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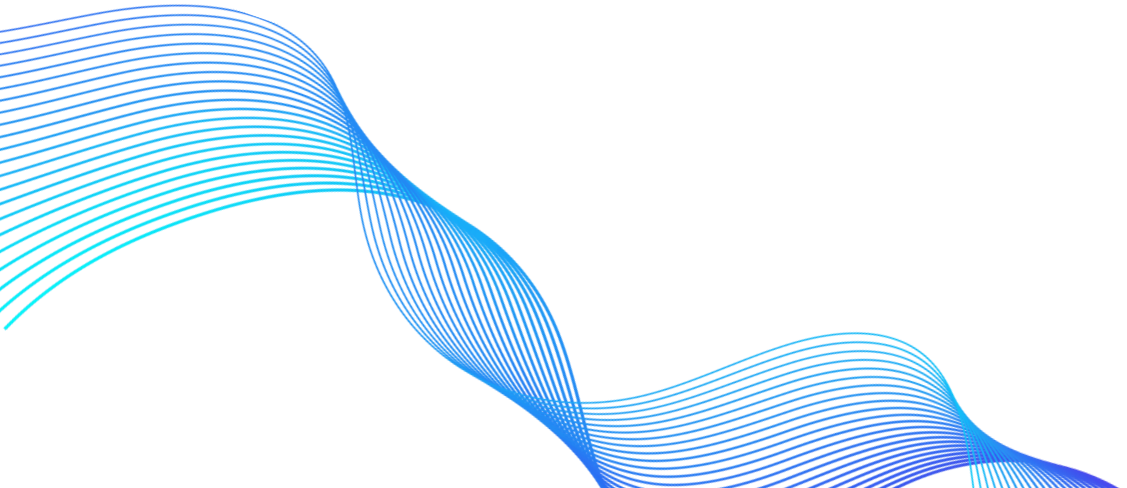
Communicating on 1.5°C

A toolkit for climate scientists



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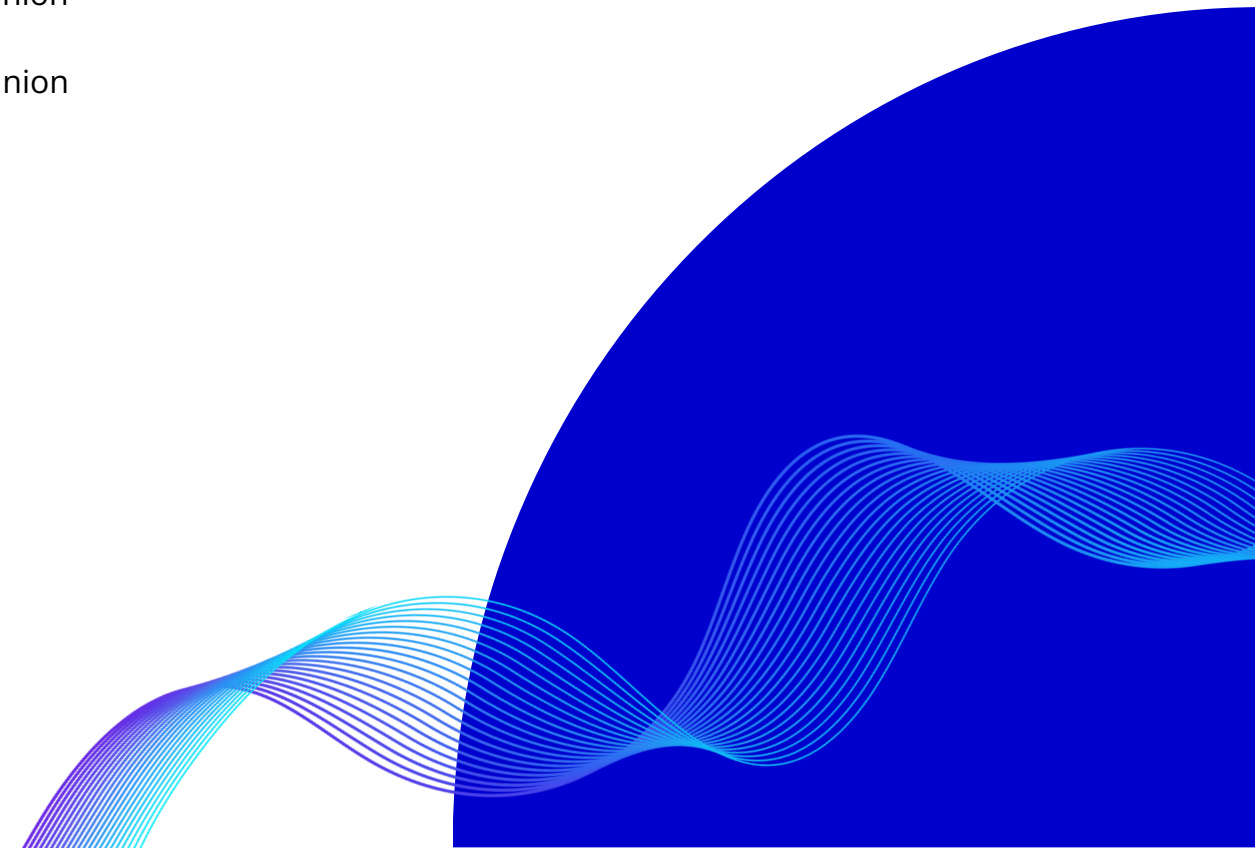

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Using this toolkit

What is this toolkit for?

The purpose of this toolkit is to help climate scientists like you effectively communicate about the likelihood and impact of the world exceeding 1.5°C of global warming with decision makers and informed policy influencers (i.e. politicians, media, business, NGOs and interest groups).

It also provides practical tips and tools to help you communicate persuasively within the context of wider, and often politically charged, debates about the climate crisis.

This toolkit helps you to land complex messages which require:

- Conveying the urgency of the situation while maintaining that we still have agency to avoid the worst outcomes
- Balancing realism with hope
- Avoiding alarmism while not downplaying the severity of the climate crisis

Many scientists can feel great pressure when stepping into the public realm, especially on a topic of such importance and complexity. This toolkit is designed to help you to compellingly share your expertise in meaningful ways as part of the global effort to protect our planet.

Who is this toolkit for?

This toolkit is for climate scientists who need to comment on or share perspectives about the world exceeding 1.5°C of global warming. The guidance provides a baseline for you to springboard from depending on your individual expertise and research specialisms.

When should this toolkit be used?

The guidance in this toolkit is designed for what is often referred to as ‘set piece communications opportunities’ such as panel discussions, keynote addresses and media interviews.

Importantly, it is intended for an informed audience. Although elements will apply to the general public, this is not geared towards public communications.

Methodology

How and why was this toolkit developed?

The process of developing this toolkit began with climate scientists. Understanding the needs and concerns of scientists has been central to producing this guidance. Alongside this, we have engaged with members of the public, policymakers and media and communications specialists to gain a rigorous and in-depth grasp of the landscape.

Understanding the needs of climate scientists

The Grantham Institute initially carried out a series of focus groups (March - June 2024) with climate scientists to understand their challenges in communicating around the issues of 1.5°C. They also carried out a media discourse analysis of coverage of the topic over a 12 month period (July 2023 - July 2024). This research delivered the following key insights:

- **Simplify scientific communication:** Deliver clear messages about 1.5°C, balancing technical accuracy with accessibility.
- **Combine urgency and empowerment:** Warn about exceeding 1.5°C while emphasising our agency to limit temperature increase and reiterating our ability to mitigate some of the worst outcomes.
- **Address complex issues openly:** Develop strategies for discussing scientifically and politically sensitive topics transparently and effectively.
- **Prevent the undermining of climate action:** Avoid inadvertently undermining climate action, for example by supporting narratives of ‘doomism’.

These findings made clear that developing a core narrative to communicate the risk of exceeding 1.5°C was essential in order to help climate scientists to compellingly communicate both the science behind the current situation and the complexity of the wider issues.

Testing different narrative options

In light of this, we conducted two workshops with climate scientists, policymakers and communications specialists to develop the building blocks for a core narrative on communicating on 1.5°C. Participants considered issues including audience, framing, tone of voice and risks associated with getting the message wrong. This resulted in a variety of different narrative options.

To test these narratives, we ran four focus groups: two with members of the general public and two with policy and media professionals to elicit feedback about how the narratives would work 'in the real world'. Again, there were common sets of feedback across the groups that enabled us to further refine and reach one consolidated narrative:

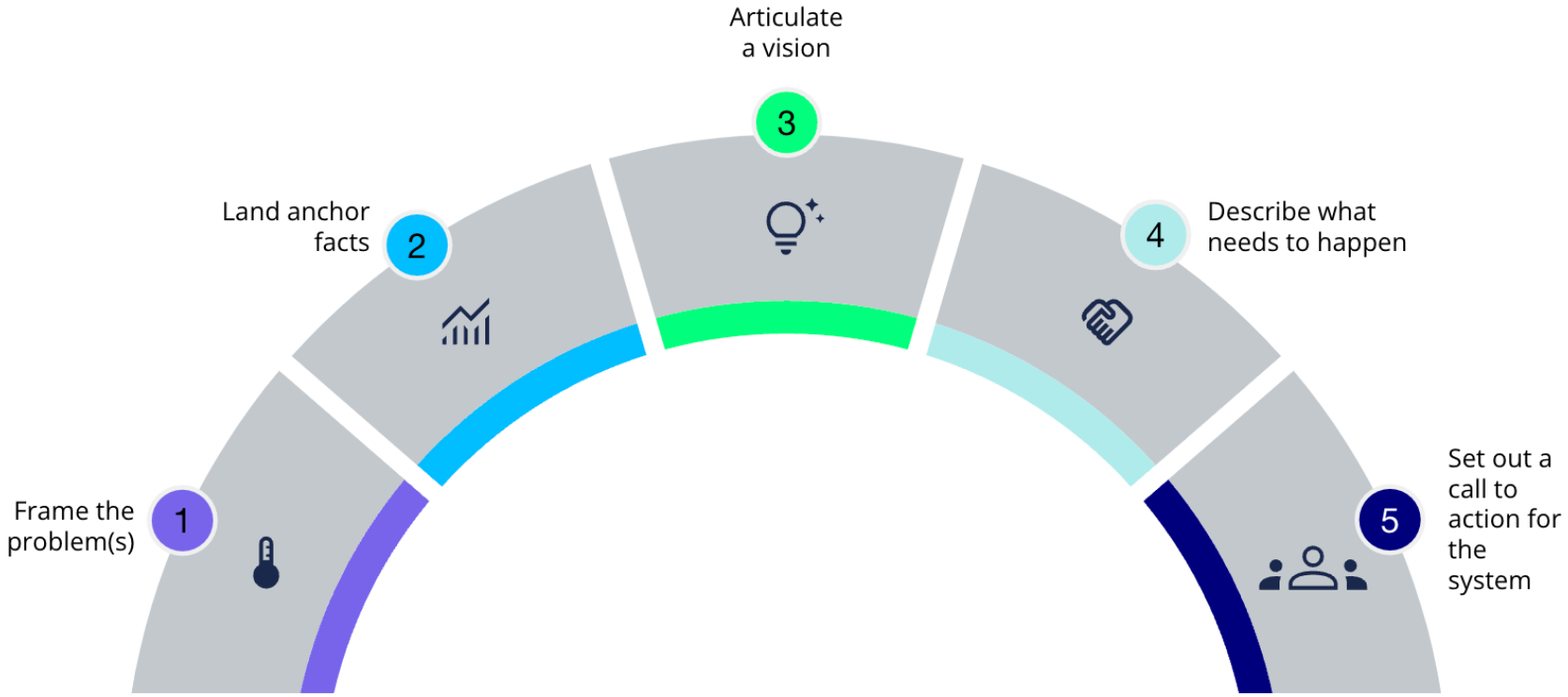
Be emotionally engaging and relatable	Facts alone are insufficient to motivate action. The narrative needs to connect with human emotions, using real-world examples that speak to people's daily lives and local contexts.
Balance urgency with hope	While it's important to convey the severity of the climate crisis, the narrative must also highlight achievable solutions, co-benefits, and individual and collective agency. This approach empowers policymakers and the public, rather than overwhelming them with doom.
Focus on credible, near term solutions	Many participants felt strongly that discussing overshoot scenarios or unproven technologies could encourage inaction. Instead, the narrative should stress immediate, practical actions and avoid framing 1.5°C as flexible.
Leverage the authority of scientists	All agreed that scientists are trusted messengers, and the narrative should reflect their unique credibility. The language should feel authentic to scientists, focusing on the evidence rather than sounding like political rhetoric.

The narrative

What is a narrative?

Narratives are a way of shaping ideas so that your audiences more readily agree and accept what you are telling them. Facts tell us about something. Narratives tell us what something is about - they provide context and meaning.

This narrative is based on a tested framework following a clear arch with five parts.



[1] Purpose Union has developed and iterated this framework in competitive debating scenarios as well as applying its principles to a variety of successful campaigns and influencing strategies in the UK and globally.

Narrative element	Explanation
Framing	Define the issue, its urgency and the external context. Essentially, explain why people should care. This is crucial as if you don't frame the issue, others will frame it for you.
Anchor facts	Present key proof points to ground your argument and substantiate your choice of frame.
Vision	Outline the desired outcome and how solving this problem will lead to positive change.
What needs to happen	Set out the actions that are needed from the audience and how they can contribute to the solution.
Call to action	Motivate immediate action with clear steps for the audience to follow.

Depending on the format of your communication, the length of time you have (or word count) and the setting in which you are communicating, you may not be able to incorporate all parts of this narrative structure. The idea is not to learn the narrative by memory and repeat it verbatim. Instead, this narrative gives you a structure in which to confidently and persuasively set out your argument. It is designed to be modular, flexing to different audiences and forums as appropriate. The audience cheatsheet will give you further guidance on this.

The core narrative

Framing

Opens with immediate positioning of you as a trusted voice, proven right by events

Presents the positive outcome first, which is easier to engage with

As scientists, our message is clear. The effects of climate change which we have warned about for decades are with us already. This is happening while we are still below 1.5°C of warming - the level beyond which the effects of climate change become notably more dangerous, unpredictable and potentially irreversible. If we don't take serious action now, we will continue to heat the world well beyond any acceptable level of warming with massive consequences for people and the natural world we rely on.

This story doesn't have to end in failure. Strong climate action makes everyone a winner. We need to urgently use the resources and skills we have relied upon before - science, collaboration and long term thinking - to create a safer, more affordable future for us all.

Does not shy away from the jeopardy and frames it in terms of protection from harm, cost and fairness

Continuing our current trajectory, we don't change our behaviour or tackle the causes of climate change. **The effects of climate change we are already experiencing will increase and our lives will continue to become more dangerous, not less. More expensive, not less. More unfair for those who did not cause climate change, not less.**

Anchor facts

These proof points came out of our research as the most immediate, tangible, and likely to speak to audiences worried about the here and now

Already we are seeing the impacts:

- **Homes becoming uninsurable due to floods**
- **Food becoming unaffordable as extreme weather ruins harvests**
- **Intense heat and worsening air pollution damaging your health**
- **Increasing conflict and migration as parts of the world become uninhabitable**
- **The cost of living soaring due to the huge costs of dealing with our warming world**
- **[Insert additional localised data points here]**

Provides an emotive link between distant threats and the present: a child born today

This is the world as it is now, where we are rapidly approaching a 1.5°C rise in global temperatures. Then there's the future. **A child born today will see the year 2100.** On our current trajectory, that child will be subjected to 3°C of global warming. That's *double* the amount of warming scientists and politicians have agreed we can experience to have a liveable planet.

Provides examples of our demonstrated capacity/ agency to achieve change previously thought unlikely

But if the damage of climate change is exceeding our expectations, so too is progress on some of the things we need to fight it. For example, the world has tripled its renewable power capacity since 2010, far ahead of what was thought possible.[2] We now need to replicate that in many other parts of society and the economy.

[2] BloombergNEF, Tripling Global Renewables by 2030 (BloombergNEF, 2023), 1, https://assets.bbhub.io/professional/sites/24/BNEF_2023-11-21_triplingrenewables_Final.pdf.

Vision

We win if, instead of fearing what is to come, we seize this chance to make our economies and societies stronger, fairer and greener. The good thing is we already have much of the science and solutions we need to make this future a reality. We can choose the easier way or the harder way but we will have to do it. It's cheaper and quicker if we act now rather than waiting.

Illustrates the co-benefits both of acting on climate mitigation, and doing it now

Ultimately we all share a common goal of ensuring a liveable, healthy planet for us all to share in. **That means communities with green spaces, improved air quality, well insulated homes and efficient public transportation systems.** An economy providing decent jobs in environmentally friendly industries, reducing waste and inefficiency. And a countryside with increased biodiversity, and cleaner, healthier water.

What needs to happen

With ambitious action to reduce emissions, we can create a safer, better, more prosperous world.

Gives a tangible 'to do' list, breaking down a large problem into more manageable chunks

How can we get there? We need to move away from oil, gas and coal development and rapidly transition to renewable energy. We must switch to clean alternatives, like electric vehicles and heat pumps. We need to restore nature and ensure that products are longer lasting and more easily repaired, wasting less resources. We must reduce energy demand by better insulating buildings, which will in turn lower people's bills. And we need to invest and innovate, to perfect and spread the technologies we will need to finish the job.

Broadens the story out beyond informed audiences (i.e. to your direct audiences's stakeholders - voters, listeners, consumers)

To deal with the changes already brought by climate change, we also need to adapt many aspects of day to day life to reduce risks and better cope with the increasing environmental challenges we face - from updating our health services to strengthening and elevating infrastructure and adjusting farming practices.

This isn't just about the role of scientists and politicians. We need to bring everyone along on the journey and this needs to happen in a fair way. Those who did the least to cause climate change, and those least able to afford its costs need to be supported, and we need policies that deliver good, sustainable lives for everyone.

Call to action

Presents the benefits of action, and reduces the idea of 1.5°C as a cliff edge

For every fraction of a degree of warming we avoid, there are enormous benefits to be reaped - improving health, boosting food security, preventing economic shocks and preserving wildlife in the sea and on land, while promoting business competitiveness and creating new jobs.

As scientists, we can help diagnose the problem and develop and test new solutions. But we can't solve this on our own. The solutions will only come with collective and policy action. We need decision makers to take the action to make this happen.

Restates your role, and the division of labour for others

Citizens are also a key part of this story. They must engage with our political leaders and ask for ambitious climate policies. The impacts of climate change are expensive for economies - we must make them politically costly too.

The cost of inaction is too high, and the opportunities if we do act are too great to ignore.

Note: This narrative is intended to be a foundational reference point for your communications. We strongly encourage you to layer this with your own climate expertise and specialisms. Please see p. 13 for more on this.

Key messages

The core narrative is the reference point for all your communications around 1.5°C. However, you do not need to recite it in full at every opportunity. Below, we have distilled the key messages that you should prioritise for each step of the narrative arc.

Narrative element	Key message
Framing	As scientists, we have long predicted the impacts we are already seeing from climate change, which are making our world more dangerous, expensive and unfair. But strong climate action makes everyone a winner. We know that through urgent action utilising science, collaboration, and long-term thinking, we can create a safer and more affordable future.
Anchor facts	Current climate impacts include uninsurable homes, food insecurity, health risks, and rising living costs. Without action, global warming could reach 3°C by 2100, double the level of warming deemed "acceptable". But we know that where we have the right technology and policy in place, we can make huge strides to prevent this happening - for example, the world has tripled its renewable power capacity since 2010.[3]
Vision	We all share a common interest in creating stronger, fairer, and greener economies and societies. We can achieve this - and do it cheaper and faster - by acting now, using existing solutions and science to ensure a liveable planet with improved communities, economies, and ecosystems.

3 BloombergNEF, Tripling Global Renewables by 2030 (BloombergNEF, 2023), 1, https://assets.bbhub.io/professional/sites/24/BNEF_2023-11-21_triplingrenewables_Final.pdf.

Narrative element	Key message
What needs to happen	Ambitious action requires transitioning to renewable energy, electrifying systems, restoring nature, adopting circular economies, and implementing fair policies to support sustainable living and adaptation across all sectors.
Call to action	Every fraction of a degree of warming avoided brings significant benefits. Scientists, decision-makers, and citizens must work together to implement ambitious climate policies, as the cost of inaction is too high, and the opportunities if we do act are too great to ignore.

Further guidance

Do’s and don’ts

The narrative is rooted in key communications principles and backed by research and extensive testing. However, the way that these messages are delivered in practice is also highly important. This section sets out the do’s and don’ts you should be aware of when speaking to your audience. These are particularly useful when you are layering in your own expertise and insights over the core narrative.

Try to adopt a conversational style, making the narrative sound natural rather than as if you’re reading from a script.

Use the narrative as the foundation and add your own specialist knowledge as an additional layer (where it is consistent with the narrative).

Try to relate questions that you may have back to the narrative’s key messages. One way of achieving this is by briefly touching on the direct question posed to you and then pivoting back to a key message.

Whenever possible, keep the tone hopeful by emphasising solutions, progress, and the benefits of acting now. A positive message can inspire action and engagement rather than overwhelm with fear.

Don’t overwhelm your audience with too much technical detail.

Avoid using jargon or diving into complex scientific explanations unless you are speaking to an expert audience. For non-experts, too much detail can confuse or alienate them. Stick to clear, relatable language.

Don’t downplay the financial impacts or costs of action, as these are important to decision-makers. Instead, acknowledge them and explain how addressing climate change can create economic opportunities, jobs, and long-term savings.

It's important to acknowledge the scale of the challenge, but always bring the conversation back to the fact that there are solutions and that urgent action can make a difference. Make sure your audience feels empowered, not helpless.

Start with what we is known, but embrace uncertainty and be transparent. Climate science often involves projections and possibilities. Don't pretend everything is certain—acknowledge areas of uncertainty while reinforcing what is known and what actions can still be taken. Deliver this with confidence.

While data is important, bombarding the audience with numbers without explaining their real-world significance can disengage them. Use statistics sparingly and always connect them to tangible outcomes or examples people can relate to.

Avoid using language that might suggest that 1.5°C is a 'cliff edge', such as 'threshold', 'target', 'goal', 'limit' and 'breaching'. Instead, describe the way that impacts will get increasingly worse the greater the level of warming, or use alternatives such as 'milestone', 'guardrail', 'exceed', 'surpass'.

Audience cheatsheet

In a world of 8 billion people, with myriad media sources, one narrative cannot speak to everyone. This narrative is not designed to do that. As part of the development process, we constructed four climate personas from the available literature. These were:

Concerned Contributors (30-35%)	• Highly worried about climate change impacts • Willing to make personal sacrifices and contribute financially • Strong supporters of climate action policies • Tend to be from more vulnerable/warmer countries • Underestimate others' willingness to act
Cautious Supporters (30-35%)	• Moderately worried about climate change • Support climate action in principle but hesitant about personal costs • Approve of government action but wary of radical changes • Often from middle-income countries • Uncertain about others' views on climate change
Disengaged Pragmatists (15-20%)	• Limited knowledge and engagement with climate issues • Passively support climate action but take little personal action • Open to gradual policy changes that don't disrupt status quo • Often from countries less immediately impacted by climate change • Assume others are similarly disengaged
Sceptical Resistors (10-15%)	• Doubtful about climate change severity or human causes • Resistant to climate policies that could impact economy/lifestyle • Often from high-income, fossil-fuel dependent countries • Overestimate climate scepticism in general population • May see climate action as threat to traditional values or way of life

[4] "Britain Talks Climate", Climate Outreach, 2024, https://climateoutreach.org/britain-talks-climate/; Andre et al., "Globally representative evidence on the actual and perceived support for climate action", Nature Climate Change 14, no. 3 (2024): 253-259; "The Purpose Pulse 2021", Purpose Union, 2022, https://www.thepurposepulse.com/2021; Leiserowitz et al., "Climate Change in the Indian Mind", Yale Programme on Climate Change Communication (2022); Ayers et al., "Changes in Global Warming's Six Americas: an analysis of repeat respondents", Climatic Change 177, no. 6 (2024): 96.

For the purposes of this narrative we did not focus on the Concerned Contributors who are already on side or the Sceptical Resistors who are unlikely to have their minds changed. Instead we sought to build a narrative that would work for both the **Cautious Supporters and the Disengaged Pragmatists.** However, when speaking with different groups of stakeholders there are some common audience needs that are useful to be aware of and this will lead to placing greater or lesser emphasis on different parts of the narrative. These are set out in the table below.

	Audience Needs	Narrative Emphasis
Policymakers	Clear, evidence-based information to inform decision-making Understanding of economic implications and opportunities Actionable policy recommendations	**Key argument: The impacts we are already experiencing from warming under 1.5°C shows the high costs of climate inaction. Sustainable policies are vital for economic competitiveness. A fair transition supports vulnerable communities and requires global collaboration.** The urgency of action: we're already experiencing climate change effects at less than 1.5°C warming. These impacts will become notably more dangerous for every increment of warming, and the need to cut emissions more and more urgent. Economic costs of inaction vs. benefits of action (i.e. global economies seeing clean industries as vital to their long term competitiveness) Importance of fair transition and supporting vulnerable populations The need for adaptation action to deal with warming that is already locked in Long-term thinking, international collaboration, climate diplomacy and effective leadership

	Audience Needs	Narrative Emphasis
Policymakers (cont.)		Specific policy recommendations: • Move away from oil, gas, and coal development • Rapid transition to renewable energy • Electrification of transportation and heating systems • Support for circular economy initiatives
Media	Compelling narratives and data points Clear explanations of complex scientific concepts Human interest angles	**Key argument: As climate impacts hit home—from uninsurable properties to food and health risks—the world faces a choice: a 3°C trajectory or a liveable 1.5°C future. Stories of renewable energy successes and citizen activism reveal a path to a fairer, greener world that depends on global cooperation and public action.** Real-world impacts of climate change: uninsurable homes, food insecurity, health risks The contrast between our current trajectory (3°C warming) and remaining at an “acceptable” level of warming (below 1.5°C) Success stories in renewable energy adoption The vision of a greener, fairer, and more prosperous future The role of citizens in engaging with political leaders The global nature of the crisis and the need for collaborative solutions

	Audience Needs	Narrative Emphasis
Business	Understanding of risks and opportunities Information on regulatory trends Insights on consumer expectations	**Key argument: Early climate action opens doors to innovation, cost savings, and market leadership in the green economy. Embracing this meets growing consumer and investor expectations and secures long-term competitiveness. The transition is inevitable—businesses can lead it or risk falling behind.** Climate change as a major business risk: supply chain disruptions, increased operational costs Opportunities in the green economy: renewable energy, electric vehicles, circular economy The inevitability of transition: "We can do it the easier way or the harder way, but we will have to do it" Cost-effectiveness of early action Consumer and investor expectations for sustainable practices (i.e. global economies seeing clean industries as vital to their long term competitiveness) Potential for innovation and new market opportunities in climate solutions

	Audience Needs	Narrative Emphasis
NGO/ Interest Group	Scientific backing for advocacy efforts Understanding of policy landscape Tools for public engagement	**Key argument: Climate action urgently depends on civil society's leadership, holding decision-makers accountable and ensuring a just transition for vulnerable populations.** The need for continued urgent action to tackle climate change. The critical role of civil society in driving climate action The importance of holding decision-makers accountable and the relationship between NGOs and policymakers The need for a just transition that supports vulnerable populations The power of collective action and community engagement The interconnectedness of climate change with other social and environmental issues Specific areas for advocacy: • Renewable energy adoption • Nature restoration • Circular economy initiatives • Climate adaptation measures

FAQs

This section outlines a suggested approach to react to questions that you may be asked. We have specifically highlighted these questions as they are both scientifically complex and political, representing the intersection that climate scientists identified as most challenging in the Grantham Institute's focus groups.

The answers are wholly or partially derived from the narrative. Do tweak your answers based on your audience (use the audience cheatsheet as a guide). **Importantly, your aim should be to pivot back to the core narrative to steer the conversation back to the messages we have developed.**

Unpacking the rationale for the 1.5°C limit

Q: What is the 1.5°C level? [5]
A: The 1.5°C milestone is the lifeline set in the Paris Agreement to limit global warming to well below 2°C and ideally below 1.5°C when compared to pre-industrial levels. It's not just a number; it's the difference between a challenging future and a potentially unliveable one for many. Every fraction of a degree beyond today's level will make life more dangerous, more expensive and more unfair.

Q: Why is 1.5°C significant?
A: 1.5°C isn't an arbitrary number - it's a critical milestone beyond which the effects of climate change become increasingly dangerous and potentially irreversible. It's the line between difficult adaptation and widespread damages, which will become more and more destructive for people and communities. Crossing this line means more homes becoming uninsurable, food becoming unaffordable, and health being increasingly damaged by intense heat and air pollution.

5 Please note that non-scientists will often use the word 'target' to describe 1.5°C. In alignment with the guidance in this toolkit, you should steer back to the word 'level' when answering questions phrased like this.

Q: What are the consequences of surpassing 1.5°C of warming?
A: Exceeding 1.5°C doesn't spell game over, but it does push us closer to a losing scenario. The climate impacts we are already seeing will worsen. We'll experience more extreme weather events, rising sea levels threatening coastal communities, and increased risks to food and water security. The cost of living will soar due to the huge costs of dealing with our warming world. Every increment of warming beyond 1.5°C makes our future more dangerous and less certain.

Q: How does climate change at 1.5°C compare to 2°C or higher?
A: The difference is stark. At 1.5°C, we face significant challenges, but at 2°C or higher, we're looking at a world that could become uninsurable, unaffordable, and in parts, uninhabitable.

Q: What are climate "tipping points" and how do they relate to the 1.5°C limit?
A: Tipping points are the sleeping giants of the climate system - thresholds beyond which large-scale and possibly irreversible changes can occur. They're like dominoes; once tipped, they can trigger a cascade of effects. The risk of triggering these tipping points increases significantly beyond 1.5°C of warming. Staying as close to this level as possible isn't just advisable; it's essential to avoid potentially catastrophic changes to our planet's systems.

Questions on the Paris Agreement goal of "holding the increase in global average temperature to well below 2°C and pursue efforts to limit it to 1.5°C above pre-industrial levels"

Q: How close are we to 1.5°C of warming?

A: We're dangerously close. As of 2024 *[note: all values we have are currently for 2023]*, we've already heated the world by about 1.3°C.[6] The effects of climate change we've been warned about for decades are with us already. The closer we get to this level, the more we are moving into uncharted and perilous territory, and the more urgent it becomes that we take action to cut our emissions and adapt.

Q: Average temperatures for 2024 broke the 1.5°C limit. What does this mean for the Paris agreement?

A: The Paris Agreement looks at temperatures over a longer time period than just one year, but seeing temperatures like this is a warning sign that we are not on the right trajectory. We are already experiencing climate impacts and these will only get worse for every fraction of a degree that temperatures continue to rise.

Q: Is the 1.5°C limit still achievable?

A: On our current trajectory, it is likely that warming will rise above the 1.5°C level, but that doesn't mean we can give up; the case for ambitious action only becomes stronger. Humanity can still win, but we need to urgently use the resources and skills we've relied upon before - science, collaboration, and long-term thinking. It's cheaper and quicker if we act now rather than waiting. We have much of the science and solutions we need; it's a matter of scaling up action immediately.

6 Forster et al., "Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence", Earth System Science Data 16, no. 6 (2024): 2625-2658; Betts et al., "Approaching 1.5 °C: how will we know we've reached this crucial warming mark?" Nature 624, no. 7990 (2023): 33-35.

Q: When will we exceed 1.5°C?
A: If we keep emitting greenhouse gases at the same rate as today, we expect it will happen some time in the early 2030s. We will be moving into uncharted and perilous territory, which makes it more urgent than ever that we take action to cut our emissions and adapt.

Q: Is it time to give up on 1.5°C and focus on 2°C instead?
A: No. We should aim to keep temperature rise as low as possible and that means we should be aiming to reduce our greenhouse gas emissions as much as possible. We know that for every fraction of a degree that temperatures rise above 1.5°C, the effects of climate change become more dangerous, more expensive and more unfair for those who did not cause climate change.

Q: What gives scientists hope in the face of the climate challenge?
A: Despite the urgency of our situation, there are reasons for hope. The world has tripled its renewable power capacity since 2010, far ahead of what was thought possible.[7] Renewable technologies have advanced rapidly and become much cheaper, and we are seeing a significant uptake in electric vehicles. Many countries, cities, and businesses are setting ambitious targets. There's growing public awareness and demand for action. We have the knowledge and tools; now we need the will to scale them up. Every action we take brings us closer to a safer, healthier, more prosperous world. The future is always in our hands.

7 BloombergNEF, Tripling Global Renewables by 2030 (BloombergNEF, 2023), 1, https://assets.bbhub.io/professional/sites/24/BNEF_2023-11-21_triplingrenewables_Final.pdf.

What needs to happen?

Q: What are the main steps to limit warming to 1.5°C?

A: We need ambitious action on multiple fronts:

- Move away from oil, gas, and coal development
- A rapid transition to renewable energy
- Switch to clean alternatives, like electric vehicles and heat pumps
- Restoring nature and ensuring that products are longer lasting and more easily repaired
- Investing in and innovating new technologies
- Adapting our infrastructure, health services, and farming practices to cope with changes already underway

Q: What role do individuals play when it comes to the 1.5°C limit?

A: Everyone has a part to play in this story. While systemic changes are crucial, individual actions matter too. This involves people taking action in their day to day lives, but also engaging with political leaders and demanding ambitious climate policies - including to make sure that clean options become the default across the economy. We need to make the impacts of climate change not just economically costly, but politically costly too. Each of us can contribute by using energy more efficiently, choosing sustainable transportation, adopting more plant-based diets, reducing waste, and advocating for climate policies.

Q: How does the 1.5°C limit relate to net zero emissions?

A: To stabilise temperatures at 1.5°C we need to reach net zero carbon dioxide emissions globally by 2050. This means balancing the carbon dioxide we emit (which should be as little as possible) with removals from the atmosphere. It's a monumental task, but one that offers enormous opportunities for innovation, job creation, and building a more sustainable world.

Q: What message should the public understand about 1.5°C?

A: The message is clear: the effects of climate change are already here, but there's still time to avoid the worst impacts that would come the further the world warms beyond 1.5°C. Every fraction of a degree matters. 1.5°C was set as a line in the sand for the impacts believed to be unacceptable to poor and vulnerable populations - this will only worsen if we exceed it. We have the science, the solutions, and increasingly, the public will. What we need now is urgent, ambitious action from everyone - policymakers, businesses, and individuals alike. The future of our planet depends on it, and the opportunities if we act are too great to ignore.

Q: What is the role of technology in helping societies adapt to higher levels of warming?

A: The good news is we already have most of the solutions we need to cut emissions. Technology will play an important role in adapting to a warmer world. Renewable energy, electrifying transport and heating, and improving efficiency in agriculture and infrastructure will help reduce further warming. Smart technologies, such as data-driven early warning systems, will improve disaster preparedness, while green innovations will create jobs and make societies more resilient.

Q: How can we ensure a just transition while limiting warming to 1.5°C?

A: The two go hand in hand. Failing to limit warming to 1.5°C means failing to protect the most vulnerable people and communities. Remember, climate change is a multiplier of existing social inequality. Climate impacts like extreme flooding are more likely to affect the communities who are least responsible for the climate crisis. At the same time, many of the actions needed to tackle climate change will also help address current inequalities. Crucially, all political, economic and social systems are designed by people. That means they can also be changed by people. We need governments to take action which ensures that nobody is left behind in the fight against climate change.

Politics, policies and current affairs

When answering politically charged questions like these, emphasise your role as a scientist and pivot back to the responsibility of governments to take action. Where possible, speak to the global trajectory rather than commenting on country-specific policies.

Q: Is the government doing enough to tackle climate change?
A: Current global policies are set to deliver a world much closer to 3°C. As scientists, our message is clear - the effects of climate change which we have warned about for decades are with us already. Scientists like me will continue to do our job to understand, explain and help to fix the climate crisis. But it is up to decision makers to take action to make this happen.

Q: What are the main political obstacles to staying within the 1.5°C limit?
I'm not going to comment on the desirability of one political party or movement over another. As a scientist and an observer of the science-based approaches taken by our leaders, governments must understand that the social, health and economic impacts of climate change are being felt by their citizens now. While progress is being made in areas like renewable energy, much more ambition at speed is needed.

Q: Do you agree with [climate policy] / do you think [climate policy] is the right approach?
As a scientist, my job is to help to understand how and why climate change is happening, what the impacts will be, and how we can stop it. But the responsibility for designing and implementing policies - and for the impact of those policies - lies with the government. They are the ones who need to take decisive action.

Q: What impact will the 2024 US election have on efforts to stay beneath 1.5°C of warming?
My role as a scientist is to support the understanding of climate change and its impacts. Governments are responsible for implementing climate-friendly policies. The policies Donald Trump has promised to deliver, if enacted, will release millions of tonnes of additional carbon into the atmosphere. This will accelerate global warming and make the kind of damage caused by the recent Hurricane Helene more common. Change will have to happen at all levels in America - from the federal to the local - to cut carbon, adapt its infrastructure to the impacts already being felt across the country, and support those nations around the world hit even harder.

Emerging areas of debate

If these are not your primary areas of research, aim to pivot back to the core narrative and avoid spending time on these topics at the expense of the key messages.

Q: Is it possible to temporarily exceed 1.5°C and return below it later, and what would the impacts be in that scenario?
A: We don't know for sure. This is not something that has ever been done before, so there is lots of uncertainty about what might be possible. We do know that even if it is possible to bring temperatures back down again, some of the impacts we will see in the meantime are irreversible, like the lives that will be lost in extreme heatwaves, floods and hurricanes.

This is why our attention should be focused on trying our best to keep as close as possible to 1.5°C. Global progress on renewables shows what we can achieve this with focus - the world has tripled its renewable power capacity since 2010, far ahead of what was thought possible.[8]

Q: If we're likely to exceed 1.5°C, should we start using solar geoengineering to bring temperatures down?
A: Even in the best-case scenario, solar radiation modification could only ever address *some* of the symptoms of climate change and it could be a source of new tensions and additional risks. The best solution is to address the root cause of the problem: to reduce our greenhouse gas emissions as soon and as deeply as possible.

Q: What role does carbon capture technology play as a solution to stay within the 1.5°C limit?
A: While we need to switch to using as much renewable energy as possible, for some heavy industries - like cement and some types of steel production - renewables are not currently an option, so carbon capture technology is needed to help these sectors pollute less. But it's important that carbon capture doesn't become an excuse to keep using fossil fuels - the world must rapidly shift away from production and consumption of fossil fuels in order to keep temperatures as close to 1.5°C as possible.

8 BloombergNEF, Tripling Global Renewables by 2030 (BloombergNEF, 2023), 1, https://assets.bbhub.io/professional/sites/24/BNEF_2023-11-21_triplingrenewables_Final.pdf.

Climate science explainers

Q: How do we measure global average temperature?
A: Measuring global temperature is a testament to human ingenuity and collaboration. We use data from thousands of weather stations, ships, buoys, and satellites worldwide. This global network of measurements allows us to track the pulse of our planet. As we see that pulse quickening with rising temperatures, it underscores the urgency of our climate challenge.

Q: How do we know human activities are causing the observed warming?
A: The evidence is overwhelming and undeniable. We can directly measure increasing CO2 levels and trace their origin to human activities. The observed warming pattern matches what we'd expect from greenhouse gas increases, and natural factors alone can't explain the rapid changes we're seeing. Our models, based on fundamental physics, show that warming is caused by human factors. We are the cause, which means we can also be the solution.

Q: How do scientists make predictions about future warming?
A: Our projections are based on complex computer models that are like digital twins of the Earth's climate system. These models are grounded in fundamental physics and tested against past climate data, combining our best understanding of how the planet and physics works. They incorporate various factors including greenhouse gas emissions, ocean currents, and atmospheric chemistry. While no model is perfect, they give us crucial insights into possible futures. Importantly, they show us that our actions today will determine which future becomes reality.

Q: Why do we sometimes see different figures for the amount of global warming to date?
A: Global warming is currently increasing at about 0.25°C per decade.[9] The precise number will depend on whether scientists report warming averaged over the last decade, the 2010s, or the most recent year. The different figures are all part of the same trend, which is one of a warming world and where the need to cut greenhouse gas emissions is becoming increasingly urgent.

[9] Forster et al., "Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence", Earth System Science Data 16, no. 6 (2024): 2625-2658.

General climate change and climate science

Q: How does climate change relate to other global environmental issues?
A: Climate change is the great amplifier of other environmental challenges. It exacerbates biodiversity loss, ocean acidification, air pollution, and water scarcity. But here's the good news: many actions to address climate change have co-benefits for these other issues. By tackling climate change, we have a unique opportunity to address multiple global challenges simultaneously, creating a healthier, more sustainable world for all.

Q: What's the difference between climate change "mitigation" and "adaptation"?
A: Mitigation and adaptation are two sides of the climate action coin. Mitigation is about tackling the root cause - reducing emissions to limit the extent of climate change. Adaptation involves adjusting to the changes that are already happening or inevitable. We need both. Mitigation is our best chance to avoid unmanageable change, while adaptation helps us manage the unavoidable. The less we mitigate, the more we'll need to adapt, and at much greater cost. And in some cases, the impacts of climate change will be so severe that we simply won't be able to adapt.

Q: How does global warming affect extreme weather events?
A: Global warming is already intensifying extreme weather events and, turning what once were rare occurrences into commonplace threats. We're seeing more intense and frequent heatwaves, heavier rainfall and flooding in some regions, more severe droughts in others, and potentially stronger hurricanes. These aren't predictions for the future - they're happening now, making our world more dangerous and expensive to live in. And they'll only get worse if we don't act.

Q: What's the difference between weather and climate in the context of global warming?
A: Weather is what you see out of your window; climate is the long-term pattern measured over decades. While a single hot day isn't climate change, the increasing frequency of heat waves, intense storms, and other extreme weather events is. Climate change is altering the backdrop against which all weather occurs, loading the dice for more extreme events that threaten lives, livelihoods, and the stability of our societies.

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Appendix

Further Resources

This toolkit is designed to be a living document and will be updated in response to ongoing feedback and questions from the community of scientists using it.

The Grantham Institute has also produced an Evidence Bank of robust, up-to-date facts and figures on key aspects of climate change mitigation, impacts and adaptation. It also provides short briefings on relevant contextual information (such as government policies) that it might be useful to be aware of before engaging on public platforms. It is available at: https://www.imperial.ac.uk/grantham/policy/evidence-bank/

We plan to update this document periodically. If you have any feedback or suggestions for topics to include in the future, please leave us some comments here: https://forms.office.com/e/XwFsuvYXjX

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Appendix

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