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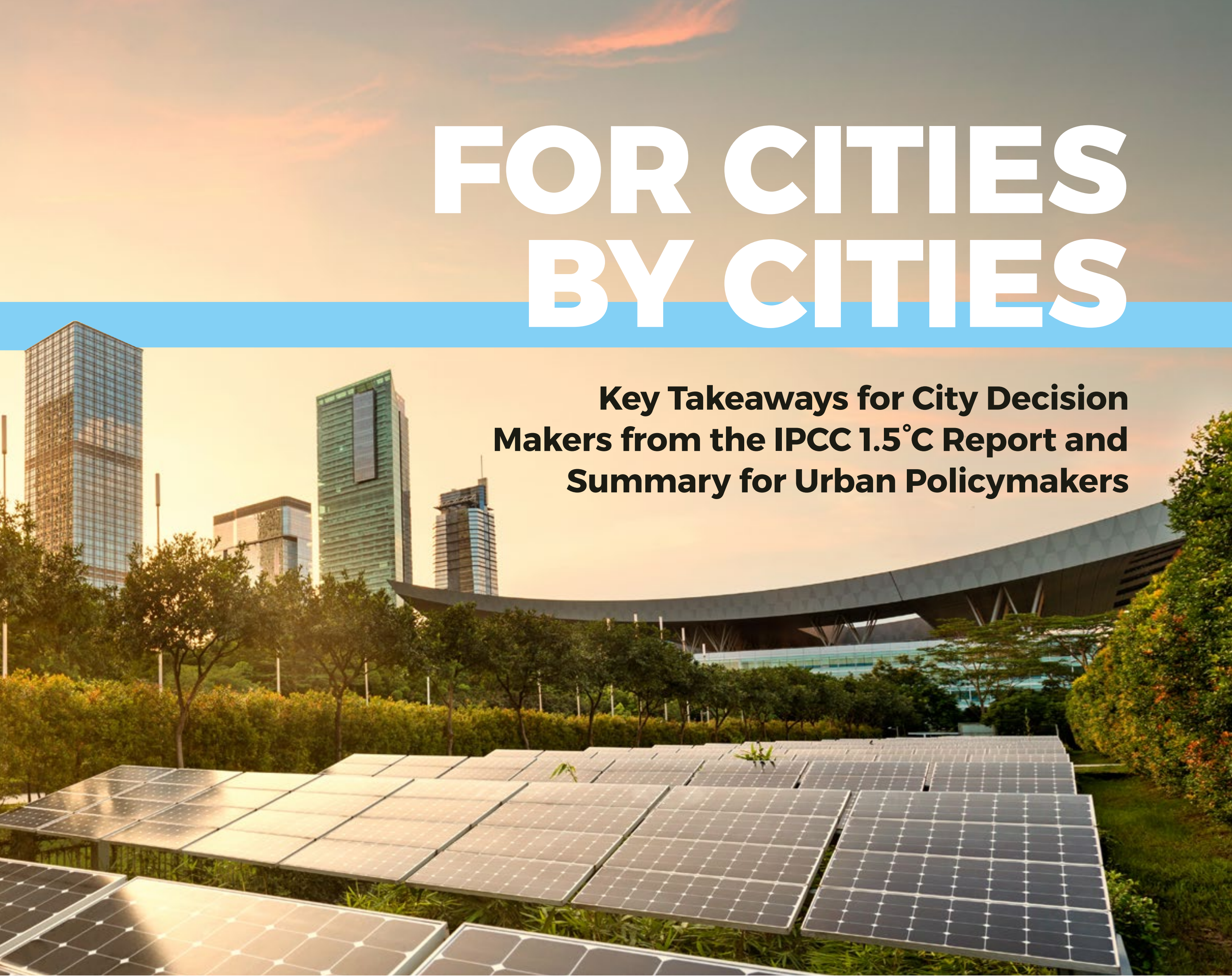
Key Takeaways for City Decision Makers from the IPCC 1.5˚C Report and Summary for Urban Policymakers



Cities worked together to summarize the most relevant information and actionable findings related to the latest science on 1.5˚C.

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C was produced by IPCC scientists – at the request of nations at the adoption of the Paris Agreement – to explain the pathways to and impacts of 1.5°C.

A Summary for Urban Policymakers (SUP) produced by members of the SR1.5 author team also synthesized findings for cities. This briefing document was subsequently compiled by city policymakers to summarize the most actionable information for cities on the latest 1.5°C science.

THE PARIS CLIMATE AGREEMENT COMMITTED SIGNATORIES TO MAINTAIN GLOBAL HEATING TO WELL BELOW 2˚C ABOVE PRE-INDUSTRIAL LEVELS AND TO PURSUE EFFORTS TO LIMIT THIS INCREASE TO 1.5˚C.

TOP LINES

1. Limiting global heating to 1.5°C is critical.

2°C of heating has long been cited as the threshold to avoid dangerous levels of climate change. We now know that even 2°C of heating is dangerous. The projected impacts of 2°C versus 1.5°C of heating include half a billion more people struggling to get enough to eat, double the number of people suffering from water scarcity, and dramatic increases in ecosystem loss.

2. It is still possible to limit global temperature rise to 1.5°C.

But only if ambitious climate action is made an urgent priority for all leaders. There is no historical precedent for the pace of the transformation at the scale needed. Both transformational mitigation and adaptation are necessary. For a two-thirds chance of limiting temperature rise to 1.5°C, emissions must be reduced as deeply, and quickly as possible and carbon emissions must be reduced to net zero by 2038.[1] For a fifty percent chance of limiting temperature rise to 1.5°C, net zero emissions must be reached by 2048.[1]

3. We're not on track.

The world agreed to limit global temperature rise to well below 2°C, and to aspire to limit temperature rise to 1.5°C, but we are not on track for either. If successfully implemented, current national commitments to actions under the Paris Agreement are estimated to put us on track for more than 3°C of heating by 2100 and increasing thereafter. Two times the current national commitments to reduce emissions are necessary.

4. Time is running out.

Climate change has already raised global temperatures by 1°C. Each year we delay emission reductions, the window to reach zero emissions is reduced by approximately two years to remain below 1.5°C. The sooner and more boldly we act, the greater likelihood of success. The longer we wait, the more expensive and difficult it will be to reduce emissions and the more natural, managed, and human systems will be exposed to significant risk. The necessary transformation requires change far beyond the scale of the industrial revolution with the speed of the digital revolution.

5. Every decision we make today matters.

The decisions made today about energy, transport, building, and water infrastructure will lock in global emissions for decades. Even if greenhouse gas emissions stop completely, sea levels will continue to rise, temperatures may continue to rise, and the impacts of the climate crisis will continue to worsen. At the time that net zero emissions are reached, the cumulative carbon emissions in the atmosphere will determine the amount of heating the world will experience.

6. City leadership is necessary to limit global heating to 1.5°C.

In cities and urban areas, there are actions that policymakers—along with residents, civil society, the academic, business, and finance communities—must take to help limit heating and adapt to the impacts of the climate crisis. The effects of a city's actions are not limited to its own borders or region, and lessons learned in cities and urban areas can serve as inspiration and resources for solutions elsewhere.

RISKS

The risks of heating beyond 1.5˚C

We must limit heating as much as possible. Every bit matters. Each half of a tenth (0.05) of a degree Celsius of heating will lead to worsened outcomes.

Exceeding 1.5°C will have significant impacts on biodiversity, ecosystems, oceans, health, livelihoods, food security, water supply, human security and economic growth.

If heating exceeds 1.5°C, much of the economic and related social progress made since the end of World War II will be undone.[2] Exceeding 1.5°C, even if temporarily, will lead us into a highly uncertain world where basic social and economic activities will be disrupted. Overshoot (global temperature increase of 1.6°C or more) will push some natural and human systems beyond their ability to adapt and into a new world for which we have limited scientific knowledge and no institutional or governance experience.

The world is on track for 3°C of heating or more. We now know that 2°C of global heating is much more dangerous than 1.5°C and will inequitably impact vulnerable populations.

The world beyond 1.5˚C

Exceeding 1.5°C, even if temporarily, will lead us into a highly uncertain world where basic social and economic activities will be disrupted. Overshoot (global temperature increase of 1.6°C or more) will push some natural and human systems beyond their ability to adapt.

IMPACTS

The impacts of 2˚C compared to 1.5˚C of heating[2]

1. **Death and illnesses** will significantly increase from exacerbated urban heat islands, heat waves, extreme weather, floods, droughts, coastal inundation, and increased vector-borne diseases including malaria and dengue fever.
2. The population suffering **water scarcity** will double.
3. **Food insecurity** will increase due to decreased crop nutrition and yield as well as fish depletion due to ocean heating and acidification. Ecosystem loss will further heighten food insecurity: plant and insect species will become extinct at two- and three-times higher rates respectively. 457 million more people will be exposed to food insecurity.
4. **Migration** will increase from agriculture-dependent communities as temperatures rise and water stress increases. Cities will face the challenge of accepting new immigrants (domestic and international) increasing the likelihood for conflict. The climate refugee crisis, already underway, will escalate.
5. Ninety-nine percent of **coral reefs** will be lost (versus up to 90% in 1.5°C).

WHAT MUST BE DONE

To limit heating to no more than 1.5˚C

Relative to present day levels[3]. See Appendix A for detail.

2020
Global carbon emissions must flatten and begin to fall.[4]

2030
Global carbon emissions must fall 45-75%.[5]

2038
Global carbon emissions must reach net zero
for a 67% probability of meeting 1.5°C.[6]

2048
Global carbon emissions must reach net zero
for a 50% probability of meeting 1.5°C.[6]

To achieve no or limited overshoot of 1.5˚C[7]

See Appendix B for detail.

1. The carbon intensity of electricity must decline to near-zero or *beyond* by 2050.[8]
2. The global building stock in place in 2050 must have 80 to 90% lower emissions than 2010 levels.[2]
3. At least 5% of existing buildings must undergo energy retrofits each year in developed countries.[2]
4. New buildings must be built fossil-free and near-zero energy beginning in 2020.[2]
5. Electricity generation must double and be more than 70-85% renewable.[9]
6. The transport sector must reduce its final energy use by 30% and must supply the majority of energy with low carbon fuels like electricity, hydrogen, and biofuel by 2050.[2]
7. Natural gas should make up less than 35% of electricity generation by 2030 and 0-25% of electricity generation by 2050.[8]
8. Coal must be completely phased out as soon as possible.[8]
9. Cities must concurrently and dramatically reduce short-lived climate pollutants like black carbon and methane.[2]
10. Some level of carbon dioxide removal (CDR) must be implemented. The amount of CDR necessary will depend on how quickly emissions are reduced. CDR can take the form of afforestation, removals in agriculture, forestry, and land use, and bioenergy with carbon capture and storage (BECCS).[2] There is a lack of experience and knowledge on how to implement CDR in and around cities. Experimentation will be necessary in cities so that CDR may be scaled when needed.

1.5˚C-compatible pathways

Emission pathway that get us to 1.5°C fall into two general categories. The first category keeps global temperature at or just below 1.5°C throughout the rest of the century and is called ‘no overshoot’. The second category consists of ‘overshoot pathways’ in which temperatures temporarily exceed 1.5°C before returning to 1.5°C by 2100. If heating is limited to 1.6°C, this is called ‘limited overshoot’.

WHAT MUST BE DONE

Mitigating the Climate Crisis by Reducing Emissions

The transformation to a sustainable, clean energy future requires change well beyond the scale of the industrial revolution at the speed of the digital revolution. All cities and regions must dramatically increase their efforts to align with 1.5°C.

Adaptation

While action to limit temperature rise to 1.5°C is crucial, it is also imperative that cities prepare for future climate change. Adapting to further heating requires action at national and sub-national levels and could mean different things to different people in different contexts. Adaptation requires local knowledge, including local climate projections and risks, and an understanding of stakeholders to address vulnerabilities based on social, cultural, political and economic factors.

Adaptation actions ensure basic human rights and universal access to basic services and safe housing and reduce exposure to climate risks. Examples include:

1. Planning to safeguard people and infrastructure – the anticipated growth in urban population will require extensive construction of urban infrastructure and buildings. Such growth can also be the catalyst for adopting new technologies, buildings and infrastructure that are low or near zero-emissions and adapted to expected future climate change. Cities can play a key role in both developing and approving future infrastructure and property developments and ensuring that they are climate-proof;
2. Diversifying systems, including food, energy, and financial systems;
3. Embracing alternative lifestyles and employment;
4. Partnering with local academic and research institutions to document and publish on local risks and adaptation work;
5. Placing greater emphasis on ecosystem-based adaptation, green infrastructure, and the use of natural systems to sequester carbon in areas, manage water, and reduce the urban heat island effect;
6. Investing in climate insurance.

Whether incremental or transformational, there are limits to adaptation pathways. Beyond certain thresholds, especially if heating exceeds 1.5°C, some systems cannot adapt and some impacts to both human and natural systems cannot be reversed. Adaptation and mitigation must be jointly and aggressively pursued.

What the climate crisis requires

Adapting to climate change requires local knowledge, including local climate projections and risks, and working with stakeholders to address vulnerabilities based on social, cultural, political and economic factors.

WHAT MUST BE DONE

Governance

1. All countries, regions, cities, businesses, and residents must work together and align policies. Achieving 1.5°C is only possible with active engagement at all levels. Local, regional and national governments, citizens, business and academic institutions are all key stakeholders that need to work together. Policies must be coordinated and aligned across sectors to enable collaborative multi-stakeholder partnerships.

2. Local action is most effective when local and regional governments are supported by national governments, and when a multilevel dialogue drives aligned policies that generate a greater and more efficient impact.

LOCAL, REGIONAL AND NATIONAL GOVERNMENTS, CITIZENS, BUSINESS AND ACADEMIC INSTITUTIONS ARE ALL KEY STAKEHOLDERS THAT NEED TO WORK TOGETHER.

POLICIES MUST BE COORDINATED ACROSS ALL SECTORS.

WHAT MUST BE DONE

Climate Finance and Investment

1. Tentative commitments of climate finance in support of the Paris Agreement amount to approximately 100 billion USD per year by 2020. This falls far short of what is necessary. An additional $9-14 trillion (5% to 10% of the annual global capital revenue) in the next decade is necessary to achieve 1.5°C.
2. In the energy system alone, an estimated annual average investment of around 2.4 trillion USD between 2016 and 2035 is needed to keep heating below 1.5°C.
3. The scale of necessary investments is well beyond the fiscal capacity of countries most at risk, as well as that of potential official development assistance. The same is true for cities where resources are almost universally too tight to develop and implement ambitious policies. Innovation in funding, financing, incentives and guarantees, and developing appropriate resources is necessary. These innovative approaches must be quickly developed, tested, and scaled. A re-imagination of the global financing system as well as local funding, financing, and appropriate resources could help address these gaps.
4. The investment opportunities generated by a market transition to a sustainable, clean energy economy cannot be achieved without effective multi level government policies.

ACT FAST AND ACT TOGETHER

Cities must promote:

Alignment

of citywide GHG reductions with the global trajectory for 1.5°C.

Strong cooperation

among countries, regions, cities, businesses, and residents.

Leadership

on climate education and awareness of climate risks and solutions and changes in incentives to accelerate behavior change.

Rapid adoption

of tested and new technologies that reduce emissions.

IN THE ENERGY SYSTEM ALONE, AN ESTIMATED ANNUAL AVERAGE INVESTMENT OF AROUND 2.4 TRILLION USD BETWEEN 2016 AND 2035 IS NEEDED TO KEEP HEATING BELOW 1.5˚C.

CONCLUSION

Cities' Shared Responsibility

Most of the 8 billion people that will be impacted by the climate crisis in the next decades live in cities. Half of the world's citizens live in cities today and two-thirds will live in cities by 2050. We must ensure that our cities remain prosperous, livable and sustainable. The transition to a resilient and low carbon future is an opportunity to put humanity, along with local and global economies, on a much healthier, prosperous, equitable, and sustainable trajectory and to protect other organisms on earth.

There are sizable social and economic benefits from emission reductions, including higher productivity and job creation, better health and life expectancy of citizens, improved air quality, more walkable and livable cities, lower vulnerability and greater resilience to extreme events including fires, floods, and hurricanes. Cities are already experiencing social and economic benefits as they begin to transition to a lower carbon economy.

Cities must now accelerate efforts to adapt to future risks and prove what is possible by adopting sustainable urban planning and new technologies and by transforming buildings, infrastructure, and transit systems to near zero-emissions in line with the global trajectory necessary for 1.5°C.

WE NOW KNOW WHAT WORKS AND WHAT DOESN'T FOR BOTH MITIGATION AND ADAPTATION.

WE KNOW WHAT INTERVENTIONS CAN HELP US SUCCEED IN RAPIDLY SCALING UP IMPLEMENTATION OF CLIMATE SOLUTIONS.

NOW, WE MUST ACT.

APPENDIX A: EMISSIONS TRAJECTORIES

Annual global carbon dioxide emissions characteristics for 2020, 2030, 2050, 2100.[5]

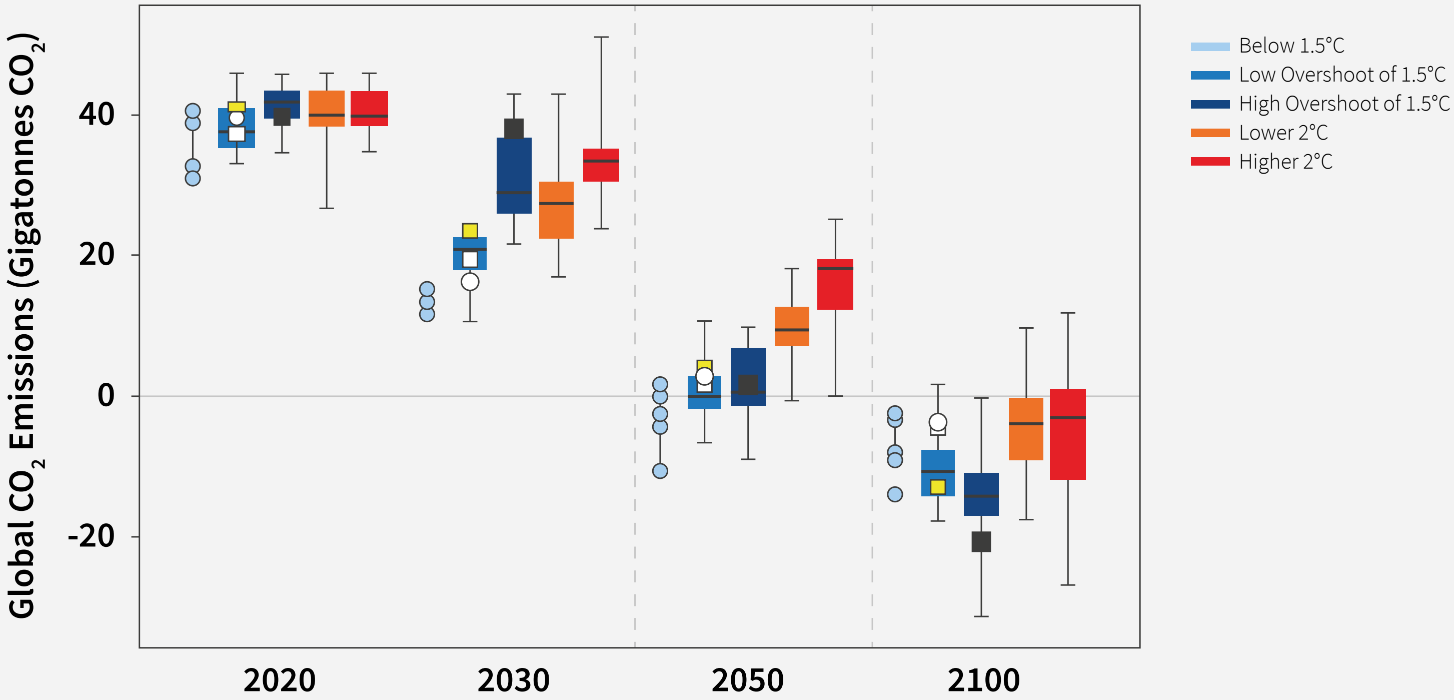


Figure 2.6 of SR1.5

Light blue represents scenarios that achieve no overshoot of 1.5°C

Medium blue represents limited overshoot of 1.5°C

Dark blue represents high overshoot of 1.5°C

Orange and red represent 2°C

2017 CO_2 emissions: 42 GtCO2 (SR1.5, chapter 2, pp 107).

Global CO2 Emissions (Absolute, $GtCO_2$)	2017	2020 (IQR)	2030 (IQR)	2050 (IQR)
No 1.5°C Overshoot	42	30 - 41	10 - 17	-10 - 3
Limited 1.5°C Overshoot	42	32 - 41	17 - 22	-2 - 4
High 1.5°C Overshoot	42	39 - 45	25 - 35	-1 - 8

Global CO_2 Emissions (Percent Reductions Rel. to 2017)	2020 (IQR)	2030 (IQR)	2050 (IQR)
No 1.5°C Overshoot	0 - 27%	59% - 76%	93 - 124%
Limited 1.5°C Overshoot	0 - 22%	46 - 59%	90 - 105%
High 1.5°C Overshoot	(+) 5% - 10%	15 - 39%	80% - 102%

APPENDIX B: ENERGY SUPPLY

Global primary energy supply of no to low overshoot 1.5°C pathways.

	Median (max, min)	Count	Primary Energy Supply (EJ)			Share in Primary Energy (%)			Growth (factor) 2020 - 2050
			2020	2030	2050	2020	2030	2050	
Below - 1.5°C and 1.5°C - low-OS pathways	Total primary	50	565.33 (619.70, 483.22)	464.50 (619.87, 237.37)	553.23 (725.40, 289.02)	NA	NA	NA	-0.05 (0.48, -0.51)
	Renewables	50	87.14 (101.60, 60-16)	146.96 (203.90, 87.75)	291.33 (584.78, 176.77)	14.90 (20.39, 10.60)	29.08 (62.15, 18.24)	60.24 (87.89, 38.03)	2.37 (6.71, 0.91)
	Biomass	50	60.41 (70.03, 40.54)	77.07 (113.02, 44.42)	152.30 (311.72, 40.36)	10.17 (13.66, 7.14)	17.22 (35.61, 8.08)	27.29 (54.10, 10.29)	1.71 (5.56, -0.42)
	Non-biomass	50	26.35 (36.57, 17.78)	62.58 (114.41, 25.79)	146.23 (409.94, 53.79)	4.37 (7.19, 3.01)	13.67 (26.54, 5.78)	27.98 (61.61, 12.04)	4.28 (13.46, 1.45)
	Wind & solar	44	10.93 (20.16, 2.61)	40.14 (82.66, 7.05)	121.82 (342.77, 27.95)	1.81 (3.66, 0.45)	9.73 (19.56, 1.54)	21.13 (51.52, 4.48)	10.10 (53.70, 3.71)
	Nuclear	50	10.91 (18.55, 8.52)	16.26 (36.80, 6.80)	24.51 (66.30, 3.09)	2.10 (3.37, 1.45)	3.52 (9.61, 1.32)	4.49 (12.84, 0.44)	1.24 (5.02, -0.64)
	Fossil	50	462.95 (520.42, 376.30)	310.36 (479.13, 70.14)	183.79 (394.71, 54.86)	82.53 (86.65, 77.73)	66.58 (77.30, 29.55)	32.79 (60.84, 8.58)	-0.59 (-0.21, -0.89)
	Coal	50	136.89 (191.02, 83.23)	44.03 (127.98, 5.97)	24.15 (71.12, 0.92)	25.63 (30.82, 17.19)	9.62 (20.65, 1.31)	5.08 (11.43, 0.15)	-0.83 (-0.57, -0.99)
	Gas	50	132.95 (152.80, 105.01)	112.51 (173.56, 17.30)	76.03 (199.18, 14.92)	23.10 (28.39, 18.09)	22.52 (35.05, 7.08)	13.23 (34.83, 3.68)	-0.40 (0.85, -0,88)
	Oil	50	197.26 (245.15, 151.02)	156.16 (202.57, 38.94)	69.94 (167.52, 15.07)	34.81 (42.24, 29.00)	31.24 (39.84, 16.41)	12.89 (27.04, 2.89)	-0.66 (-0.09, -0.93)

Table 2.6 of SR1.5

Values given for the median (maximum, minimum)

Growth factor = [(primary energy supply in 2050)/(primary energy supply in 2020) - 1]

Global electricity generation of no to low overshoot 1.5°C pathways.

	Median (max, min)	Count	Electricity Generation (EJ)			Share in Electricity (%)			Growth (factor) 2020 - 2050
			2020	2030	2050	2020	2030	2050	
Below -1.5°C and 1.5°C - low-OS pathways	Total generation	50	98.45 (113.98, 83.53)	115-82 (152.40, 81.28)	215.58 (354.48, 126.96)	NA	NA	NA	1.15 (2.55, 0.28)
	Renewables	50	26.28 (41.80, 18.50)	63.30 (111.70, 32.41)	145.50 (324.26, 90.66)	26.32 (41.84, 18.99)	53.68 (79.67, 37.30)	77.12 (96.65, 58.89)	4.48 (10.88, 2.65)
	Biomass	50	2.02 (7.00, 0.76)	4.29 (11.96, 0.79)	20.35 (39.28, 0.24)	1.97 (6.87, 0.82)	3.69 (13.29, 0.73)	8.77 (30.28, 0.10)	6.42 (38.14, -0.93)
	Non-biomass	50	24.21 (35.72, 17.70)	57.12 (101.90, 25.79)	135.04 (323.91, 53.79)	24.38 (40.43, 17.75)	49.88 (78.27, 29.30)	64.68 (96.46, 41.78)	4.64 (10.64, 1.45)
	Wind & solar	50	1.66 (6.60, 0.38)	8.91 (48.04, 0.60)	39.04 (208.97, 2.68)	1.62 (7.90, 0.38)	8.36 (41.72, 0.53)	19.10 (60.11, 1.65)	26.31 (169.66, 5.23)
	Nuclear	50	10.84 (18.55, 8.52)	15.46 (36.80, 6.80)	21.97 (64.72, 3.09)	12.09 (18.34, 8.62)	14.33 (31.63, 5.24)	8.10 (27.53, 1.02)	0.71 (4.97, -0.64)
	Fossil	50	59.43 (68.75, 39.48)	36.51 (66.07, 2.25)	14.81 (57.76, 0.00)	61.32 (67.40, 47.26)	30.04 (52.86, 1.95)	8.61 (25.18, 0.00)	-0.74 (0.01, -1.00)
	Coal	50	31.02 (42.00, 14.40)	8.83 (34.11, 0.00)	1.38 (17.39, 0.00)	32.32 (40.38, 17.23)	7.28 (27.29, 0.00)	0.82 (7.53, 0.00)	-0.96 (-0.56, -1.00)
	Gas	50	24.70 (32.46, 13.44)	22.59 (42.08, 2.01)	12.79 (53.17, 0.00)	24.39 (35.08, 11,80)	20.18 (37.23, 1.75)	6.93 (24.87, 0.00)	-0.47 (1.27, -1.00)
	Oil	50	2.48 (13.36, 1.12)	1.89 (7.56, 0.24)	0.10 (8.78, 0.00)	2.82 (11.73, 1.01)	1.95 (6.67, 0.21)	0.05 (3.80, 0.00)	-0.92 (0.36, -1.00)

Table 2.7 of SR1.5

Values given for the median (maximum, minimum) values.

Growth factor = [(primary energy supply in 2050)/(primary energy supply in 2020) - 1]

APPENDIX B: ENERGY SUPPLY

Carbon intensity of electricity (gCO_2/MJ).

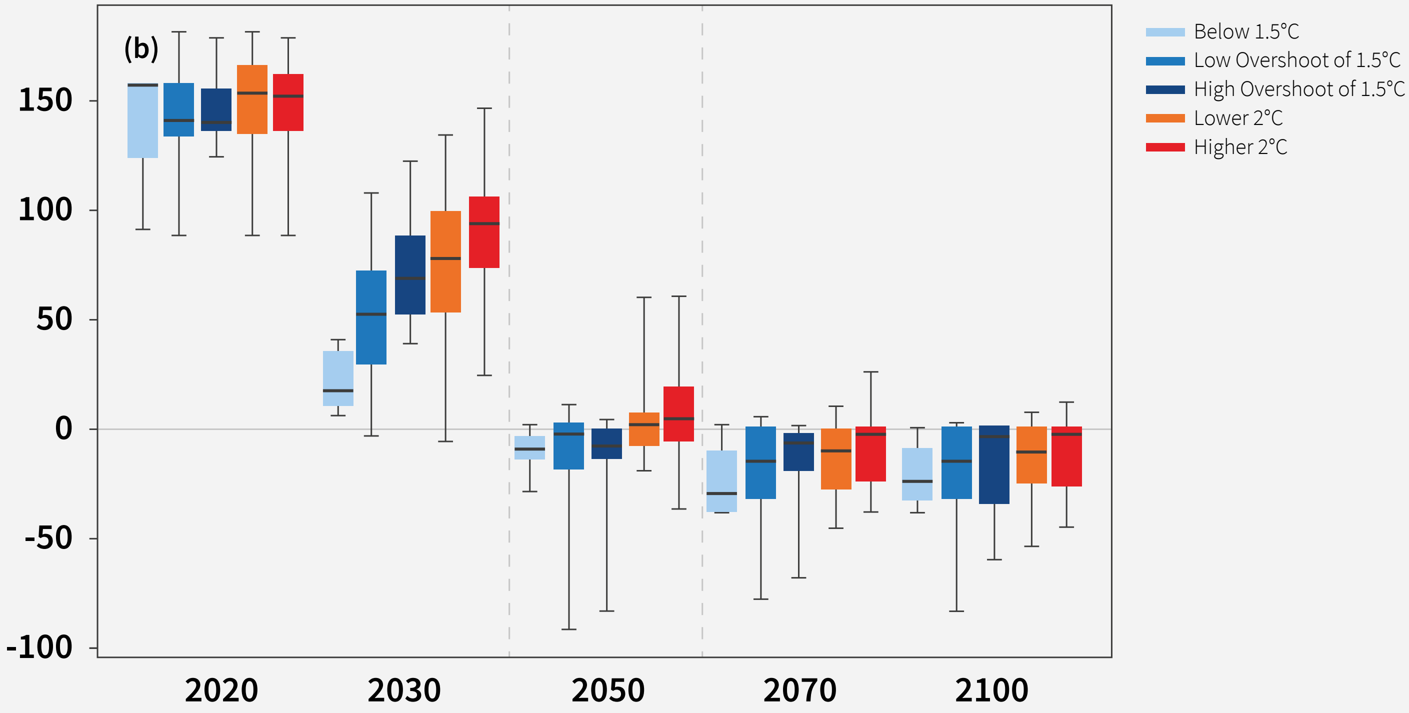


Table 2.14 of SR1.5

Carbon intensity of residual fuel mix (gCO_2/MJ).

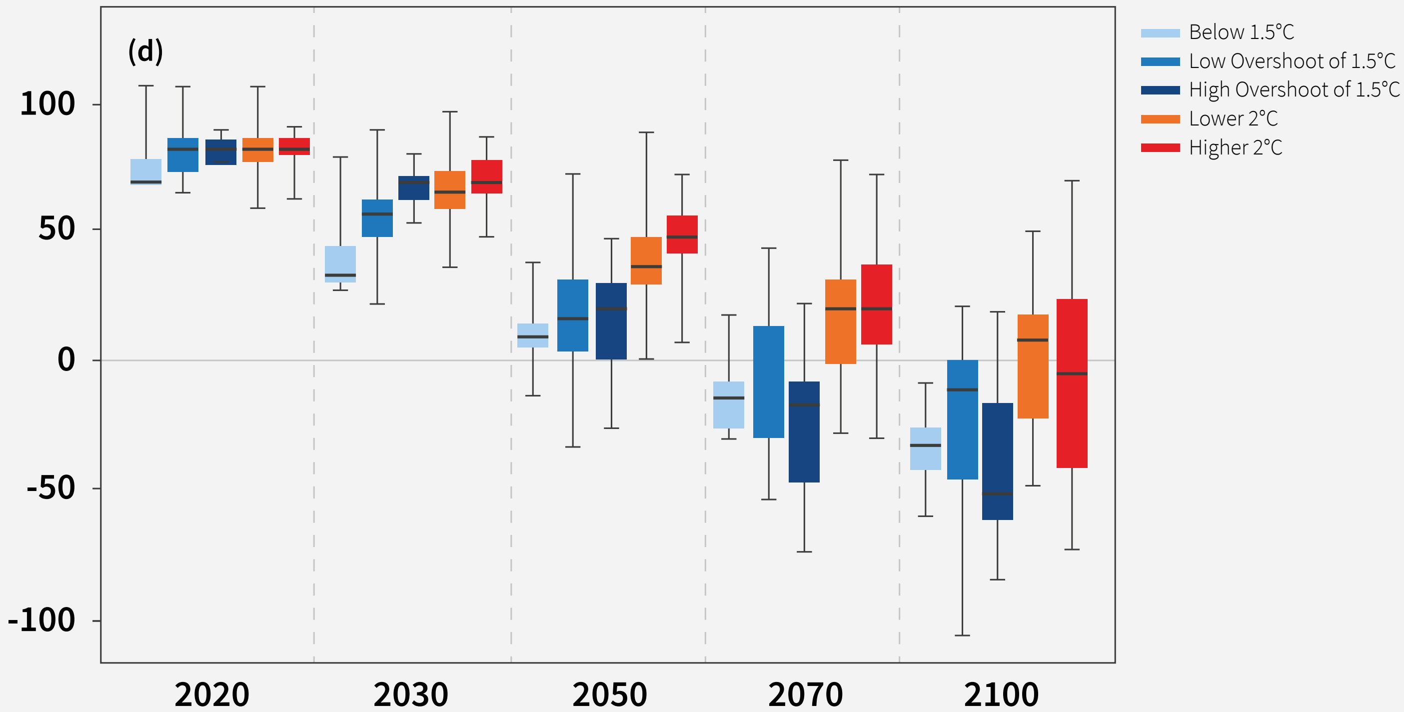


Table 2.14 of SR1.5

Light blue represents scenarios that achieve no overshoot of 1.5°C

Medium blue represents limited overshoot of 1.5°C

Dark blue represents high overshoot of 1.5°C

Orange and red represent 2°C

ENDNOTES

1. Source: IPCC SR1.5 Summary for Urban Policymakers; for a 50% chance of limiting to 1.5°C, net zero emissions must be reached by 2048.
2. Source: IPCC SR1.5 Summary for Urban Policymakers.
3. Present-day = 2017.
4. Source: SR1.5. See Appendix A for detail.
5. Source: SR1.5. See Appendix A for detail. By 2030, global carbon emissions must fall roughly 45-60% from 2017 levels for a less than one-in-two chance that heating will be capped at 1.5°C (60% or fewer reductions by 2030 will likely lead to at least limited overshoot of 1.5°C). The "No Overshoot"/"Below-1.5°C" category is a set of scenarios which clearly keep heating below 1.5°C with at least a 50% probability of success. The SR1.5 Chapter 2 Executive Summary and SR1.5 Summary for Policymakers both focus on the set of pathways that limit heating to 1.5°C with "No or Limited Overshoot"/"Low Overshoot" as this set of scenarios is more robust than the "No Overshoot"/"Below-1.5°C" set of scenarios and based on pathways from modelling frameworks in which there is a higher degree of confidence. The "No or Limited Overshoot"/"Low Overshoot" category is a set of scenarios that must be understood in the context of the uncertainties in temperature projection that are assessed in Chapter 2 of the SR1.5. These scenarios are projected to result in a maximum of 0.1°C exceedance of 1.5°C. When assessed with climate models that incorporate recent updates of radiative forcing, "No or Limited Overshoot"/"Low Overshoot" scenarios were projected to keep maximum heating to below 1.5°C. Due to these factors and considerations, this document puts forth a range that draws from both the "No Overshoot" and "Limited Overshoot" scenarios from Appendix A to express emissions reductions necessary by 2030 for limiting heating to no more than 1.5°C.
6. Source: IPCC SR1.5 Summary for Urban Policymakers; for a two-thirds chance of limiting temperature rise to 1.5°C, emissions must be reduced to net zero by 2038; for a 50% chance of limiting to 1.5°C, net zero emissions must be reached by 2048.
7. Sources: SUP & SR1.5. See Appendix B for detail.
8. Source: IPCC SR1.5. See Appendix B for detail.
9. Source: SR1.5, 2.4.2.2. See Appendix B for detail; IPCC SR1.5 Summary for Urban Policymakers.

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iihs™ INDIAN INSTITUTE FOR HUMAN SETTLEMENTS

UCLG United Cities and Local Governments

UN HABITAT FOR A BETTER URBAN FUTURE

WWF

FOR CITIES BY CITIES

KEY TAKEAWAYS FOR CITY DECISION MAKERS FROM THE IPCC 1.5˚C REPORT AND SUMMARY FOR URBAN POLICYMAKERS

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Click here to read the *Summary for Urban Policymakers*