

Deep Decarbonization And Sustainable Development

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SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE AND JUSTICE

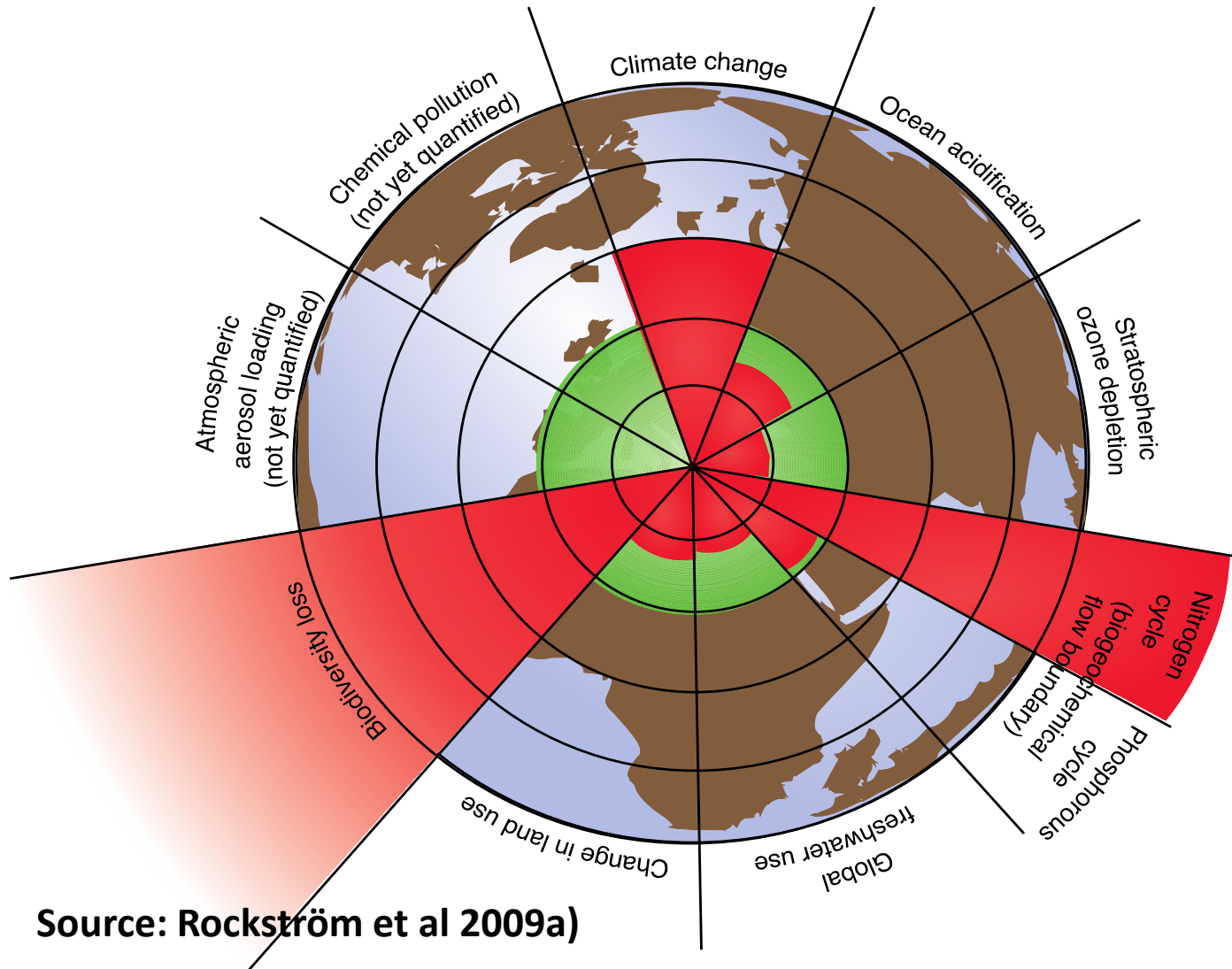


17 PARTNERSHIPS FOR THE GOALS



SUSTAINABLE
DEVELOPMENT
GOALS

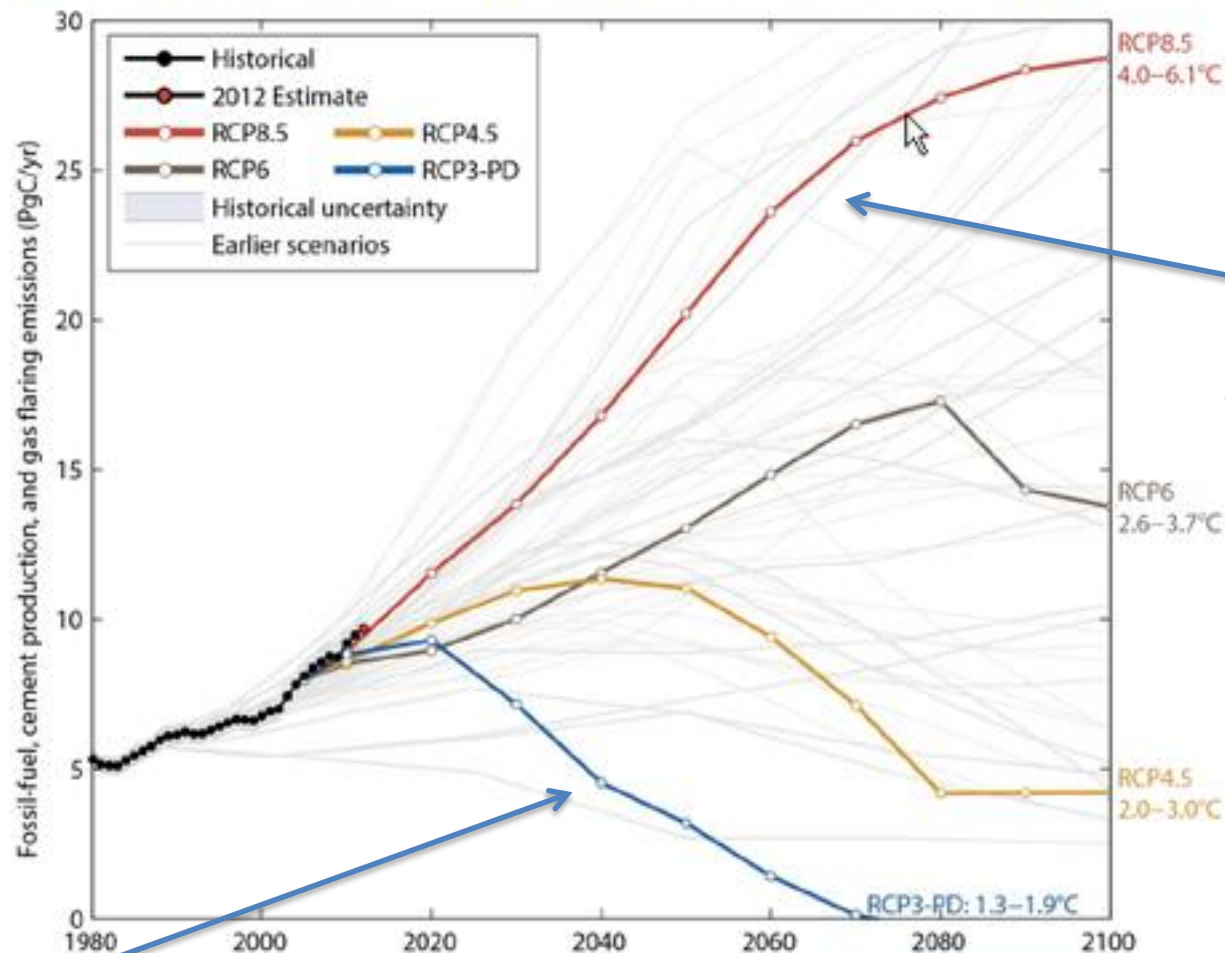
“PLANETARY BOUNDARIES”



THE PARIS AGREEMENT

Hold the increase in the global Average temperature “to well below 2° C” and “pursue efforts to limit the temperature increase to 1.5° C.

Emissions are heading to a 4.0-6.1°C “likely” increase in temperature
Large and sustained mitigation is required to keep below 2°C



BAU:
4-6 degree C

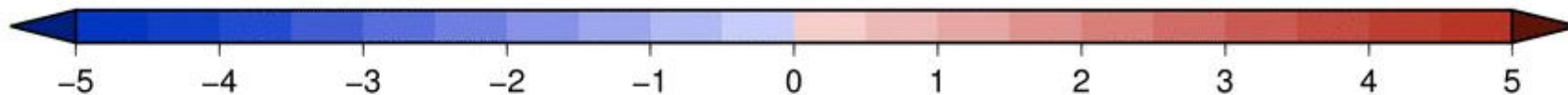
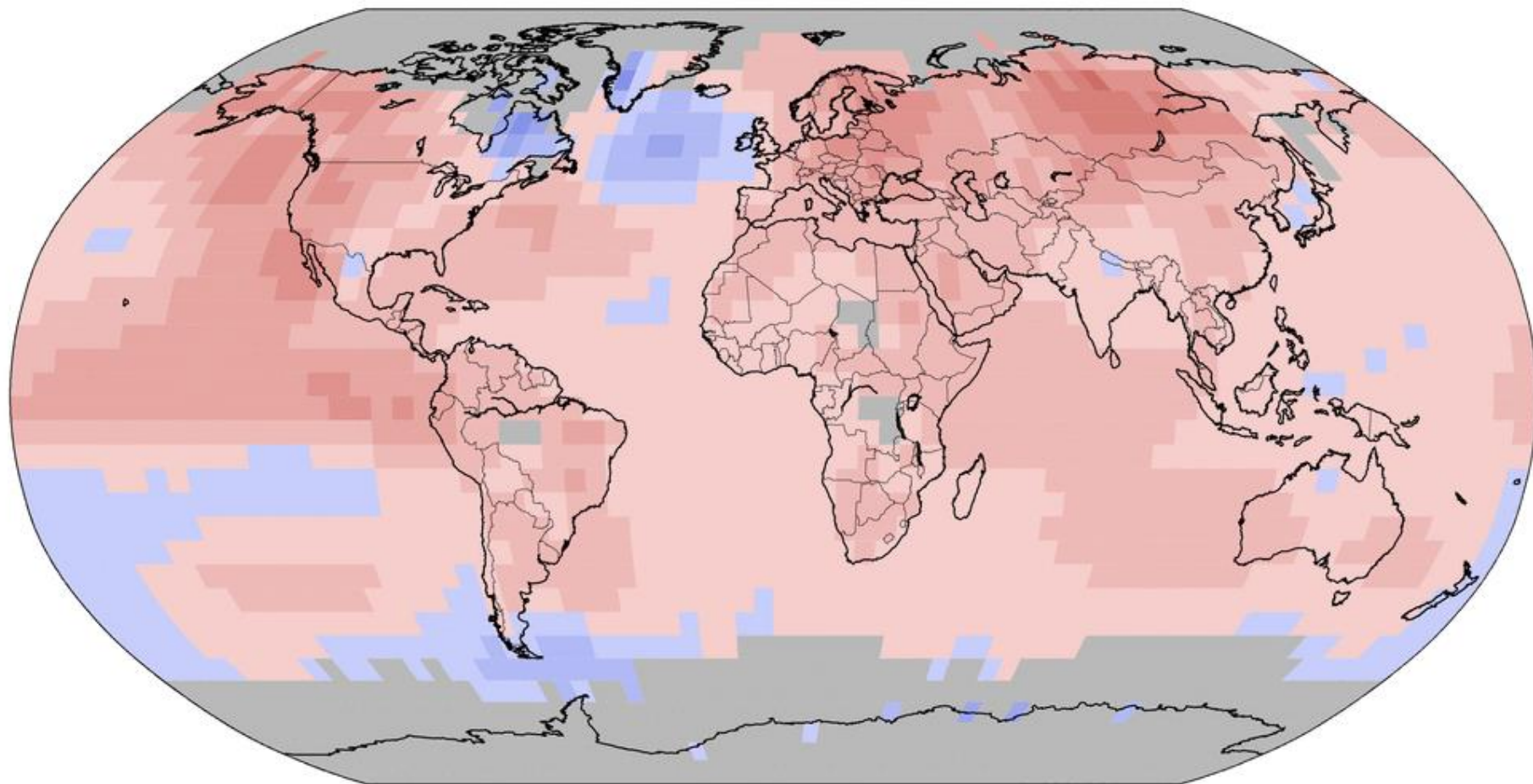
Linear interpolation is used between individual datapoints

2-degree C

Source: [Peters et al. 2012a](#); [Global Carbon Project 2012](#);

Land & Ocean Temperature Departure from Average Jan–Dec 2015 (with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0

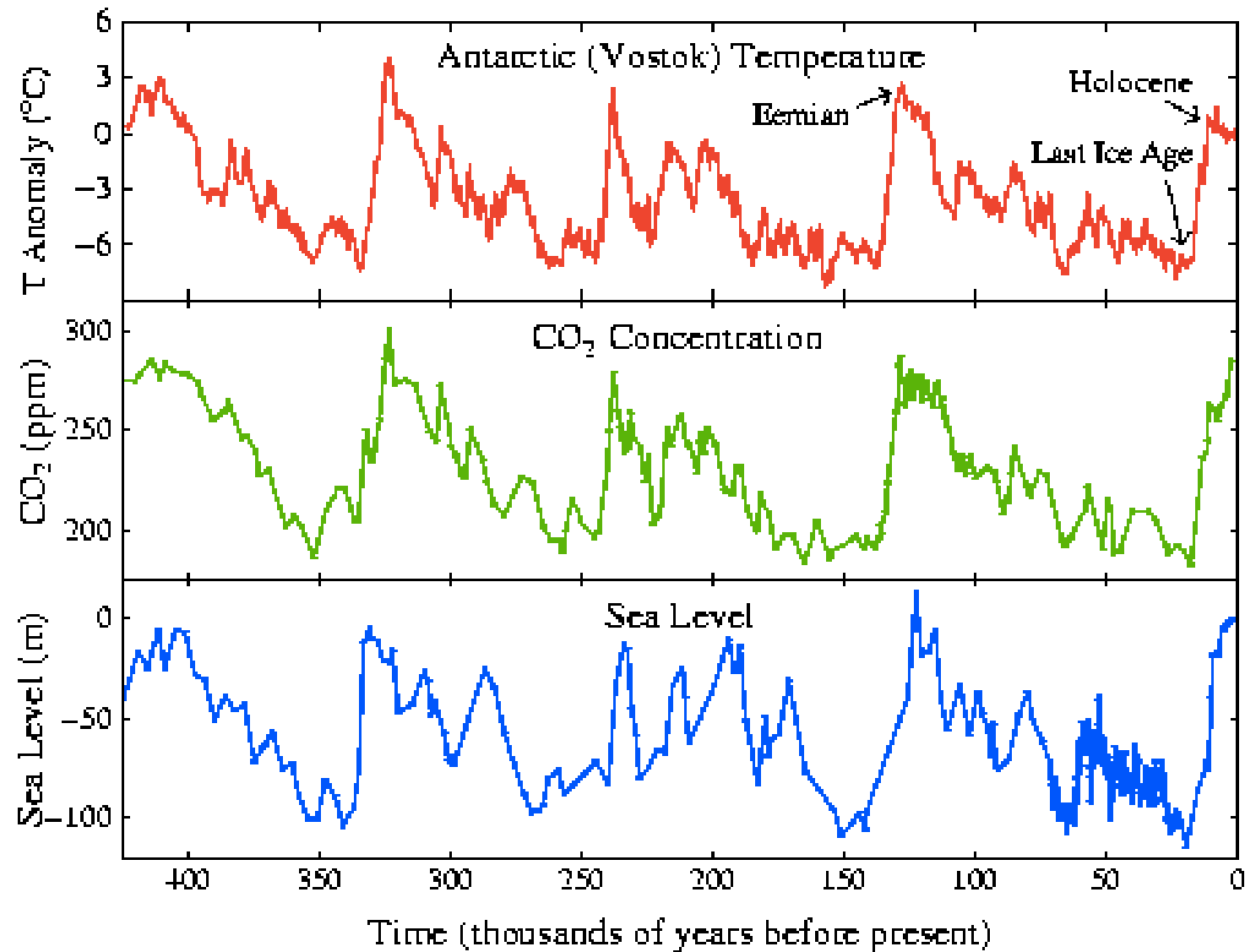


National Centers for Environmental Information
Wed Jan 13 12:14:51 EST 2016

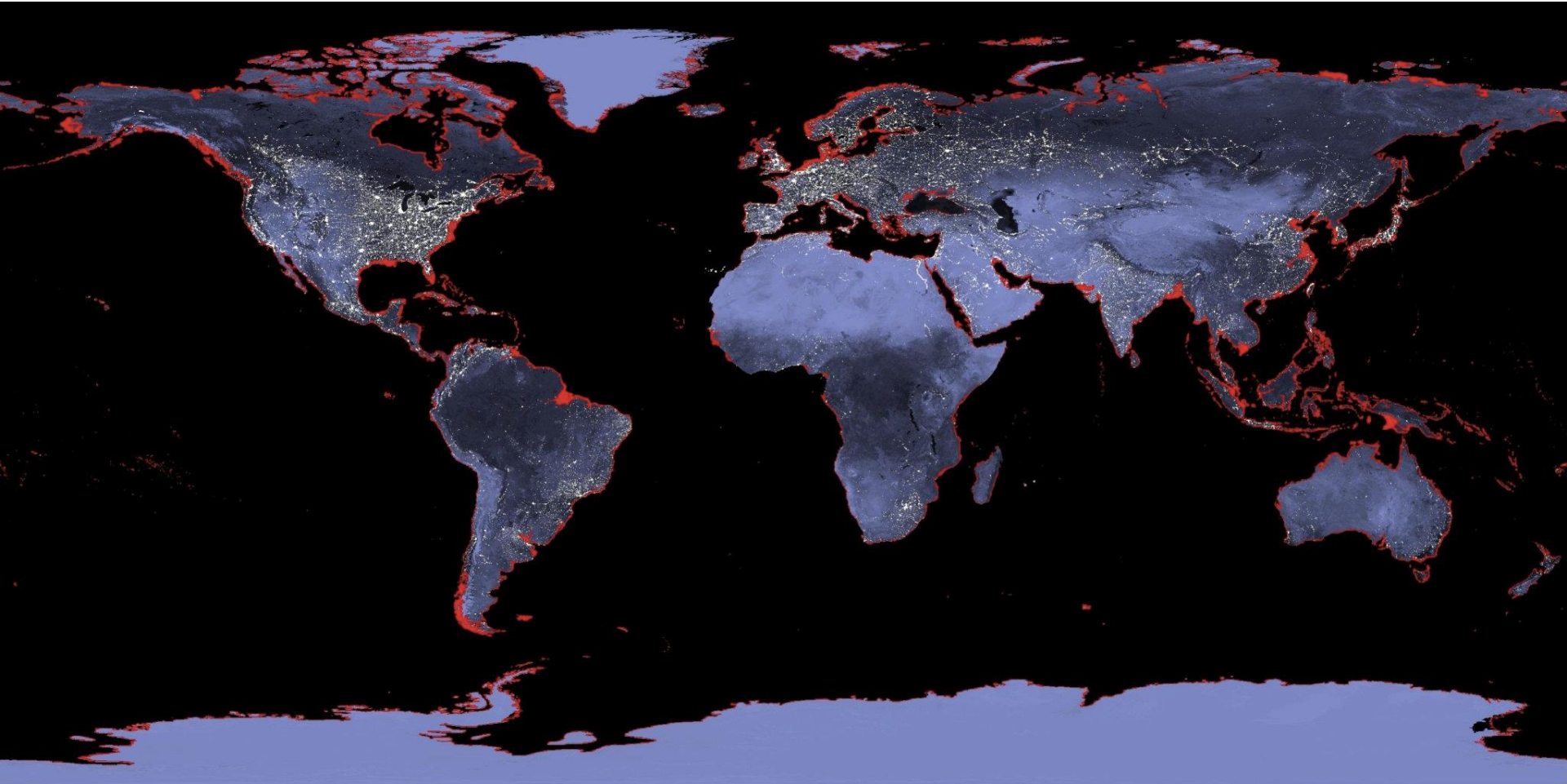
Degrees Celsius

Please Note: Gray areas represent missing data
Map Projection: Robinson

Sea Level in the Eamian



Land Lost to 6M Sea Level Rise, NASA



CO2 Emissions from Energy, 1960-2014 (Gigatons)

Region	Low Income Countries	Lower-Middle Income Countries	Upper-Middle Income Countries	High Income Countries	TOTAL	Share of Total
East Asia and Pacific	6.3	14.9	162.2	88.7	272.0	24.8%
Europe and Central Asia		32.2	40.6	296.8	369.6	33.8%
Latin America & the Caribbean	0.1	1.2	33.3	15.2	49.8	4.6%
Middle East and North Africa		7.8	20.2	20.4	48.4	4.4%
North America				286.4	286.4	26.2%
South Asia	0.2	46.7			46.9	4.3%
Sub-Saharan Africa	2.2	3.2	16.4		21.8	2.0%
						100.0
TOTAL	8.7	106.0	272.7	707.5	1,095.0	%
Share of Total	0.8%	9.7%	24.9%	64.6%	100.0%	

LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGIES, ARTICLE 4, PARA 19

All parties should “formulate and communicate long-term low greenhouse emission development strategies” by 2020

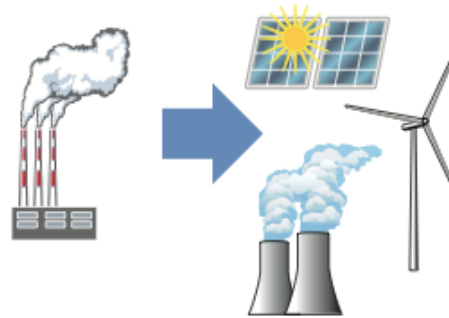
Main Decarbonization Strategies

Strategy

Energy Efficiency



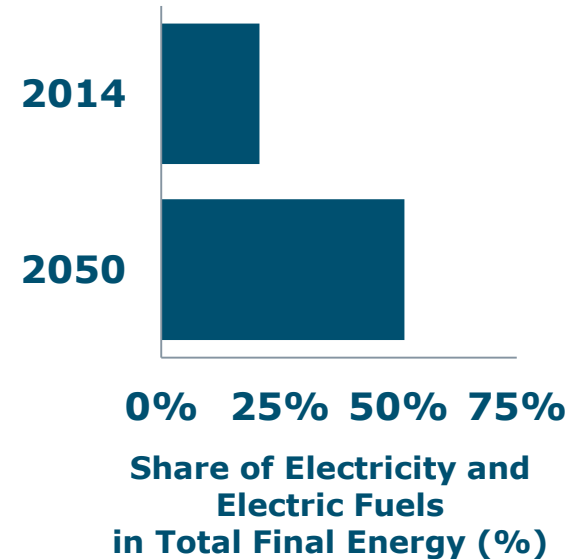
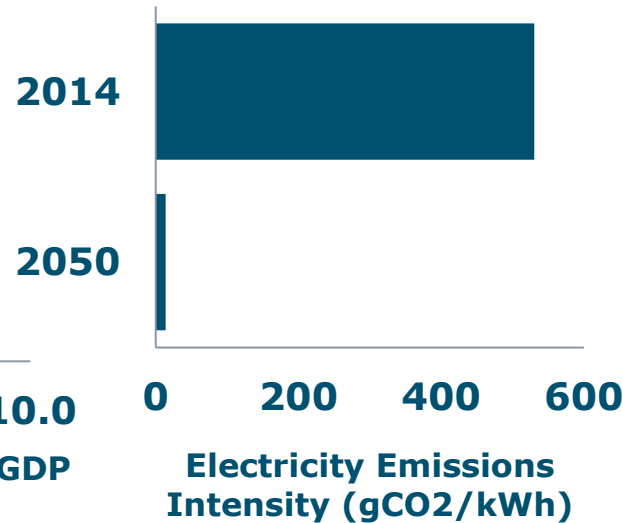
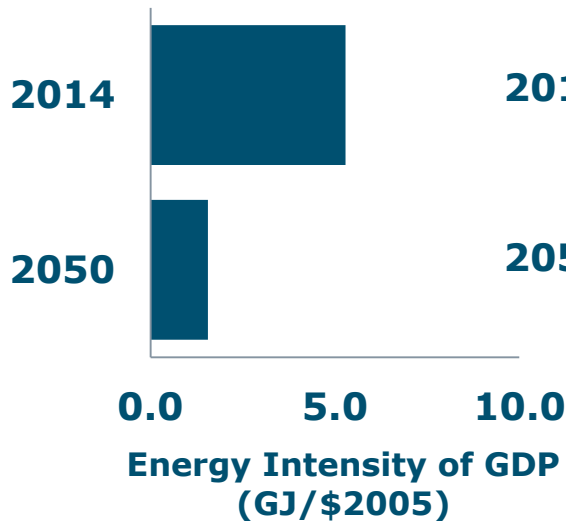
Decarbonization of Electricity



End Use Fuel Switching to Electric Sources



Key Metric of Transformation



pathways to
deep decarbonization

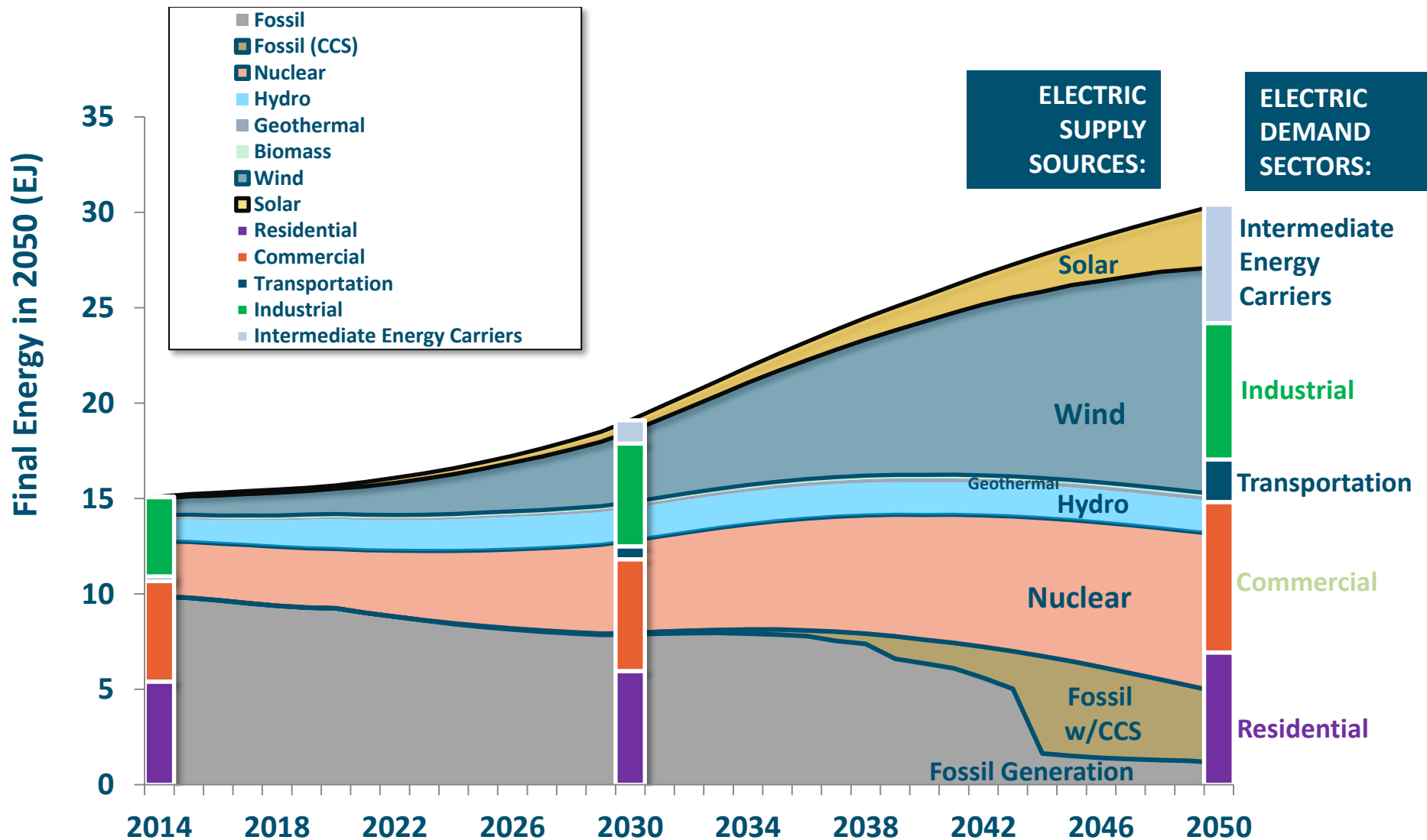
interim 2014 report

THE DEEP
DECARBONIZATION
PATHWAYS
PROJECT

IDDRI
Institut de Développement
Durable et de Recherche
Internationale



Electricity Supply: By Fuel Type and Demand Sector



WHO'S RESERVES WILL BE STRANDED?

Table 1 | Regional distribution of reserves unburnable before 2050 for the 2 °C

Country or region	2 °C with CCS					
	Oil		Gas		Coal	
	Billions of barrels	%	Trillions of cubic metres	%	Gt	%
Africa	23	21%	4.4	33%	28	85%
Canada	39	74%	0.3	24%	5.0	75%
China and India	9	25%	2.9	63%	180	66%
FSU	27	18%	31	50%	203	94%
CSA	58	39%	4.8	53%	8	51%
Europe	5.0	20%	0.6	11%	65	78%
Middle East	263	38%	46	61%	3.4	99%
OECD Pacific	2.1	37%	2.2	56%	83	93%
ODA	2.0	9%	2.2	24%	10	34%
United States of America	2.8	6%	0.3	4%	235	92%
Global	431	33%	95	49%	819	82%

FROM McGLADE AND EKINS, NATURE MAGAZINE, JANUARY 8, 2015

Total CO2 in Coal Reserves

Billion Tons

Total Coal CO2		Income group				Share of Total
Region	Low Income Countries	Lower-Middle Income Countries	Upper-Middle Income Countries	High Income Countries	TOTAL	
East Asia and Pacific	1	72	357	259	689	30.8%
Europe and Central Asia	-	101	128	480	710	31.7%
Latin America & the Caribbean	-	0	30	7	36	1.6%
Middle East and North Africa	-	0	3	-	4	0.2%
North America	-	-	-	516	516	23.1%
South Asia	0	247	-	-	247	11.0%
Sub-Saharan Africa	7	1	27	-	36	1.6%
TOTAL	9	421	546	1,262	2,238	100.0%
Share of Total	0.4%	18.8%	24.4%	56.4%	100.0%	

Total CO2 in Oil Reserves

Billion Tons

CO2 in Crude Oil
Proved Reserves

Income group

Region	Low Income Countries	Lower-Middle Income Countries	Upper-Middle Income Countries	High Income Countries	TOTAL	Share of Total
East Asia and Pacific	-	3	9	1	13	2.5%
Europe and Central Asia	-	0	12	28	41	8.0%
Latin America & the Caribbean	-	0	12	96	108	21.0%
Middle East and North Africa	-	3	115	159	277	53.8%
North America	-	-	-	54	54	10.6%
South Asia	-	2	-	-	2	0.4%
Sub-Saharan Africa	1	14	3	0	19	3.7%
TOTAL	1	22	151	339	514	100.0%
Share of Total	0.3%	4.3%	29.4%	66.0%		

CO2 in Natural Gas Reserves

Billion Tons

CO2 in Natural Gas Reserves

Region	Low Income Countries	Lower-Middle Income Countries	Upper-Middle Income Countries	High Income Countries	TOTAL
East Asia and Pacific	0.0	7.9	12.2	2.5	22.7
Europe and Central Asia	0.0	5.7	21.3	98.0	125.0
Latin America & the Caribbean	0.0	0.6	3.0	12.3	15.9
Middle East and North Africa	0.0	5.6	83.2	80.5	169.2
North America	0.0	0.0	0.0	3.9	3.9
South Asia	0.1	4.6	0.0	0.0	4.7
Sub-Saharan Africa	5.7	10.6	0.8	0.1	17.1
TOTAL	5.7	35.1	120.4	197.3	358.5

CO2 in Fossil Fuel Reserves

CO2 in Fossil Fuel Reserves

Region	Income group				TOTAL	Share of Total
	Low Income Countries	Lower-Middle Income Countries	Upper-Middle Income Countries	High Income Countries		
East Asia and Pacific	1	82	379	262	724	23.3%
Europe and Central Asia	-	108	162	607	876	28.2%
Latin America & the Caribbean	-	1	44	115	160	5.1%
Middle East and North Africa	-	9	201	239	449	14.4%
North America	-	-	-	574	574	18.5%
South Asia	0	253	-	-	253	8.1%
Sub-Saharan Africa	14	26	31	0	72	2.3%
TOTAL	16	479	817	1,798	3,110	100.0%
Share of Total	0.5%	15.4%	26.3%	57.8%	100%	

Key Principles for Long-Term Success

Low-Emissions Development Strategies (LEDS) to 2050

Specialized Public Institutions for the
Energy Transition

Low-Carbon Technology:

Renewables, Hydro, Nuclear, CCS

Electric Vehicles, Electric Heating

Use Pricing and Regulation

Phase out Coal Without CCS

Plan to Strand High-Cost Hydrocarbons

Use Cross-Border Grids and Systems

Fair Climate Financing

Official Development Aid to Meet the SDGs

Potential Pathways to Negative Emissions

Biological Sequestration (ending deforestation, restoring degraded lands, afforestation)

BECSS (Bio-Energy plus CCS)

Direct Air Capture and CCS

Potential Pathways to Continued Use of Carbon Fuels:

Fossil Fuels + CCS at Facility

Fossil Fuels + Direct Air Capture + CCS

Direct Air Capture + Renewable Energy =
Synthetic Hydrocarbons (artificial photosynthesis)

What is a “Fair” Allocation of the Climate Burden?

Fair depends on who has the “right” to emit CO₂.

If every country has the “right” to its climate, then fairness should mean that each emitter compensates other countries for the damages it creates.

This is the “Polluter Pay” Principle

A Suggested Approach to Climate Fairness

Maximize world income through an efficient allocation of mitigation efforts (least-cost transition to low-carbon energy plus biological storage and CCS)

Compensate each country for climate losses using a Global Losses and Damages Fund (and “attribution”)

Allocate the quotas to the Global Losses and Damages Fund according to each country’s historic contribution to global GHG emissions (measured as CO₂eq)

Share in the global public financing of R&D with open licensing of all key technologies (global patent pool)

Provide adequate development aid to ensure the SDGs

In Practice, we should aim for the following:

Effective price on Carbon through combination of taxes, permits, feed-in tariffs, and REDD+

International transfers for losses and damages

Concessional financing of LIC mitigation (mainly MDBs)

Technology transfer for LICs and LMICs (mainly low-cost licensing)

Extra years for LIC and LMIC countries to transition to low-carbon energy plus extra comp for faster transition

Increased Global R&D

Increased Official Development Aid

LOW-EMISSIONS SOLUTIONS CONFERENCE

AT COP 22 on November 14-16, 2016

Co-Hosted By the Government of Morocco
with:

UN Sustainable Development Solutions Network
World Business Council on Sustainable
Development (WBCSD)
Local Governments for Sustainability (ICLEI)

The World in 2050 Initiative

Hosted at the International Institute
For Applied Systems Analysis (IIASA)

With:

Earth Institute

Potsdam Institute for Climate Impact Research

Stockholm Resiliency Institute

PBL Netherlands Environmental Assessment Agency

And many others!

THE SDSN GLOBAL NETWORK

