Dr Kim Nicholas @KA_Nicholas

Thread Reader App
59 tweets - 08 Oct 2018
KA_Nicholas/status/1049173550828015616

Steeling myself with a strong coffee to sit down and read major new report on avoiding dangerous #climatechange (@IPCC_CH #SR15, available here: ipcc.ch/report/sr15/). My takes to follow (1/n)

As always, the #peerreview effort by @IPCC_CH is Herculean. A couple hundred volunteer scientists read & cited 6,000+ studies to support conclusions w/ evidence. Responded to 42,001 comments in 3 rounds of review. The most robust process there is to establish scientific consensus

Key statistics of the Special Report on Global Warming of 1.5ºC

91 authors from 44 citizenships and 40 countries of residence
- 14 Coordinating Lead Authors (CLAs)
- 60 Lead authors (LAs)
- 17 Review Editors (REs)

133 Contributing authors (CAs)
Over 6,000 cited references
A total of 42,001 expert and government review comments
(First Order Draft 12,895; Second Order Draft 25,476; Final Government Draft: 3,630)

https://pbs.twimg.com/media/Do9qCY7XkAAuEE2.jpg

Now, this #SR15 report title is descriptive, but doesn't exactly roll off the tongue...

Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

https://pbs.twimg.com/media/Do9q_Z_W0AEfT38.jpg

Humans have caused 1.0°C warming so far, which will last for 100s to 1000s of years. We have not yet emitted enough to warm 1.5° but are on track to do so w/ current emissions rates as soon as 2030. More warming = more risks. #SR15 headline statements

Limiting warming to 1.5° instead of 2° makes a big & important difference to land and marine species & ecosystems, & the benefits humans derive from nature (fisheries, water supply, food security), human health & security, & economic growth. #SR15 headline statements

#sealevelrise will continue for centuries, but how much and how fast depends on our choices for greenhouse gas emissions going forward. SLR will be 0.1m lower at +1.5° instead of +2°, and rise slower, which enables more possibilities for adaptation. #SR15 headline statements

There are many adaptation options that reduce risk; more options open to us to adapt to #climatechange of +1.5 vs. 2°. However, even at 1.5° there are some unavoidable losses. There are some climate changes humans & nature cannot adapt to. #SR15 headline statements

To limit warming to 1.5°, humans must reduce CO2 & other greenhouse gases by 45% by 2030 (vs 2010 levels). Requires deep, rapid reductions in all sectors (energy, land, urban, transport, buildings, industry). This needs much more investment in mitigation #SR15 headline statements

Limiting warming to 1.5° requires human greenhouse gas emissions to go to ZERO by 2050. Any emissions remaining after 2050 must be removed from the atmosphere to avoid contributing to further warming. #SR15 headline statements

Limiting warming to below 2° requires reducing CO2 20% by 2030 (vs. 2010 level) and to ZERO by 2075 (if any emissions remain then, they must be removed from the atmosphere). #SR15 headline statements (Limiting warming at any given temp requires net zero emissions.)

To limit warming to 1.5°, humans will have to remove some carbon from the atmosphere. This has its own risks. If we reduce emissions fast, we can limit amount of carbon removal needed & avoid relying on bioenergy with carbon capture and storage (BECCS). #SR15 headline statements

Current #ParisAgreement pledges to 2030 are not on track to limit warming to 1.5°. Bigger emissions cuts are needed in the next decade to make 1.5° possible. #SR15 headline statements

Limiting warming to 1.5° generally improves sustainable development but implies both tradeoffs & synergies for

#SDGs. Investments, policy, tech, behavior change are all needed to limit risks from warming 1.5°. #SR15 headline statements

We all have to pitch in to make 1.5° possible. Countries, civil society, business, indigenous & local communities. Working together supports sustainable development, int'l cooperation critical for poor & vulnerable people & regions. #SR15 headline statements

Moving on to the #SR15 Summary for Policymakers: The warming observed so far matches predictions within 20%. Current warming is 0.2°/decade from past and present emissions. (Scientists have good predictions of #climatechange & it's happening fast.)

Warming is uneven: Some regions & seasons already warm faster than average (land warms faster than ocean; #Arctic is 2-3x higher warming). #SR15 SPM

#extremeweather events have increased with 0.5° warming. #SR15 SPM (Thus, the difference between 1.5 and 2° is very relevant).

The amount of CO2 we emit determines the temperature at which we can stabilize the planet (the big global thermostat knob; we've already emitted a lot, which lasts a very long time). Non-CO2 emissions are also important on short time scales (fine-tuning knob). #SR15 SPM

In the long run, removing carbon from the atmosphere and/or further reducing non-CO2 greenhouse gases may be needed to 1. prevent further warming due to Earth system feedbacks, 2. reverse ocean acidification & 3. prevent more #sealevelrise. #SR15 SPM

It's better to prevent a mess than clean it up: Stabilizing temperature below 1.5° in the first place is less risky than allowing temperatures to peak higher (eg., 2°) and then removing a lot of CO2 to get down to 1.5° later. #SR15 SPM

More damage & more suffering from climate extremes at 2°: Extremes are worse with 0.5° more warming. Extreme hot days at +1.5° average projected to be +3° hotter, at 2.0 avg +4° hotter. #SR15 SPM

Greater warming (2° vs 1.5°) also predicted to lead to greater risks of heavy precipitation in some regions (leading to greater flood risks), and more drought in others. #SR15 SPM

The difference between 1.5 and 2° is critical for #sealevelrise. Antarctica and/or Greenland melt could be triggered between 1.5 and 2°, leading to global catastrophic risk of multi-meter rise over 100s/1000s of years. #SR15 SPM

Difference between 1.5° and 2° warming is huge for #biodiversity. Species range losses projected to be 3x higher for insects (basis of many food chains), 2x higher for plants (basis of all food chains) & 2x higher for vertebrates (many cuddly & iconic creatures) at 2°. #SR15 SPM

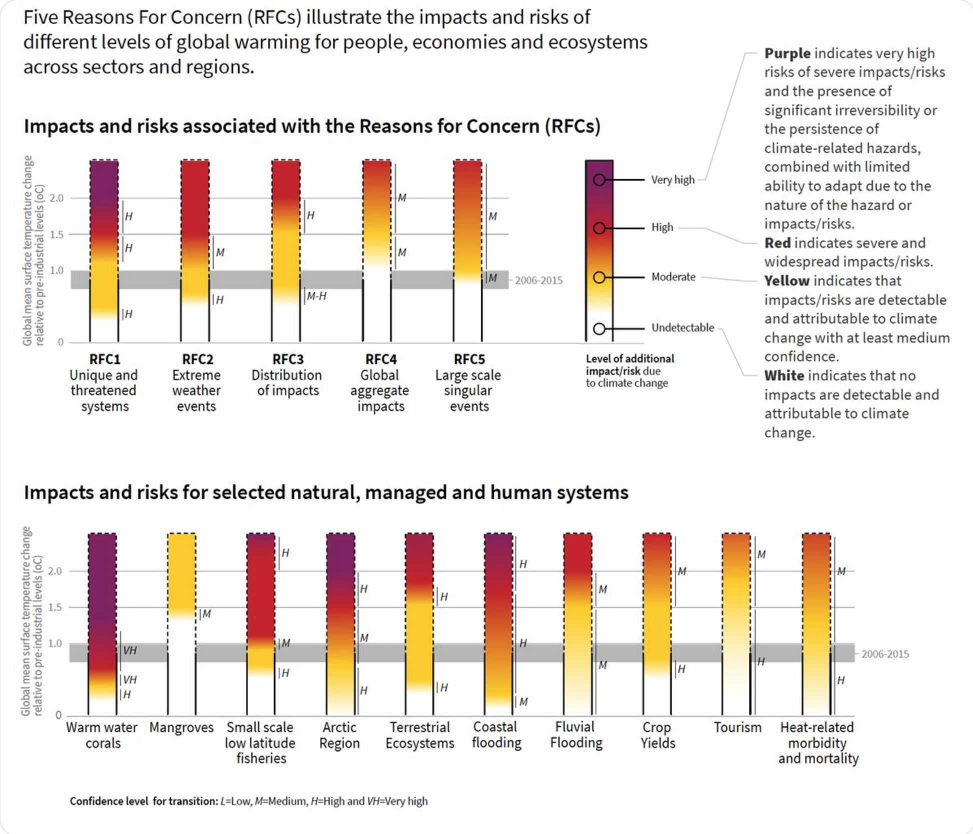
More warming = more risk of "ecosystem transformation from one type to another." Particularly worrying is loss of boreal forest & tundra. Limiting warming to 1.5° would prevent thawing of 1.5-2.5 m km2 of permafrost over centuries. #SR15 SPM

Coral reefs are very sensitive to #climatechange; they're one example of unavoidable loss we've already locked in (predicted decline 70-90% under 1.5° warming). But that grim number is still much better than near-total ">99%" loss under 2°; half a degree matters. #SR15 SPM

Warming >1.5° threatens food production, part of the definition of dangerous warming to be avoided by @UNFCCCwebcast: Yields & nutritional quality of maize, rice, wheat are lower under 2° than 1.5°, esp. in Sub-Saharan Africa, Southeast Asia, Central & South America. #SR15 SPM

The argument that fossil-fueled development is needed to combat poverty does not hold up: Continued economic growth is threatened by the temperature increase from 1.5 to 2°, especially in the tropics and Southern Hemisphere. #SR15 SPM

New science keeps pushing back the safe threshold for critical, global, and/or irreversible impacts and risks. Even at 1.5° risks to unique & threatened systems are very high & extreme weather risks high. Risks get worse at warming beyond 1.5°. #SR15 SPM



https://pbs.twimg.com/media/Do9_l9JW0AEZ1l5.jpg

[coffee empty and stomach growling, must break for breakfast now, will be back to finish my plain-language summary of #SR15 after a break!]

[I have refueled & finished the SPM, here comes the rest of my translation of #SR15 #climatechange report to plain English #scicomm]

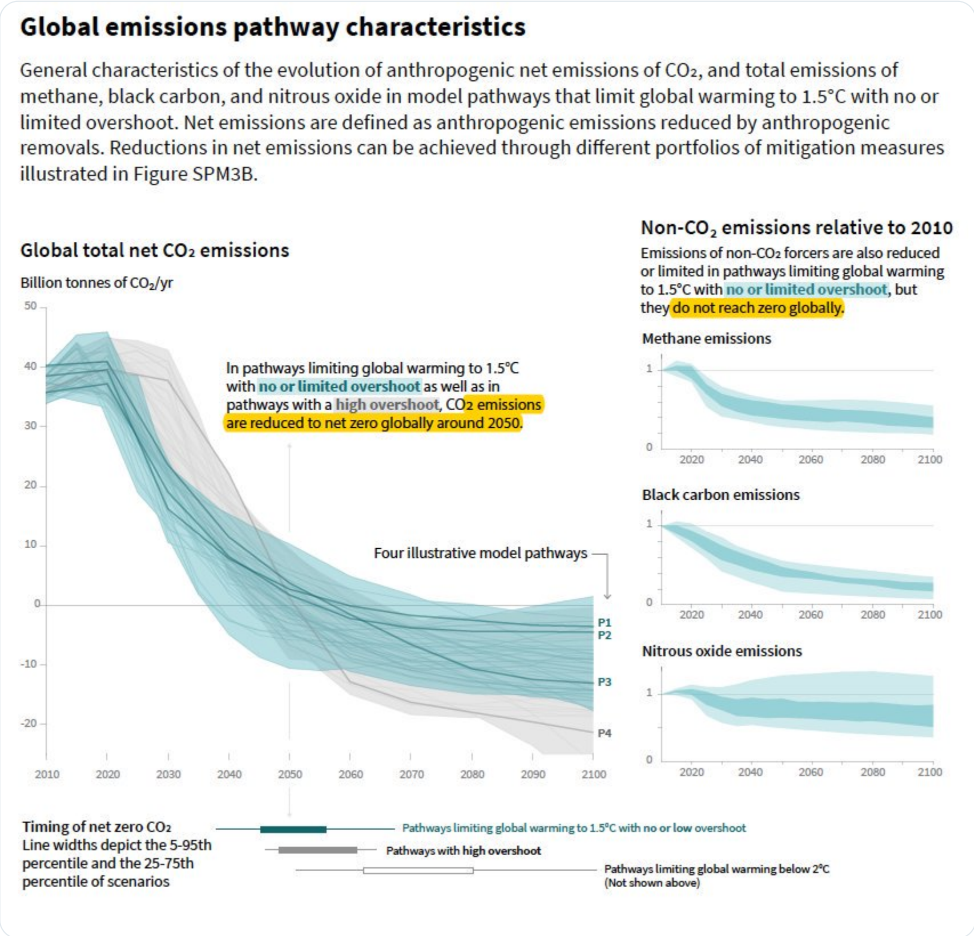
Pathways to limit warming to 1.5° vary in how they combine emissions reductions (= lowering energy & resource intensity (increasing efficiency) + decarbonizing (switch to carbon-free energy sources)) & removing CO2 from the atmosphere. #SR15 SPM C1.1

Pathways to 1.5° require 35% reductions in black carbon & methane by 2050 (vs. 2010). This also reduces aerosols (particles) which cool climate- meaning for a few decades we won't see full benefit of these efforts, but they're there. Esp large benefits for health. #SR15 SPMC1.2

The #carbonbudget determines humanity's chance of staying below a given temperature increase. No matter how you calculate it, humanity has already used up the great majority (74%-84%) of forever's budget. Rapid emission reductions are needed for either 1.5° or 2°. #SR15 SPMC1.3

Pathways to 1.5° did not assess "solar radiation management" (eg putting mirrors in space to reflect incoming sunlight). This is deemed risky, unethical, and does not solve ocean acidification. Limiting warming requires reduced GHG emissions. #SR15 SPMC1.4

Limiting warming to 1.5° requires zeroing out CO2 emissions fast, and rapid reductions in methane + black carbon (though not to zero). N2O declines the least. #SR15 fig SPM3.a



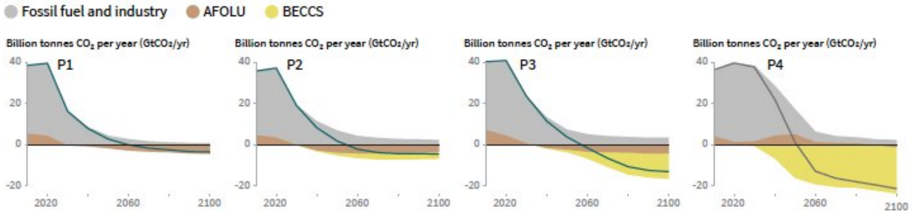
https://pbs.twimg.com/media/Do-Vo9iW0AILD_M.jpg

A range of pathways can achieve 1.5°. The most sustainable (left) rapidly reduces #fossilfuels & therefore CO2, ramps up renewables, & lowers energy demand, avoids need for risky #BECCS. The least sustainable (right) continues to kick the can down the road. #SR15 Fig SPM3b

Characteristics of four illustrative model pathways

Different mitigation strategies can achieve the net emissions reductions that would be required to follow a pathway that limit global warming to 1.5°C with no or limited overshoot. All pathways use Carbon Dioxide Removal (CDR), but the amount varies across pathways, as do the relative contributions of Bioenergy with Carbon Capture and Storage (BECCS) and removals in the Agriculture, Forestry and Other Land Use (AFOLU) sector. This has implications for the emissions and several other pathway characteristics.

Breakdown of contributions to global net CO_2 emissions in four illustrative model pathways



P1: A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or low overshoot	No or low overshoot	No or low overshoot	High overshoot	No or low overshoot
CO_2 emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-59,-40)
└ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-104,-91)
Kyoto-GHG emissions in 2030 (% rel to 2010)*	-50	-49	-35	-2	(-55,-38)
└ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
*Final energy demand** in 2030 (% rel to 2010)*	-15	-5	17	39	(-12, 7)
└ in 2050 (% rel to 2010)	-32	2	21	44	(-11, 22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47, 65)
└ in 2050 (%)	77	81	63	70	(69, 87)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78, -59)
└ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95, -74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
└ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
└ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
└ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
└ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(243,438)
└ in 2050 (% rel to 2010)	832	1327	878	1137	(575,1300)
Cumulative CCS until 2100 ($GtCO_2$)	0	348	687	1218	(550, 1017)
└ of which BECCS ($GtCO_2$)	0	151	414	1191	(364, 662)
Land area of bioenergy crops in 2050 (million hectare)	22	93	283	724	(151, 320)
Agricultural CH_4 emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-46,-23)
Agricultural N_2O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,4)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

** Kyoto-gas emissions are based on SAR GWP-100*
*** Changes in energy demand are associated with improvements in energy efficiency and behaviour change*

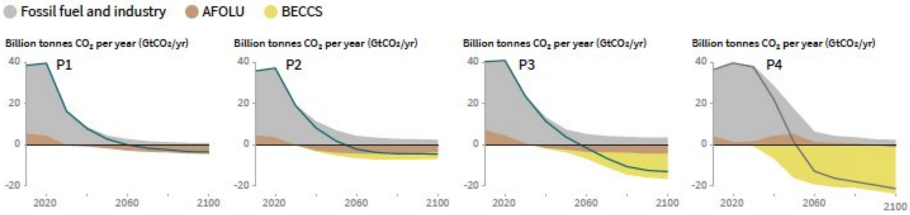
https://pbs.twimg.com/media/Do-WRbMXkAELgbs.jpg

Note that major differences between pathways to 1.5° is how fast we act now (to 2030). They end up at similar places in 2050: high renewables (70+%) and greatly reduced CO2 (90+%). Difference is delay requires enormous use of risky bioenergy #BECCS. #SR15 Fig SPM.3b

Characteristics of four illustrative model pathways

Different mitigation strategies can achieve the net emissions reductions that would be required to follow a pathway that limit global warming to 1.5°C with no or limited overshoot. All pathways use Carbon Dioxide Removal (CDR), but the amount varies across pathways, as do the relative contributions of Bioenergy with Carbon Capture and Storage (BECCS) and removals in the Agriculture, Forestry and Other Land Use (AFOLU) sector. This has implications for the emissions and several other pathway characteristics.

Breakdown of contributions to global net CO_2 emissions in four illustrative model pathways



P1: A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or low overshoot	No or low overshoot	No or low overshoot	High overshoot	No or low overshoot
CO_2 emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-59,-40)
└ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-104,-91)
Kyoto-GHG emissions in 2030 (% rel to 2010)*	-50	-49	-35	-2	(-55,-38)
└ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
*Final energy demand** in 2030 (% rel to 2010)*	-15	-5	17	39	(-12, 7)
└ in 2050 (% rel to 2010)	-32	2	21	44	(-11, 22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47, 65)
└ in 2050 (%)	77	81	63	70	(69, 87)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78, -59)
└ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95, -74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
└ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
└ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
└ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
└ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(243,438)
└ in 2050 (% rel to 2010)	832	1327	878	1137	(575,1300)
Cumulative CCS until 2100 ($GtCO_2$)	0	348	687	1218	(550, 1017)
└ of which BECCS ($GtCO_2$)	0	151	414	1191	(364, 662)
Land area of bioenergy crops in 2050 (million hectare)	22	93	283	724	(151, 320)
Agricultural CH_4 emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-46,-23)
Agricultural N_2O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,4)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

** Kyoto-gas emissions are based on SAR GWP-100*
*** Changes in energy demand are associated with improvements in energy efficiency and behaviour change*

https://pbs.twimg.com/media/Do-XVSLWwAE4aek.jpg

Limiting warming to 1.5°C requires rapid, far-reaching transitions & deep emissions reductions across sectors. These system transitions have never been done at global scale now required, but fast transitions have happened before w/i sectors, technologies & regions. #SR15 SPMC2.1

Pathways to 1.5° have lower energy demand (incl more efficiency) & electrify faster than 2° pathways. By 2050, 70-85% of electricity is generated with renewables. Remainder nuclear + gas with carbon capture & storage. #SR15 SPMC2.2

There is zero future for coal under 1.5°: Pathways to 1.5° have 0-2% electricity generation by #coal in 2050. #SR15 SPMC2.2

Industry must be nearly carbon-free in the next several decades: Industry must reduce CO2 emissions 75-90% by 2050 (vs. 2010) to meet 1.5° warming. Industry reductions of CO2 by 50-80% are compatible with 2° warming. #SR15 SPMC2.2

Industry can achieve 1.5° or 2° compatible pathway using a range of tech & practices (e.g., electrification, hydrogen, "sustainable bio-based feedstocks, product substitution, and carbon capture"). Improving efficiency of existing system alone is not sufficient. #SR15 SPMC2.3

Transport must decarbonize very fast to meet either 1.5° (7-13x more in 2050 than in 2020) or 2° (5-9x more). #SR15 SPMC2.4

All pathways to 1.5 involve #landuse change. Scale depends on e.g. how fast emissions reduced + sustainable (plant-based) diets taken up. Slow reductions = huge conversion of pasture + ag land to energy crops & forests; major sustainability challenge. #SR15 SPMC2.5

(Had to dig into chapters to get this one): Currently most global energy investments go to #fossilfuels (red bars). To meet either 1.5° or 2° needs ca. 20% increase in overall energy investment by 2050 & big shift in investments from fossils to #renewables. #SR15 Fig 2.27

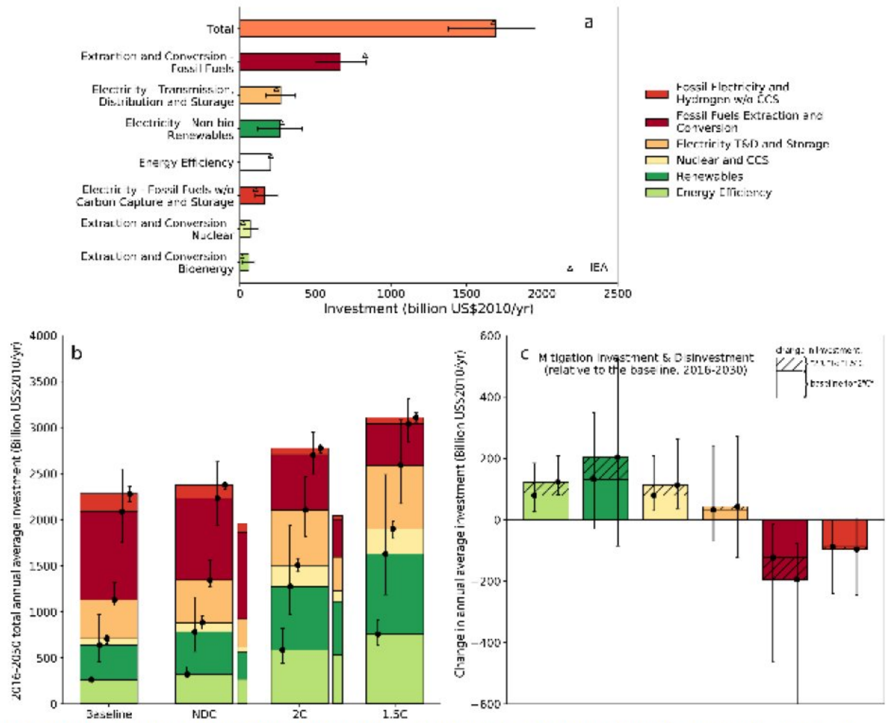


Figure 2.27: Historical and projected global energy investments. (a) Historical investment estimates across six global models from (McCollum et al., 2018) (bars = model means, whiskers full model range) compared to historical estimates from IEA (International Energy Agency (IEA) 2016) (triangles). (b) Average annual investments over the 2016–2050 period in no-climate policy 'baselines', scenarios which implement the NDCs ('NDC'), scenarios consistent with the Lower-2°C pathway class ('2°C'), and scenarios in line with the 1.5°C-low-OS pathway class ('1.5°C'). Whiskers show the range of models; wide bars show the multi-model means; narrow bars represent analogous values from individual IEA

https://pbs.twimg.com/media/Do-ebeoW4AAUyq_.jpg

Important to see context for need for 4-5x increase in low-carbon and efficient energy investments (SPM C2.6): this is relative to low levels today, where energy investments concentrate on #fossilfuels. That will not be the case if we decide to limit warming to 2° or below. #SR15

Meeting 1.5° is more expensive than 2°, about 12% more total energy investments by 2050, and 3-4x higher cost per ton to reduce emissions. #SR15 SPM C2.7 (This is because we've waited so long to reduce emissions that the rapid reductions now needed for 1.5 aren't the cheapest.)

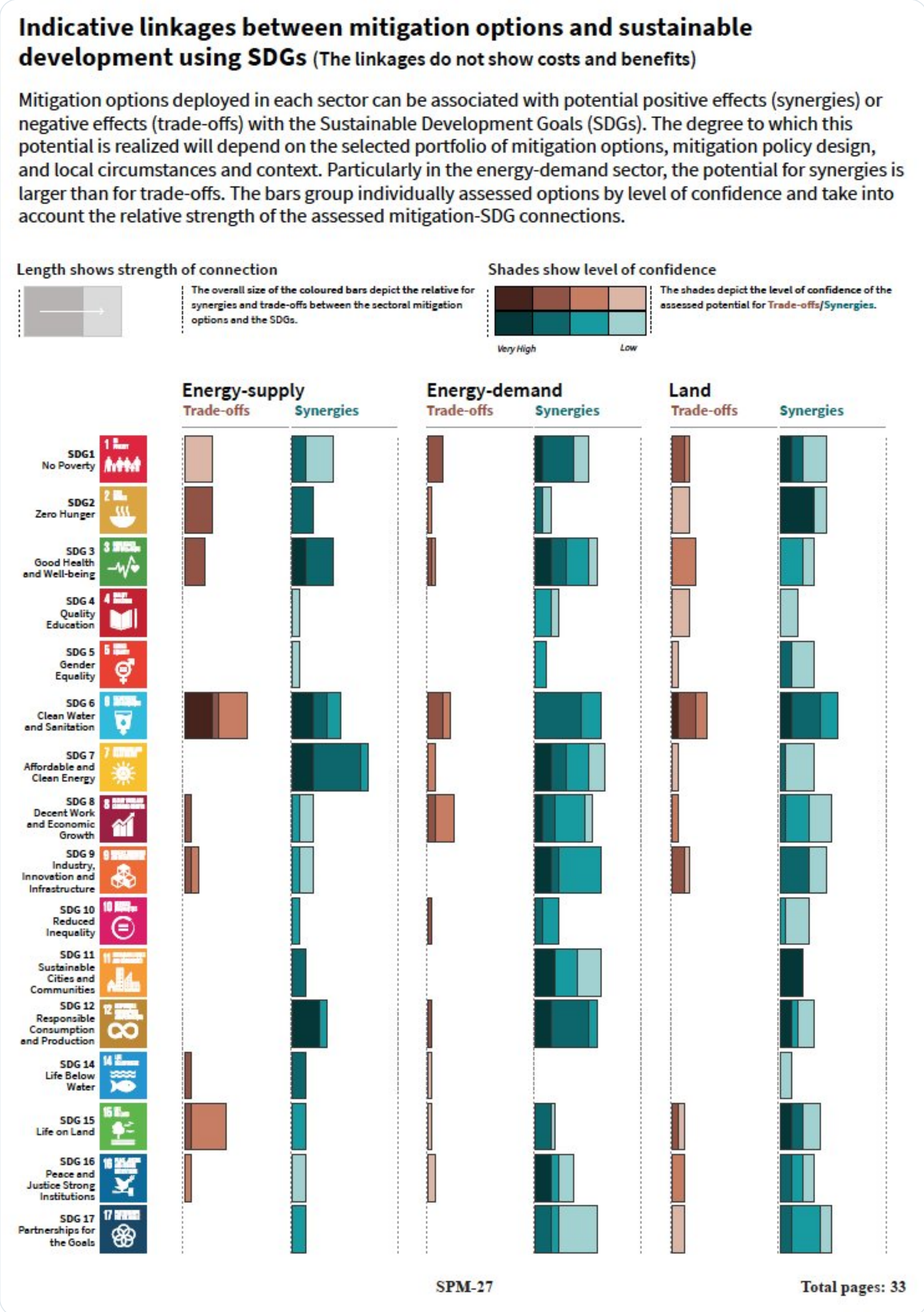
Science cannot guarantee that planning to emit now, remove later (carbon dioxide removal after delayed emissions peak) will work to reduce temperature, even if it is somehow deemed socially acceptable & done at scale. #SR15 C3.3

Carbon dioxide removal should not be seen as a global, one size fits all solution. Putting all eggs in this basket is risky. Nonetheless, there may be smaller scale natural climate solutions like restoration and soil carbon sequestration that have co-benefits. #SR15 SPM3.4 & 3.5

Current Paris pathways = about +3° global warming by 2100, and cannot meet 1.5° even if we invest more after 2030. We must reduce emissions more and faster- about 50% below 2010 levels by 2030- to limit warming to 1.5°. #SR15 SPM D1.1

The next decade is critical for emissions reductions and therefore chance of staying below +1.5°C. Delaying reductions increases expense, lock in to high carbon infrastructure, stranded assets, and reduces future options. #SR15 SPMD1.3

Comprehensive view of #sustainability (economic, social, environmental) shows strong benefits to many #SDGs (health, energy, cities, sustainable production/consumption, oceans) from limiting climate change to 1.5°C. Need to carefully balance risks to water & biodiversity. #SR15



https://pbs.twimg.com/media/Do-jfS_XkAEaDKs.jpg

Revenue and employment generation for regions currently dependent on #FossilFuels is at risk if world wants to stay below 1.5°. Need to diversify economy and energy sector to address this challenge. #SR15 D4.4

Limiting warming to 1.5° means investing about 2.5% of world GDP in the energy system between now and 2035. #SR15 SPM D5.3 (Given all the risks above, what a bargain!!)

Adapting to and limiting warming to 1.5° requires "wide-scale behaviour changes" and public acceptability, which hinges on what consequences the public expects, & fairness of political distribution & process. #SR15 SPM D5.6

It's not development "vs." climate: "Sustainable development supports, and often enables, the fundamental societal and systems transitions and transformations that help limit global warming to 1.5°C." #SR15 SPM D6

We have to tackle sustainable development comprehensively: Pathways characterized with "lack of international cooperation, inequality and poverty" could not make it to 1.5°C. #SR15 SPM D6.3

@threadreaderapp unroll