Achieving SDG including sustainable energy for all within planetary boundaries

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Global CO₂ Emissions
# Sustainable Development Goals (SDGs)

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The Key Energy Challenges

Energy Access

Climate Change

Energy Security

Air Pollution
Health Impacts

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2015 #6
2030 Energy Goal

- Universal Access to Modern Energy
- Double Energy Efficiency Improvement
- Double Renewable Share in Final Energy

Aspirational & Ambitious but Achievable
SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all

- 7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services
- 7.2 increase substantially the share of renewable energy in the global energy mix by 2030
- 7.3 double the global rate of improvement in energy efficiency by 2030
- 7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies
- 7.b by 2030 expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly LDCs and SIDS
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: integrated models to sustainability narratives
- 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
Growth of emissions between 2000 and 2010 has been larger than in the previous three decades.

Based on Figure 1.3, the growth rate is approximately +2.2%/yr.

49 Gt (Uncertainty: ±4.5 Gt)

- F-Gases
- N₂O
- CH₄
- CO₂ From Land Use
- CO₂ Fossil Fuel and Industrial Processes
Window for action rapidly closing

65% of our carbon budget compatible with a 2°C goal already used

Total Carbon Budget:
2900 GtCO₂
Window for action rapidly closing

65% of our carbon budget compatible with a 2°C goal already used

Total Carbon Budget:
2900 GtCO₂

Amount Used:
1870-2011:
1900 GtCO₂

Amount Remaining:
1000 GtCO₂

AR5 WGI SPM
Urbanization World

Population

Historical (UN)

IIASA SRES B1 scenario

IIASA SRES A2r scenario

IIASA SRES B2 scenario

Source: Grubler et al. 2012

Historical (UN)

1850 1900 1950 2000 2050 2100

0% 20% 40% 60% 80% 100%
Urbanization
World, UK, BRICs

Population

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

1850 1900 1950 2000 2050 2100

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
Cumulative Carbon Emissions

RCP 2.6
Cumulative Carbon Emissions

Net-negative emissions

RCP 2.6

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Sustainability Transformation

“Doing More with Less” within Planetary Boundaries

→ Legitimacy of BAU eroding

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

→ Values and norms

→ Policy regimes

→ Increasing problem perception

Time

Transformation Diffusion

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Source: WBGU, 2011
Laudato Si’
On Care for Our Common Home

POPE FRANCIS

POPE FRANCIS

PRAISE BE TO YOU

Laudato Si’
On Care for Our Common Home

IGNATIUS
This is the size of ONE TONNE CO₂
Take up the challenge ~ reduce every way YOU can. Now!
Interregional gas price gaps

Source: Alboran Research, 2014
Global Primary Energy
Historical Evolution

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

- Dampfmaschine
- Elektrischer Motor
- Ottomotor
- Vakuumröhre
- Fernseher
- Kommerzielle Luftfahrt
- Micróchip
- Nuklearenergie
- Renewables
- Nuclear
- Gas
- Oil
- Coal
- Biomass

Global Primary Energy Historical Evolution
Global Primary Energy
A Transformational Pathway

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
A Transformational Pathway

- Baseline
- Geothermal
- Solar
- Wind
- Hydro
- Nuclear
- Gas wCCS
- Gas w/o CCS
- Oil
- Coal wCCS
- Coal w/o CCS
- Biomass wCCS
- Biomass w/o CCS

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Global Primary Energy
A Pathway with a Full Portfolio

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

Source: Riahi et al, 2012

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Global Primary Energy
A Pathway with a Full Portfolio

Source: Riahi et al, 2012
Global Water Withdrawals
A Pathway with Full Portfolio

Source: Fricko et al, 2014
Global CO$_2$ Emissions
IPCC AR5+

Global CO$_2$ Emissions (GtCO$_2$)

- IPCC AR5 2 Degree
- RCP 6.0
- RCP 4.5
- RCP 2.6
- RCP 8.5
- GEA (SE4ALL)

- Peak by 2020
- reductions of 35-75% by 2050
- almost zero or negative in the long term
EU CO₂ Emissions

CO₂ emissions (GtCO₂)

- GEA
- 2 Degree (>50%)
- RCP2.6
- Pledge

1900 1950 2000 2050 2100

EU CO₂ Emissions
USA CO₂ Emissions

CO₂ emissions (GtCO₂)

- GEA
- 2 Degree (>50%)
- RCP2.6
- Pledge
China CO₂ Emissions

- GEA
- 2 Degree (>0%)
- RCP2.6
- Pledge
China CO₂ Emissions

China National Center for Climate Change Strategy & International Cooperation

Source: Fu Sha, Zou Ji, Liu Linwei, 2015
Policy Integration at the Urban Scale

Simulated energy use, urban settlement of 20,000, using the SimCity Model

Source: Grubler et al, 2012
Multiple Benefits of Integrated Policies

Source: McCollum et. al, 2012; IPCC, 2014

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THANK YOU

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IPCC Fifth Assessment Report

Nebojsa Nakicenovic
Nominated for the IPCC Chair by Austria and Montenegro

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