6.33 and TS
IIASA-GEF Nexus Research Partnership

Drivers of Global Transformations

Place-Specific Basin Developments

Science for Policy

Water

Energy

Food
Global Primary Energy
Historical Evolution

- Other renewables
- Nuclear
- Gas
- Oil
- Coal
- Biomass

EJ

1850 1900 1950 2000

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Coal
Renewables
Nuclear
Gas
Oil
Biomass

Historical Evolution

- Dampfmaschine
- Elektrischer Motor
- Ottomotor
- Vakuumröhre
- Kommerzielle Luftfahrt
- Fernseher
- Mikrochip
- Nuklear-energie
- Renewables Nuclear
Global Primary Energy
no CCS, no Nuclear

Energy savings (efficiency, conservation, and behavior)
~40% improvement by 2030

~55% renewables by 2030

Nuclear phase-out (policy)

Source: Riahi et al, 2012
Global Water Withdrawals
no CCS, no Nuclear

Source: Fricko et al, 2014
Global Primary Energy
A Transformational Pathway

Source: Riahi et al, 2012

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~40% improvement by 2030

~30% renewables by 2030

Energy savings (efficiency, conservation, and behavior)
Global Primary Energy
A Transformational Pathway

Source: Riahi et al, 2012
Global Water Withdrawals
A Transformational Pathway

Source: Fricko et al, 2014
Science for Transformation

- Better integration across science communities
  “Climate or development first” approach too narrow
- More integrated & holistic assessment of climate change policy in the context of other priorities:
  - Multi-objective & multi-policy framing to better understand climate policy tradeoffs & benefits
  - “Nexus” approaches to reach multiple objectives simultaneously: energy, water, food & urbanization
- Challenges are huge:
  - Different constraints and priorities across scales
  - Normative goals involved in policy prioritization

Source: Nakicenovic & Riahi, 2014
THANK YOU

naki@iiasa.ac.at