

Energy transition in the context of SDGs and the Paris Agreement and the need for an integrated planning approach

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Characterizing the ongoing energy transition



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SDG Goal 7: Affordable and clean energy

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency

7.A By 2030, enhance international cooperation

7.B By 2030, expand infrastructure and upgrade technology for all in developing countries



SDG 7.1.1
**UNIVERSAL ACCESS TO
ELECTRICITY**



SDG 7.1.2
**UNIVERSAL ACCESS
TO CLEAN FUELS AND
TECHNOLOGIES FOR
COOKING**

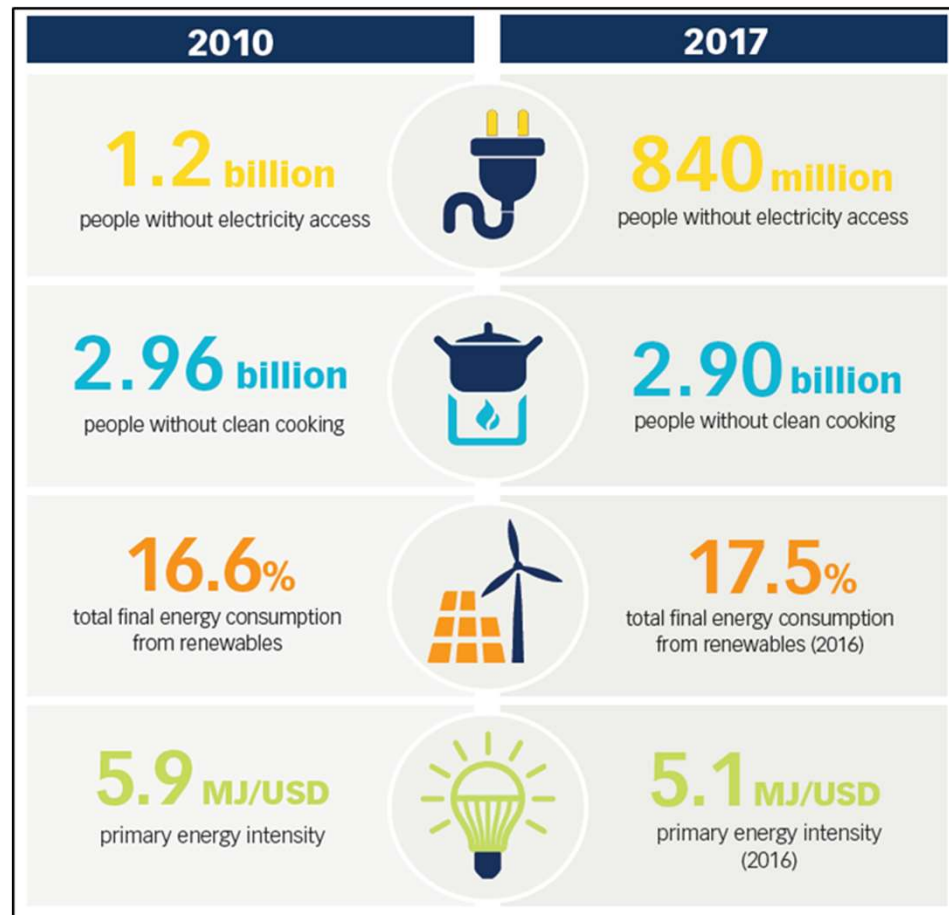


SDG 7.2
**DEPLOYMENT OF
RENEWABLE ENERGY**



SDG 7.3
**IMPROVEMENT OF
ENERGY EFFICIENCY**

SDG Goal 7: Progress



Percentage of population with access to electricity

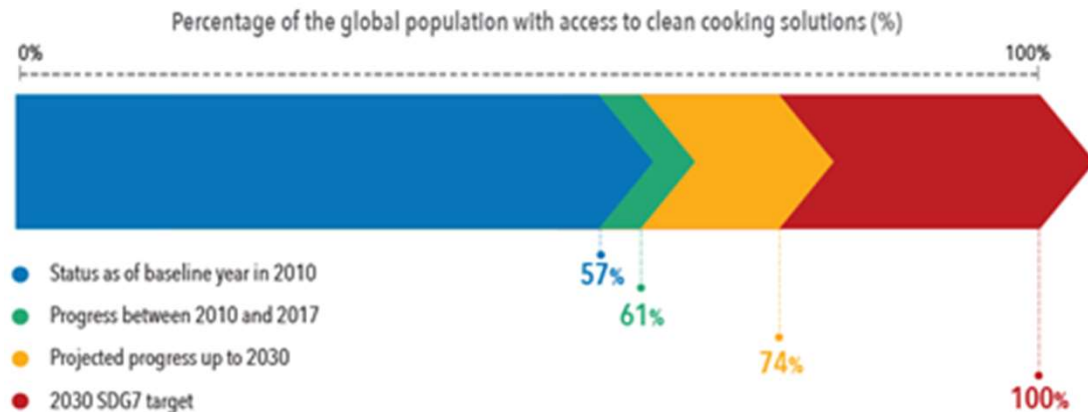
- 1 bn without access now
- 650 million in 2030 BAU
- (South) Asia and Sub-Saharan Africa are hotspots



- Electricity for economic growth and prosperity are lacking in many parts of Asia while policy makers focus on subsistence level of electricity for showing impact
- Affordability, quality, and reliability of electricity in many regions a key issue despite access
- Bangladesh, Pakistan, Afghanistan and Nepal in South Asia remain a key region → Bangladesh (4.7%) and Myanmar (3%) has fastest growth in access in 2010-17
- Key challenge in isolated areas: islands, off-grid locations, and mountain regions, despite having rosy national electrification rates

Percentage of population with access to clean cooking

- Globally 3 billion without access to clean fuels and technologies for cooking
- Asia is clearly a hotspot



- The projected **progress** in energy access by 2030, assuming they will be successful under current policy regimes, **are encouraging**
- **Yet huge gaps** remains beyond 2030
- **Millions of deaths already** attributed to indoor air pollution annually (3.8 million deaths per year), **loss of labor productivity** and disproportionate impacts on **women and children**

Paris Agreement

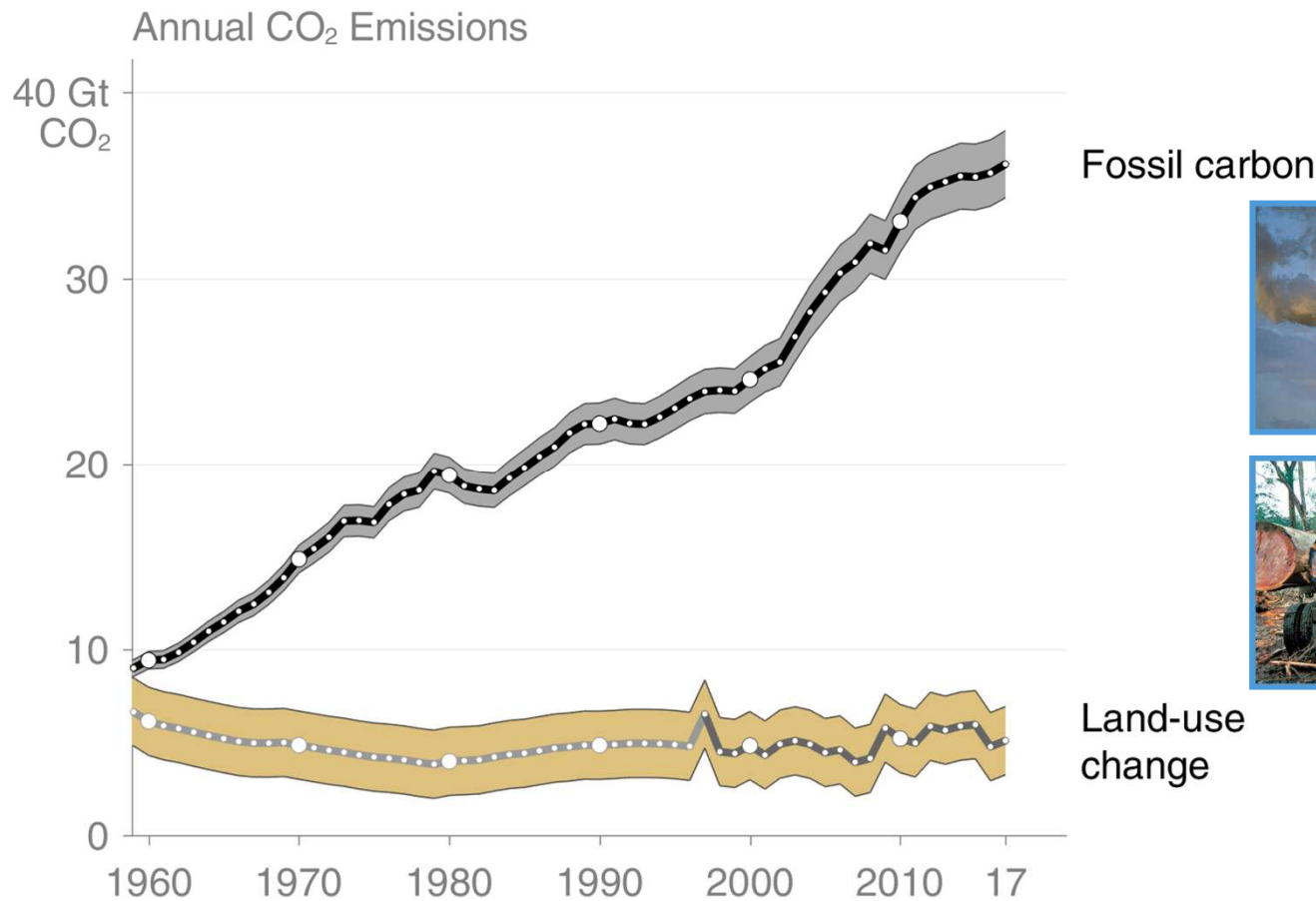


- Successfully raising the mitigation aim to the higher bar of dangerous threshold
- A clear signal to stakeholders for early peaking of emissions and envisioning the world after 2050 as a GHG-neutral one
 - complete decarbonizing of the energy sector
 - ramping-up renewable energy deployments
 - carbon capture and storage, and reforestation
- The commitment of 100 billion US\$ by 2020 by developed countries

Challenges: “Implementation of commitments” and “progressively moving to higher level of commitments”

Total global emissions

Total global emissions: 41.2 ± 2.8 GtCO₂ in 2017, 53% over 1990
 Percentage land-use change: 43% in 1960, 13% averaged 2008–2017



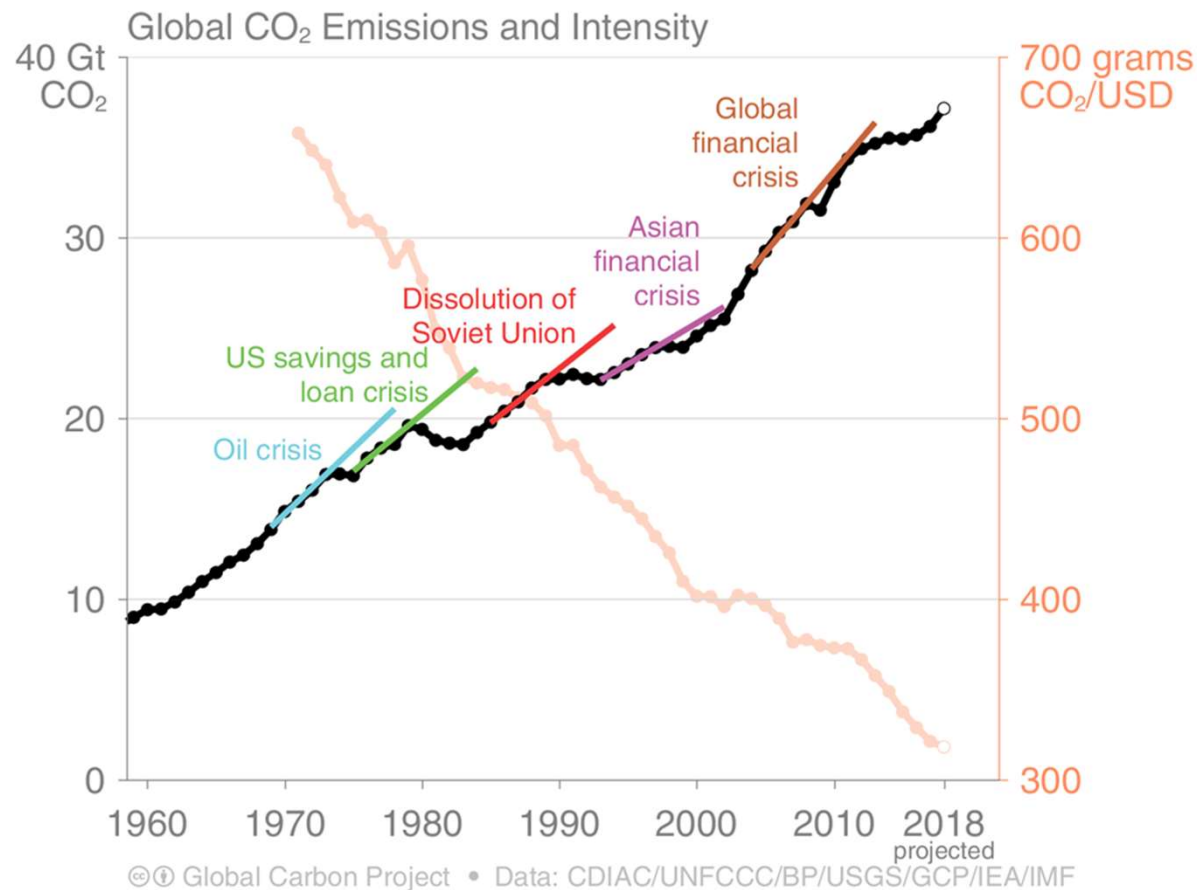
© Global Carbon Project • Data: CDIAC/UNFCCC/BP/USGS/GCP

Land-use change estimates from two bookkeeping models, using fire-based variability from 1997

Source: [CDIAC](#); [Houghton and Nassikas 2017](#); [Hansis et al 2015](#); [van der Werf et al. 2017](#);
[Le Quéré et al 2018](#); [Global Carbon Budget 2018](#)

Fossil CO₂ emission and intensity

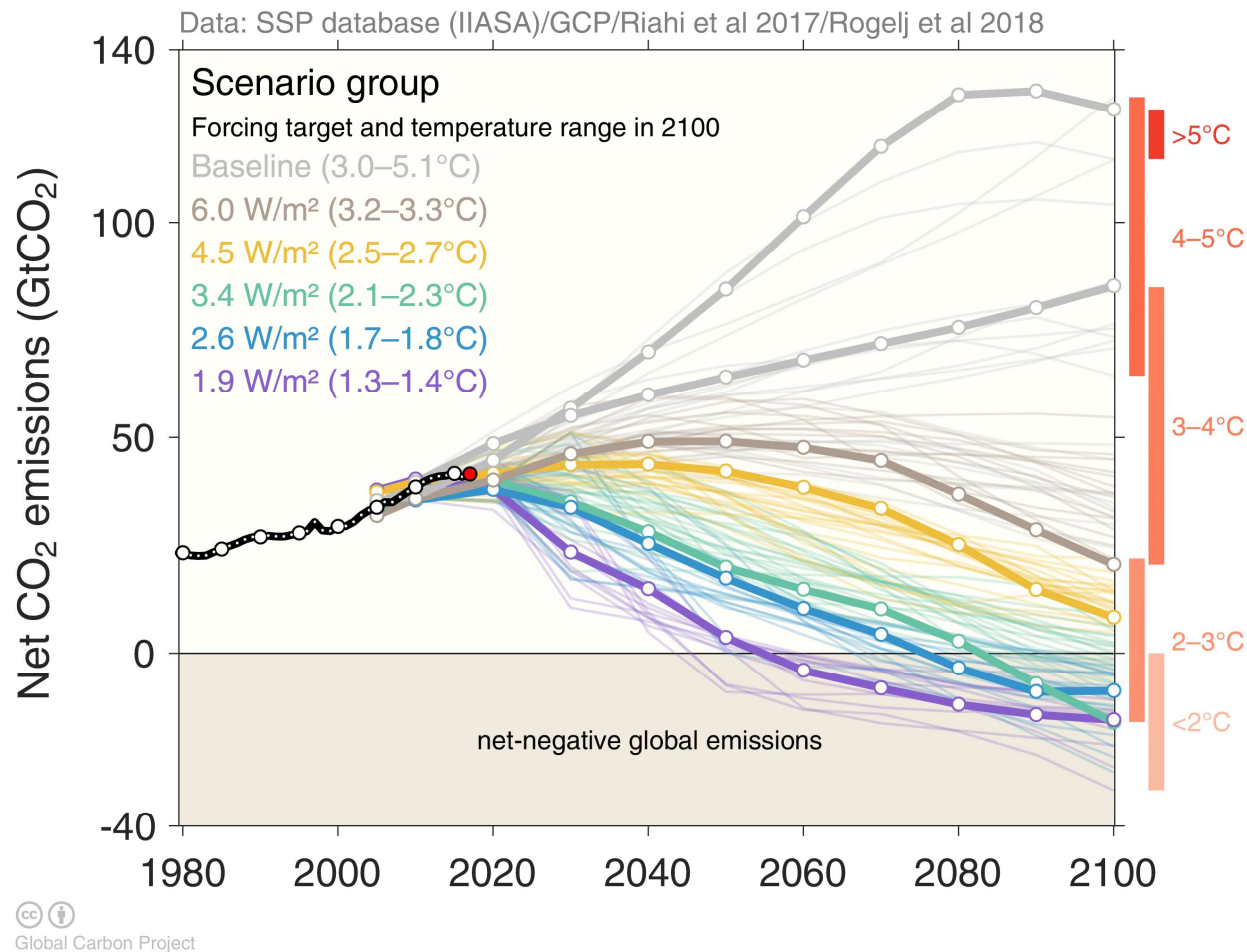
Global CO₂ emissions growth has generally resumed quickly from financial crises. Emission intensity has steadily declined but not sufficiently to offset economic growth.



Economic activity is measured in purchasing power parity (PPP) terms in 2010 US dollars.
Source: [CDIAC](#); [Peters et al 2012](#); [Le Quéré et al 2018](#); [Global Carbon Budget 2018](#)

Shared Socioeconomic Pathways (SSPs)

The Shared Socioeconomic Pathways (SSPs) lead to a broad range in baselines (grey), with more aggressive mitigation leading to lower temperature outcomes (grouped by colours)

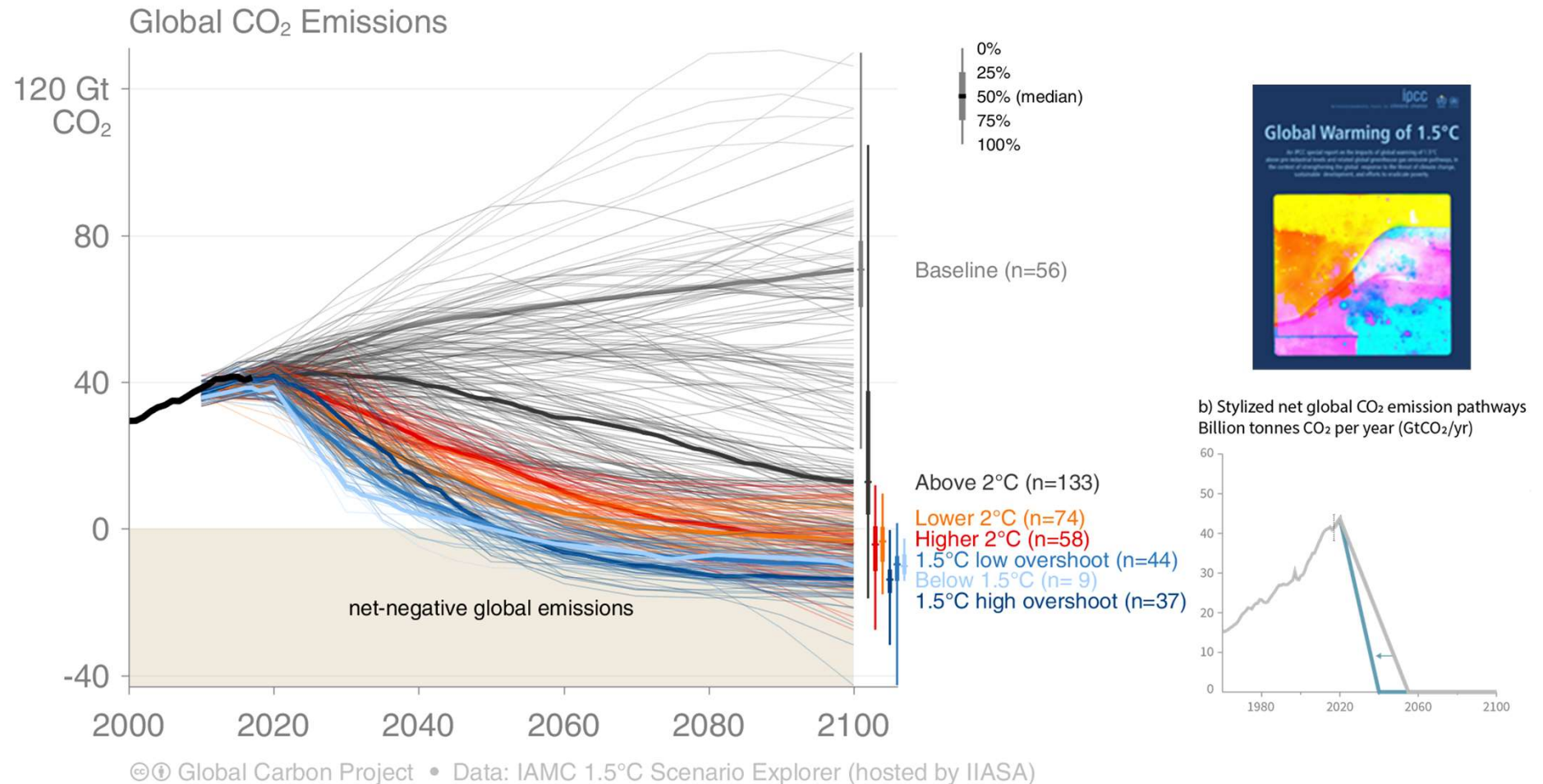


This set of quantified SSPs are based on the output of six Integrated Assessment Models (AIM/CGE, GCAM, IMAGE, MESSAGE, REMIND, WITCH). Net emissions include those from land-use change and bioenergy with CCS.

Source: [Riahi et al. 2016](#); [Rogelj et al. 2018](#); [IIASA SSP Database](#); [IAMC](#); [Global Carbon Budget 2018](#)

The IPCC Special Report on “Global Warming of 1.5°C”

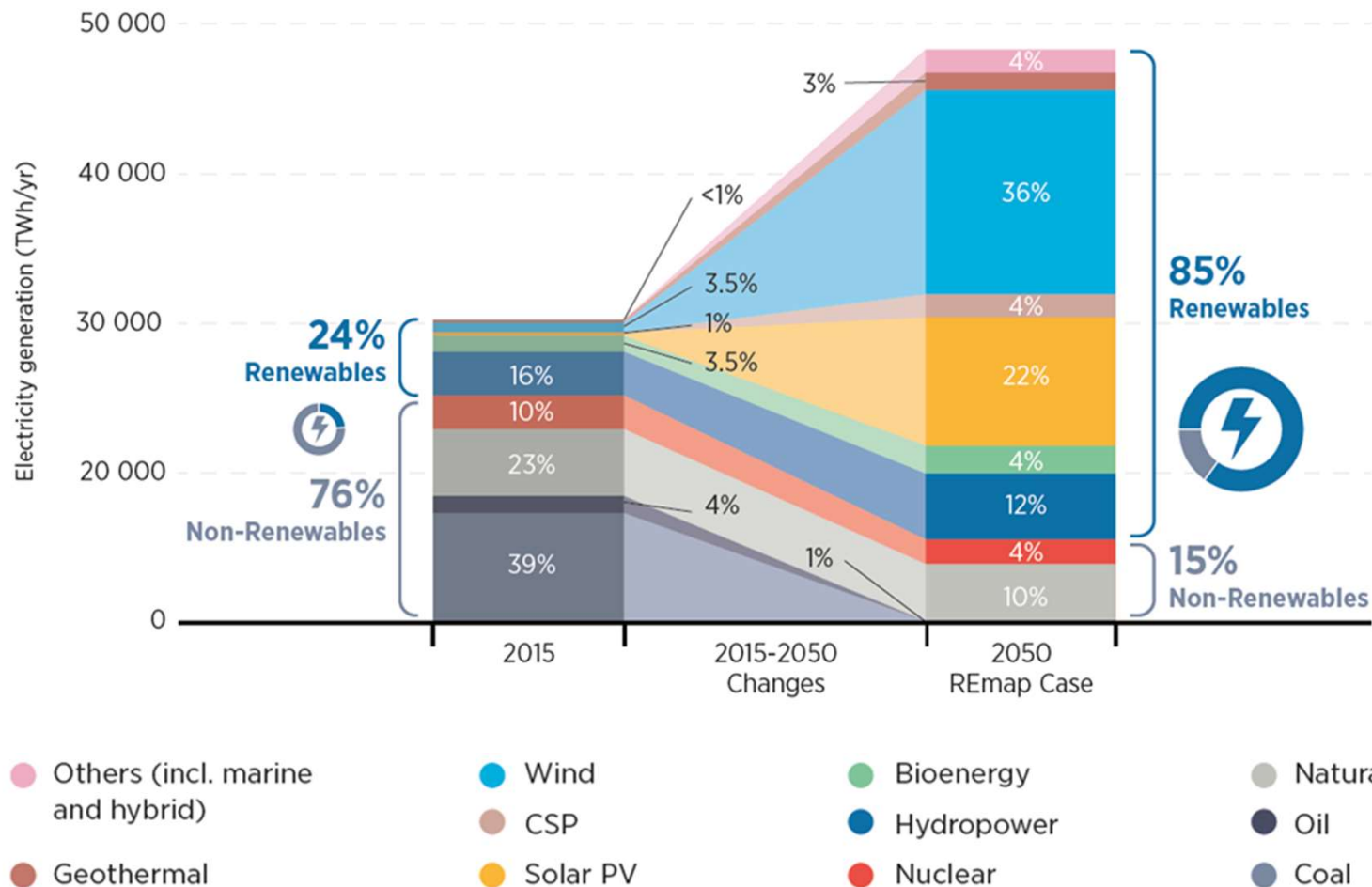
The IPCC Special Report on “Global Warming of 1.5°C” presented new scenarios: 1.5°C scenarios require halving emissions by ~2030, net-zero by ~2050, and negative thereafter



Net emissions include those from land-use change and bioenergy with CCS.

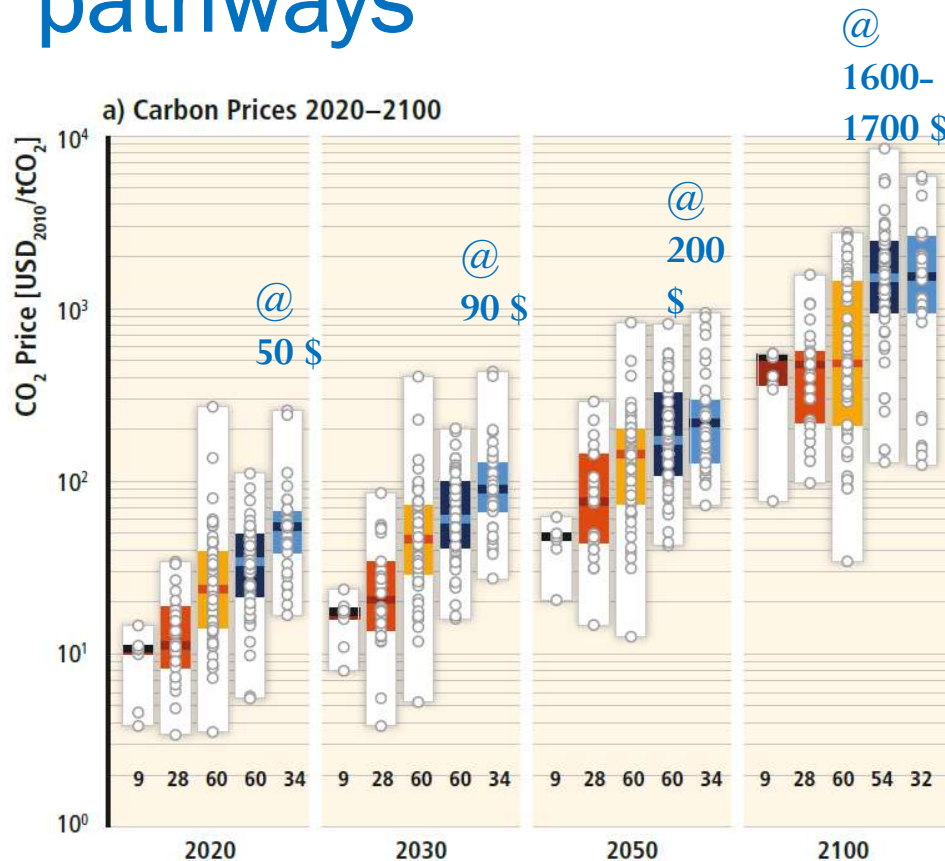
Source: [Huppmann et al 2018](#); [IAMC 1.5C Scenario Database](#); [IPCC SR15](#); [Global Carbon Budget 2018](#)

Electricity generation by source in a Paris Agreement compatible scenario



Carbon prices for different transformation pathways

IPCC 2014 Mitigation



High-Level Commission on Carbon Prices, co-chaired by Joseph Stiglitz and Lord Nicholas Stern

\$40-80/tCO₂e by 2020

\$50-100/tCO₂e by 2030

- Only 5% of priced-carbon are in Paris Agreement track
- Half are under 10\$/tCO₂e

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Setting the context for energy transition → What do Paris Agreement and SDGs expect from energy sector?



**Characterizing the ongoing energy transition, -
the 10 key trends**

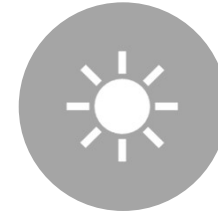


Guiding the transition → needs an integrated approach

1. Renewable Energy is already capturing greater attentions worldwide
→ will be the most important part of the energy transformation story in the coming decades



RE MAKES 17.5% IN 2016 OF FEC → A THIRD OF GLOBAL POWER GENERATION CAPACITY IN 2018



IN 2018 OVER 60% OF THE NEW INSTALLED POWER CAPACITY IS ALREADY RE → NEW 171 GW IN 2018 ALONE



44% OF GLOBAL RE GENERATION CAPACITY IS IN ASIA → 61% OF ADDITIONAL INSTALLED CAPACITY GLOBALLY IN 2018, AMOUNTING 105 GW, WAS IN ASIA



THIS IS JUST THE BEGINNING.....

2. Falling cost of renewables is already making it competitive in many regions → advances in storage technology and its economics will enable more 'variable' electricity such as wind and solar into the energy system



From 2009, the solar PV module prices have fallen by about 80% and wind turbine prices have fallen by 30 to 40%



By 2025, the cost of electricity from solar PV could fall by as much as 59% from 2016, CSP by up to 43%, and onshore and offshore wind by 26% and 35%



True benefits of renewable can only be realized if integration of large-scale storage is technically and economically feasible



Projections show that total electricity storage capacity could triple in energy terms by 2030



Storage will be a core of all new energy technologies into the future, at the utility scale and the household due to falling prices → provide grid stabilization, storing in electric vehicles, supporting mini-grids and microgrids, and self-consumption from rooftop solar

- Indoor air pollution
- Urban air pollution
- Resource depletion
- Other broader environmental problems

3. Sustainability consideration, especially climate change mitigation and air pollution, will be a key driver for future energy transformation, in parallel to economics and market forces

- **87 countries (2017) have renewable energy targets expressed as % share in primary and final energy**
- **In 146 countries, sector-specific targets for renewable power are in place**
- **In 48 countries, the targets for renewable for heating and cooling exist**
- **Renewable energy target for transport sector exist for 42 countries.**
- **Ambitiously, 57 countries worldwide have 100% renewable target**

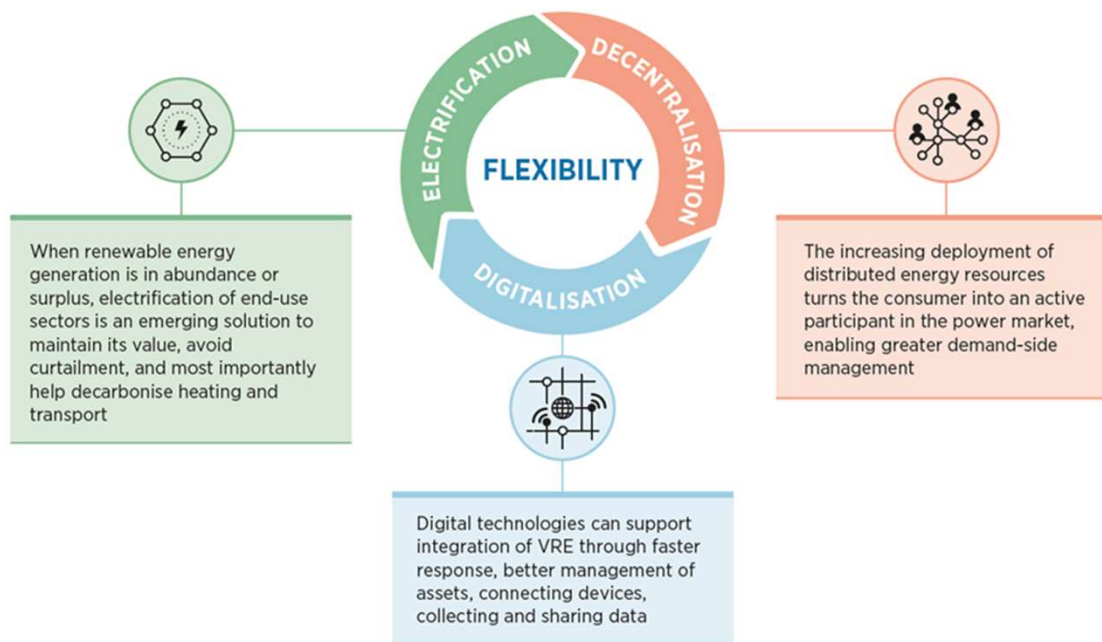
4. Power System
of the Future
will be
characterized by
renewable,
highly-
decentralized,
prosumer-
based, **storage-**
coupled, flexible
and IoT driven

Benefitting from emerging technologies and innovations including data analytics, blockchain, AI applications and system integration

Traditional model of large, top-down and centrally-distributed energy production and distribution is being replaced by modular, consumer-driven and evenly distributed power generation

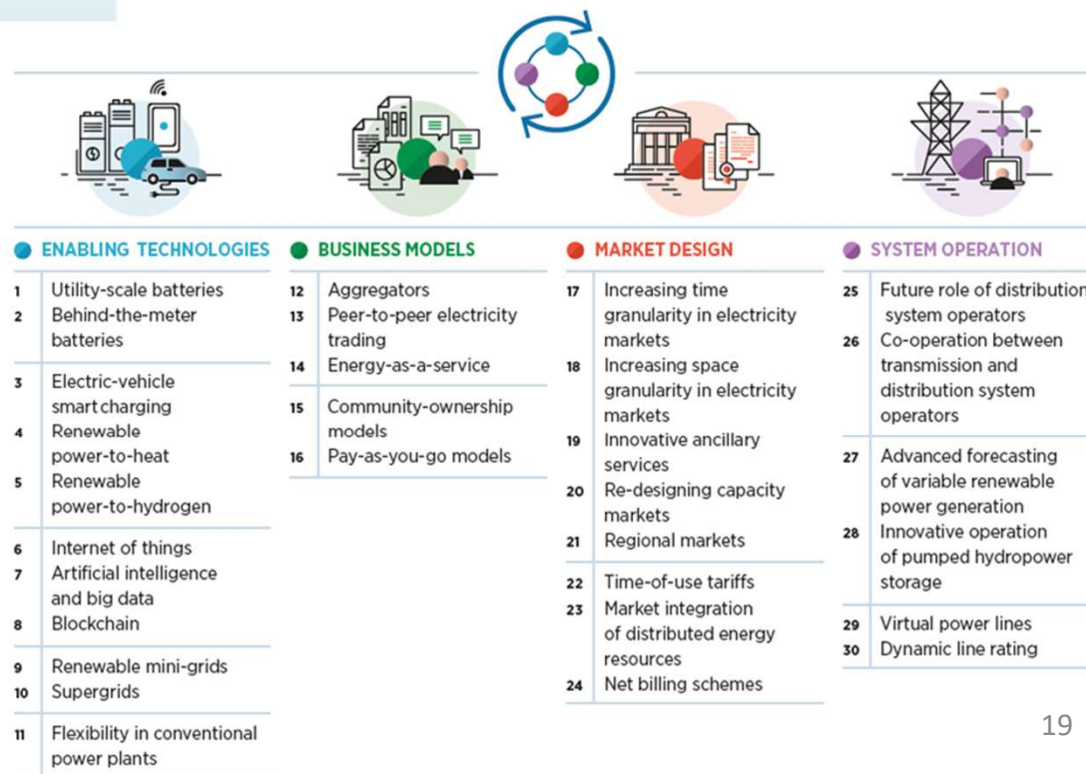
The key factor in the future grid could be a bi-directional energy flow and far reaching data and data-driven optimization

This implies that innovation is key for more variable electricity integration and thus in entire global energy transformation story



The three trends transforming the power sector

The landscape of innovations for power sector transformation



5. City and urbanization will be a powerful story in the global energy transformation



55% OF THE
WORLD'S
POPULATION
ALREADY LIVE
IN URBAN
AREAS AND
FURTHER
INTENSIFYING



ENERGY
CONSUMPTION
PER PERSON IN
CITIES IN
DEVELOPING
COUNTRIES
FAR HIGHER



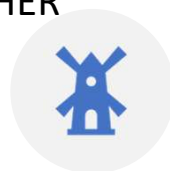
83% IN URBAN
AREAS HAVE
ACCESS TO
CLEAN
COOKING FUEL
IN CONTRAST
TO 34% IN
RURAL



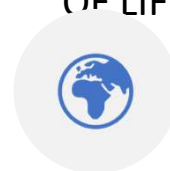
CITIES VITAL IN
TECHNOLOGY UPTAKE
AND EXPERIMENTATION,
AFFECT KEY
SUSTAINABILITY
DRIVERS AND AN AGENT
OF LIFESTYLE CHANGE



MORE THAN
40 CITIES
ALREADY
OPERATING ON
100%
RENEWABLE
ELECTRICITY



UK: OVER 80
TOWNS AND
CITIES
COMMITTED
TO RUN ON
100% CLEAN



SMART CITIES INITIATIVES
GLOBALLY AND IN KEY
COUNTRIES ARE TAKING
RENEWABLE ENERGY AND
ENERGY EFFICIENCY AT
THE VERY CORE

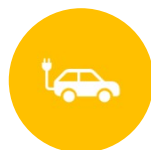
6. Divestment, renewable energy-based job and rise of a new industry is on the horizon



More and more investment in renewable energy



New and additional installed capacities are largely dominated by renewable energy



More EVs in the market will further tilt energy system in favor of electricity



Volume of carbon financing is slowly gathering pace



Renewable energy sector employed 11 million people in 2018



Off-grid solar sales are rising, and growing numbers of jobs are also being created while expanding energy access in isolated areas



How to further accelerate this divestment trends, spur new investment and promote job creation by?

- Monopolistic and vertically-integrated market → more horizontal and competitive market structure
- Power exchanges, liberalized energy trade
- New and more agents shaping market
- RE markets have started to compete with fossil fuel markets
- New market structure is expected to evolve, more autonomous transaction will take place, and new models of electricity pricing will be required

7. Market is moving towards vertical and horizontal deregulation and more competitive

8. Regional energy integration and markets are evolving more slowly than anticipated in Asia → require to address the political economy and new market models



**SAARC
FRAMEWORK IS
DYSFUNCTIONAL →**
ELECTRICITY TRADE
IN BBIN AND
BIMSTEC CONTEXT
IS GAINING
MOMENTUM



**BBIN → CROSS-
BORDER
TRANSMISSION
CAPACITY OF
ABOUT 3,000 MW
WITH FURTHER
3,600 MW UNDER
CONSTRUCTION,
AND MORE 4,000
MW UNDER
PLANNING**



**SURGING
ELECTRICITY
DEMAND IN
RESOURCE-STARVED
BANGLADESH AND
INDIA, CLEAN
ELECTRICITY FROM
NEPAL AND
BHUTAN**



**GMS REGION IS
AHEAD IN
ELECTRICITY TRADE
WHILE ASEAN
POWER GRID (APG),
DESPITE HUGE
PROMISE, IS
EVOLVING MORE
SLOWLY THAN
ANTICIPATED**



THE SOLUTION →
UNDERSTANDING
AND FIXING THE
POLITICAL
ECONOMY;
DEVELOPING MORE
APPROPRIATE
REGIONAL MARKET,
MARKET
MECHANISMS AND
THE REGULATORY
REGIMES

9. Policies, governance and institutional arrangements are stretched to cope up with the new technologies, scale issues, changing demand structure and the market dynamics



MAJOR POLICY DRIVES

- GHG MITIGATION GOALS
- PROMOTING RENEWABLE ENERGY WITH TARGETED-POLICIES SUCH AS FIT, RPS, RENEWABLE ENERGY CERTIFICATES, NET METERING, CORPORATE TAX RELIEFS
- BIOFUEL BLENDING TARGETS
- REWARDING ENERGY EFFICIENCY IMPROVEMENTS
- RESULT-BASED FINANCING
- INVESTMENT FACILITATIONS
- AND OTHERS



NEW AND INNOVATIVE MEANS ARE INCREASINGLY BEING SOUGHT BY THE DECISION MAKERS



PACE OF REFORMS IN REGULATORY REGIMES AND INSTITUTIONAL ARRANGEMENTS ARE PROVING SLOW TO COPE WITH SUCH DYNAMISM AND POLICIES ARE MORE REACTIVE

10. Human choice, behavior and political economy are central to the energy transformation as well as for the narratives of solutions

Understanding the energy use behavior, judgement and decision biases and its drivers are key

Effects of social norms and networks are tremendous on energy use behavior

Tendency to undermine the choice, behavior and political economy of the demand → fixate too much on supply and its economics

Choices and behavior revolve around agency, structure and the interplay of power, contingency and practice

Tremendous need for a understanding these elements in Asia



What all these
tell us?

Innovation in technologies,
policies and governance is the
must

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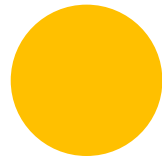
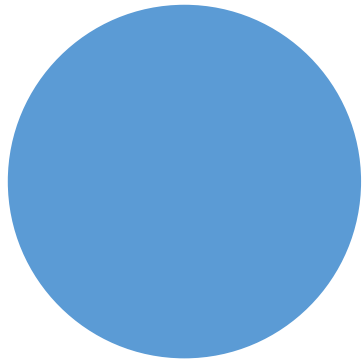
Characterizing the ongoing energy transition



Guiding this transition → needs an integrated approach

Integrated approach is must in Energy Sector

- National energy planning → comprehensiveness, nullify rebound effect → evidence-based
 - Planning for SDG7 and considering synergies with other SDGs
 - Comprehensive policy making → demand -supply
 - Appropriate governance → actors, multi-level governance
 - Institutional arrangement → Silo busting
 - Technology → needs assessment, facilitation and uptake
 - Leveraging financing and investment → push-pull approach



Thank you

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