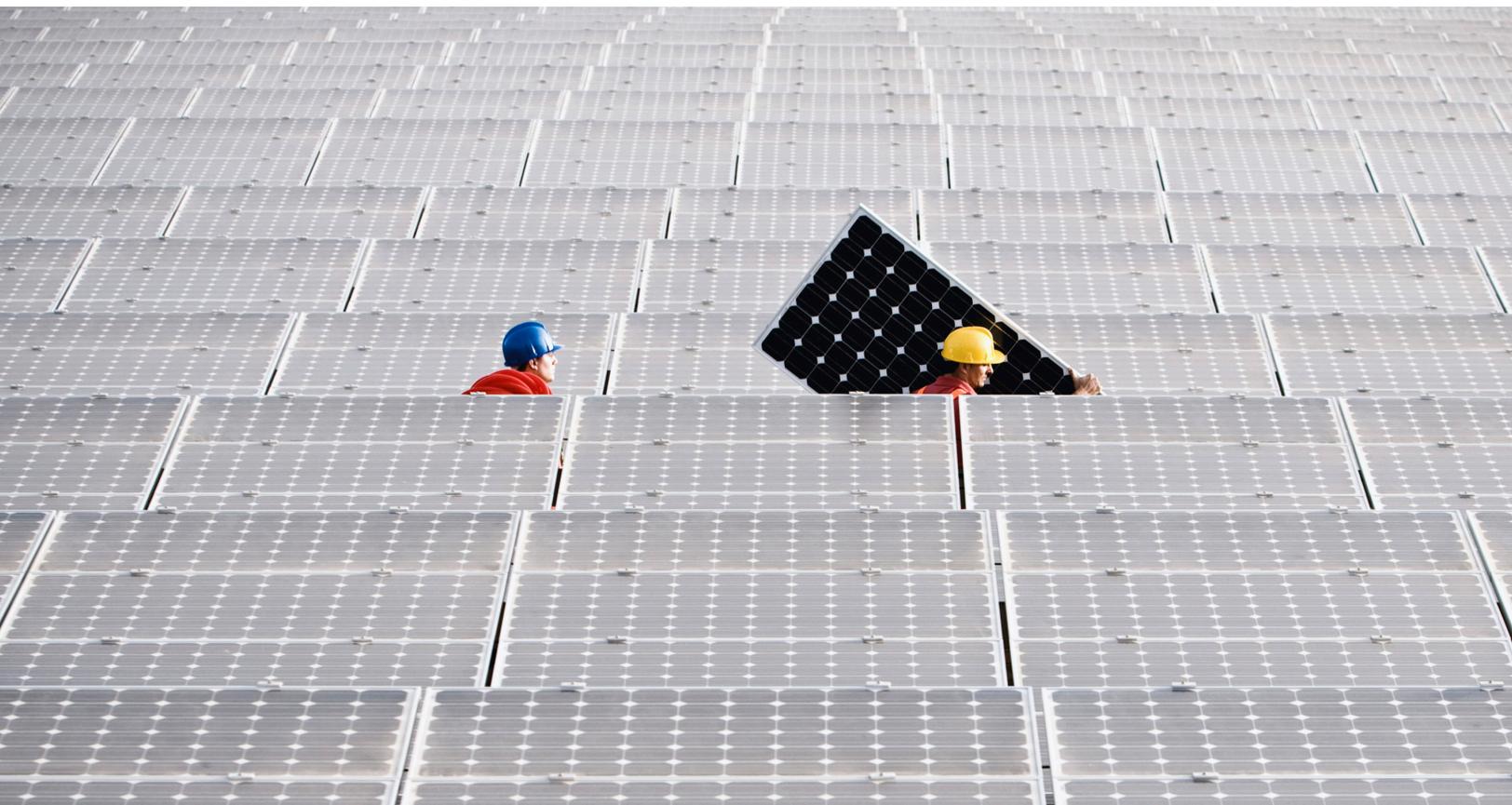


Sustainability Practice

Climate math: What it takes to limit warming to 1.5°C

We can limit climate change and reduce carbon emissions to zero if leaders in key industries act now. Here's an action plan to reach those ambitious targets.



In this episode of the *McKinsey Podcast*, Diane Brady speaks with Kimberly Henderson and Christer Tryggestad about what can be done to truly decarbonize global business at scale. An edited transcript of their conversation follows.

Diane Brady: Welcome to the *McKinsey Podcast*. I'm Diane Brady. Along with ushering in a global pandemic, 2020 was another record year for global temperatures. But in Washington, DC, and beyond, there is a renewed sense of urgency to do something about it. I'm joined today by two colleagues who have created a detailed road map for what actions need to happen to limit warming to 1.5°C.

Kimberly Henderson is a partner in McKinsey's Sustainability Practice in Washington, DC, and Christer Tryggestad, a senior partner in Oslo, is a leader of McKinsey's Oil & Gas and Electric Power & Natural Gas practices. Kimberly and Christer, welcome.

Christer Tryggestad: Thank you.

Kimberly Henderson: Thanks, Diane.

Diane Brady: Kimberly, let's start by explaining why 1.5°C is so critical.

Kimberly Henderson: Sure thing. So Diane, if you think about how climate change will progress, there are obviously a number of events that will become more severe and more frequent. Those include wildfires, hurricanes, severe storms, drought, flooding, and high temperatures.

Those events will progress over time, and we would expect to see them becoming more and more severe. And there's one aspect of limiting climate change that is purely about limiting the severity and the frequency of these extreme events. However, there are also fundamental changes in the Earth's system that we're seeing.

These are called climate feedbacks. Essentially what's happening is that climate change is

triggering certain changes on planet Earth that then will lead to more climate change. It becomes a vicious cycle. And these feedbacks have increasingly high risk of happening the higher the temperature level is.

A 1.5°C change is considered likely to stabilize the climate and limit these feedbacks. But if we see temperature levels much beyond that, it's likely we would trigger many of these feedbacks. Should I bring to light a little bit for you what kinds of things could happen?

Diane Brady: Sure. To some extent, people aren't clear as to whether we've reached a point of no return or what 1.5°C will look like. Is it more of the same?

Kimberly Henderson: So there will be some climate change at this point, no matter what we do. We have seen 1.1°C of global warming already. We're already seeing the implications of that. So at 1.5°C, we could still expect to see more climate change. But it's a matter of degree.

It's a question of risk level. And again, I think it's important to understand these feedbacks. Because there are things like losing our forests. If we lose our forests, which would happen at higher-climate-change levels, that will cause more global warming. It will be self-reinforcing.

And similarly, losing ice cover warms the Earth. And so the global warming that is leading to the ice loss could then drive further global warming. And that's what we really want to avoid. We want to be able to stabilize the climate. And at a certain level, we would lose the ability to do that. But now we still have the capacity to stabilize the climate. And 1.5°C gives us the best chance to do that.

Diane Brady: Christer, I'm used to talking about these issues through the prism of sustainability and renewable energy. You lead the Oil & Gas Practice. Can you talk a little bit about how the priorities are playing out there?

Christer Tryggestad: Yes, I'm very happy to do that, Diane. So the sustainability trend actually hit both the oil and gas and the power industries some time ago. If you look at the drivers of climate change, energy is a very important part of that; 75 percent of emissions are related to energy.

For the electric-power industry, we saw the change starting quite a few years ago with incumbent power companies shifting their portfolios away from the more traditional coal and gas burning toward renewables, mainly solar and wind power. And we also saw a series of new entrants moving into the solar- and wind-development space. You could almost say that what we're now seeing is the next wave of that, which is more focused on storage and hydrogen—clean hydrogen, often green hydrogen—as the new growth avenues for power companies that want to make a business and create value based on the sustainability trend.

For the oil and gas industry, the trend is a little bit newer. But it's happening, especially with many European oil and gas companies now making significant shifts in their portfolios and creating renewable-power generation with quite some force.

Diane Brady: What's motivating that? Is it public pressure?

Christer Tryggestad: I think it's a combination of various things. Public pressure and reputation certainly could be a driver. But I think many of these companies would not do anything unless they also saw a clear business rationale for doing it. So they clearly see good value-creation opportunities related to renewable energy.

Diane Brady: Kimberly, talk about the study that you both worked on. What sectors did you look at, and what levers really are critical?

Kimberly Henderson: We looked at every sector that generates greenhouse-gas emissions directly. So we looked at the oil and gas industry, cement, steel, mining. We looked at agriculture. We looked at power, of course, all types of transport. We covered

the full suite of industries that are significant greenhouse-gas emitters.

We worked with our experts in each of these sectors; we work with each of these sectors in our client work to determine what is the pathway for each sector that would be consistent with the 1.5-degree pathway and what needs to happen technically to get there.

So what measures can each industry, each company, take to reduce its emissions? When we stepped back and looked across all industries, we found that there were ten things that need to happen that could lead us to a zero-carbon economy.

There's one category that's around demand: how we power and fuel our lives. That is what people often think of and much of what Christer spoke about. How we power and fuel our lives includes electrifications—electrifying our transport systems and industry and buildings.

It includes the renewables adoption where we already see renewables at scale. But we need them at a much greater scale for a 1.5-degree pathway. It includes hydrogen that's produced in a low-carbon way and bioenergy. That's all the things that need to happen in powering and fueling our lives differently.

There's an additional category in managing carbon. So we need certain industries to capture carbon at the point where it's emitted, and then either store it underground or use it in a product. We also need to start managing the carbon balance in the atmosphere. That means taking CO₂ out of the atmosphere. The easiest way to do that is reforestation, since plants absorb carbon. If we reforest areas of the Earth, that will help reduce the CO₂.

Diane Brady: Christer, from a fuel and gas perspective, would you call this aspirational or doable?

Christer Tryggestad: Both. We've shown by a bottom-up, segment-by-segment analysis that it is

actually feasible to get there. At the same time, it's extremely challenging.

Diane Brady: When you look across your sector, Christer, where is the energy being placed?

Christer Tryggestad: There are several things. First, many of the oil and gas companies are addressing their own emissions from their core operations. The other thing is that we see a change of portfolio. So companies are moving away from the fuels that have a significant impact on climate change—heavy oils, for example—toward cleaner fuels or cleaner types of energy, like renewable power.

Kimberly Henderson: Diane, I want to come back to the point made previously about policy. I think it's important to understand that private-sector actions will largely be dictated by policy or at least enabled by policy. So policy and regulation are critical to achieving a pathway that's anything like this.

Without policy, a lot of the decisions that need to be made aren't economical. For companies to reduce their emissions, for instance, there's a better business case if there's some sort of a consequence from having those emissions, which in many parts of the world right now there is not.

Or if you want to build a new business, for that business to make money, there needs to be a policy or a regulatory framework that allows for that. In many of these technology areas, such as carbon capture, that is a pure cost. So unless there is some sort of regulation or subsidy or incentive or tax, carbon capture will not make sense as a new business model. This is a critical enabler. I want to make clear that it's inseparable from the private-sector actions.

Diane Brady: It reminds me a bit of the ethanol debate people used to have. Let's look at the different areas. Reforming food and forestry is the first shift you advocate.

Kimberly Henderson: I'll take the two pieces in turn. For forestry, what we find in our analysis

is that for this pathway, we would need to stop deforestation. Right now, we deforest an area about the size of Greece globally every year. And we would need to reforest a large area. In our analysis, by 2030, we would need to reforest an area the size of Turkey. So that is a significant change in how we manage our forests and how we support forest growth.

Diane Brady: So when you say Turkey relative to Greece, you essentially mean that we have to be planting a lot more than we're taking out?

Kimberly Henderson: Yes. We need to essentially stop deforesting. And the area we're deforesting every year, we should be thinking about reforesting an area at that scale every year. So it's a reversal in what we're doing today.

Diane Brady: Where are some of the biggest problem areas with food? We hear a lot about factory farms, for example, but that's from a consumer perspective. From the business perspective, where are the challenges?

Kimberly Henderson: The biggest climate challenge in the food space is methane. It's not CO₂; it's methane.

Diane Brady: Cows.

Kimberly Henderson: Yes. Within food and agriculture, cows are the primary source of methane. Rice production also generates methane, and any food waste generates methane. But cows are the biggest part of the problem. If you were to take the global population of cows and assume that they are a country in themselves, then that country would be one of the top three greenhouse-gas-emitting countries in the world. To give you a sense of scale, all the cows on the planet are generating emissions roughly on par with the United States.

So this is a major source of greenhouse gases that would need to be reduced. There are some technical measures to help reduce that: certain breeding and genetic selection, methane inhibitors, feed-mix

additives. That said, for the reduction in methane that we'd likely need to see, we would expect to probably need a reduction in beef consumption.

Diane Brady: Are we asking people to consume less rice as well?

Kimberly Henderson: No. With rice, there probably are changes in production methods that could help reduce methane and help reduce greenhouse gases.

Diane Brady: Christer, talk about electrification.

Christer Tryggestad: Sure. Electrification. That's the second major shift that is required to reach the 1.5-degree pathway. And when we talk about electrifying our lives, we basically talk about two end-use segments: road transport and buildings.

Road transport today is roughly 15 percent of CO₂ emissions. By electrifying that segment—together, of course, with greener electricity through renewables—you can significantly reduce and almost eliminate those emissions.

Diane Brady: Electric cars?

Christer Tryggestad: That's electric cars. It's trucks. It's buses, three-wheelers, et cetera.

All road transport, if you will. The second element is around buildings. Another 5 to 8 percent of the global emissions comes from heating, whether it's space heating, water heating, et cetera, all related to buildings. By moving from whatever source of energy, for example, gas, toward clean electricity, you can then eliminate those emissions as well.

Diane Brady: Kimberly, you talk about adapting industrial operations to make them more efficient. Is that a small fix?

Kimberly Henderson: Efficiency is part of it. It's not only about that. To Christer's point on electrification, there is huge electrification potential in the industrial sectors now. Things that are currently using fossil fuels could be switched to electricity and switched to clean electricity.

So that's one part of the industrial transition that needs to happen. Efficiency is, of course, a part of it: improving energy efficiency, recycling—steel recycling will be very important to reducing emissions—and process optimization.

There's an efficiency component here that is critical for certain industries. We talked about methane with regard to cows. The other major

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source of methane is the fossil-fuel value chain: the production of oil and gas and coal. And then the transport, distribution, and storage, particularly of gas that generates methane. Those industries need to take measures to control that methane and reduce those emissions.

Diane Brady: I'd like both of you to take us to the front lines, to what people are telling you. Since every part of the economy really needs to decarbonize to get to this pathway, are you finding a lot more interest, especially given the current climate realities we're facing?

Kimberly Henderson: Yes. I think private-sector decision makers largely understand this. Christer mentioned the pressure around climate change is growing. That's coming from a number a number of places. There's public pressure. There's pressure from investors, pressure from regulators, pressure from customers. Increasingly, we see companies asking their supply chain to become zero carbon. If you take an automotive company, for instance, they can have thousands or tens of thousands of suppliers that they are now asking to become zero carbon.

In the private sector, it's now become part of mainstream thinking that we will need to decarbonize. The questions that people are still grappling with are the speed, the scale, and how to make the business cases work. It's not clear exactly what needs to be done, and when, for everyone, but the realization that this will be an imperative for pretty much every industry is there.

Christer Tryggestad: Agreed. I see all my clients now quite focused on sustainability topics. There are two elements. One is about intentionally making the businesses more robust toward future regulation and future consumer demands. The second is pursuing growth opportunities and value-creation opportunities. Of course, the technology cost is going down, as you indicate. That makes it easier for many companies to both take the protective measures and also to pursue interesting value-creation opportunities.

Kimberly Henderson: Diane, if you think about cost, there are a few aspects that companies think about. There's the cost of the measures that they implement themselves, which—for renewables, for instance—is very competitive now. So that's a viable option for many companies.

Then there's also a profit question. When Christer talks about diversification and what new industries companies want to play in, that's a different question: Can we make money? Those are two very separate questions that companies are grappling with.

Diane Brady: Christer, we are in the middle of a global pandemic with COVID-19. How does that affect the discussions around this or the ability to do it?

Christer Tryggestad: It is clear that now a lot of public attention and government measures are focused on handling COVID-19, and rightfully so. For many countries and regions, you would also see that the financial headroom to address the climate challenge will be reduced for years to come.

At the same time, I do see COVID-19 as an opportunity to address climate change. First, you could say that the crisis itself has significantly reduced CO₂ emissions in the short term. While many of these emissions will come back, our research also shows that there will be a net-negative effect from COVID-19 over the longer term.

Secondly, and maybe most importantly, the restart of economies that's now needed is also a very good opportunity to incentivize many of the green investments that are required to drive and accelerate the transition toward a limit of 1.5°C.

Also, for many of these investments, the degree of technology, on average, will have relatively high employment per invested dollar compared to many other investments. Finally, you could also say that if there's one thing the COVID-19 crisis has shown us, it's that societies are able and willing to take dramatic measures in the face of a

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crisis. I would say there's a little bit of comfort in that as well.

Kimberly Henderson: I think COVID-19 has also helped to shatter some status quo bias. For a long time, many people just found it hard to imagine what climate change will really mean and what the risk is and how bad it could be for human society because we've never seen anything like it before. I think the pandemic has opened people's eyes to the reality that there could be these exogenous shocks, these exogenous risks that completely change how we need to operate as a society and what we need to do. I think that the pandemic has opened up the aperture of the risks that people are willing to consider and start to prepare for.

Diane Brady: When we think about the magnitude of this problem, it almost induces an existential angst—that there's so little we can do. How optimistic are each of you that we can make real progress here?

Kimberly Henderson: I'm actually very optimistic. Technically, we know what to do. This is solvable. You know, some people seem to think that we need to go invent new things and that it will be a genius in a lab that solves this. That's not needed, actually.

We have the technologies we need. We need to scale them. We need to get the cost down. But we are technically able to tackle this problem. What we need is a step change in willpower to get there. For people who feel anxious or worried, I think now is the time to actually feel empowered.

This is a moment for leadership. The 2020s are a pivotal decade that will determine the future of the planet and the future of human society. The decisions made now really matter. For people worried about climate change, they should be making different decisions and seeking to influence decisions that are being made in the world—by the public sector and the private sector. Now is the time to really drive this change. It

just requires a lot of action in a very short time frame.

Diane Brady: Christer, in Europe, the thinking seems to be further along on this.

Christer Tryggestad: Yes. So, to your question, am I optimistic? I think it is important to underline that when we talk about a 1.5-degree scenario, the challenge of getting there is tremendous. We're talking about net-zero emissions by 2050, which is in itself a big task. Even more challenging is the fact that we need to reduce emissions by more than 50 percent over the next ten years. That's practically tomorrow when you talk about emissions from many of the processes that we're currently looking at.

What still gives me some optimism is the fact that I see a lot of momentum right now. I work a lot in the oil and gas industry. And if you look at how oil

companies are talking about this topic, compared with only a year ago, it's fundamentally different—at least from Europe.

I see that trend accelerating. It's also driven by economics. I think we will continue to see that acceleration. Will that take us to 1.5°C? Maybe not. But at least it takes us a lot closer than the current business-as-usual or reference cases would indicate.

Diane Brady: Kimberly and Christer, thank you for joining us.

Kimberly Henderson: Thank you, Diane.

Christer Tryggestad: Thank you, Diane.

Diane Brady: That was Kimberly Henderson and Christer Tryggestad. If you'd like to see more research on the 1.5-degree pathway, please go to [McKinsey.com](https://www.mckinsey.com). I'm Diane Brady.

Kimberly Henderson is a partner in McKinsey's Washington, DC, office, and **Christer Tryggestad** is a senior partner in the Oslo office. **Diane Brady** is a senior editor in the New York office.

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