# Making a Running Start

11 November 2025
Peter Coffee

On my first full-time day of FfILoEing (I guess that's pronounced "filing"), it seems useful to get a running start, by reviewing some previous work that was done in other roles and at other behests -- but turns out to have given some hints about future themes and goals, where that "future" has today become "now."

I asked a neutral party--ChatGPT--"What does Peter Coffee say about environmental stewardship and sustainability?" I did not tell the LLM where to find its source material, so it went to the Internet At Large; it came back (with ridiculous speed) with things that I'm sure it would have taken me much longer to track down.

I'll condense this a bit: one suspects that ChatGPT would have followed an instruction to do that, but let me feel some sense of participation:

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**What Peter has said relevant to sustainability / stewardship**

- On travel, communications and environmental impact:
  "*The part of the job I would not do? I'd be fine if it did not involve the 180-plus days of travel and close to 200,000 air miles per year...if telepresence could become a more accepted mode*."
  This speaks to thinking about the environmental consequences of business practices (in this case, business travel) and being willing to change modes of operation in light of those consequences.

- On investing into the broader community/supply-chain ecosystem:
  "*Sometimes you have to say...are we sufficiently ready, that we should now be investing at the margin in educating our customers, or maybe making investments in our suppliers or in community response…that you invest in the community around you, not because it's the nice thing to do, but because it's the smart thing to do*."
  This suggests a view that sustainability (in a broad sense) isn't just about the internal operations of a business, but about the health of the ecosystem--suppliers, customers, community--around it. You can't have sustainable operations if your supply-chain is unsustainable.

- On resilience, long-term thinking, and avoiding "short-term optimisation" with lack of slack/robustness:
  "*We've spent 20 years educating managers and organisations to do relentless narrowly focused optimisation, minimise cost, tighten supply chains… The problem is, people got promoted for minimising slack, not for finding resilience*."
  While this is more about business resilience than environmental stewardship per se, the implication is: sustainability and resilience are closely linked.

- On redefining what the business is doing (and thus what its impact is):
  "*Try to forget the thing you've gotten good at doing, and dial your brain back to the reason anyone wanted you to do it in the first place*."
  This statement hints at the need for purpose-driven change, which can include environmental purpose and stewardship rather than simply doing what we've always done.

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ChatGPT was unexpectedly generous in giving me credit for redeeming social value, heading another list with "My interpretation: How his thinking applies to environmental stewardship" (this time, ChatGPT numbered the items):

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**Here are how his ideas map onto the topic of environmental stewardship:**

1. Ecosystem mindset: He emphasises that organisations should look beyond direct operations, considering the supply chain and the upstream and downstream ecological impacts.
2. Resilience over pure efficiency: When businesses optimise too narrowly, they may sacrifice robustness. Climate change, resource constraints, ecosystem shocks demand resilience. Environmental stewardship is part of that resilience: preserving resource bases, ensuring long-term viability rather than short-term gains.
3. Rethinking business purpose: his statement about "why anyone wanted you to do it in the first place" invites organizations to revisit their fundamental value proposition.
4. Operational choices that matter: His comment about reducing travel reflects the practical changes organisations can make. In environmental stewardship, operational changes--remote work, reducing logistics footprint, efficient infrastructures--are part of the story.
5. Investing in community and ecosystem: He frames investment in suppliers/customers/community as "smart business" -- not just philanthropic, but strategic and risk-mitigating.

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Take-aways? You want take-aways? Once again, ChatGPT output...

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**Here are some practical actions aligned with his thinking:**

- Map your ecosystem
- Shift from cost-only metrics to resilience metrics
- Define the core need your business fulfills -- and ask how to meet that need in a way that doesn't deplete or disrupt ecosystems
- Treat environmental/community investments as strategic
- Culture and mindset: Encourage teams to ask, "Is this just doing an old thing more cheaply, or are we doing something differently that preserves natural capital?"

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This is already too long, and it's just the kickoff -- and just this morning, at least three things crossed my news feed that ought to become topics for future sharing and comment. So, more to come.

Thanks for being here. We'll see what we can do about framing, emphasis, and optimization (I don't know why ChatGPT was using British English spellings like "optimisation" up above) to bend the curve in better directions -- quickly.

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# Characterizing Climate Change: It Takes Two Kinds of Number

18 November 2025
Peter Coffee

To grasp the impact of climate change, we have to use two kinds of number – but only one kind of math, just simple arithmetic.

- The first kind of number is measures of scale: area of Amazon rainforest, volume of Greenland ice, mass of our planet's oceans. These numbers tend to be big.
- The second kind is measures of rate: tons per year of greenhouse gas emissions, meters per year of glacier recession, hectares per year (or football fields per second) of planet-wide deforestation. These trends versus time may not seem as big as the measures of planetary scale, but there's often multiplication to follow – with results that get big in a hurry.

A simple calculation that puts climate change in perspective, for me, is the math of Greenland's ice sheet. It's not easy to visualize this, but that ice is almost two miles deep at the thickest point – with an average thickness of roughly a mile, and this is over an area of about 660 thousand square miles. In round numbers, we're talking about 700 thousand cubic miles of ice. Divide that by 140 million square miles of ocean, and we get a value of 0.005 miles of potential sea-level rise if the whole thing melts – because, unlike a melting iceberg that was already floating in the ocean, a Greenland's worth of melting ice would be new water coming in. (Note also that this would be *fresh* water, and someday we'll talk about why that matters.)

Meanwhile, if 0.005 miles of sea-level rise doesn't sound like a lot, perhaps it sounds bigger in units of everyday weather reporting: that's more than 26 feet. That's about the same as the largest storm surge ever recorded in the United States, the 27.5 feet in Pass Christian, Mississippi during Hurricane Katrina in 2005. There is, however, an important difference between ice melt and storm surge: we would now be talking about something that is (i) worldwide and (ii) lasting longer than just a few hours or days. I try not to use the word "permanent," but this might qualify.

I don't want to weaken the case by seeming to exaggerate, so I'll note that no one is currently talking about this happening in less than several hundred years – but that's not a "never mind," because the last several years have mostly seen the surprising data and unexpected interactions pushing things in the wrong direction. The most direct causative factors, like global average temperature, keep growing. To put this in simple and tangible terms, the surface of that Greenland ice was 95 per cent liquid in the summer of 2019 – compared to an average of only 64 per cent during the period from 1981 to 2010. Seriously, it's *melting*.

Further, if we want to do a little more math, then high-school physics might add some further urgency: yesterday's warming of the ice sheet's surface turns into a "warm front," so to speak, that diffuses downward today and tomorrow – which can't be stopped, no matter what we do at the surface. If we flipped a switch and went back to 1900s levels of greenhouse gas emissions tomorrow, that heat would still be on its way down to the bottom – and when it gets there, some ice may start sliding on its new underfilm of water. Complications to follow.

I opened this with "two kinds of number," and there are also two kinds of problem:

- There are problems that can be solved when they are seen: get a headache, take an aspirin.
- There are other problems that have to be attacked more proactively: cancer is treated as soon as it's detected, even if it's not yet causing discomfort. This is why I have a problem with statements like what Bill Gates shared last month, when he said that "Every effort in the world's climate agenda should…be prioritized by its ability to save and improve lives cost-effectively." That sounds to me like "fix today's headaches, the cancer can wait."

Climate change is like cancer. We know it's happening. Visible symptoms and simple math. Like the photons that left Proxima Centauri in August of 2021, which are going to get here sometime today, it's a future that in a sense has already happened even if we can't yet see it – but we need to believe it.

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# COP30 Weakens Carbon Commitment; Follow The Money?

25 November 2025
Peter Coffee

Sometimes, a phrase on a screen stabs into the reader's eye like a red-hot needle. The COP30 UN Climate Change Conference, held last week in Brazil, appears to be declaring that

> "The Conference of the Parties… *Acknowledges* that the global transition towards low greenhouse gas emissions and climate-resilient development **is irreversible** and the trend of the future." (Italics in original, boldface added)

My eye still hurts from reading that phrase, "is irreversible": to be 'irreversible,' doesn't something have to be moving forward with something resembling intention and speed? Hasn't 'reversibility' already been demonstrated, just last week, by the change from an earlier draft of that statement?

Yes, we have the receipts. Just three days earlier, language being proposed had included as a possible option:

> "*Encourages* all Parties to cooperate for and contribute to…global efforts…to develop just, orderly and equitable transition roadmaps, including to **progressively overcome…dependency on fossil fuels**" (again, my boldface)

with an immediately following clause reading,

> "*Urges* Parties to work together towards **phasing out inefficient fossil fuel subsidies** that do not address energy poverty or just transitions, as soon as possible" (ditto)

with still another option later on that would have said that the Conference,

> "*Decides* to establish an annual consideration [of various reports] accelerating action around…**transitioning away from fossil fuels** in energy systems, in a just, orderly and equitable manner, accelerating action in this critical decade." (ditto)

The most remarkable change from the earlier draft to (what appears to be) the final language is literally a single word: the word 'fossil' is entirely absent from the later text. Completely gone, not appearing even once in those seven pages, and people noticed: "A climate decision that cannot even say 'fossil fuels' is not neutrality, it is complicity," said Panamanian representative Juan Carlos Monterrey Gómez – adding, "and what is happening here transcends incompetence."

Before this news broke over the weekend, I had been looking forward to writing something about carbon capture – the actual sequestration of carbon, which some hope will offset the (now newly demonstrated) difficulty of getting nations to commit to emitting less. OPEC representatives, in particular, have long urged that carbon capture be viewed as lessening the urgency of carbon emission reduction – and carbon capture has been discussed since at least as long ago as 2009, when the Global Carbon Capture and Storage Institute was launched as an international effort led by Australia.

As of last month, though, estimates MIT's *Technology Review*, "hundreds of companies that have spun up in recent years have disclosed deals to sell some 38 million tons of carbon dioxide pulled from the air…roughly the amount the US pumps out in energy-related emissions every three days. And they've only delivered around 940,000 tons of carbon removal. The US emits that much carbon dioxide in less than two hours." As noted on this site last week, scale matters, and carbon removal efforts have yet to achieve it – making it all the more important to maintain, not to slacken, the pace of reducing carbon emissions.

We may have to hope that the profit sector will *demand* that governments take action to coordinate a global transition, and there are emerging hints that this might happen: in September of last year, according to a survey by Deloitte,

> "Seventy percent of the survey respondents said rising emissions and global temperatures will have a 'high or very high' impact on operations…and 45% said they are changing their business model to reduce emissions and prepare for a low-carbon economy… Nearly all the respondents, 92%, said they can continue to grow their company while shrinking its carbon footprint."

Even a short-term, purely self-interested argument is clearly gaining strength: as noted by the World Economic Forum in September,

> "Companies in the S&P Global 1200 index will face $1.2 trillion in annual costs from physical climate impacts by 2050. Most of the index's market value lies in the United States, with most losses stemming from extreme heat, manifesting as lost labour productivity, accelerated asset depreciation and higher energy costs, among others."

Yes, COP30 may have been "the deadliest talk show ever"—in the words of Harjeet Singh, at India's Satat Sampada Climate Foundation—but what diplomats were too diplomatic to accomplish may instead become a domain of economics…and engineering, which was where I was planning to go this week. More, we may hope, to come.

**COP30 Weakens Carbon Commitment – But Follow The Money**

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# See It, Measure It, Story It

2 December 2025
Peter Coffee

William Thomson, perhaps better known as Lord Kelvin (as in ºK), is often quoted as having said that "When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind." He wasn't wrong, but he didn't go far enough.

In 1883 (when Thomson said the above), it was still a novelty to *have* accurate numbers for a physics of mass, length, and time. The mass of the Earth had still been getting re-estimated by mountaintop measurements as recently as 1880. Several more years would pass after that before "let's synchronize our watches" could become a battlefield phrase, with the 1890s advent of mass-produced timepieces. As for what might seem our simplest measures, of length, between 1919 and 1929 the estimated size of our galaxy would grow by a factor of a thousand: a whole lot more than a rounding error. In short, putting numbers on things hasn't always been easy.

Thomson was therefore on the bleeding edge, in his time, when he said that "you have scarcely, in your thoughts, advanced to the stage of science" if you couldn't offer a measurement of your topic. Today, though, that's just a starting point, because mere numbers are now the easy part. Numbers come at us from all directions, with timeliness and precision: for example, more than 20 billion Internet-connected devices are quite ready to drown us in real-time data.

If we're going to "advance to the stage of science," this overwhelming volume of available measurements must be assembled into comprehensible stories – either to explain what's already happening, or to offer a convincing prediction of what's to come. Today's sad state of both popular discussion and political posturing suggests that we're not meeting the need to turn our numbers into compelling stories. This is why STEAM education, developing both a readiness to reason with numbers and a fluency in sharing what they mean, has to be considered a crucial component of climate-change mitigation strategy – because that's going to require a shared understanding of the physical, political, and economic worlds.

Three news items have caught my eye this week to trigger this line of thought. The first was a comment on why trucks, rather than far more fuel-efficient trains, handle more of our freight transportation than simple math suggests they should. The second was a warning about the future prospects for math as part of the language for discussing our choices. I'll get to the third in a moment.

First, the warped incentives favoring trucks over trains:

> Highway transportation accounts for roughly 30% of all U.S. greenhouse gas emissions, with trucking representing a quarter of that total. Rail freight is four times more fuel-efficient than trucking and produces 75% less greenhouse gas emissions per ton transported. Overall, trucking is five times more expensive to society than rail – but trucking companies don't invest in roadway infrastructure. The government handles construction, maintenance, expansion decisions, and financing. These government subsidies *allow the industry to avoid the capital investment and strategic planning required of other modes while enjoying universal access to virtually every business in America*. [My italics added]

This is not just about numbers. It's about the story of why those numbers are what they are, including the history of the highway system and the political hazards of raising the fuel taxes that were initially planned to support it. Without that story, the numbers only describe the problem: they don't illuminate any paths toward its solution.

Second, however, was this bleak assessment of the story skills required:

> Five years ago, about 30 incoming freshmen at UC San Diego arrived with math skills below high-school level. Now, according to a recent report from UC San Diego faculty and administrators, that number is more than 900 – and most of those students don't fully meet middle-school math standards… Last year, the university launched a remedial-math course that focuses entirely on concepts taught in elementary and middle school… One of the course's tutors noted that students faced more issues with "logical thinking" than with math facts per se. *They didn't know how to begin solving word problems*. [I added those italics, too]

Word problems. The mapping of a situation into a calculation, and the remapping of the math result into understanding – and recommendation – and decision – and action.

This leads us toward what Stephen Wolfram calls, more generally, "computational thinking":

> What is computational thinking? Its intellectual core is about formulating things with enough clarity, and in a systematic enough way, that one can tell a computer how to do them… Like math, it forces a certain precision and clarity of thinking. But like writing, it's fundamentally about communicating ideas. And also like writing, it's a fundamentally creative activity… It's not so much about programming: it's about what should be programmed; it's about the overall problem of formulating things so they can be put into computational form.

That brings up the third thing that crossed my feed this week: a segment on *60 Minutes* about high school students using gene editing tools to develop, it may turn out, diagnostic and treatment methods for Lyme Disease that may shrink diagnosis times from weeks to days. For starters. It moves me to quote Stephen once more, from the same source as above:

> In many standard curriculum subjects, kids in school only get to do pale shadows of what professionals do. But when it comes to computational thinking, they've now got the same tools – and it's now realistic for them to do the same professional-grade kinds of things.

The excuses, the "I can't do anything about a problem this big" escape clauses, are being deleted from our social contract – because now we can see something, measure it, understand it, reason about how to change it, model that method and refine it, and tell the story in a way that leads people to say "We can do that." Repeat. More to come.

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# Prices Are Signals: Don't Mute Their Alarms

9 December 2025

Peter Coffee

The politics of climate policy have swung from science-based consensus to partisan posturing – but below that fog and froth, there's a powerful current of pricing (and paying for) rapidly growing risks in the market for homeowner's insurance.

To start things off, let's run the highlights reel:

- In **1992**, the United Nations Framework Convention on Climate Change was ratified as a formal treaty by the United States Senate, in a voice vote with no recorded dissents. **Acknowledging reality**, and cooperating with other countries to address it, was **not considered a partisan issue**.
- Two decades later, again by unanimous consent, both houses of the U.S. Congress approved **flood insurance reforms** that were largely inspired by rapid and costly change in climate-related risks. "Nationally, **the Special Flood Hazard Area is projected to be 40%-45% larger by 2100, with approximately 70% of this increase due to climate change**," observed a report from the Congressional Research Service. Again, this was not considered a partisan issue: this was about the safety of people's homes, jobs, and lives.
- Fast forward by one more decade, though, and in **2024** we find the Florida state legislature passing a bill that deleted all references to "climate change" from the statement of the state's energy policy. One alteration revisedly instructed the Department of Agriculture and Consumer Services to **"advocate for energy ~~and climate change~~ issues."** Apparently, even merely mentioning that climate change issues might exist has become something that's Just Not Done.
- Most recently, **in July of this year**, a U.S Department of Energy report asserted that "models and experience suggest that $CO_2$-induced warming might be less damaging economically than commonly believed, and excessively aggressive mitigation policies could prove more detrimental than beneficial." **Wishful thinking codified as policy.**

Now that we're caught up—and perhaps, a little shocked to realize how much the flavor and texture of the conversation changed in just three decades—let's look at some measures of current reality, and contrast them with some new and troubling behaviors of delusion.

**Reality**:

- "In 2023, private insurers lost money on homeowners policies, meaning these companies paid more in claims than they collected in premiums, in 18 U.S. states… That total is up from 2018, when insurers were in the red in 12 states, and 2013, when insurers lost money in only eight states."
- Some estimates suggest that "Insured losses from natural disasters in the U.S. now routinely approach $100 billion a year, compared to $4.6 billion in 2000." Between 2020 and 2023, insurance premiums in the top 20 percent of counties for climate risk increased by 22 percent and studies have found that insurance premiums have increased 40 percent faster than inflation.

**Delusion**: a few weeks ago, the housing-market web site Zillow "quietly removed a feature that showed the risks from extreme weather for more than one million home sale listings on its site." Yes, really. According to *The New York Times*,

> The website began publishing climate risk ratings last year using data from the risk-modeling company First Street. The scores aimed to quantify each home's risk from floods, wildfires, wind, extreme heat and poor air quality. But real estate agents complained they hurt sales. Some homeowners protested the scores and found there was no way to challenge the ratings. Earlier this month Zillow stopped displaying the scores…

We are unwinding far more than merely three decades of fact-based behavior. We're behaving in a way that might have made 14th-century Genoese merchants shake their heads – because it was at least as long ago as the year 1347 that risk pools and insurance policies began to emerge, not merely in connection with a single voyage (a la *The Merchant of Venice*) but in a more general marketplace of assessing and pricing risks.

It gets worse, though, because the burden of delusion is often being carried by those who can least afford it. Also from *The New York Times*,

> The typical American household last year paid about $500 in home insurance premiums for every $100,000 of home value, or 0.5 percent… But in California, which suffered through more than 7,000 wildfires last year, the typical homeowner paid premiums as low as .05 percent of home value. By contrast, in parts of Alabama, Oklahoma, Louisiana and Texas, the average homeowner faced home insurance premiums greater than 2 percent of the value of local homes.

What would cause such an uneven pricing of risk? It's not, as one might presume, the uneven distribution of risk itself. Rather, according to research from the Harvard Business School cited by the *NYT*,

> In states where officials tightly control what insurance companies can charge, premiums tend to be priced below what they would be if they reflected the true likelihood of damage from storms, fires or other catastrophes… After big losses in those tightly regulated states, such as California, national insurers tend to raise rates in more loosely regulated states.

When we mess up the signaling behavior of prices, attempting in effect to slow down the car by holding back the needle of the speedometer, markets get correspondingly messed up. From that same *NYT* article,

> In communities where insurance rates exceed the actual risk, homeownership can be unaffordable. And in places where insurance prices are too low, it encourages people to move into homes in areas likely to be hit by wildfires or other disasters that could deliver financial ruin. The market is "incentivizing all sorts of crazy behavior" [HBS researcher Ishita Sen]

Climate change already presents a structural challenge to the most basic model of how insurance works.

> Insurance has worked when many people had a similar risk that was somewhat predictable for large numbers of people, but was not highly correlated among individuals. For example, any typical house has little chance of burning down in any given year, and a single house afire doesn't usually burn down an entire neighborhood; it's therefore been possible for people to pay a small (and predictable) insurance premium, rather than risking loss of the entire value of one's home.

In short words, insurance works when

- many different parties are exposed to common and familiar risks,
- with magnitudes that can be estimated from past experience and present observation,
- but uncorrelated in that any one party's damage from that risk is unrelated to any other party's likelihood of the same thing happening at the same time.

Climate change risks are different in every one of those respects: these are risks

- that are not familiar,
- that are not readily estimated by current observation,
- and that are likely to have impacts over an entire region in massive incidents such as wildfires and floods.

At the very least, we'll do well not to introduce deliberate distortion, or indulge in pretend-it's-not-real concealment, when our signaling systems are already hard pressed to reflect a complex and rapidly changing situation. We need all the help we can get to deal with what's to come.

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# Getting Our Heads In The Game

16 December 2025

Peter Coffee

If you haven't already finished holiday gift shopping, or even if you think you have, there's still time to have the board game "Daybreak" show up in time for family gatherings or for get-togethers with friends. The game's creators upliftingly call it "a hopeful vision of the near future, where you get to build the mind-blowing technologies and resilient societies we need to save the planet"; at the same time, it's a pretty galvanizing experience to spend an evening making the tradeoffs and dealing with the dependencies that are involved in making that happen. Or not.

The good news, for people who dread board games because they can lead to challenging conflict, is that this is a cooperative game where the group as a whole either succeeds or fails. The other news is that this is a simulation of making global, geopolitical, scientific, and social choices aimed at keeping the planet a good place to live. It takes a solid hour to play, probably longer the first once or twice as the flow of the game gets learned, but I can anecdotally report that even pre-high-school students clamor to play it again – whenever there's a big enough block of before- or after-dinner time to do so.

Among the key ideas that the game turns into gameplay are

- **Resilience**: social, ecological, and infrastructure. Some of the actions that are useful to take will make demands on systems and stakeholders. Building a willingness, and a capacity, to meet those demands may be as much of a challenge as building and deploying the technologies involved.
- **Engagement**: some of the actions that are useful to take will depend on the people with the money to make it happen, and the markets that can help that money find opportunities within reasonable frameworks of regulation. Winning the game doesn't just happen by agreeing on what would help; there are also mechanisms of incentives, alignments, and cross-border cooperations that have to be recognized and energized.
- **Tipping Points**: this is a big one. In each round of the game, carbon that's been added to the environment must be either offset (for example, by having planted trees) or reflected in global temperature increase. When specific effects, like ocean acidification or Amazon forest dieback, hit various thresholds then there are step-change consequences. These are invariably Bad Things.

I don't want this to sound like daunting complexity: there is negligible math involved in the game, mostly just being able to count small numbers to figure out if certain projects can proceed and to represent environmental changes. The math in a game of Monopoly is a whole lot harder.

Among the reasons that I'm using this week's sharing slot to talk about this game is that new stuff keeps happening that makes this game look downright precognitive. For example, a December 10 article in the journal *Nature* adds a new phrase to my climate change vocabulary: "**hypertropical**," a climate in which **hot droughts** put a forest into a state where trees can no longer circulate nutrients. From a well-written December 11 summary in *Popular Mechanics* (yes, really),

> The main problem at the heart of this emerging biome is that extended droughts will **drop soil moisture content** by volume. **Once this number reaches a threshold** [below which] only a third of the soil's pores are filled with water, transpiration rates in trees drop rapidly, which greatly increases stress. This **causes trees to shut down carbon capture entirely**, which either effectively starves them or creates air bubbles in the tree's sap, the latter of which the authors describe as a type of plant-based embolism.
>
> "Normally, plants are pretty good at trying to compartmentalize and just say, 'OK, I'm willing to sacrifice that branch to keep this core piece alive,'" Jeffrey Chambers, the lead author of the study from the University of California Berkeley, said in a press statement. "But **if there are enough embolisms, the tree just dies**."
>
> (My boldfacing added to the above)

As I was reading this, Daybreak's "tipping point" element immediately came to mind. Sometimes, as Hemingway famously said about bankruptcy, things happen "gradually and then suddenly."

This is why, as noted in this space a few weeks ago, some things need to be treated as urgent even before they're too big to ignore. The Daybreak game board offers us a map, literally, on which to make those urgencies understandable. Recommended.

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# What's The Plan For *After* The Win?

23 December 2025
Peter Coffee

When there's a clear need to make a transformational change, **fixing the problems that are right in front of us can seem like the crucial concern**. That's especially true when every day's new data, or new insight into mechanisms and interactions, seems more likely to say "it's worse than we realized" than it is to surface offsetting adaptations.

What hit my news feed **this morning, for example**, was the NOAA Arctic Report Card for 2025, which leads off with bullet lists of "Headlines" grouped by categories of "In the air," "In the ocean" and "On land": the ones that jumped out at me, combining from all three groups, were

- **Surface air temperatures across the Arctic** from October 2024 through September 2025 were the warmest recorded since 1900. Since 2006, Arctic annual temperature has **increased at more than double the global rate** of temperature changes.
- In March 2025, **Arctic winter sea ice** reached the lowest annual maximum extent in the 47-year satellite record. The **oldest, thickest Arctic sea ice (> 4 years) has declined by more than 95% since the 1980s**.
- **Atlantification**—an influx of water properties from lower latitudes—has reached the central Arctic Ocean, hundreds of miles from the former edge of the Atlantic Ocean. This weakens the Arctic Ocean's layering of waters of different densities, therefore enhancing heat transfer, melting sea ice, and threatening ocean circulation patterns that exert a long-term influence on the weather.
- In over 200 Arctic Alaska watersheds, iron, and other elements released by **thawing permafrost** have turned pristine rivers and streams orange over the past decade. In **"rusting rivers"**, the increased acidity and elevated levels of toxic metals degrade water quality, compromising aquatic habitat and eroding biodiversity.

Adding to this kind of primary payload of Bad News, though, is a kind of collateral damage. Under a constant barrage of **attention-grabbing data**, we may give too little attention to **challenges that lack immediate urgency**, but have long lead times for solution. That's especially the case when complex, multi-stakeholder interactions make for discomfort and discouragement.

For example, it's clear that solar power is an important contribution to reducing carbon emissions from electrical power production: this morning, the U.S. Energy Information Administration shared its latest "Monthly Electric Generator Inventory" indicating continued growth of non-fossil-fuel capacity, having previously projected this August that "solar would account for more than half of the 64 GW that developers plan to bring online this year."

Well and good, but **solar panels are manufactured artifacts with finite lifetimes**. This is not a new observation. It was *fifty years ago* that a professor's comment in a materials science lecture led to me to write this in 2017:

> "A solar panel does not produce energy," noted my freshman-year professor in solid-state chemistry, and he was not just talking about a panel's need to see sunlight joules from which to liberate volt-ampere-hours. A solar panel takes energy to produce, he pointed out, and it has a finite lifetime (typically losing at least 20% of its effectiveness over 25 years) – so in effect, the energy to mine the materials and manufacture the panel and transport and install it are pre-invested in the object, and must be compared against a reasonable and bounded estimate of its lifetime output. Only in the past few years has that balance shifted toward a net positive number, and large-scale facilities' life-cycle economics are still a moving target.

In 2022, this question received a "Supply Chain Deep Dive Assessment" from the U.S. Department of Energy, which warned that critical materials for solar panel production pose challenges both technical and geopolitical. Excerpting key points from that report,

- Decarbonizing the electricity sector in the United States would require significant acceleration of annual PV [photovoltaic] deployment. Compared with 19 gigawatts (GWdc) of PV deployed in the United States in 2020, **annual PV deployment would need to double in the early 2020s and to quintuple by the end of the decade** in the most aggressive grid decarbonization scenario. [Note that this is consistent with the current projection for 2025 that was mentioned just above.]
- Periodic repairs can extend solar system lifetimes beyond the conventional useful life of 20–30 years and degraded solar panels can be transferred and reused in applications compatible with lower system output. By extending useful lifetime, repair and reuse can delay the need for new resource extraction and manufacturing and delay end-of-life disposal. Further, **certain solar system components and materials can be recycled**…

…but…

- **The global PV supply chain is almost entirely dependent on ingot and wafers from China**. Additionally, many of the other pieces of the module supply chain, such as the manufacturing of production-facility equipment and balance-of-module components (e.g., glass, aluminum frames), are predominantly located in China.
- Forced labor in the mining and processing of raw materials in China's Xinjiang province adds a new dimension of uncertainty to the solar supply chain's reliance on Chinese production. Metallurgical-grade silicon (MGS) and the coal used to produce electricity have been highlighted by the U.S. government as direct beneficiaries of **government-sponsored forced-labor programs**.

…and as of this July, as estimated in the Proceedings of the National Academy of Sciences,

- By the early 2030s, the global cumulative amount of **PV waste** is expected to reach 8 million tons, and by the 2050s, the PV waste level could reach a staggering 78 million tons.
- While the environmental impact of [PV panel] construction has received much attention, what happens at the end of their life cycle has garnered less scrutiny. At present, **only about 10% of PV panels are recycled**, with the majority being dumped, burned, or buried.

At least two entire books could be written about

- the process, and the pace, of Arctic indicators of urgency
- the complexity, and the long-lead process development and project management, of treating solar panels as a major contributor to global energy portfolios for decades to come

For now, these are merely offered as examples (one each) of the news-of-the-day demands to keep up with what's being discovered and understood, while also thinking ahead about what would be a good problem to have: how will we prepare for a time when this can be less about alarming headlines, and more about being *ready* to manage a different (and better) world?

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# Boundary Conditions – Sometimes There's *Good* News

30 December 2025

Peter Coffee

Responding to last week's note on **arctic observations and the solar panel life cycle**, a good friend said that she found it "both interesting and discouraging." The 'interesting' is good to hear – and I do apologize for the length of that piece, even if she did apparently get all the way through it.

I'll try hard to keep these notes under 800 words, because it's not as if any of them will ever be the last word on anything. The 'discouraging,' though, is something I'll try even harder to avoid. I offered her **my hope that 'interesting' can power us through the rough road of 'discouraging'—to reach the faster track of 'imaginable'**—but that's **not good enough**.

I need to be sure that whenever possible, **examples of achievable improvement** will be offered to fuel that effort. Let's start now: among the items of good news during 2025 was a March 5 bulletin from MIT that "**the Antarctic ozone layer is healing**, as a direct result of global efforts to reduce ozone-depleting substances…[a] new study is the first to show, with high statistical confidence, that this recovery is due primarily to the reduction of ozone-depleting substances, versus other influences such as natural weather variability or increased greenhouse gas emissions to the stratosphere."

Double underline that key conclusion. Previous studies, the MIT bulletin notes, "showed large uncertainties regarding how much of this recovery was due to concerted efforts to reduce ozone-depleting substances, or if the shrinking ozone hole was a result of other 'forcings,' such as year-to-year weather variability from El Niño, La Niña, and the polar vortex." **A 'fingerprint' in the data**, arising from a comparison of simulations to actual observations, allowed the team to "**say with 95 percent confidence that ozone recovery was due mainly to reductions in ozone-depleting substances**."

As further stated in the journal *Nature*, the team asserted that their results "provide robust statistical and physical evidence that actions taken under the Montreal Protocol to reduce [ozone-depleting substances] are indeed resulting in the beginning of Antarctic ozone recovery."

This is consistent with an engaging data graphic that was shared in 2023 at *Science Advances* depicting the planet's state in terms of **nine "boundary processes"** – with the stratospheric ozone layer being one of the most literal 'boundaries' in question. You probably suspected that this note would not be *entirely* good news, and I'm sorry to have to add that the state of **the ozone layer is one of only three** boundaries that were shown to be in the **"safe operating space"** as of that date.

The most recent update of that graphic from the Stockholm Resilience Center is reproduced below under terms of its Creative Commons License; as of now, ozone is still in the green, but in the time since the earliest version of this analysis—in 2009—there have been **"boundary crossings"** in processes including **ocean acidification**; **freshwater use**; and "**land system change**" (defined as "transformation of natural landscapes, such as through **deforestation and urbanization**" such that "remaining forest areas in tropical, boreal, and temperate biomes have fallen below safe levels").

That reference to deforestation follows my mention of planting trees as one of the elements of the board game "Daybreak," in notes on the game two weeks ago: there will be more to come on that subject, not on a game board but in the real-life rain forest of the Pacific Northwest, in a note sometime soon. For now, these ~600 words will help me reduce my average imposition on your time, so I think I'll stop here.

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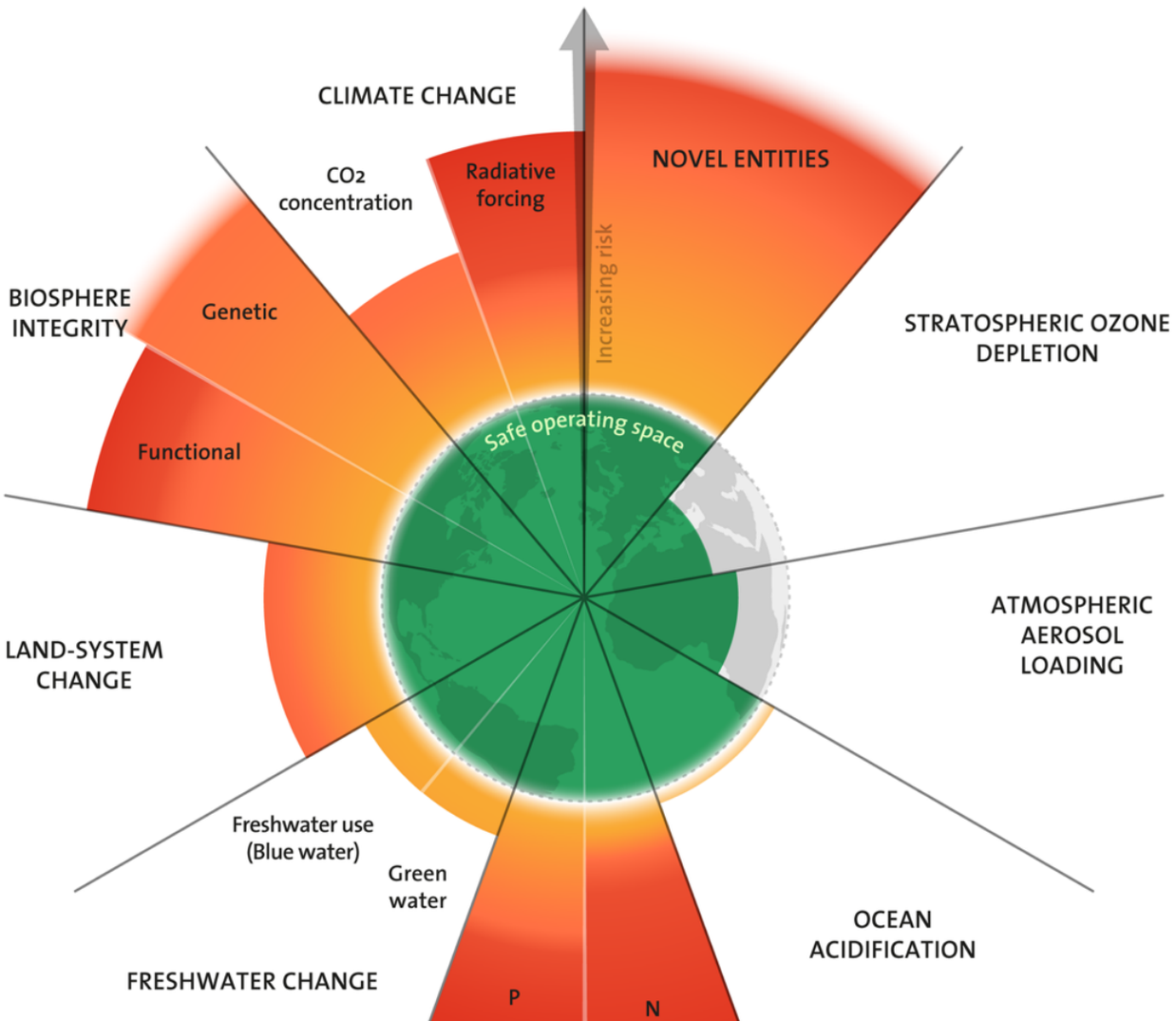
The length of the wedges symbolizes what the current state of the corresponding process is, in relation to the distance from the planetary boundary (end of the green area) and the Holocene baseline (origin of the diagram). The color symbolizes the risks associated with each.



Azote for Stockholm Resilience Centre, based on analysis in Sakschewski and Caesar et al. 2025

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# Let's Speak For The Trees

6 January 2026
Peter Coffee

Last week, I said that there would be more to come on the subject of **trees and their role in carbon sequestration**. My timetable for talking about this got pulled forward by last month's postponement of EU enforcement of a Deforestation Regulation, originally adopted in April of 2023 – with compliance requirements now delayed until 30 December 2026.

This EU regulation won't ban any product entirely. Rather, to quote from the references above,

> Companies will only be allowed to sell products in the EU if the supplier of the product has issued **a so-called "due diligence" statement confirming that the product does not come from deforested land or has led to forest degradation**, including of irreplaceable primary forests, after 31 December 2020. [My boldfacing added to any quotations used here, both above and in what follows]

An EU participant in the process puts this in everyday terms that make this feel, correctly and usefully, like a matter of every person's individual responsibility:

> Until today, our supermarket shelves have all too often been filled with **products covered in the ashes of burned-down rainforests and irreversibly destroyed ecosystems** and which had wiped out the livelihoods of indigenous people. All too often, this happened **without consumers knowing about it**. I am relieved that European consumers can now rest assured that they will no longer be unwittingly complicit in deforestation when they eat their bar of chocolate or enjoy a well-deserved coffee.

This is about nothing more, but also nothing less, than surfacing the choices we make and the consequences that they can have.

As noted here a few weeks ago, though, sometimes a personal understanding of a global impact requires an effort to make the numbers comprehensible. Hectares per year are difficult to visualize, but "football field every three seconds" perhaps provides a more urgency-inspiring measure.

Somewhere in between, and hitting me hard as measures of magnitude, are some figures from the United Nations Food and Agriculture Organization [PDF]:

- The world has lost a net area of 178 million hectares of forest since 1990, which is an area about the size of Libya. [For people like me who would have to look at a map to get a handle on that, the EU's initial announcement of the 2023 action—linked above—rephrases this to "**An area larger than the EU was lost to deforestation between 1990 and 2020**, with EU consumption causing around 10% of losses."]
- The world's **total growing stock of trees decreased** slightly, from 560 billion $m^3$ in 1990 to 557 billion $m^3$ in 2020, due to a net decrease in forest area.
- Most forest carbon is found in the living biomass (44 percent) and soil organic matter (45 percent), with the remainder in dead wood and litter. The **total carbon stock in forests decreased from 668 gigatonnes in 1990 to 662 gigatonnes in 2020.**

The latter two bullet points **may seem like small reductions**, percentage-wise: that would be an unfortunate take-away, since **there's a clear need to be *increasing* the planet's carbon-sequestration capacity**. As estimated by Australia's Commonwealth Scientific and Industrial Research Organisation this past November,

> **Global $CO_2$ emissions from the use of fossil fuels continue to increase**. They are set to rise by 1.1% in 2025, on top of a similar rise in 2024. All fossil fuels are contributing to the rise. Emissions from natural gas grew 1.3%, followed by oil (up 1.0%) and coal (up 0.8%). Altogether, fossil fuels produced 38.1 billion tonnes of $CO_2$ in 2025.

Further, it may be a distraction to focus only on *emissions* from fossil fuel *combustion*. As noted recently by researchers at the Luskin Center for Innovation at UCLA,

> As demand for gasoline declines, oil and gas companies are betting their future on plastic. What once powered our cars is now being refined, cracked and polymerized into bottles, packaging and single-use products that will outlive us all…

A key point is that **even if the hydrocarbons aren't being burned, their continued extraction and processing has side effects** on public health:

> **Living near oil and gas development is linked to a wide array of health harms**: respiratory disease, cardiovascular illness, adverse birth outcomes and elevated cancer risk. The higher odds for these conditions persist even when controlling for socioeconomic and environmental factors… [P]ollutants from **drilling and refining** — such as volatile organic compounds, nitrogen oxides, particulate matter and formaldehyde — degrade air quality and increase asthma, heart attack and low-birth-weight rates.

Farther downstream, as Neal Stephenson colorfully and memorably phrased it in *Zodiac*, "**Plastic is essentially frozen gasoline**." One way or another, once the hydrocarbons are out of the ground, the carbon is likely to wind up in places where it's not doing the planet any good.

I'm already nearing 800 words, so please look to future notes for discussion of

- Impacts on the African continent – where (as noted last month by *The Economist*), "deforestation rates in **the Congo basin** mean it **may soon emit more carbon than it absorbs.**"
- Opportunities and challenges in **the Pacific Northwest rain forest**, "the Emerald Edge": as described by The Nature Conservancy, "the world's largest coastal temperate rainforest, spanning Alaska, British Columbia, Washington state and Oregon [which] **plays a critical role in regulating the global climate**."

More to come.

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# "Uninvestable" May Be The Word Of The Year

13 January 2026
Peter Coffee

Much in the news, since January 3, have been questions concerning **Venezuelan oil**. Most of those questions should be categorized under **"What's the least bad way to do this?"** – since, as Peter Drucker (and others in similar words) have long observed, **there is no *right* way to do the wrong thing**.

I might surprise you by inviting the head of ExxonMobil to testify on this point, but Darren Woods may have given us an early candidate for Word of the Year for 2026 when he said last week that the country was "**uninvestable**." Woods has specifically mentioned "weak legal protections, restrictive hydrocarbon laws, and a history of asset seizures" as deterring factors, but why stop there? There are plenty of other reasons not to do this.

For one thing, people talk about Venezuela having "enormous oil reserves…one of the largest hydrocarbon resource bases in the world," but "reserves" does not just mean "what's there." The phrase that makes things happen, "proven reserves," combines two requirements:

- what's *technically* recoverable, meaning that it could be extracted "from well established or **known reservoirs** with the **existing equipment** and under the **existing operating conditions**" – but there is also the question of,

- what's *economically* recoverable, meaning that it wouldn't be a money-losing proposition to go after it. Note that when the U.S. Geological Survey called Venezuela's Orinoco Oil Belt "one of the world's largest recoverable oil accumulations," their document [PDF] warned that "**No attempt was made in this study to estimate economically recoverable resources or reserves…no time frame is implied** other than the use of reasonably foreseeable recovery technology." (N.B. – **they *didn't* say "existing," only "foreseeable."**)

If you don't want to read more than a few short phrases, **I'll just quote an influential non-expert** on the subject (currently claiming to be the "acting president of Venezuela") – who in 2024 "called the country's crude 'horrible,' 'tar,' 'the dirtiest stuff you can imagine,' and the '**worst oil probably anywhere in the world**.'" Or we *could* quote **experts**, who observe that a better word for the stuff under Venezuela would be "**bitumen**": "a highly viscous, complex hydrocarbon contained within an oil sands formation" that is "almost solid at room temperature." One qualified commentator says that

> Most of it comes out of the ground with **the consistency of cold peanut butter**. To even move it through a pipe, you must mix it with costly imported diluents (such as naphtha), which adds roughly $15 per barrel to your costs before you've even reached a port. And when it gets onto a tanker, it's still **some of the hardest crude on the planet to turn into something useful**.

Further, this fun fact: of the **massive naptha input** needed to make Venezuelan oil transportable (which still doesn't necessarily mean "investable"), **more than half comes from Russia and China**. What could possibly go wrong? This is one of many times when **the phrase "supply chain" understates the complexity** of the interconnections that make everyday products seem effortlessly available. The closer we look, the more challenges we see, which is why I call them not simple "chains" but rather "fractal maps."

Looping back to ExxonMobil's Darren Woods, though, we get **another phrase that might be even more important** than whether the proposition is "investable." Woods also referred to what his company does as **a "depletion business"**: he said that its product "is in great demand and will be in demand for many, many, many decades to come," but the existence of a demand curve merely means that there is some quantity that will be bought at some price. The same is true of buggy whips or slide rules, but neither represents what anyone would call a sizable opportunity for investment.

Unlike the marginal solar panel or wind turbine or geothermal system, whose unit costs generally decline with growing scale and improving technology, **the next barrel of oil that's produced will almost inherently cost more than the one before** – because if that weren't so, the "next" barrel would have been produced first. Again, I'm not seeing a great opportunity for investment – to produce a low-quality product, from an expensive place, to sell into a shrinking market? No, thank you.

Sometimes, all you need to do is a little math.

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# Fossil Fuels Aren't Looking Energetic

# Fossil Fuels Aren't Looking Energetic

20 January 2026
Peter Coffee

It starts out like a thoughtful review of a high-profile TV series, but a *New York Times* essay on the Paramount+ series "Landman" quickly unfolds into well-researched **analysis of the oil-from-underground industry**. It opens with a quote from the series in which an industry operator compares his business to a drug cartel, saying that drugs are addictive to people but oil is addictive to the entire world order: "You sell a product that your customers are dependent on," he says to a drug dealer, adding "It's the same; our [business] is just bigger." By the time we get to the bottom of the page, though, **the weakening of global petroleum addiction is starting to look like a future that's now**.

"**The party's not ending tomorrow, but it is ending**," is another quote from "Landman" that shows up a few paragraphs later, along with the essayist's own observation that "many of the fossil fuel workers I've interviewed told me they recognized that, **despite record production**, the industry has been shedding jobs for years…and that they increasingly see green energy jobs as the future and fossil fuels as the past."

In 2021, Stanford University professor Mark Jacobson asserted that "There's **enough solar to power the world more than 300 times over. And wind seven times over**." He directly confronted questions about the need for critical materials to build wind turbines, batteries, and other renewable-energy infrastructure: even the most extreme scenarios for lithium mining, for example, he estimates to require a tiny fraction of the land that's currently being made unavailable and unhealthy by "1.3 million active oil and gas wells and 3.1 million inactive ones…the entire gas and oil industry and fossil fuel industry in the US takes up 1.3% of the land." This is, he observes, the proper baseline for comparison of a fossil past to a renewable future.

Trends and ratios like these are not, of course, confined to the United States, and China (for Great Big Example) is accelerating on a renewables path: "**China's mostly coal-based thermal power generation fell in 2025 for the first time in 10 years**, government data showed yesterday [19 January 2026], as growing renewable generation met growth in electricity demand even as overall power usage hit a record." In an outlook for China's energy and climate actions anticipated for the rest of this year, one observer noted that "independent analyses suggest China's $CO_2$ emissions may have plateaued or even begun to decline in 2025." Moreover, the scope of this crossing of curves extends well beyond China: "**Solar and wind are growing fast enough to meet all new electricity demand worldwide for the first three quarters of 2025**," reports the web site Electrek, adding an estimate that fossil power production will "stay flat for the full year, marking **the first time since the pandemic that fossil generation won't increase**."

This *isn't* about gritting our teeth and paying more for cleaner power. In June of last year, the **Levelized Cost of Energy+ study** from financial advisory service Lazard calculated that "**On an unsubsidized $/MWh basis, renewable energy remains the most cost-competitive form of generation**." The detailed infographic is not licensed for reproduction here, but it's a free download [PDF] – and The Cool Down helpfully summarizes the key numbers as

- **Onshore wind** is the least costly form of energy, averaging around **$50 per megawatt-hour**
- **Utility-scale solar** costs, on average, **$61 per megawatt-hour**
- Coal and gas were much higher — **coal** averaged **$119 per megawatt-hour**, and **gas** averaged **$77 per megawatt-hour**

It's nice when following the money leads to a better place.

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# Imagine A World Where We Can't Hold A Winter Olympics

27 January 2026
Peter Coffee

"Climate change is **altering the geography of where the Winter Olympics and Paralympics can be held**. We see a shrinking and contraction of climate reliable locations," observes Daniel Scott of the University of Waterloo in comments reported last week in *The New York Times*.

Published in the journal *Current Issues in Tourism* (there really is a journal for *everything*), a study co-authored by Scott delivers a TL;DR (per *NYT*) that "By 2050, **of the 93 cities deemed suitable to handle the logistics of holding both the Olympics and Paralympics, just four would be able to host the events without snow-making**."

For anyone who thinks that climate change is a cocktail-party topic for Subaru-driving tree huggers, perhaps the idea of **elite athletes bogged down in "wet, mushy snow** surrounded by barren hillsides…entirely man-made and kind of brown on the sides" will offer a new perspective – and that would be a good thing, because **stereotypes of "what an environmentalist looks like"** are a hindrance to getting stuff done. For now, though let's just talk about the Olympics, which I've used for almost twenty years as a way of making "the future" feel more real.

In an Olympic year, like this one, my talk track starts with "They're about to light an Olympic torch in [this time] two places: Milan, and Cortina. Two years from now, they'll light another one in Los Angeles. **When you're watching that Olympic opening in L.A.**, what would you like to be able to say you'd gotten done since 2026? And **what would you be most embarrassed to have to admit you had *not* done in those two years**? Can we agree that getting started on that, today, would be good?"

I think this works because it lets us **talk about time in a way that makes it harder to postpone action**. When we *start* with a *certain* future date (like 14 July 2028), and schedule *back* toward the present with realistic estimates of times required for tasks, we wind up with an urgency that we *don't* get from "we'll do that after we work today's to-do list."

For example, in a conversation I once had with an IT leader at a well-known university, he lamented that they were using a student information system that he felt was twenty years out of date. "How do you get twenty years behind?", asked a peer from another institution; "One day at a time," I said, without meaning to be either funny or cruel. **Forward-moving time can get away from us; when we schedule from the future back to now, time hits us in the face.**

The logic is similar to that of **using a "countdown"** before a rocket launch or other event, where **reaching "zero" is an unambiguous moment of "now"** – even if the original idea was purely dramatic, rather than being an engineering choice. Further, the idea of "schedule by subtraction" is not confined to rocketry: it's also asserted to be the essential skill of "punctuosity," a word brought forward from its 1700s obscurity by "Parkinson's Law" originator C. Northcote Parkinson, who wrote that

> **The punctual person has substituted a process of subtraction for the simpler process of addition**. The important meeting is at 11.45. Punctual Peter takes that as his fixed point and works backward; the less competent Steve did it the other way. Starting at 9.00 on the stuff in his intray, he worked forward from there, with so long for this and just time for that - which brought him, unbriefed, to the meeting at 11.48. He was **adding instead of subtracting**, which **means being late and disorganized.**

(Parkinson wrote this in 1962, in his business culture commentary *In-Laws and Outlaws*. The Huntington Library calls this a "Rare Book," so I guess I had better take care of my two copies.)

For a painful example of **people working forward from today's concerns, instead of backward from tomorrow's demands**, we need only look at the conversations at this year's **World Economic Forum meeting in Davos**. Four years ago, conversations there were focused on efforts like the Net Zero Banking Alliance, but at this year's Davos gathering it was clear that "climate issues have taken a back seat to A.I. and geopolitics." What had been a move toward "engineering a swift, worldwide shift away from fossil fuels and toward clean power sources like wind and solar" became **a capitulation to "energy pragmatism."** How will we wind up being twenty years too late? **One year, one quarter, at a time**.

Of course I'll concede that **sometimes, we *have* to let time run forwards. For example, at the Olympics**, measurement to standards limited only by physics is required when winners are decided by continually shrinking fractions of a second. (If I may offer a personal opinion on this: if it can't be decided by a stopwatch, a tape measure, or a weighing scale, I don't know how it even qualifies as a "citius, altius, fortius"—faster, higher, stronger—Olympic event, but enough about figure skating. ["You call this a *sport?*", asks an incredulous former hockey player in the movie, "The Cutting Edge," on his first encounter with "the judges have their favorites."])

When we're talking, though, about something with a lot more momentum than a skier—something like a planetary climate—then **it's not about stopwatches; it's not about "we'll get to that next quarter."** It's more like "the L.A. torch will be getting lit in 2028: what do we need to have gotten done by then?" More on that to come.

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# Seeing A Truly Different Future Requires Different Tools

3 February 2026
Peter Coffee

In one of his many memorable covers for *Byte* magazine, Robert Tinney literally painted a picture of what I feel is the most important use of a computer. His **January 1977 image, entitled "Crystal Ball"** (print still available for purchase) depicts, it seems to me, our current half-century-later third step on the journey of "what computers are able to do, and who gets to do those things."

I'll label our first step, during the 1940s and 1950s, as "**computerization**" – which merely **sped up a process whose inputs we could easily define, and whose outputs we expected and could readily confirm**. Think COBOL and FORTRAN, initially on massive mainframes but soon after on "minicomputers," as the means of expression and action – but only for the few with corporate or military-grade resources at their disposal.

I'll call the second step "**simulation**" (1960s through early 2000s) – which also worked with **well-structured input, processed through clear and well-specified actions and interactions**. By the middle of the 1980s, this could be done at useful scale and speed on a desktop machine – using anything from FORTRAN, to Smalltalk, to "no code required" spreadsheets. What mattered, though, regardless of the tool that was chosen, was that a simulation could produce results that might accelerate our understanding of complexity. This step of the journey was still limited, however, to exploring worlds for which we specifically provided selective data and purpose-built logic as their descriptions.

Tinney's painting looked beyond these limits. It showed a view through a window of a smoke-obscured skyline, foregrounded by ugly and unhealthy-looking industrial activity; on the desk in front of the window, though, there's an image of a blue-sky and pastoral setting surrounding a futuristic city, with a computer that was presumably modeling a pathway to that future. I remember seeing it on first publication, and wanting…that. I was sure that someday, we'd have it.

*Brief digression on the nature of "futurism": the other details of Tinney's painting reflect what the late Sir Arthur C. Clarke described as the dilemma of forecasting the future, that* ***an accurate description of the future will be dismissed as crazy – but a believable description will fall hugely short of what's really going to happen****. Tinney went for recognizable believability, and showed that world model running on an 8-bit Altair 8800 (standard memory, 256 bytes) with floppy disks and punched paper tape as its only means of persistent data storage.* ***Real world modeling needed a global connectivity, a massive capacity, and an abundance of computational power that few would have dared to predict*** *we would one day have in hand-held devices – let alone in the vast resources of an "AI factory" data center. End of digression.*

That said, let's talk about **what Tinney's painting envisions *correctly*: a capability of connecting to the real world, measuring present state, inferring ongoing process, and telling us things that we did *not* tell it to figure out**. This is what's happening now, for example with the "Destination Earth" initiative of the European Commission, which seeks to build a "digital twin" of our planet. The effort combines a "data lake" compiled from space-based and other sources, a platform comprising calculation and decision-making tools, and a "digital twin engine" that assembles a variety of process models into something that can genuinely surprise us.

We find a similar spirit of discovery, rather than mere description, in work being done at MIT to improve weather forecasting in the complex and rapidly changing environment of the arctic regions. Researchers there have added machine learning to their decades of examining the arctic's patterns and interactions: their newly advanced models warned, this winter, of a potential mid-December cold surge for the U.S. east coast weeks earlier than previous techniques enabled.

I didn't quickly come up with a good word for the third step that follows after computerization and simulation. The best word that I can propose emerged, to give credit where it's due, from this (condensed for brevity) exchange with ChatGPT:

> ***Q:*** *What is a word that means visualizing the future behavior of a complex system that can not be formally defined?*
>
> ***A:*** *If you tell me the context (physics, economics, software, AI, philosophy, everyday speech), I can help you nail the exact word that will sound right.*
>
> ***Q:*** *Let's call this a domain of economics and sociology*
>
> ***A:*** *If you want a single word that sounds natural in papers –* ***foresight***

I like it. Let's call our three-step progression "Computerization; Simulation; Foresighting." (I'm tempted by the parallelism, but I'm not going to push for "foresightification.")

Let's define success as making better foresight more possible, for more people; let's make it readily applicable to domains like climate change, and the future of work in an epoch of ubiquitous AI, where our "unknown unknowns" require nothing less.

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# Talent Pools Require Constant Replenishment

10 February 2026
Peter Coffee

This week required my annual filing of interview reports on hopeful college applicants. It's a time for renewed amazement at the quality of the talent pool, along with a recurring reminder that **we need to *engage* that talent today in solving planet-sized problems tomorrow**.

This is **a problem for every organization that depends on a combination of technical and scientific knowledge, relevant practical skills, and readiness to go to where the work needs to be done**. In the environmental space, some of these organizations are well known—with Greenpeace, The Nature Conservancy, and the World Wildlife Fund being among the names that perhaps come first to mind—but there are many others. The American Society of Mechanical Engineers warned last year, though, that talent shortage is an economy-wide concern, observing:

> There are currently more than 920,000 engineering roles open in the U.S., with more than 61,000 alone looking for mechanical engineers. Experts that have examined the data also suggest the data points to **a maximum of 15 percent of open roles that could be filled by new talent per year**. This, of course, leaves a massive 85 percent (825,000) employee deficit. This figure, specialists point out, despite this substantial number, **doesn't account for people retiring**.

That last passing reference (my boldface added) to the loss of talent through retirement deserves special emphasis – because **demographics aren't a matter of "prediction," but rather a task of simple arithmetic**. Given a certain number of engineers aged forty-plus as of Time Zero, the number of prospective engineering retirees during the subsequent two or three decades is not a wild guess.

Nor is this just about engineers, because the supply/demand trends for skilled workers in electrical, plumbing, HVAC and other infrastructure trades are also on predictable pathways to deficit. "A 'silver tsunami' of workers has swelled in recent years, causing many infrastructure employers to see 10% (or more) of their workers retire annually – and as more of these workers reach the end of their careers with fewer younger workers to pick up the baton, **vast amounts of institutional knowledge and skills may be lost forever**," warned The Brookings Institution in 2023.

That warning remains relevant now: the *Financial Times* recently headlined the problem of "How economies forget," pointing out that

> Knowledge loss is counterintuitive because we live in a world overflowing with learning. That pushes us to think of knowledge as infrastructure: a building that, once erected, will stand for ages. But knowledge is both alive and fragile. It is **embodied in people, and the teams and communities they form**, and is transmitted through repeated, almost ritualistic practices. Imagine trying to train a new generation of surgeons in a world where no surgeons remain.

This is not hypothetical. The same *Financial Times* essay observed that when the U.S. space shuttle program ended in 2011, the knowledge of how to build reusable spacecraft did not go into some kind of dormant state for revival when needed – rather,

> Retiring the shuttle was not just grounding a spacecraft. It meant disbanding the team required to sustain a complex capability. Manuals and blueprints are poor substitutes for hands-on experience. To restore human launch capability, the US had to invest billions in contracts with SpaceX and Boeing in an effort to rebuild that capacity and those teams. An effort that, according to a 2019 NASA audit, was running roughly two years behind.

With the future of the talent pool being a multi-decade trajectory, it seems clear that **addressing that challenge requires a multi-decade runway** – as in, a combination of initiatives and resources that engage and support teenage (and even pre-teenage) populations. One example is NASA's TechRise Student Challenge, which last year lofted middle-school students' experimental payloads on a high-altitude balloon – and this year, will fly them on a suborbital spacecraft that will give them three minutes of microgravity. I had the opportunity to watch one of last year's groups doing its final debugging and integration before shipping off their payload for its balloon flight: seeing middle-schoolers soldering and coding and testing in a garage was an opportunity for hope.

Likewise, my interview-season conversations this year have included time with a high-school senior with his own nonprofit corporation addressing challenges of rural literacy, another who has taken a robot to a village overseas to support her tutoring of students there, and a graduate student working with marginalized (mostly agricultural) workers to acquaint them with their opportunities to get testing and remediation of water contamination issues.

There are two final quotations that come to mind: one from a movie, one from real life. In the movie *Margin Call*, an MIT Ph.D. rocket scientist played by Zachary Quinto explains how he wound up on Wall Street: "It's all just numbers really, just changing what you are adding up – and to speak freely, the money here is considerably more attractive." That's a problem: as noted in the journal *Research Policy*,

> The US financial sector has become a magnet for the brightest graduates in the science, technology, engineering and mathematical fields (STEM) [with] reallocation towards finance… more pronounced among experienced workers peaking at prime age… [T]he reallocation of STEM is associated with large wage premia in finance, which are heterogeneous across occupations, age groups, degrees and along the wage distribution. Returns to STEMs are higher than returns to other degrees in finance and become very high in finance and managerial occupations at the top of the distribution, especially for postgraduates.

The **loss of "experienced workers peaking at prime age" requires particular attention** in view of findings like this month's note from the Stanford Center on Longevity, reporting that

> Although processing speed declines after early adulthood, other dimensions improve, and overall cognition peaks near retirement age. Studies from the past 15 years show that some qualities like vigilance may worsen with age alongside processing speed, but others improve, including the ability to avoid distractions and accumulated knowledge.

On a wall of the central lobby at MIT, though, there's inscribed an optimistic sentiment that I often cite from one of its early presidents (who referred to the Institute, as once was common, simply as "Technology"):

> I see proceeding from our Technology of the future **a vast and vigorous army, sound of body, strong of mind, able to play their part effectively anywhere in the world**. As in the past, they will have been inured to hard work; in the future as in the past, they will have had the best professional training that could be given to them. They will, however, have many advantages that were denied to their predecessors. The consequence of that will be, that there will go forth a larger number who are broad enough and effective enough to take a leading part in shaping the destinies of the world.

With a *New York Times* "Climate Forward" newsletter in my inbox, just this morning, that spotlights "the swift and meticulous dismantling of climate rules we are now seeing," it seems clear that building that army is as important to "the destinies of the world" as anything else that is being done—or that can be done—today.

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# Simple Molecule; Complex Challenge

17 February 2026
Peter Coffee

For anyone who's ever crossed paths with *Star Trek*, the phrase **"a five-year mission"** triggers the rest of the opening words: "to **explore strange new worlds**; to seek out new life and new civilizations…" (Fun fact, if you search Google with "five-year mission" in quotation marks, at least the first three pages of hits are all about that thirty-second fragment of sixty-year-old TV.) *Star Trek*, though, had three seasons of original-series opportunity to explore – unlike **a real-life five-year mission,** meant to explore our own still-strange world, that ended unexpectedly last June after only fifteen months. Even so, despite a premature loss of contact, **the "MethaneSAT" spacecraft showed us things about our planet** that could not be seen before.

If we don't want future explorers from elsewhere to come upon our planet, and wonder how a world in the "Goldilocks zone" wound up becoming uninhabitable, we'd better look at what MethaneSAT has found.

**It's carbon dioxide that mostly hogs the spotlight on "greenhouse gases,"** especially since a bold decision in 2009 to regulate that gas as a "pollutant"– despite the fact that animals exhale it, and trees inhale it. Nonetheless, the U.S. Environmental Protection Agency formally stated [PDF] that the "well-mixed greenhouse gases" sextet of "carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$)…may reasonably be **anticipated both to endanger public health and to endanger public welfare**."

That 2009 EPA action is back in the news this week, since its core "endangerment finding" has now been formally rescinded by the present administration. $CO_2$ is getting most of the attention, since conspicuous smokestack and tailpipe emissions from $CO_2$-producing combustion reactions are the obvious bad actors in greenhouse warming, but **let's talk for a moment about too-often-ignored methane** – sometimes derisively dismissed as "cow farts," although 80% of the methane that comes from cattle is from burps.

Methane is a molecule so simple that any schoolchild could model it: a central carbon atom, with a surrounding flock of four hydrogens. Methane is the main ingredient in natural gas, with large reservoirs occurring naturally underground (including under the sea floor). **Methane in the earth's *atmosphere*, though, is *not* a natural resource; it's an unnatural disaster**.

**Unnatural?** In 2022, a United Nations "Global Methane Assessment" [PDF] estimated that

- Current **atmospheric methane concentrations are now 260 per cent of pre-industrial levels**
- These increases are **overwhelmingly caused by human activity** – as opposed to natural emissions from (primarily) wetlands

**Disaster?**

- According to NASA calculations, "**Methane is a powerful greenhouse gas** that traps heat 28 times more effectively than carbon dioxide over a 100-year timescale"
- Human-activity methane emissions (mostly from agriculture, fossil fuel energy, and human waste) are responsible for **nearly 45 per cent of current net planetary warming**

Unlike smoke-belching emitters of $CO_2$, **methane leaks are often hidden from plain sight**. "Fossil fuels represent 18 percent of the total [methane emissions] budget. Of this, about 63 percent is derived from **oil and gas production and pipelines**," estimates a report on work being done by the MIT Methane Network. The natural gas distribution system is widely distributed, often neglected, implacably aging, and consequently riddled with large numbers of tiny leaks: it's a difficult target for emission reduction. "Methane **emissions from natural gas infrastructure largely erode the apparent post-2005 decline in United States emissions**," warned a paper published in November 2025.

Enter MethaneSAT, whose mission team members described its capabilities as a combination of "high precision and a wide view path…to track emission rates and locations and show how those emissions are changing over time." Summarizing the year-plus of data that *was* obtained from the spacecraft, they assert that

> Global data gathered by MethaneSAT during its year in operation show that **emissions from the global oil and gas industry consistently exceed the figures reported in commonly cited inventories** by significant margins… Overall oil and gas methane emissions as measured by MethaneSAT were 50 percent higher than reported in the widely cited Emissions Database for Global Atmospheric Research and U.S. EPA's Greenhouse Gas Inventory.

Further, and especially worth noting,

> Low-producing wells contribute an outsized share of emissions: Using MethaneSAT's unique high precision, high resolution measurements, we calculate that **40 percent of methane emissions in production-only portions of eight top oil and gas basins in the U.S. came from areas responsible for less than seven percent of production**.

The team's accomplishments in only fifteen months on orbit should make us hungry for more: "MethaneSAT has released data showing more than 221 scenes in 45 different oil and gas-producing regions globally, together accounting for half of the world's onshore oil and gas production." Well done.

Note also, importantly, that "methane intensity of producers in the New Mexico side of the Delaware sub-basin of the Permian—which has strong oil and gas methane regulations—is less than half what it is next door in Texas, which lacks strong state regulations." It's therefore not just about what's been seen. It's about what it means. **With the right levers, the world can be moved**.

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# Can Purse Strings Pull The Emergency Brakes?

24 February 2026
Peter Coffee

There's a **common challenge of "gotcha" math** that asks some version of, "If someone drives for half a mile at thirty miles per hour, what speed during the next half-mile will make their average sixty mph?" The no-math-needed answer is that the first half-mile has already taken a minute: **no time remains to finish a one-minute mile**, no finite speed can get it done. That's becoming **the math of climate-change tipping points**, requiring intensified attention to our remaining options to prevent them – as observed by Jonathan Foley, analyzing imminent threats of critical thresholds for global temperature rise at Project Drawdown:

> We need to stabilize and cut emissions by roughly 50% by the early 2030s – but we are falling behind. To get back on track, we need "Emergency Brake" measures to reduce emissions as quickly as possible. "Emergency Brake" measures must be ready to go now, without delay. They can't wait for new infrastructure to be built. They can't wait for new technology to be developed. And they can't wait for nature to accumulate carbon in trees and soils.

Foley continues: "To start, I would focus on **deforestation**, **fugitive emissions of methane** from fossil fuels, and **'black carbon' emissions** from dirty cookstoves, biomass burning, and other sources." Coincidentally, last week's note here addressed fugitive methane—and the note on 6 January addressed deforestation, so perhaps we've been looking at some of the right levers to pull.

As Foley observed, though, **there's not enough time to address things on a time scale of infrastructure overhaul** (let alone massive transformation) – **nor can we wait for nature** to do the job alone. **What *can* make things happen quickly is human behavior change** – and if you want to see people change their behavior quickly, reframe the situation from "you should care about this, because it's going to matter someday" to "**this is costing you money** right now."

Usefully, just this week, the *New York Times* looked at climate through the lens of "Is climate change making inflation worse?" – and yes, it is, which perhaps might get people to eat less beef, and adjust their clothing choices rather than relying on their furnace and their air conditioner to maintain one comfortable year-round temperature. Unlike some things, these and other changes *could* happen on a time scale of pulling the emergency brake, rather than just lightening our foot on the accelerator pedal.

**The beef connection is obvious**, as in you-can-see-it-from-space: "beef has driven about 120 million acres of forest destruction globally between 2001 and 2022, an area larger than the state of California," notes Benji Jones at *Vox*, in a comment this week on a newly published paper in the journal *Nature Food*. Beef production devastates more than four times the area that's directly affected by any other single food.

That *Nature Food* paper also warns, though, that

> Our findings indicate that while global efforts to curb deforestation appropriately focus on cattle meat, oil palm, rubber, soya, cocoa and coffee, **global monitoring efforts have largely overlooked staple crops** such as rice, maize and cassava. Given their substantial contribution to deforestation and carbon emissions, **balancing food security with forest and climate conservation will require greater attention to these**.

So, not enough to eat more tofu.

**The heating-and-cooling connection needs more rigor to measure**, since finger-in-the-wind analysis might balance a need for more air conditioning in the summers against less heating during the winters. Here in the Seattle area, for example, local news reported yesterday that the past three months have averaged more than 4ºF warmer than what's considered normal, so isn't that lowering the carbon footprint? The Climate Portal at MIT has looked at that trade-off, though, and found that "heating creates much more climate pollution than air conditioning, but **emissions from air conditioning are rising faster: cooling could soon eclipse heating as a climate change contributor**." It's about human behavior again:

> MIT scientists have studied this issue with colleagues in Portugal. "This is definitely one of these countries where people traditionally don't cool – it's in the Mediterranean, and it's at a sweet spot where it's cool enough at night," says Christoph Reinhart, MIT professor and director of the building technology program. "That is changing rapidly." And **once people have air conditioning, he adds, they typically use it all the time** to stay comfortable, and not just on the most extreme days when they can't live without it.

I've previously mentioned a Drucker-et-al. observation that **there is no right way to do the wrong thing**, and perhaps there's opportunity here for an original corollary: **there's no fast-enough way to do what's been left undone for too long**. The pocketbook connection, here and now, may be what's needed to pull the emergency-brake handles that can make things change in single-digits years.

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# Climate Impacts Create New Complexities

3 March 2026
Peter Coffee

When Apple launched the iMac, in 1998, a TV ad for its colorful debut promised "three easy steps to the Internet": "Step one: plug in. Step two: get connected. Step three…[incredulous chuckle]…there's no step three. **There's no step three!"**

That iMac intro **made a compelling claim**, in that the notion of getting Internet access simply by connecting to watts and bandwidth was a step-function change; we might even say that it started a ball rolling, toward today's general expectation of **abundant capability on demand**. Everything digital in 1998, everything else via Amazon Prime in 2005? (Yes, it's been that long.)

That expectation, though, now seems to be **verging on challenge—and even threat—with climate change a major and growing factor.**

If that Apple ad seems to make too much of nothing much, recall that prior to Windows 95 it was a science project to get on the Internet at all. TCP/IP support required technical fluency and involved a multi-step process – and we wouldn't start using the term, "**the cloud**," until roughly a decade later, so Apple wasn't a laggard. People *wanted* to be told that "the future" was now just a matter of having the right outlets, close enough to your desk for a cable to reach them.

Today, the once-novel promises made by iMac & Amazon have become pervasive: **much of our everyday life now relies on being confident that if you can connect to it, you can have it, 24×7 at a flat-rate price**. That world view is now getting blurry.

What brings this to mind, just now, is an upcoming panel discussion at this Thursday's "Phorum" conference in Philadelphia. I'll be sharing (what I hope will be) useful data and recommendations on **a growing complexity of getting stuff done**.

We'll be specifically exploring, according to the conference agenda,

> **AI, Data Centers, Chips & The Grid:** The rapid growth of AI is raising big questions about energy demand, sustainability, and grid stability. From data centers to everyday enterprise use, how are AI systems impacting our environment and energy infrastructure? This session will explore the challenges of balancing innovation with responsibility.

I'll be on the panel as "the chips guy," which role I get from having spent years covering microchip and platform evolution during a time when the annual Microprocessor Forum [PDF] was a major tech-world event. There have been a few decades, since then, during which Apple (in particular) seemed to be proving that **users could *stop* asking "what chip does it use?"** – but in the current era of hyperscale AI, **access to the right chips in huge quantities** is becoming **a geopolitical (not merely commercial or technical) concern**.

Further, it's critical to appreciate that **this is not just about "the chips," as if they emerge from a *Star Trek* replicator** ready to plug in. It's more complicated than that:

> The **supply of finished products such as chips, computers and electrical boards is dominated by Asian economies**…[but] the minerals used in AI components span the periodic table… Minerals such as cobalt, lithium, aluminium, nickel, and copper (collectively, 'the CLANCs') are crucial for energy storage, battery materials and electrical wiring. China is the dominant buyer, purifier and processor of many of these minerals, but almost all of the actual mining happens in countries such as Chile (supplier of 20% of the world's raw copper), the Democratic Republic of Congo (73% of raw cobalt) and Guinea (70% of aluminium ores). As a group, **emerging and developing economies supply close to two-thirds (62%) of the world's raw rare earth elements and minerals**.

As this reality sinks in, the current concern about AI's real-world ingredients is echoing conversations that we were having six years ago – when **pandemic chaos was exposing the complexity and brittleness of supply chains**, then newly seen to be over-optimized for minimum cost *when* things were working as planned. "A humble cup of coffee requires 29 firms to collaborate across 18 countries," observed *The Economist* in May 2020 – and not only cups of coffee, but also doses of vaccine, turned out to be produced by planet-encircling networks rather than point-source factories:

> GlaxoSmithKline uses **an extract from the soap-bark tree** to produce a vaccine-enhancing ingredient called an adjuvant; for some of the vaccines now in development, the adjuvant may enhance their effectiveness or make a certain quantity stretch to more doses… The bark is **harvested in Peru, Chile and Bolivia during the summer months** of the southern hemisphere.

So, no, you *couldn't* just order up a double batch on Amazon Prime to deal with pandemic demand – and today, those pandemic learnings about the value of supply-chain resilience had better be getting repurposed to deal with climate impacts. As noted in another report from *The Economist*, at the end of 2024:

> **A billion-dollar extreme weather event now occurs every three weeks. Four decades ago, one occurred every four months**. These extreme weather events can take many forms, from floods to hurricanes to droughts. Yet, a consistent factor for all is that each **makes global supply chains less reliable**.
>
> More disruptions mean longer delivery times, higher costs and lower output. The **economic risks of climate change to global trade are predicted to sit around US$81bn**. This rises to at least US$122bn when factoring in economic activity linked to industry output and consumption. Such losses are **higher than the individual GDP of Slovakia, Ecuador or Kenya**.

This matters, even to people who think that climate change is an abstract concern, as warned by the Trax Group in December 2025:

> **Production schedules will become increasingly unpredictable** as manufacturers adjust output in response to component availability. Freight patterns will shift abruptly, with **more small-batch and expedited shipments replacing steady, predictable flows**. **Warehousing** operations will experience greater volatility as inventory levels swing between surges and sudden slowdowns. **Distribution** networks optimized for steady throughput may struggle with these irregular patterns. Procurement teams will face extended **negotiations as suppliers manage allocation decisions** across competing customers. **Cost pressures** will accelerate…

Whether we're talking about chips that have been strategically developed into platforms, or about the power grids that are being challenged to make the resulting wheels go 'round, complexities are coming back and even emerging anew. **As it turns out, "step three" was ahead of us all along** – and it's a big one.

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# The Shapes Of Seas and Salt Lines

10 March 2026
Peter Coffee

The embroidered patch on my red wool jacket says "14,495 Club," because in 2006 it was common to use that number as the height of Mount Whitney. As of today, though, that number is considered to be 14,505 feet, but that's not because the mountain is growing; rather, our definition of the "geoid" (**the reference shape of the planet**, the surface that would be formed by a 100%-coverage ocean at rest under only the influence of gravity) **has changed**. For purposes of anticipating effects of climate change, this is more than a cartographic concern.

When we update that shape of "sea level," that doesn't only require refreshing of the souvenirs on sale in Lone Pine (the population-2,000 "gateway" to Whitney). It also **alters the answers to questions of where and when the rising of Earth's oceans will require relocations of massive populations**. Measuring the starting point correctly, as it turns out, seems to be mostly ***not*** being done: "more than 99% of the evaluated impact assessments handled sea-level and land elevation data inadequately, thereby misjudging sea level relative to coastal elevation," warns a March 4th paper in the journal *Nature*. "Our meta-analyses on global scale show that **measured coastal sea level is higher than assumed in most hazard assessments**," the authors report, and "measured values suggest that **with a hypothetical 1 m of relative sea-level rise**, 31–37% more land and **48–68% more people (increasing estimates to 77–132 million) would fall below sea level**."

If you're visually oriented, then perhaps the Climate Change Mug from the Unemployed Philosophers Guild will be a useful aid to grasping what this means. If you wait a moment for the GIF animation to run, you'll **see the coastline-changing implications** for the western hemisphere: "before your very eyes, coastlines shrink and ocean levels rise, **Florida dissolves and Central America all but vanishes**," the vendor's description chirps, adding that "if you're the type of person who confronts difficult issues even during your downtime, you should consider getting one…it won't fix the problem, but it will illustrate it in a really cool way." Thanks, folks.

Additionally, the alteration of coastlines is just the obvious effect. The Internal Displacement Monitoring Centre, part of the Norwegian Refugee Council, has published some compelling work on "slow-onset events" [PDF] that include contamination of formerly fresh groundwater by encroaching oceans: "As areas of a country become uninhabitable and traditional livelihoods increasingly unviable, new and systemic challenges arise for communities and their governments."

Further, as previously noted here in December, sometimes things happen "gradually and then suddenly": the IDMC observes that "slow-onset events may erode communities' and ecosystems' capacity" to deal with various other phenomena, "and possibly trigger a cascade of hazards." For example, "mangrove destruction due to sea-level rise can result in higher exposure of coastal communities to storm surges as capacity of mangroves to break waves and protect low-laying coastal areas from flooding diminishes."

The U.S. Department of Agriculture is even more detailed in its warnings to farmers in the southeastern states:

> Coastal forests and farmlands in parts of the Southeast are being negatively affected by **saltwater intrusion and soil salinization** due to sea level rise, storms, tides, droughts, and water resources management. Elevated salinity levels cause **crop yield declines**, coastal forest loss, **increases in salt-tolerant invasive species**, eutrophication and marsh migration. Vegetation stressed by salinization is more susceptible to mortality by events such as droughts, hurricanes, and fires. Salinity and salinization can also cause **clay dispersion that reduces soil drainage capacity**, increases **nutrient release that can lead to algal blooms and fish mortality**, and **degraded groundwater for irrigation**.

Some of the most colorful phrasing on this comes from the U.S. Environmental Protection Agency, which describes the "chemical cocktails" that result from increasing salt content in formerly fresh-water bodies and streams:

> Increased salt concentrations…cause other pollutants in soil, groundwater, surface water, and water pipes to become more concentrated and mobile…and can cause radioactive materials such as radium in soils to become more concentrated in groundwater and surface water… Taken together, excess salts can make water undrinkable, increase the cost of treating water, and harm freshwater fish and wildlife.

To circle back to where we began this note: there's a literal answer to the question, "what kind of shape are we in?" Measuring the shape of the planet, and visualizing the effect of rising ocean levels around that complex surface, are critical efforts. Not only the coast lines that we can see, but the "salt lines" of salt water / fresh water transition, are in flux.

The authors of that *Nature* paper quoted above offer a bit of a brushback to their colleagues when they say that "Our results highlight the need for **re-evaluation of existing coastal impact assessments** and **improvement of research community standards**." Ahem. We can all do better when it comes to acquiring—and confronting—these unwelcome facts.

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# Methane Action Repays Attention

17 March 2026
Peter Coffee

As a Jeopardy! category, "**WE HAVE SOMETHING IN COMMON**" includes challenges like yesterday's "This color is in AKAs of Aaron Chwatt, the Lakota leader Maȟpíya Lúta & a 'Captain America' villain." Plot spoiler, the correct response was "What is 'red'?" – as in the comedian with stage name "Red Buttons," the Oglala warrior known as "Red Cloud," and the fictional Hydra antagonist Johann S[c]hmidt ("Red Skull"). That *was* a reasonable $800 square, possibly more difficult than most.

Now that we've seen an example challenge, let's try another: "**This climate-altering molecule is produced by coal mines, dairy farms, and garbage dumps."** Yes, there's a four-week echo happening here, because my 17 February note was also about the molecule $CH_4$ – **methane**. I apologize for mentioning it again so soon, but the last few days of my various news feeds have reinforced the need to spotlight this subject.

**First:** published today, a list of the "**Top 25 Methane Plumes**" from the UCLA Stop Methane Project filters satellite observations of 4,404 plumes at 2.489 sites to identify the worst-case emitters. Fifteen of them are concentrated in one country, **Turkmenistan**, with a total estimated outflow (just for these fifteen worst-of-the-worst) of **eighty-five metric tons per hour**. To put that in tangible terms, the project's authors estimate that a 5 tonne/hour emitter makes a contribution to global warming that's comparable to "one million SUVs or one large (500 megawatt) coal-fired power plant" – so that this one country's top-fifteen methane plumes have the global-warming impact of roughly seventeen million SUVs.

Imagine either (i) everyone in Turkmenistan (population about seven million) owning and regularly driving two or three big SUVs, or (ii) the U.S. population of about 113 million SUVs being *reduced* by about fifteen per cent, to visualize the impact of what is – and the potential for what could be done. Note well that this is only looking at a tiny fraction of the number of sites where people were talking two years ago about "mind-boggling" leakage, which would not be merely **cheap to fix**: since captured methane is sellable as natural gas, mitigation of at least half of the leakage **might more than pay for itself**. "It's very simple to do, it has no cost for the citizen, and for the producers, the cost is completely marginal," said the president of geospatial consultancy Kayrros.

**Second:** far less obvious, due to lack of smokestacks or other effluent pipes, are **methane emissions from landfills** – where organic material rots in what's often a low-oxygen environment, starting about a year after the initial dumping. The far more widely discussed greenhouse gas emissions from **fossil fuel use may, or may not, be about to peak** and then begin to decline as soon as 2030, depending on which tea leaves you choose to read…

- "Analysts say that **coal is now at or near its peak, while oil use will crest around 2030 and gas will top out before 2035**," according to Yale School of the Environment as of this past November, but…
- "A scenario where governments take no further action on climate, and clean tech firms face major constraints, such as a lack of financing or infrastructure…sees **demand for oil and gas rising through midcentury**," according to that same source.

…but **even when fossil-fuel GHG emissions eventually decline**, though, "**rapid urbanization** in the Asia-Pacific region—combined with growing urban populations, increased consumption, and inadequate waste management systems—has led to **increased solid waste generation**," notes the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) in its comments on a "regional policy dialogue" conducted last month. This is not only an Asia-Pacific problem: an estimate published this week asserts that "across the United States, about 97 million metric tons of food waste are discarded each year, of which about 37 million metric tons end up buried in landfills."

**Are landfills' methane emissions also readily fixed?** It seems to be mostly a matter of motivation: this week saw the imposition of a $3 million civil fine for (mostly) methane emissions at an Oregon landfill, which penalty the operators appear to find a tolerable cost of doing business when compared to their savings from "avoiding emissions monitoring, failing to install new gas-collection wells, operating inadequate landfill gas controls and not making needed landfill cover repairs." This does appear to be a case of **needing to price an externality correctly**, and it's reported that "the state could recalculate the fine if Valley Landfills makes the improvements."

It gets better: in Wiltshire, England, a dome covering an area of about three tennis courts is containing and collecting landfill gas to fuel the inflatable dome's power requirements for heating, lighting, and air movement – the plan being **year-round local production of foods** that would otherwise have to be imported and/or warehoused. If it works, there's room to build another hundred domes that are projected to meet four-fifths of the fruit and vegetable demand for three local towns.

Finally, there's **the coal mines and the dairy farms**. These present a different kind of challenge, since the concentration of the methane in these settings is much less than what's encountered at an oil or gas well, but modification of inexpensive catalyst materials may be a pathway to remediation techniques that work well in these conditions. The Foundation for Intelligent Life on Earth has been funding work at an MIT lab that's actively conducting such research.

In addition to our callback to the February 17 note on methane in particular, there's another callback to make here to the more general February 24 note on the need to focus on "emergency brakes." As noted by ESCAP last month, "Methane is responsible for roughly 30% of today's global temperature rise, yet it lasts only about 12 years in the atmosphere. That means **methane reduction creates near instant cooling**, unlike $CO_2$ which lingers for centuries." **Simple to do, effective quickly, cheap or even profitable, zero downside: yes, please**.

# Energy Imbalance Invites An 'Alford Plea'

24 March 2026
Peter Coffee

In criminal law, **an "Alford plea" is entered when a defendant pleads "guilty" while still asserting innocence**. What? Yes, really:

> In this type of plea, the defendant does not admit guilt for the crime but acknowledges that the prosecution has enough evidence to likely secure a conviction. This allows the defendant to plead guilty while maintaining their innocence. The court accepts the plea, resulting in a guilty verdict, but the defendant does not have to admit to the actual commission of the crime. This plea can be beneficial for individuals who wish to avoid the risks associated with a trial, particularly if they face more severe charges.

This comes to mind in response to a recently updated overview of "**extreme event attribution**" – or as it's colorfully nicknamed by the National Oceanic and Atmospheric Administration (NOAA), "the climate versus weather blame game." Reasonable people can readily agree that there's value in, as NOAA explains,

- helping people in affected communities **develop recovery and resilience plans** that match their future risk
- offering climate experts a chance to **test and improve how their models simulate different kinds of extreme weather events**

At the same time, though, NOAA also admits the "more speculative possibility" that "over time, conducting such studies will identify a set of best practices in attribution research that lawyers and judges could **apply in cases where the court needs to settle questions of liability** for the costs or harm caused by an extreme event that may have been influenced by global warming and climate change."

*Liability?* Well, yes, and hence my opening comment on the usefulness of the "Alford plea," because global corporations are appropriately terrified of growing sentiment to send the profit sector a bill for climate-related damages and repairs. The World Economic Forum warns corporate boards of directors that

> New **regulatory frameworks** are being enacted across the world, and **climate cases are on the rise**…more than 230 climate cases across 55 countries were filed in 2023 – from the United States to South Africa, Brazil, India, China, Indonesia, Panama, Nigeria and beyond, according to the Climate Change Litigation Databases. **Claims range from breach of regulation to breach of contract, from human rights violations to securities fraud**. Defendants feature companies from **a broad range of economic sectors** – from energy and agriculture to forestry, industrial production, aviation, shipping, finance and housing.

When huge amounts of money are involved, proportionately huge efforts to deflect and obfuscate are going to be made. The "Paris Agreement" treaty of 2016 (which the United States initially signed, but from which it withdrew in 2020) tiptoed through the mine field, with language like "common but differentiated responsibilities" – a more dignified phrase, to be sure, than "blame game," but Lavanya Rajamani (Professor of International Environmental Law at Oxford) has candidly commented on the resulting global debate:

> Global climate change may…test the extent of humankind's collective conscience to take moral responsibility for a problem of its own making. If the ongoing international negotiations are any indication, the world community is yet to come of age… [C]limate negotiations have witnessed **intense bickering between and within the industrial and developing world over who should take responsibility, in what measure, and under what conditions…result[ing] in a loss of momentum** that could jeopardize the two critical determinants of an effective climate regime: **universal participation** and **timeliness** in achieving the necessary international co-operation.

I wonder, though, if Professor Rajamani is taking too much for granted with the phrase, "a problem of [our] own making"? **It may be easier to get people to agree to help if they are *not* required to admit that they created the problem**. There's value in having a way for someone to say, "I'm not admitting that I did this, but let's move forward on my helping to fix it anyway" – and whatever desire one might have for someone to say they're sorry, I'd hate to let the demand for admission of guilt be a barrier to collaboration on getting the problem fixed.

Is there a maximally simple way to **put a number on the problem of climate change that does *not* entail "attribution"**?

Among the answers, and the discovery that actually kicked off this note, is the NASA "Clouds and the Earth's Radiant Energy System"(CERES) project, which seeks to ask and answer a simple question that effectively encapsulates the climate change challenge:

**What is the "Earth's Radiation Budget" (ERB), and is that budget out of balance?**

A grade-school student can understand this idea:

> Weather and climate are fueled by the amount and distribution of **incoming radiation from the sun**. About one-third of the incoming solar radiation is reflected by clouds, aerosols, molecules and the surface, half is absorbed at the surface and the remainder is absorbed by the atmosphere. Earth cools by **emitting thermal infrared radiation** to space, which **nearly balances** the energy absorbed from the sun.
>
> With no external forcing on the climate system (anthropogenic or natural), the long-term average of absorbed solar radiation (ASR) by the planet should be equal to the emitted thermal radiation (ETR) to space. Increases in atmospheric greenhouse gases ($CO_2$, $CH_4$, etc.) trap more of the emitted thermal radiation from the surface, thereby reducing ETR and leading to a net gain of energy.

This, however, may be the most important point that the CERES web site makes:

> The **planetary heat uptake accounts for the entire energy added to or removed from the climate system**. It arguably provides a more **fundamental measure of global warming** than global mean surface temperature, which is influenced by other decadal processes internal to the climate at the air-sea interface.

This helps us suppress the noise of short-term fluctuations like "El Niño" and "La Niña" events – although these are certainly important, on both a global and a personal level. "As we step into 2026, travellers heading to top global destinations should brace for a year of climate upheaval," warns *Travel and Tour World*, continuing: "With official warnings from the World Meteorological Organization (WMO), the globe is set to experience **unprecedented challenges in weather patterns**. From extreme heatwaves to record-breaking ocean temperatures and the return of El Niño, the travel landscape is about to shift dramatically."

What's noted by the WMO, in particular, is that

> **The ocean continues to warm and absorb carbon dioxide**. It has been **absorbing the equivalent of about eighteen times the annual human energy use each year for the past two decades**. Annual sea ice extent in the Arctic was at or near a record low, Antarctic sea ice extent was the third lowest on record, and glacier melt continued unabated, according to the report.

This is why, as the CERES project notes, **we need to look at the overall radiation imbalance rather than settling for measures of surface temperature**.

If we can agree on simple measures of the overall problem, we're less likely to get tangled in the weeds of who's accountable for specific events and who's going to pay for point-solution damages. **Who pays is not the question, so deciding who's to blame is not the answer**. We need to be pulling emergency brakes, not arguing over who has the right of way.

# Words Have Synonyms; Numbers Don't

31 March 2026

Peter Coffee

There may be **an actual list of words that must not be used in describing research projects**, if federal funding is desired. I'm not talking about red/blue tropes, or stereotypes that might overstate a difference of opinion or technique. I mean a March 2025 memorandum, printed out and photographed, purportedly sent from a government email account to various distribution lists and several individuals – with a subject field reading "Search Key Terms for Agreements | Exceptions Request to the Agreements Moratorium List."

That allegedly official memo warns, "The following list of key words must be used when evaluating all urgent and critical agreement sub[missions]…those **entries that include these terms or similar terms cannot be submitted**." The two major sections are labeled "DEI" (you can probably guess some Things That Must Not Be Said in that context) and "Climate" – with impermissible language including,

> climate OR "climate change" OR "climate-change" OR "changing climate" OR "climate consulting"…OR "climate models" OR "climate model" OR "climate accountability" OR "climate risk"…OR "climate resilience" OR "climate smart agriculture" OR "climate smart forestry"…OR "climate science" OR "climate variability" OR "global warming" OR "carbon sequestration" OR "GH emission" OR "GHG monitoring" OR "GHG modeling"…OR "emissions mitigation" OR "greenhouse gas emission" OR "methane emissions" OR…"green infrastructure" OR "sustainable construction" OR "carbon pricing" OR "carbon markets"…
>
> (Ellipses indicate passages that were covered by overlapping pages in the photo.)

Researchers aren't, in general, stupid, and it appears that they have readily found **restatements that get through the filters**: "the number of NSF grants whose titles or abstracts mentioned **'climate change' fell from 889 in 2023 to 148 last year**, a 77 percent plunge," according to nonprofit media site grist.org, but Grist's graphic of National Science Foundation data indicates that **a substitute phrase "extreme weather" was used almost seventy per cent *more* often in 2025 than it was in 2021**. We can deplore the need to play word games, but outcomes of measurement and understanding are still being achieved – even if, as reported by Grist, one professor at American University had to get funding from the Norwegian Policy Council to study federal climate-related policymaking in the United States.

**Words, it's thus apparent, have synonyms, but numbers are what they are** – so it's perhaps **a bigger problem if we try to make numbers say what we wish were true**, instead of using them to measure what is. A current example of choosing math that gives a desired answer is a legislative debate about the time scale for calculating the climate impact of methane – and yes, I realize that $CH_4$ has been coming up a lot lately here, but please bear with me.

The state of New York, in the person of governor Kathy Hochul, is reviving a 2023 proposal to **account for Global Warming Potential (GWP) on a time scale of one hundred years** rather than twenty years. Why would this seemingly technical detail be worth anyone's effort to change? Because a 100-year calculation **makes for a huge reduction of methane's effect**, since methane is removed from the atmosphere by relatively rapid reactions. If methane effect is calculated on a 100-year scale instead of a 20-year scale, then methane emissions today can be made to

look like a *much* smaller relative problem, since the 100-year method is plugging in a time span that's five times as long for that natural scavenging to take place.

The resulting lowering of methane's GWP number would allow a slower pace of retiring or repairing methane-emitting natural gas infrastructure, while still achieving mandates for greenhouse-effect mitigation. Or **should "achieving" come with big fat air quotes?**

There's an open letter to New York State leadership (from more than five dozen researchers and practitioners at Cornell, Stanford, MIT, and other centers and partnerships) that challenges the proposed change of method, observing that "at the **100-year timescale**, a pound of **methane is 29.8 (GWP-100) times more potent** than a pound of carbon dioxide, but at the **20-year time scale**, that same pound of methane is **82.5 (GWP-20) times more potent** than a pound of carbon dioxide at trapping heat." The researchers then note that "over the past 10 to 15 years, the science on methane as a driver of climate disruption has become much stronger"; they review the history of prior use of a 100-year time scale, back in the 1990s, and call attention to a 2013 update from the Intergovernmental Panel on Climate Change that "clearly stated that the use of a 100-year time period was 'arbitrary'…[and that] **the IPCC has recommended selecting a time frame for methane appropriate to the concern**."

From that same open letter,

> GWP-100 does a terrible job of representing the climatic damage caused by methane…**understating the effect of any new methane emission source by a factor of 4-5 over the 20 years following the introduction of the new source**… **If we brought the human-caused methane emissions rate to zero today, in less than 20 years, we would have reduced global warming from methane and $CO_2$ emissions by 40% - it would take over 100 years to do the same with an equivalent decrease in $CO_2$ emissions**. The use of GWP-100 hugely underestimates this impact and suggests far less urgency to reduce methane emissions.

Governor Hochul isn't trying to hide her rationale for making methane emissions seem to be less of a problem, or for finding political cover to cut those emissions much less quickly. "Absent changes to the law," she writes, "the New York State Energy Research and Development Authority found **the impact of meeting the Climate Act's 2030 targets would be staggering** – more than $4,000 a year for upstate oil and natural gas households, and $2,300 more for New York City natural gas households. And gas prices at the pump would jump an additional $2.23 per gallon above where it would otherwise be. As Governor, I can't let that happen." Well, that says the quiet part out loud, doesn't it? When elections happen every few years, even a 20-year projection might seem so distant that it can be (and must be?) ignored.

Word games may be sadly necessary to get some good things done, but numbers games like these can *prevent* the right things from getting done. It's not just about the value of a number, but also about its shape: The Climate Brink distinguishes methane from $CO_2$ by calling the former a "flow" pollutant ("its climate effect is a function of the *rate* of emissions") while the latter is a "stock" pollutant ("whose impacts are a function of *cumulative* emissions"). It follows that cutting *new* emissions of $CO_2$ takes a long time to make a difference, while cutting new methane emissions has far more rapid benefits. These are simple facts that can be described by simple numbers – and unlike the euphemisms that are being found to evade the "Moratorium List" in government research funding requests, the numbers of climate chemistry are implacable; the costs of policy choices are matters of math.

**What we collectively "can't let happen"** over the next twenty years, or the next hundred years, are legitimate topics of debate – but **let's debate from a starting point of reality, rather than working backwards from what we'd prefer to be told**.

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# Renewable Energy Sources Are Seizing The High Ground Of "Reliable"

7 April 2026
Peter Coffee

**Wind and solar power**, traditionally targets of cheap shots by decarbonization skeptics, are taking on a new role as the **reliable energy sources in a world of geopolitical chaos**. The spring of 2026 may turn out to have been a pivotal moment for **readiness to redirect capital, and refocus politics**, toward renewable-energy options.

As noted, early this month, in the French newspaper *Le Monde*:

> Sanctions against Iran, pressure on Venezuela, repeated demands on the Organization of the Petroleum Exporting Countries (OPEC) to increase production—while threatening trade reprisals against countries that do not comply—tariff threats to push more liquefied natural gas (LNG) toward Europe, and, more recently, critical tensions resulting from the conflict in the Middle East: **every month brings a new batch of unprecedented or even bizarre disruptions**…
>
> Brent Crude prices have sometimes swung by more than 10% in a single day in response to chaotic announcements. LNG futures markets have experienced unprecedented price gaps between European and American platforms. **Industrial buyers, for whom unpredictability is the greatest fear, have seen the specter of 2022 and the war in Ukraine reemerge: the impossibility of planning their energy supply with any medium-term visibility.**

By comparison, the same article observes,

> A nuclear power plant, a solar or wind farm, a heat pump, an electrolyzer, a biomethane plant, a building renovated to passive standards – all these assets have in common that they **produce or save energy at a predictable cost**.

Criticisms of wind and solar often boil down to variations on the question, "**What happens when it's dark and the wind isn't blowing?**" Given the events of the past several weeks, a possible riposte might be "**What happens to your oil and gas reliance when you can't sail tankers through the Strait of Hormuz?**" – with a follow-up observation that the sun and the wind aren't subject to anyone's whims or strategies.

Further, **adding an energy-storage component to the mix is one hugely obvious part of the answer**: rigorous analysis in the journal *Nature Communications* finds straightforward trade-offs among solar power capacity, wind power capacity, and energy storage capacity, with a bottom-line result that **adding 10 per cent "excess capacity" was comparable in effect to adding about four hours' worth of energy storage**.

Additionally, there are powerful synergies to be gained by linking systems over larger regions to level out the effects of varying wind. The same *Nature Communications* paper examined options at varying scales—national, regional, and continental pooling and sharing of power—with perhaps the most notable conclusion being that "**supply gaps in continental-scale solar-wind systems might be entirely eliminated in Africa, Asia, and South America**, and limited to <2% of demand and 49, 26, and 13 h[ours per year] in Europe, Oceania, and North America, respectively, given excess annual generation of 50% and 12 h of storage."

Caveats must be recognized. The authors warn that the calculations above reflect **efficient networks and acceptance of land use requirements**, so there's some optimistic bias there; on the other hand, technical improvements can also be expected. Appliances, for example, can be remotely scheduled to **draw power preferentially at times of peak wind and solar power production**, and in general "stronger **positive correlation between solar/wind availability and demand** may be observed as renewable energy gradually dominates the power system."

The **positives, furthermore, are strengthening as wind and solar systems are produced with improved processes and at larger scale**. The energy used to build and install a wind turbine has typically been paid back in the first seven months of operation, and wind produces the smallest greenhouse-gas emission per kiloWatt-hour of energy compared to other sources [PDF].

In workshop notes from the Columbia University Center on Global Energy Policy, a "no, really?" pronouncement takes the form of "oil price boom and bust cycles are most likely here to stay, and increased volatility is a distinct possibility in the foreseeable future." That <sarcasm> daring prediction </sarcasm> was made nine years ago. Since then, it's been noted that

> In 2021, wind energy accounted for 58% of electricity production in Iowa, and 43% of electricity production in Kansas. **Wind power has enabled Iowa not only to reduce energy costs, but to generate additional revenue by selling excess power to neighboring states during shortages**. In California, electricity generated from wind power increased from roughly 3% in 2009, to roughly 7% in 2022. Electricity generated from natural gas declined from roughly 56% in 2009, to roughly 47% in 2022. Yet even with this increased reliance on wind power, California's grid reliability has remained consistent, and largely above national averages. **California has even been able to briefly meet 103% of its energy demands exclusively from renewable sources**, demonstrating that a large economy can by powered by renewable energy.

The Yale School of the Environment sums this up with the long-standing cliché that "In God we trust; all others bring data," observing that by the most commonly used measure of power reliability,

- Germany—where renewables supply nearly half of the country's electricity—boasts a grid that is one of the most reliable in Europe and the world.
- The United States, where renewable energy and nuclear power each provide roughly 20 percent of electricity, had five times Germany's outage rate.
- The Texas grid became more stable as its wind capacity sextupled from 2007 to 2020.

Compare these notes against today's statement from Iran, with its indefinite prospect of "regulated passage through the Strait of Hormuz under the coordination of the Armed Forces of Iran" – which the country's Supreme National Security Council says will give the country a "unique economic and geopolitical standing." Sun and wind are looking a lot more reliable.

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# Global Is The New Local

14 April 2026
Peter Coffee

The light that left Proxima Centauri this morning (14 April 2026) will hit the Earth on the 10th of July in 2030. I use variations of this calculation, in many different settings, to illustrate the idea of **a "future that's already happened"** – but we don't need to travel 25 trillion miles to make that point today, because the Strait of Hormuz is only 7,400 miles (as the tanker sails) from the Chinese port of Qingdao (which is the largest single recipient of those deliveries).

Perhaps, though, I should say that Qingdao *was* the largest recipient of Hormuz-transiting oil – because this is a week when a "future that's already happened" is going to hit the planet, with an impact far more painful than mere starlight. "**The final ships to clear the strait before the Iran war began on February 28 are expected to reach their destination in Malaysia and Australia by April 20**," estimated Jamie Smyth in yesterday's *Financial Times*, with cascading effects that will wrap around the planet like a tsunami. Smyth continued,

> With **Asian refineries responding by buying up a record number of crude oil cargoes that would normally have sailed to Europe and the US**, analysts said refiners in some of the world's wealthiest countries may soon also face shortages. "It **will hit the west in a month** when all the Asian cargoes bought leave the Atlantic basin," said Nic Dyer, an analyst at Energy Aspects.

This will come, it appears, as a shock to people who thought that U.S. status as a "net exporter of oil" would insulate U.S. energy prices from what's happening on the other side of the planet. Yes, I mean that almost literally: the Strait of Hormuz is about 155º of longitude east of Lebanon, Kansas, the centerpoint of the Lower 48 states. That may seem like a safely decoupling distance, but Hugh Daigle of the University of Texas debunked that delusion in an interview on NPR.

The simple part of the problem, as Daigle outlined, is logistics:

> **Refineries in California generally are processing crude oil that comes from the Middle East and Asia**. And you might ask why, you know, if we're producing all this oil in the U.S. And the reason is that there's just **not enough pipeline capacity to move oil produced here in Texas over to California** where it could be refined.

The harder part of the problem is chemistry, or perhaps I should say chemical engineering:

> You can think of crude oil like a cookie batter. So it's got all kinds of different chemicals in it. And when we put that into a refinery, it's like, we want to get the eggs back out, we want to get the flour back out. And so depending on what the composition of that crude oil is, what chemicals are there to start with, you're going to use different types of refining processes to get those end products out. **We're set up to refine a particular type of crude oil that comes from places like western Canada and Venezuela and Mexico**… When you look at supply versus demand, you know, we're bringing oil in here, we're refining it, and then we're sending those products overseas, or maybe we're keeping those products at home. **You can't just say, well, the stuff that we produce here, we just keep it here. Just - that's not the way the market works.**

If "uninvestable" was the word of the year (with reference to Venezuela), then perhaps "that's not the way the market works" will turn out to be the motto. Some would even say it's the epitaph, as suggested in this month's assessment from Samantha Gross at the Brookings Institution:

> The perceived risk in oil markets will change after the conflict; **the world can't go back to the time before the war**. Saudi Arabia, the UAE, Qatar, Kuwait, Bahrain, Iran, and Iraq export most of their oil through the Strait of Hormuz, although Saudi Arabia and, to a lesser extent, the UAE and Iran have pipelines that avoid the strait. **In all, the world is missing about 11 million barrels per day (mbd), or 11%, of crude oil supply**, compared to the roughly 20 mbd that transited the strait before the conflict. Additionally, the oil market considers spare production capacity to understand supply risk, but **nearly all the world's spare capacity is in Saudi Arabia and the UAE**. Finally, **it's difficult to imagine Saudi Arabia continuing to be the secure marginal supplier of oil** so long as Iran can harass traffic through the strait.

Putting this all together, I'm reminded of the maxim that "all politics is local," most commonly attributed to Phillip ("Tip") O'Neill – holder of the record for longest continuous service as the Speaker of the U.S. House of Representatives. I'm "reminded" in the sense of "it's opposite day," because the time-delayed connections described above will have **planet-encompassing effects – despite what might seem the localized events** in roughly 5,000 square miles of waterway.

The future that's already happened has many aspects yet to be seen – and every organ of society will soon be coming to terms with the time lags yet to come, with responses in coming months and years that will have profound climate-affecting consequences. But when the wave function collapses, which reality will we be in?

- Will renewable-energy transition happen more quickly? Or, will "emergency" relaxation of mitigation mandates increase the risk of "tipping point" effects?
- Will "never again" reaction to single-point-of-failure shipping routes result in more dispersed, more resilient energy supply chains? Or will dominance of solar-power and smart-grid technologies make China the next era's controlling player?

You can break apart a fully assembled jigsaw puzzle in seconds, but it may take hours to reassemble it – and it will likewise take years to repair the costly and complex damage that's been done in the past several weeks. That means starting the work of repair before the breakage is impossible to ignore.

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# It's Becoming Less About Oil; More About Water

21 April 2026
Peter Coffee

James Bond movies often suffer from fanciful plots, but 2008's "Quantum of Solace" strikes a blow for relative realism with its MacGuffin of "who will control the water?" In the movie's final conversation between 007 and M, we learn that the principal villain died with motor oil in his stomach – that being the only drinkable thing that was left with him in a desert. The moral of the story, that **there are substitutes for oil but no substitute for water**, was made with a rhetorical hammer rather than a (more typical for the Bond canon) featherweight pun.

Two decades later, **renewable energy sources grew enough to satisfy an entire year's global growth** in electricity demand – while **the *share* of total world energy demand that's met by oil has *declined***, as of last year, to less than 30 thirty per cent, far below its peak share of forty-six per cent in 1976. Also of note is that **last year, renewable energy met more of U.S. demand than coal** for the first time on record, with **solar power being the largest component of growth** in global energy supply.

So much for the good news. Now for an update on water, this week from the Associated Press:

> **More than 61% of the Lower 48 states is in moderate to exceptional drought**—including 97% of the Southeast and two-thirds of the West—according to the U.S. Drought Monitor. It's the **highest levels for this time of year since the drought monitor began in 2000**.
>
> Sticking out like a sore thumb is a **highly technical but crucial measurement** of "the sponginess" of the atmosphere – or how much moisture the hot, dry air is sucking up from the land it's baking. It's called **vapor pressure deficit**. It's **77% above normal and more than 25% higher than the previous record for January through March in the West**.

I could quote more paragraphs from that source, but that's what hyperlinks are for. What's more useful here, I hope, is to add some "then what?" and "what else?" elaboration on **why this is more than just an "it's dry out there" you-knew-that**.

Among the "oh, that's not good" follow-ons is that **fire risk is not only driven by dryness**. It's also increased by the loss of resilience when there are **far more "burning hours" in the day**, as noted in a study released this week by a team of researchers in Canada:

> Increasing fires were **able to spread up to tens of kilometers within hours and sustain weeks of overnight burning**. These diurnal surges not only outpace traditional tactics (e.g., nighttime suppression) and resource mobilization but also **place communities at acute risk with compressed evacuation timeframes and overwhelmed local defenses**, as tragically demonstrated by the 2023 Maui Fire (Hawaii), the 2024 Jasper Fire (Alberta), and the 2025 Los Angeles Fires (California).

Further, the **sharing of fire-fighting resources across different regions is becoming more difficult** as "synchronicity" (everything's burning at the same time) becomes a growing consideration. A team of researchers from USA, UK, and China noted earlier this year that globally,

> The warming trend not only intensifies hot and dry conditions locally but also **increases the likelihood of extreme fire weather occurring simultaneously across regions**. Significant increases in synchronous fire weather [SFW] occurred during 1979 to 2024, with more than a twofold increase observed in most regions.

We can get more specific about measures of the problem and its effects: from the same source just cited,

> The increase in SFW poses challenges for firefighting cooperation networks across the European Union (EU), the Association of Southeast Asian Nations (ASEAN), and fire-prone countries such as the US, Canada, and Australia. For instance, **Portugal and Spain experience extreme fire weather on the same day for 19 days per year on average**… Moreover, **the window for bilateral cooperation among the US, Canada, Mexico, Australia, New Zealand, Portugal, and South Africa may be constrained** by the increasing intercountry SFW.

It may seem **anticlimactically "well, of course" to note that this all affects food supplies** – but for completeness, we should also include the estimate from the U.S. Department of Agriculture that overall food prices will rise by 3.6 per cent during 2026, driven by the pile-on of energy price spikes and fertilizer shortages along with "missing water." The last of these is more complex than might be obvious:

> Scientists studying the Colorado River Basin have identified a troubling trend: **snowpack-based forecasts are increasingly overestimating how much water actually reaches rivers**. Where is the water going? Warmer, drier spring conditions explain nearly 70 percent of the difference between predicted and actual river flows, researchers found. The culprit isn't just evaporation, it's biology. **Plants, fueled by warmer temperatures and increased sunlight, are acting "like giant straws, all drawing on the snowpack,"** said researcher Daniel Hogan. That means less water makes it into rivers, reservoirs, and irrigation systems – even in years that appear, on paper, to have adequate snow.

Farmers and others will have to make relatively quick decisions, like when to shrink their herds or their orchards, with recovery times that will stretch out for years to come. From the source just cited above: "Drought does more than reduce output in a single season, economists emphasized. It **reshapes production capacity, delays recovery and increases the volatility of food supply in the years that follow**."

Proverbially, oil and water don't mix. Real-worldly, right now, their challenges are likewise quite different – and in the former case, starting to show signs of improvement, but in the latter requiring **wide-ranging action to deal with rapid changes whose effects may define the future's "normal."**

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# We're Heading Into Uncharted Waters

28 April 2026
Peter Coffee

In 1999, which is the earliest year for which I can find this infographic, the "**Sea Surface Temperature Anomalies**" reported by the National Weather Service Climate Prediction Center were plotted with a maximum (Y-axis) value of 2 degrees Kelvin above their reference level. This makes life difficult today, when a somewhat revised format for this data plot already has **a raised ceiling of 2.5ºK – but the "Forecast ensemble mean" breaks above that value after December** of this year. **We are heading into uncharted waters** (if you'll pardon my poetic license) – with ocean temperature projections rising so quickly that the CPC won't be able to plot them in their monthly Climate Diagnostics Bulletin until they change their format again.

As noted here last month, **temperatures are neither a complete nor an immediate measure** of the climate situation: the ocean absorbs $CO_2$, the ice caps absorb heat through phase change, and it's only the more comprehensive measure of overall radiation imbalance that tells us in real time how quickly things are going in a bad direction.

It's **still worth noting**, though, that "The past six months has seen **Arctic sea ice extent 'at record or near-record lows**, alongside unusually warm conditions'" – an assessment attributed to Dr Lettie Roach, a polar climate scientist at the Alfred Wegener Institute, late last month. At the other pole, **shrinking Antarctic sea ice** is posing a grave threat to the Emperor Penguin, as "it looks like the ocean's circulation has changed, and it's almost like someone turned on the hot tap and now the bath is getting warmer" (in the words of Sarah Purkey at the Scripps Institution of Oceanography).

Parenthetically, this is also an example of the principle that **it's never just one thing**: as noted in the final sentences of "discussion and conclusions" in the formal published report on these near-Antarctic water temperature measurements,

> These changes may have important consequences for the global carbon cycle, particularly given that the region south of the Antarctic Circumpolar Current is known to be a net source of carbon outgassing. Altered upwelling pathways and stratification could influence both the **ventilation of deep carbon-rich waters** and the **efficiency of biological carbon export**, with potential feedbacks on atmospheric carbon levels.

Everything mentioned so far was the result of my digging further into last week's bulletin from the World Meteorological Organization that warned,

> For May–July 2026 (MJJ 2026), the Niño 3.4 plume indicates a rapid warming trend. Following the transition to neutral conditions in early 2026, the multi-model ensemble (MME) shows **a nearly unanimous trajectory toward El Niño by May**. By MJJ, the MME average approaches 1.5°C. The tight clustering of the models, despite the typical spring predictability barrier, underscores the high confidence in the onset of El Niño, followed by further intensification.

Underline the above with the further observation, from work supported by the National Research Foundation of Korea, that an El Niño event of the kind that's currently anticipated may trigger "climate regime shift":

> Regime shifts are **large, sudden, and persistent changes** in the function and structure of natural systems. Those occurring in the climate system are referred to as climate regime shifts (CRSs). CRSs manifest **across various time scales**, ranging from dramatic transitions between glacial and interglacial states to more abrupt multi-year to decadal shifts, which are **hard to reverse and, in some cases, irreversible**.

**It was the word "irreversible" that grabbed me by the brain stem**, and variations on that term are showing up in many analyses of the near-term trend. Bob Berwyn at Inside Climate News corresponded with one of the authors of the Korean paper quoted above, and shared resulting notes that

> There are **only three super El Niños on record**: in 1982-83, 1997-98 and 2015-16. All of them contributed to regime shifts in regional ocean temperatures, leading to **unprecedented marine heat waves** that destroyed or damaged coral reefs and caused mass die-offs and starvation among many marine organisms, from starfish to seabirds and marine mammals. Those **impacts**, as well as changes in drought and extreme heat over land areas, **persisted for years**…
>
> The [Korean] research also uncovered strong El Niño signals in the form of **soil moisture changes** in central southern Asia, central Australia, the Amazon and western Greenland. If soil moisture stays below normal for several years, crops are exposed to repeated heat and water stress **across multiple growing seasons**.

In short, it's not just about the penguins and the coral, although that would be quite enough to merit concern and action. It's also about our water and our food.

Many forecasts of climate-related events talk about things that will happen in 2030, or even in 2150 – which sounds to many, I suspect, as if there's time to think about it. When **words like "irreversible" are being used**, though, **about things that will happen in the next ten months**, perhaps the need for "emergency brakes" will get more urgent attention.

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# Throwing Fossil Fuels Out The (Overton) Window

5 May 2026
Peter Coffee

The "**Overton Window**" has formal descriptions and literary elaborations, but in plain English I suggest that it's "the realm in which **you can propose change without sounding crazy**." Effective communicators are sometimes said to have moved the window, although Joseph Lehman (who named the idea after his late friend Joseph Overton) said that this can get things backward: that "The most common misconception is that lawmakers themselves are in **the business of shifting the Overton window**, [but] that is absolutely false. Lawmakers are actually in **the business of detecting where the window is, and then moving to be in accordance with it**." Examples are readily offered, but let's not start a bar fight.

Whether Lehman is right or wrong, **a shifting Overton Window transforms angry controversy into mainstream acceptance**. A non-political example that probably *won't* start a fight (unlike, say, same-sex marriage or legalizing marijuana) might be pre-1980s science-fiction movies and TV shows: in many of these, a futuristic scene includes ash trays everywhere. Well, of course. **"No Smoking" rules for an entire building? Ridiculous** – but the Overton Window for tobacco use moved dramatically, as **witness the disappearance of smoking sections on United States domestic flights** in 1990. That was long overdue in some people's opinion, an infringement on personal freedom in the view of others – but it happened, and no one seems to be looking for an "Undo" key.

I mention this specific change because it makes a point about timing. **Smoking was (actually) banned on *airplanes*** a decade before there was an ash tray (fictionally) shown on a table ***on a space station*** in the movie "2001: A Space Odyssey." Movie set designers in 1968 simply did not see the change coming – and in general, when it's time for something to happen, people who extrapolate trends for a living are often caught by surprise. The change may look more like a tsunami than like a well-behaved tide. **The effect may be more like a snapping rubber band than like a swinging pendulum**.

It was therefore **more than just a matter of labeling** when a "**Conference on Transitioning Away from Fossil Fuels**" (TAFF) took place at the end of last month in Colombia. In that space, the need for that transition was **not a controversy that struggled even to be *mentioned* in a conference agreement** (as was the case at last November's COP30 meeting in Brazil). What made me think, "Overton!", was a comment that the Colombia participants "broke a long-standing taboo by openly linking oil and gas not just to emissions, but to war, displacement and economic instability."

The "Summary Report" from the conference puts it right out there:

> It is a truism that **burning fossil fuels causes human-induced climate change**. But **this truth is rarely spoken** at UN climate change meetings. The focus has been on emissions, not their sources. The First Conference on Transitioning Away from Fossil Fuels (TAFF 1) sought to **shift the discussion and build momentum for concrete solutions** to end fossil fuels' grip on economies, legal frameworks, and energy systems.

The Colombia and Netherlands co-hosts of this (explicitly labeled as) "first" TAFF gathering were also right up front about their goal of **focusing the conversation on what to do, rather than debating whether it needs to be done**. The invitation-only attendee list, they said, was drafted "to avoid a rehashing of the lengthy debates at COP30" – for example, whether carbon capture technology could be invoked to turn down the urgency of reducing greenhouse gas emissions. I'll spare you the need to follow a link to what was shared here on this subject following COP30:

> **Carbon capture** has been discussed since at least as long ago as 2009, when the Global Carbon Capture and Storage Institute was launched as an international effort led by Australia. As of [October 2025], though, estimates MIT's *Technology Review*, "hundreds of companies that have spun up in recent years have disclosed **deals to sell** some 38 million tons of carbon dioxide pulled from the air…roughly **the amount the US pumps out in energy-related emissions every three days**. And they've only **delivered** around 940,000 tons of carbon removal. The US emits that much carbon dioxide in **less than two hours**. Scale matters, and carbon removal efforts have yet to achieve it – making it all the more important to maintain, not to slacken, the pace of reducing carbon emissions.

Statements that a present moment will prove "pivotal" often turn out to have been premature, but this conference—in its context of the conflict in the Strait of Hormuz—might turn out to qualify. More to come.

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# We Need To Stop Masking The Signals

12 May 2026
Peter Coffee

In the movie "Serenity," a character with a passion for information hacking says "**You can't stop the signal**." What brought this to mind were two posts on Medium by writer "Martina H": the one that triggered me this morning, "**The Supermarket Is Hiding a World Too Hot to Feed Itself**," and an earlier post (linked back from the new one) that explored other depths of that idea.

The first of those Medium posts, written two days ago, grabbed my brain with this sentence: "the whole machine is built to make me stop thinking: to make berries in Sweden in May feel normal, to **make the diesel and the distance and the damage disappear behind clean labels and cold air**." The second one, written this past February, reinforced this with its observation that

Even farmed salmon depends on **a chain of invisible conditions**: plankton blooms that feed wild fish turned into pellets, oxygen levels that keep cages from turning into suffocation chambers, currents that flush waste, temperatures that stay within metabolic limits. When marine heatwaves sweep through the oceans, fish suffocate in nets. When oxygen collapses, cages become mass graves. When parasites thrive in warmer water, antibiotics rise.

**It's words like "disappear" and "invisible" that I'm finding to be triggering**, and not for the first time. I went off on this topic last December, when I said that "we'll do well not to introduce deliberate distortion, or indulge in pretend-it's-not-real concealment, when our signaling systems are already hard pressed to reflect a complex and rapidly changing situation." I'm pretty much guaranteed to phrase this in more vulgar words when I see a story, for example, about drawing from the Strategic Petroleum Reserve to **alleviate the political risks of high gasoline prices**. Masking the signal, in this way, is **like playing loud music to cover the annoying noise of an alarm**.

Gasoline prices are not the only signals that are trying to get our attention. This past weekend, the *Financial Times* reported that "**In the past month, more than 700 wildfires have burned over 60,700 acres in Georgia, surpassing the state's yearly totals of acreage** burnt by wildfires since 2017"; that sounded so unlikely that I asked ChatGPT for a second opinion, and it found numbers of 37,000 acres per year for the ten-year average compared to 55,000 acres for just the two worst recent incidents. Further, the hyperlink for the "55,000 acres" story was "southern-georgia-wildfires-burn-**52000**-acres-clinch-brantley-counties" – so it seems as if **we're having trouble keeping the signals abreast of the rapidly changing situation, even when we *don't* deliberately mask them**.

Our "Serenity" character referenced above had two other important things to say:

- "There's **the truth of the signal. What I see**. And, there's the puppet theater…the Parliament jesters foist on the somnambulant public."
- "**Everything goes somewhere, and I go everywhere**."

Where will the signals appear? In another, particularly grim, post from Martina H we get a few ideas about that: "the grocery aisle, the gas bill, the cramped minutes at the checkout line – the receipt will start to climb…" The signals will become increasingly difficult to ignore.

This week's note is therefore not about any one signal, but about a more general idea: **we all need to "go everywhere," or at least go to places (literal or figurative) where we aren't being told (or even invited) to go** – and we need to see what's really there, and decide what to do about it, while livable choices are still available.

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# It's Getting Wetter Out There – Or Is It?

19 May 2026
Peter Coffee

Sometimes it seems as if the planet is trying to get our attention: as a state visit to China was ending over the weekend, with superpower leaders "not talking about climate change," the *Financial Times* noted that "China was lashed by heavy rains which caused flash floods and evacuations in central and eastern areas…including downpours in Beijing… **Jiangmen in the southern Guangdong province received almost a month's rain on Thursday and Friday**." This followed, though, a period of notable dryness: "Since May, most areas in central and eastern China had less than 20mm of cumulative rainfall and were in **various stages of drought from mild to severe**," noted the same *FT* story. **If the planet is going to be so outspoken, what is it trying to tell us?**

Overall, **higher temperatures mean more water in the atmosphere and more rain falling back to the ground**. This is elementary-school science: students in second grade are typically taught the basics of evaporation, condensation, and precipitation. "Pour yourself a glass of water and take a sip. Did you know that the water you've just swallowed is the same water that wooly mammoths, King Tutankhamun and the first humans drank? That's because Earth has been recycling water for over 4 billion years!"

So, not news, except that "The amount of water the atmosphere can hold (and eventually release) increases by 7% for every one degree Celsius (1.8 degrees Fahrenheit) increase in air temperature" – and as a result, with the observable warming of the planet (regardless of what's causing it), "record rainfall extremes have continued to increase worldwide and, **on average, 1 in 4 rainfall records in the last decade can be attributed to climate change**."

The message is becoming more clear – and "infrastructure [such as retention ponds and dams] in most parts of the country is no longer performing at the level that it's supposed to, because of the big changes that we've seen in extreme rainfall" (an observation made seven years ago). **Emphasis on the word "extreme," because this is not just about more rain overall**: a few sentences ago, I quoted a reference to an "average" and we *really* need to talk about that.

People who've never taken a statistics class are likely, it seems to me, to think they "know" that if a measure varies over time, its average encapsulates what's happening. This month, though, a paper in *Nature* warns that **higher *average* rainfall may *not* mean a wetter planet**, and doesn't that seem a little weird?

Averages can be tricky: if a tossed coin lands half the time as "heads" and half the time as "tails," then on average it lands on edge. That average is not a "most likely" outcome, but rather an "almost never." This is my favorite argument for **"any time someone quotes you an average, ask about the distribution"** of the values: not everything is a nice symmetric bell curve.

**What does this have to do with rainfall?** If you've ever encountered **seriously dry dirt**, perhaps after time away from home when you want to rejuvenate a garden, **you've seen water sit on the surface** rather than soaking in. Instead of watering the plants, it just winds up evaporating, perhaps more quickly than expected if the temperature is high. What's true for your garden is true for the planet, at much larger scale: "The world's rainfall is increasingly packed into bigger storms with longer dry spells in between," observes *USA Today* in a simpler-language summary of that paper in *Nature* linked above. "And a lot of rain all at once causes problems for overwhelmed soil."

How dramatic is the change in distribution of rain events? "The amount of precipitation falling in the most intense 1% of precipitation events increased by 42% in the Midwest and 55% in the Northeast from 1958 through 2016. In the extreme western extent of the Great Lakes region, as much as 50% of annual total precipitation falls during only 10 days of the year."

To shift for a moment into that *Nature* paper's more academic language, "Intense precipitation can exceed soil infiltration capacity, accumulating at the surface where lower aerodynamic resistance increases evaporation, particularly during longer and sunnier dry periods. **The concentration effect**—encompassing both radiative and hydrologic partitioning changes—**reduces the water retained on land almost as much as total precipitation increases it.**" In an email to *USA Today*, one of the paper's authors said in plainer English that "Regardless of how much precipitation falls, **when rain and snow come in stronger bursts separated by longer dry spells, less water tends to remain on the land** (in soils, lakes, and groundwater) for use by people and nature."

More rain falling, but less water for our faucets. More floods; less food. **The averages aren't what matters**.

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# Worst Case Perhaps Less Bad – But Least Bad Case Getting Worse

26 May 2026
Peter Coffee

There's been a lot of media buzz surrounding "the formal **retirement of the RCP8.5/SSP5-8.5 scenario**," an event that **some are framing as an admission** "that climate projections were wrong." Even a relatively skeptical voice on the subject of climate change has offered, however, a more nuanced view:

> The truth is more complicated. The authors of the paper in which the scenarios were dismissed as "implausible" attributed the downgrade to "**trends in the costs of renewables, the emergence of climate policy and recent emission trends**," an explanation that can be seen as a **justification of current climate policy rather than a rejection of it**. On the face of it, that's fair enough.

The most vigorous dancing on the grave of RCP8.5 appears to be a reaction of "You tried to scare us! We won't listen to you any more!" There *has* been some rueful acknowledgment that this *isn't* entirely surprising, and that it could have been forestalled by a more careful presentation over the past several years.

For example, writing at *Carbon Brief*, Zeke Hausfather warned almost seven years ago that "**The creators of RCP8.5 had not intended it to represent the most likely 'business as usual' outcome**, emphasising that 'no likelihood or preference is attached' to any of the specific scenarios. **Its subsequent use as such represents something of a breakdown in communication** between energy systems modellers and the climate modelling community." That's putting it politely.

Unfortunately, once the phrase "business as usual" had been spoken by the telegenic Greta Thunberg, it became tempting and even fashionable for others to use those words – often in ways that **made RCP8.5 seem like a prediction instead of a possibility**.

A view from Canada provides a useful perspective on what has, and what has not, changed in the updated view:

> Abandoning what are now outdated scenarios is "truly a good news, bad news story," said Canadian Climate Institute president Rick Smith. "The worst-case scenario of how terrible things might get in terms of warming by the end of the century is not quite as bad as we thought," he said. "But **the best-case scenario is not quite as good as we hoped for**."

It's crucial to appreciate that **the retirement of RCP8.5 is *not* the same thing as an all-clear outlook for the planet.** The RCP family of models are inherently optimistic in that they do not address, at all, some mechanisms of global warming that are coming to be understood as far more threatening than previously thought to be:

> We currently have an incomplete understanding of the Earth's carbon cycle. As Earth warms, it releases its own emissions, like methane from wetlands. These types of emissions are not well represented in the models which produce the RCPs. The only "tool" that these models have to increase GHG concentrations is by increasing emissions from fossil fuel combustion; but this does not mean that these are the only sources of GHG emissions. These **carbon "feedbacks" mean that a pathway with less burning of fossil fuels but greater emissions due to land use change or natural feedbacks could result in higher levels of warming than captured in the RCPs**.

From another commentary, "Although the lower ends are comparable in both sets of simulations, **the highest climate projections are significantly warmer in the emission-driven simulations because of stronger carbon cycle feedbacks**." I'm not sure that "feedbacks" is the best word for this. Something like "cascades" might be better, but here is a description of one effect that RCP models don't represent:

> Like a warm can of Coke, which loses its carbonation when you warm it up and remove the top, **the ocean's $CO_2$ solubility decreases as the ocean warms… Current projections of future warming may actually underestimate the degree of warming expected from a particular carbon emissions pathway**.

If that seems a little vague and "trying to be scary," let's be more specific:

> **Impacts on ice sheets are a very important part of the climate change and have yet to be fully integrated into the standard climate models**. So independent efforts with ice sheet models were set up using the output from the CMIP5 and CMIP6 models – they used two scenarios, RCP85 and RCP26 to bracket possibilities in ISMIP6 (Seroussi et al, 2020). Interestingly, they found that, particularly for Greenland, **none of the models had melt rates as high as observed even with RCP8.5 forcing**. Thus for a situation where the (ice sheet) models are insufficiently sensitive, *a higher than expected forcing might give you a more likely outcome*. [My italics added]

Thus, RCP8.5 remains a useful tool for anticipation and planning, even if its specific assumptions are now considered "implausible":

> The main scholarly criticisms of RCP8.5 have been that it was misrepresented as a "business as usual" scenario, and that its estimations for coal burning, specifically—as opposed to other sources of emissions—were unrealistically high. Yet **the kind of climate impacts that happen when RCP8.5 is plugged into a global climate model are very much not off the table**.

This will get to be (even) far(ther) too long unless I defer additional discussion of non-obvious greenhouse gas emissions. I want to end, though, with a vivid analogy from Marshall Shepherd at *Forbes* that may **illuminate, in simple terms, what has really happened** in the RCP8.5 withdrawal:

> **Let's say a person goes out drinking at the bar. There are a range of outcomes** that we could predict a few hours later. They include:
>
> - He just drinks soda all night and watches the game. Drives home safely.
> - He has a couple of beers but remains below the legal limit and gets home safely.
> - He has 4 to 5 beers and is above the legal limit and takes a risky drive home or calls rideshare.
> - He has 10 beers and drives home under extreme impairment or calls a rideshare.
> - He has 10 beers and starts a bar fight that results in multiple injuries and several arrests.
> - **He drinks all of the beers at the bar and in the cooler too with expected dire outcomes.**
>
> What the UN panel did, from an analogy standpoint, is **take the last scenario off the table**. He was never going to drink *all* of the beer, but there are **still very problematic scenarios *on* the table**.

An extreme worst case set of behaviors, globally, is no longer considered likely – but the need to anticipate comparable effects remains.

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# Damage To Data Creates Unknown Knowns

2 June 2026
Peter Coffee

In 2002, then-Secretary of Defense Donald Rumsfeld famously answered a question about combat intelligence with a reference to "**unknown unknowns**": that is, things that are not merely unknown, but that we have not even thought to consider, perhaps because they're **things that have never happened before or that have not had previous importance**.

Some, at that time, derided Rumsfeld's phrase as if it were a novel (or even nonsensical) coinage, but the term had been in published use since at least as early as 1968 – notably in aerospace and other military domains, with "unk-unks" even achieving the status of a common informal contraction. More than half a century later, it seems to me that **much of our conversation about abrupt climate change *has* to include our recognizing, investigating, measuring, modeling, and forecasting unk-unk measurements and processes.** I suspect that future notes here will include many examples.

**This week's note, though, looks at something that might seem actually contradictory**, what Slavoj Zizek in 2004 called "**unknown knowns**." Excuse me, isn't that an obvious oxymoron? It's not, because what Zizek meant was that there are "**disavowed beliefs we pretend not to know about**." These are "unknown" knowns in the sense that we are refusing to *acknowledge* the knowledge. Perhaps we don't want to admit its truth because it's a result of past errors; perhaps we don't want to be burdened with responsibility to do something about that truth.

Al Gore called such truths "inconvenient," but we seem now to be escalating things: not merely neglecting to address what we don't want to acknowledge, but **actively corrupting measurements and abandoning records of events and trends**. We are committing governmental and institutional acts of un-knowing.

First example, and the item in my news feed that got me thinking about this, is **the altered approach to carbon accounting that appears to be embedded in China's February 2026 "Statistical Communique."** A footnote in that document now refers to "carbon dioxide emissions *in the process of energy activities and industrial production* [my italics]," which (as Al Gore might say) *conveniently* seems as if it may be newly excluding non-energy sources of emission such as production of cement or incineration of plastics.

"On paper, the change in the carbon-intensity metric effectively halves the rate of growth in China's $CO_2$ emissions over the past five years," estimated analyst Lauri Myllyvirta on *Carbon Brief* last week. This is not a minor adjustment, but rather a change that creates what Myllyvirta calls a "Germany-sized" reduction of China's self-reported $CO_2$ footprint. TL;DR points include,

- The change in the definition of carbon intensity has the effect of **weakening China's climate targets and introducing more uncertainty into tracking progress**
- On the basis of China's new numbers, it will **require less effort to hit the 2030 target** for a 65% reduction in carbon intensity on 2005 levels, as per China's Paris pledge
- This target can now be met **even if $CO_2$ emissions go up** between 2025 and 2030, whereas the previous metric would have required a reduction

This one example already felt like a topic for this week, but then I encountered **another demonstration of willfully choosing *not* to know**: the International Disaster Database, known as **EM-DAT**, has primarily been funded by the U.S. Agency for International Development which is **no longer providing that support**. Analyst Antoine Soetewey summarizes the problem as follows:

> EM-DAT's value is not just in the quantity of records. It lies in the **rigour and consistency** of its methodology over time and across countries. That is exactly what makes it **irreplaceable**. In a world awash with data, curated and quality-controlled datasets of this kind are rare. If EM-DAT were to close, the result would not be a smooth substitution. It would be **fragmentation, proprietary data silos, and reduced access**, particularly for lower-income countries that are already under-represented in global evidence.

An open letter on this situation makes the following assessment:

> In an era of intensifying climate extremes, cascading risks, and compounding crises, reliable data are not a luxury. They are the **infrastructure for informed decision-making**. Disaster risk reduction, early warning systems, anticipatory action, and climate adaptation all require credible historical baselines. We cannot measure progress against the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals, or the Paris Agreement without consistent data on disaster impacts. **We cannot credibly argue for risk-informed development if the underlying evidence base is fragmented**.

Third example: the U.S. National Centers for Environmental Information announced in May that its "**Billion Dollar Weather and Climate Disasters**" product "will be **retired, with no updates beyond calendar year 2024**." One climate risk analyst opined that "What makes this resource uniquely valuable is not just its standardized methodology across decades, but the fact that it draws from **proprietary and non-public data sources** (such as reinsurance loss estimates, localized government reports, and private claims databases) that are **otherwise inaccessible to most researchers**."

He added that "Without it, replicating or extending **damage trend analyses**, especially at regional scales or across hazard types, is **nearly impossible** without significant funding or institutional access to commercial catastrophe models." **Something that we usefully knew, through 2024, is being chosen to be *less* knowable**.

There is an Arabic proverb on the subject of knowledge, and of knowledge *about* one's knowledge, that is said to go like this:

> People are of four types:
>
> - Those who know, and know that they know – they are scholars, so follow them
> - Those who know, but do not know that they know – they are asleep, so awaken them
> - Those who do not know, but know that they do not know – they are seeking guidance, so guide them
> - Those who do not know, and do not know that they do not know – they are dolts, so shun them

I don't know what the proverbist would say about "**Those who know, but do not admit to that knowledge or take up its responsibilities**" – but "awaken" or "guide" may not be sufficiently vigorous verbs, while "shun" is not an option as long as we just have one planet. Suggestions welcome.