Integrated Research: Nexus partnership studies with GEF and the World in 2050 Project

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The World in 2050
Integrating knowledge on SDSN pathways to global sustainable development

Inaugural Meeting – 10-12 March 2015
The World in 2050

- Global development within a safe and just operating space and planetary boundaries
- “Safe Space” of interaction among SDGs: sustainability narratives to integrated models
- Transformational pathways based on existing literature e.g. SSPs, GEA, SDSN’s DDPP
- Co-benefits of transformation toward the “safe space” and how to achieve sustainable futures
The World in 2050 “Consortium”

- AIMES
- Future Earth
- Centre for Integrated Studies on Climate Change and the Environment
- Earth League, whole Earth system modelling initiative
- Earth Institute, Columbia University
- Global Ocean Ecosystem Dynamics (GLOBEC)
- Indian Institute International Futures
- Indian Institute of Technology (IIT)
- International Energy Agency (IEA)
- International Food Policy Research Institute (IFPRI)
- International Monetary Fund (IMF)
- International Institute for Applied System Analysis (IIASA)
- Joint Global Change Research Institute at Pacific Northwest National Laboratory (PNNL JGCRI)
- National Center for Atmospheric Research (NCAR)
- National Institute for Environmental Studies (NIES)
- UN Population Division
- UNEP- World Conservation Monitoring Centre (UNEP-WCMC)
- World Bank
- Organisation for Economic Co-operation and Development (OECD)
- Potsdam Institute for Climate Impact Change (PIK)
- PBL - Netherlands Environmental Assessment Agency
- Stanford University
- Stockholm Resilience Centre
- The City University of New York (CUNY)
- Tsinghua University

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Possible Unified Analytical Approach

Proximate Drivers
- Population
- Economy
- Technology
- Governance

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

Scenario Narratives

Integrated Models

Source: Paul Raskin, 2002
Urbanization World

Population

Historical (UN)

IIASA SRES A2r scenario

IIASA SRES B1 scenario

IIASA SRES B2 scenario

Source: Grubler et al. 2012
Urbanization
World, UK, BRICs

Population

1850 1900 1950 2000 2050 2100

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

UK
IIASA SRES A2r scenario
IIASA SRES B1 scenario
IIASA SRES B2 scenario
BRICs

Historical (UN)

Source: Grubler et al. 2012
Cumulative Carbon Emissions

Net-negative emissions

RCP 2.6

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Sustainability Transformation
“Doing More with Less” within (Planetary) Boundaries

- Growing number of actors of change:
  - green businesses
  - cities
  - civil society
  - science
  - IGOs (UNIDO etc.)

- Legitimacy of BAU eroding

- Increasing problem perception

- Values and norms

- Policy regimes

Vision: Sustainable Future

Time

Transformation Diffusion

Source: WBGU, 2011
IIASA-GEF Nexus Research Partnership

Mega-drivers

“Urbanization”

“Climate”

“Technology”

WATER

Sustainable Solutions

FOOD

“Development”

ENERGY

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Major Study Characteristics

- Integrated analysis of the nexus including water, energy and food as well as urbanization, technology and links to place-specific and “basin” perspectives;

- Stakeholder process especially with the public sector in place-specific contexts and extended collaboration with broader IIASA scientific network;

- Based on the integrated analysis, stakeholder and networking activities, development of policy-relevant tools for supporting decision making.
Model Integration

Hydro-Climate
- Global Climate Model (CMIP5)
- Global Hydrologic Model (MATSIRO – H08) (VIC – RBM)

Scenario Storyline (SSP-RCP)
- Population, urbanization, GDP, etc.

Energy
- Global Energy Model (MESSAGE)
- Power Plant Capacity, Generation, Water Use
- Geospatial supply curves

Energy-related water demands and hydropower locations

Geospatial Energy Model (*Proposed*)

Land Use
- Global Land Use Model (GLOBIOM)
- Global Forest Model (G4M)

Agricultural Water Demand
- Surface and groundwater availability and quality
- Bioenergy vs. land use emissions and water use

Surface and groundwater availability and quality
- Energy-related water demands and hydropower locations

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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

Baseline
Geothermal
Solar
Wind
Hydro
Nuclear
Gas wCCS
Gas woCCS
Oil
Coal wCCS
Coal woCCS
Biomass wCCS
Biomass woCCS

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

Energy savings (efficiency, conservation, and behavior)
~40% improvement by 2030
~30% renewables by 2030

Source: Riahi et al, 2012

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2015 #16
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 transformational change in the context of SDGs:
  - Multi-objective & multi-policy framing to better understand different 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

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Co-benefits of GHG Mitigation

Policy Costs of Achieving Different Objectives
Global Energy Assessment Scenario Ensemble (n=624)

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

Source: IPCC, Figure 6.33 and TS