Vox

The case for “conditional optimism” on climate change

Limiting the damage requires rapid, radical change — but such changes have happened before.

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Optimism! Kinda. | Shutterstock

Is there any hope on climate change, or are we just screwed?

I hear this question all the time. When people find out what I do for a living, it is generally the first thing they ask. I never have a straightforward or satisfying answer, so I usually

dodge it, but in recent years it has come up more and more often.

So let’s tackle it head on. In this post, I will lay out the case for pessimism and the case for (cautious) optimism, pivoting off a new series of papers from leading climate economists.

First, though, let’s talk about the question itself, which contains a number of dubious assumptions, and see if we can hone it into something more concrete and answerable.

“Is there hope?” is the wrong question

When people ask about hope, I don’t think they are after an objective assessment of the odds. Hope is not a prediction that things will go well. It’s not a forecast or an expectation. But then, what is it exactly?

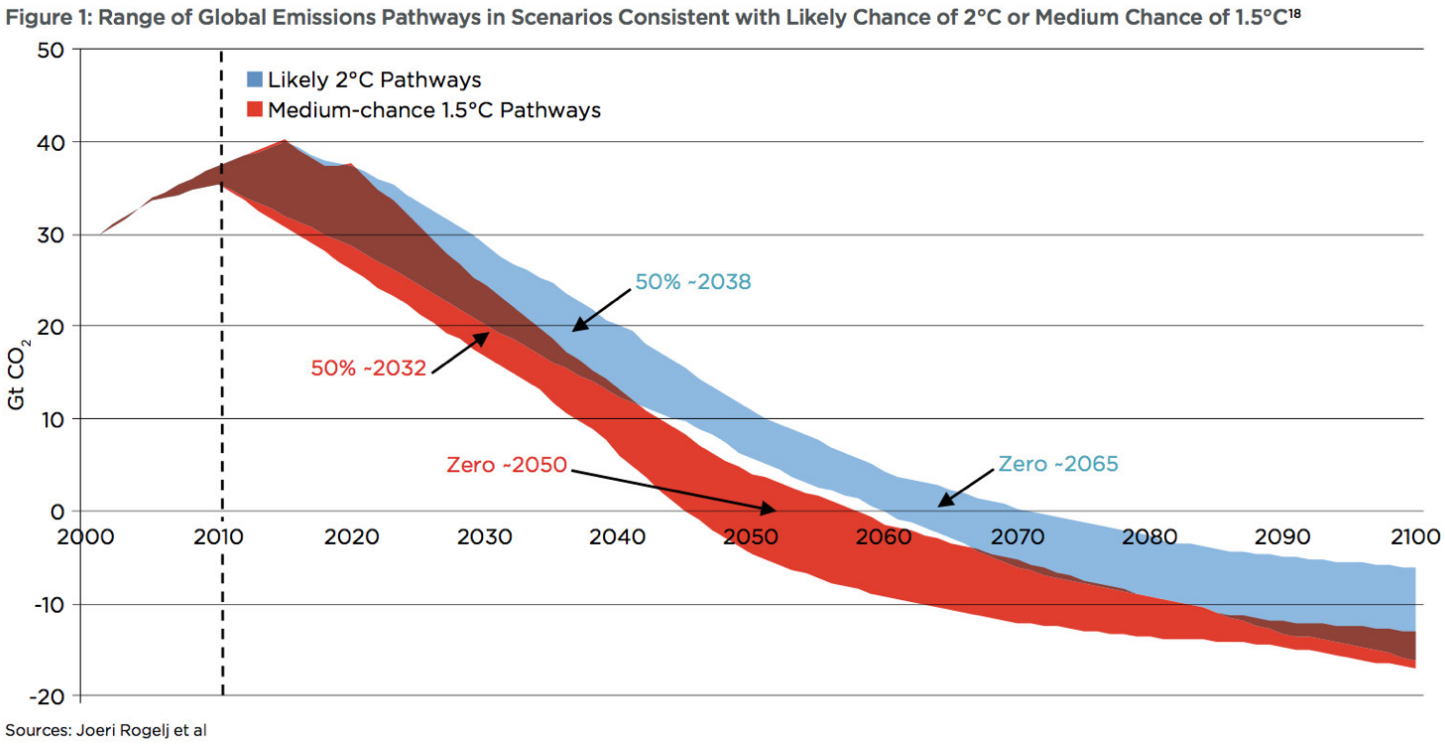
It’s less intellectual than emotional; it’s a feeling. As I wrote at length in **this old post**, the feeling people are groping for is *fellowship*. People can face even overwhelming odds with good spirits if they feel part of a community dedicated to a common purpose. What’s terrible is not facing great threat and long odds — what’s terrible is facing them alone. Happily, those working to address climate change are not alone. There are more people involved and more avenues for engagement every day. There’s plenty of fellowship to be found.

More importantly, though, when it comes to climate change, “Is there hope?” is just a malformed question. It mistakes the nature of the problem.

The atmosphere is steadily warming. Things are going to get worse for humanity the more it warms. (To be technical about it, there are a few high-latitude regions that may see improved agricultural production or more temperate weather in the short- to mid-term, but in the long haul, the net negative global changes will swamp those temporary effects.)

The international community has agreed, most recently in the Paris climate accord, to

try to limit the rise in global average temperature to no more than 2 degrees Celsius above preindustrial levels, with efforts to keep it to 1.5 degrees.



2 degrees (much less 1.5) requires rapid reductions in GHGs. | Oil Change International

But there's nothing magic about 2 degrees. It doesn't mark a line between not-screwed and screwed.

In a sense, we're already screwed, at least to some extent. The climate is already changing and it's already taking a **measurable toll**. Lots more change is "baked in" by recent and current emissions. One way or another, when it comes to the effects of climate change, we're in for worse.

But we have some choice in how screwed we are, and that choice will remain open to us no matter how hot it gets. Even if temperature rise exceeds 2 degrees, the basic structure of the challenge will remain the same. It will still be warming. It will still get worse for humanity the more it warms. Two degrees will be bad, but three would be

worse, four worse than that, and five worse still.

Indeed, if we cross 2 degrees, the need for sustainability becomes more urgent, not less. At that point, we will be flirting with non-trivial tail risks of species-threatening — or at least civilization-threatening — effects.

In sum: humanity faces the urgent imperative to reduce greenhouse gas emissions, then eliminate them, and then go “net carbon negative,” i.e., absorb and sequester more carbon from the atmosphere than it emits. It will face that imperative for several generations to come, no matter what the temperature is.

Yes, it’s going to get worse, but nobody gets to give up hope or stop fighting. Sorry.

Rather than just rejecting the question, though, let’s give it a little more specificity, so we can discuss some real answers. Let’s ask: What are the reasonable odds that the current international regime, the one that will likely be in charge for the next dozen crucial years, will reduce global carbon emissions enough to hit the 2 degree target?

Remember, the answer to that question will not tell us whether there is hope, or whether we’re screwed. But it will tell us a great deal about what we’re capable of, whether we can restrain and channel our collective development in a sustainable direction.

With all that said, let’s get to the papers.

The case for pessimism on the 2 degrees target

The argument for why we’re unlikely to hit the 2 degree target is not difficult to construct. As the **latest IPCC report** shows, for any hope of hitting 2 degrees, global emissions must peak and begin rapidly falling within the next dozen years. And they must continue rapidly falling until humanity goes net carbon negative sometime around mid-century or shortly thereafter. That means developed countries must go negative earlier, to allow for a slower and more difficult shift in developing countries.

Accomplishing that would require immediate, bold, sustained, coordinated action. And, well … look around. Look at how things are going. Look at who is running things. Look at the established economic regimes of the last half-century.

As Enno Schröder and Servaas Storm of Delft University write in their blunt and unsettling recent paper, “the required degree and speed with which we have to decarbonize our economies and improve energy efficiency are quite difficult to imagine within the context of our present socioeconomic system.”

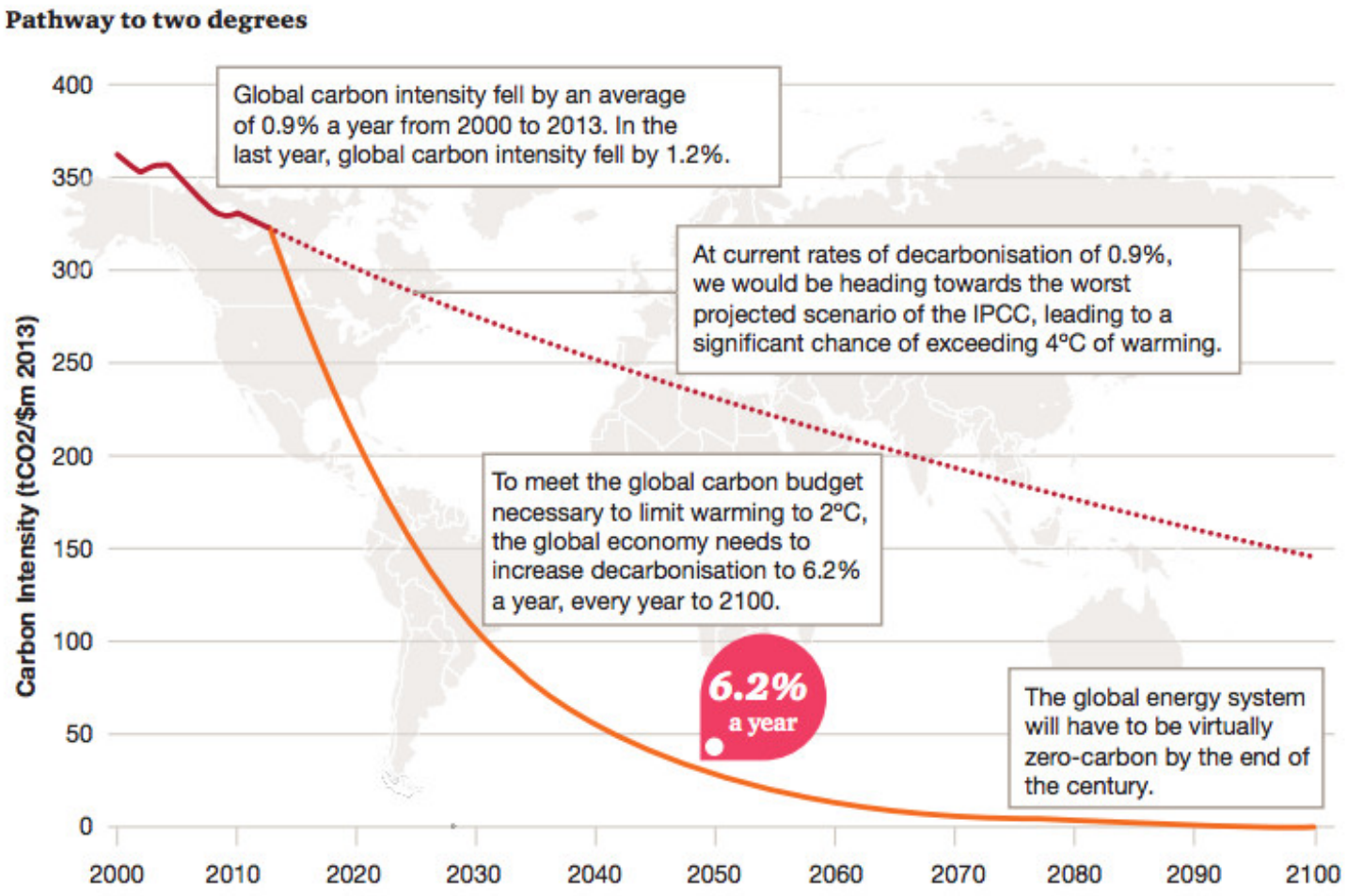
The paper is called “**The Road to ‘Hothouse Earth’ is Paved with Good Intentions**” and it is an unsparing reality check. Understanding the argument requires a brief bit of background.

The dominant climate-economic models used to generate scenarios showing how to hit the 2 degree target produce a few key common outcomes. One is that they require an extraordinary amount of energy efficiency. The bulk of the reduction in demand for fossil fuels through 2040 or so, in most successful 2 degree scenarios, is accomplished by reduction in overall energy demand. It is only around 2040 that displacement of fossil fuel energy by zero-carbon energy takes over as the dominant driver of fossil fuel reductions.

How can energy demand fall while economies grow? The great hope (and lately, great hype) is for “decoupling.”

For centuries now, the growth of economies has been tightly coupled with rising energy demand and rising greenhouse gas emissions — a one-to-one correlation, more or less. In recent years, however, several countries have seen their economies grow faster than their emissions. From this somewhat scant evidence, many analysts have concluded that modern economies are “decoupling” GDP and emissions and will eventually sever the connection completely. (Schröder and Storm run through numerous examples of this kind of optimism in their paper.)

The premise of many 2 degree scenarios is that global economies will continue growing but, thanks to the magic of decoupling, carbon intensity — the ratio of carbon emitted per unit of economic output — will rapidly fall and thus so will emissions.



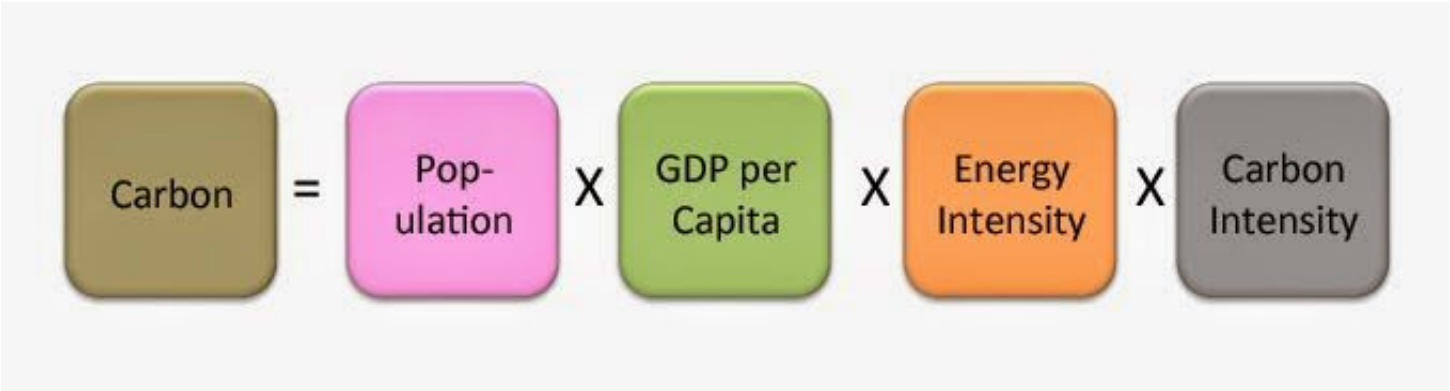
This graph from PriceWaterhouseCoopers shows how rapidly decarbonization must proceed to hit 2 degrees. | (PriceWaterhouseCoopers)

In fact, it's worth noting that the vast majority of scenarios used by climate policymakers take continued economic growth as an unquestioned premise. And they also accept that historical technology improvement rates will hold in the future. The question they basically answer: "How much can we reduce emissions while continuing to grow our economies at historical rates, with technology developing at historical rates?"

Schröder and Storm critique that question, and its answers. Their analysis has two parts.

The first looks at historical data from 1971-2015, trying to isolate the primary drivers of emission rates; it then uses the results to project how those drivers will evolve from 2015-2050.

The analysis uses the **Kaya identity**, an equation that is used to calculate how much greenhouse gas emissions an economy will produce. It looks like this:



Stochastic Trend

Greenhouse gas emissions are the result of how many people there are, how wealthy they are (gross domestic product, or GDP), how much energy they consume per unit of GDP, and how much greenhouse gas emissions they produce per unit of energy.

Schröder and Storm took those historical trends and projected them through 2050, using official numbers from the International Energy Agency (IEA) and the Organization for Economic Cooperation and Development (OECD). Long story short, they conclude that the level of action required to hit Paris targets "does compromise economic growth." The reality, they say, is that "'green' growth predicated on carbon decoupling is impossible if we rule out (as is done by the IEA and OECD) truly game-changing technological progress and revolutionary social change."

The second part analyzes the period 1995-2011 using a Carbon-Kuznets-Curve (CKC) framework. Briefly, the **Kuznets Curve** shows that countries tend to get dirtier and more polluted in their early development, but hit an inflection point at a certain level of wealth and start getting cleaner. (The empowered middle class demands more from government; the economy shifts from heavy industry to services.) The CKC just applies the same analysis to carbon emissions.

Schröder and Storm use a CKC analysis to look for evidence of decoupling from 1995 to 2011.

They specifically distinguish two different ways of classifying emissions: *territorial*, i.e., carbon emissions that take place within a country, and *consumption-based*, i.e., the carbon emissions represented by the production and transport of the (often imported) goods and services consumed by citizens of a country. (By way of example, consider a television that is manufactured in China and shipped to America. Which country is responsible for the emissions involved? Territorially, China. In consumption-based terms, America.)

In a nutshell, they found that “over this period there is some evidence of decoupling between economic growth and territorial emissions, but no evidence of decoupling for consumption-based emissions.” As economies get wealthier, they tend to offshore carbon-intensive industries, shift to more service-based economies, and clean up their energy sectors; emissions generated within their borders decline. They (at least partially) decouple their growth from territorial emissions.

But as they get wealthier, they consume more, and every bit they consume represents carbon emissions generated somewhere else. A country with a growing, developed economy may produce fewer emissions directly, but is still responsible for more greenhouse gases with every bit it grows. Again, consumption-based emissions are not decoupling from growth.

This is all a bit technical, so let’s pull the lens back a bit, to Schröder and Storm’s larger

conclusion.

Basically, it is this: The world’s current economies are not capable of the emission reductions required to limit temperature rise to 2 degrees. If world leaders insist on maintaining historical rates of economic growth, and there are no step-change advances in technology, hitting that target requires a rate of reduction in carbon intensity for which there is simply no precedent. Despite all the recent hype about decoupling, there’s no historical evidence that current economies are decoupling at anything close to the rate required.

“The key insight,” they write, “is that marginal, incremental improvements in energy and carbon efficiency cannot do the job and that what is needed is a structural transformation.” In other words, 2 degrees requires radicalism.

“Without a concerted (global) policy shift to deep decarbonization, a rapid transition to renewable energy sources, structural change in production, consumption, and transportation, and a transformation of finance,” they write, “the decoupling will not even come close to what is needed.”

The Schröder and Storm paper is part of a **debate forum** hosted by the Institute for New Economic Thinking. That forum also includes a **paper** by Gregor Semieniuk, Lance Taylor, and Armon Rezai that reaches similar conclusions. Using macroeconomic modeling, they show that the necessary reductions in energy demand are unprecedented and implausible.

An alternate strategy focused on supply rather than demand — where fossil fuel energy is displaced by low-carbon energy fast enough to do the job, even if energy intensity remains the same — is “possible macroeconomically,” but it would “require considerable modifications of countries’ macroeconomic arrangements,” which is a polite academic way of saying “it would require radicalism.”

Put simply, if we are determined to maintain the economic status quo, we cannot

possibly mitigate climate change, so we must turn to adapting to it. And if we opt for adaptation, they write, “we have to come to terms with the impossibility of material, social, and political progress as a universal promise: life is going to be worse for most people in the 21st century in all these dimensions. The political consequences of this are hard to predict.”

The choice is radicalism today or disaster tomorrow, and from all signs, humanity is choosing the latter.

Some folks pushing the “radicalism today” option. | Sunrise

The case for optimism on 2 degrees

The forum also includes a response from economist Michael Grubb, a professor at University College London and editor-in-chief of the journal ***Climate Policy***. He makes the case for what he calls “**conditional optimism**” on 2 degrees. He references economist Paul Romer’s well-known metaphor: Blind optimism is a child expecting his parents to build him a treehouse; conditional optimism is a child confident he can build a treehouse if given the tools.

Grubb accepts that politicians are unlikely to question economic growth any time soon. He also accepts, for the purposes of his analysis, that population and GDP growth (two of the four Kaya elements) are “predetermined as projected.” Within those constraints, he focuses mainly on the carbon intensity of energy supply, and there he finds reasons for optimism.

He hails both the other papers for doing what he calls “historical futures” analysis — projections of future trends that take into account real-world history and inertia — which he says is an improvement on the sort of dreamy, unanchored, blue-sky modeling that used to dominate the field.

However, he writes, “the conclusions we draw from historical data depend entirely upon what kind of process we think we are trying to measure.” The core of his analysis is that the other papers are using “the wrong mental model” — measuring the wrong process — and by doing so “they bring to the table the wrong form of maths and thereby an apparently mathematically objective pessimism.”

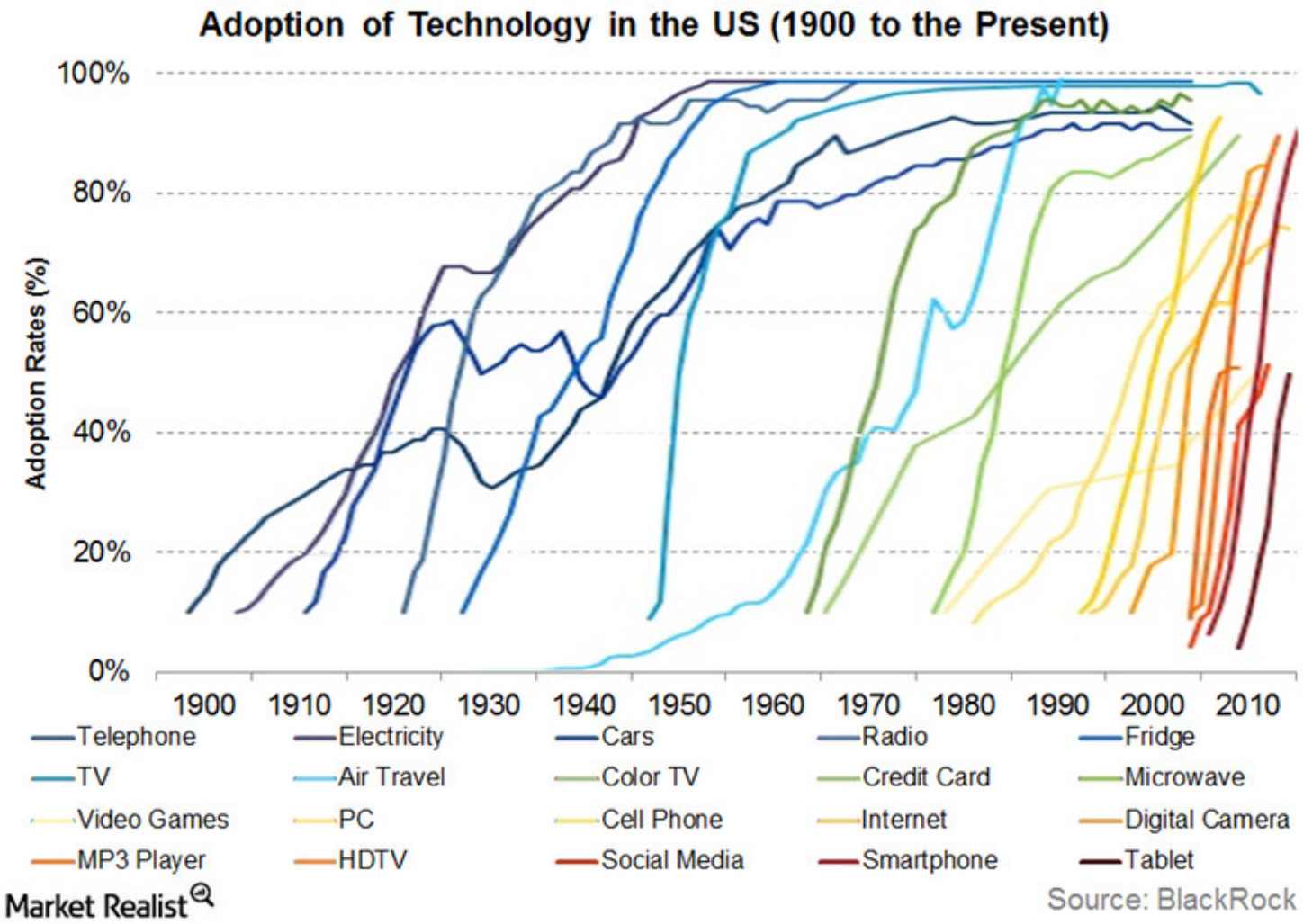
In economist-speak, the other papers are looking at “economic factor substitution driven by externality costs with relatively constant technologies,” i.e., the incremental substitution of one set of products for another, driven primarily by rising prices.

What they ought to be looking at, he says, is “logistic substitution,” which is “a dynamic substitution process driven by innovation and scale economies displacing incumbent industries.”

Unlike substitution between factors of production, logistic technology substitution is “intrinsically dynamic and largely irreversible,” driven mainly by “endogenous cost reductions and market growth of new technological systems as they displace older, incumbent industries.”

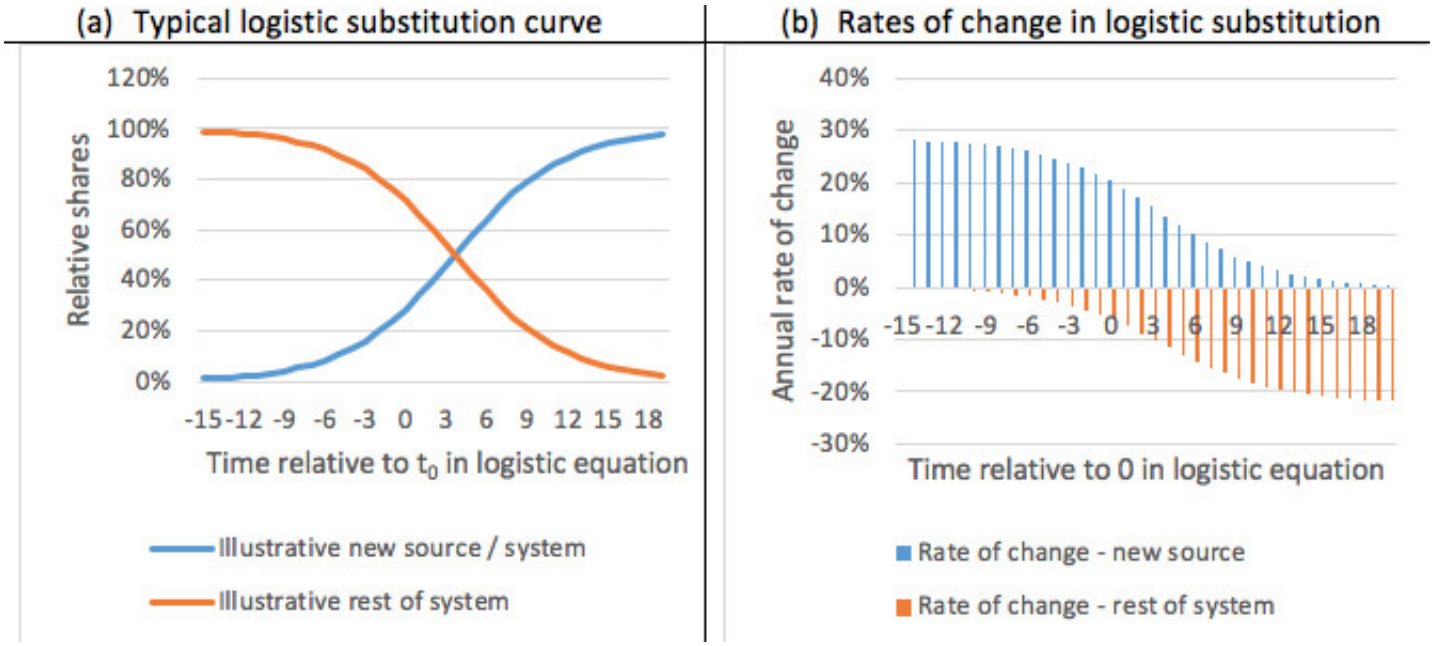
Despite the wonky terminology, logistic substitution is quite familiar to most modern-day consumers. It is represented by the famous “S curve” of technological development, whereby a technology cruises along at a low level of market penetration, reducing prices and scaling up production, and then hits some sort of magical price/value threshold after which adoption skyrockets. The tech then expands rapidly until it dominates almost the entire market, and then levels off.

Here are some examples from the last century (note that the process seems to be accelerating):



(Blackrock)

Here are the graphs Grubb uses to illustrate a “logistic penetration curve.”



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This is just an idealized example; the thing to note about it is that the rate of change for the incumbent industry can start quite slowly before accelerating quickly. Eventually, “the percentage growth rate of the new entrant declines,” Grubb writes, “but only once its share has become significant.”

If decarbonization of energy supply followed something like the logistics substitution curve above, it would take 12 years for the rate of decline in fossil fuel supply to reach even 5 percent annually. That is considered aggressive in today’s modeling. However, Grubb writes, “by the end of the 35 year time period, the incumbent industry is driven out by the newcomer, declining at rates exceeding 20 percent a year in the latter stages.”

If the decline in fossil fuel supply were linear and steady, averaged out over those 35 years, it would have to be 10 percent a year. At least at the outset, that seems almost impossible. And that’s roughly where we are with climate change: facing changes that, if averaged out over the next three or four decades, require a pace of change that seems impossible based on historical trends.

However, Grubb writes, those seemingly impossible rates of change are “entirely feasible and easily observed in the latter stages of sunset industries.” In logistic substitution, rates of change accelerate quickly; what looked impossible eventually becomes a fait accompli.

“The future indeed needs to be different from the past,” he writes, but “past data does not say it cannot be so, indeed it already holds the evidence to suggest that it will be. “

As he says, “there are examples” of energy supply changing in something like a logistic way. He cites his own home country, the UK, where coal generation has gone from 80 percent of electricity to less than 10 percent in 25 years. Then there’s the global rise of solar photovoltaic (PV) panels. “Ever since Germany launched its Energiewende in 2001,” he writes, “solar PV has seen sustained market growth at 30 to 40 percent a year, and costs have fallen *by a factor of 10 in less than a decade*.”

Similarly, electric vehicles (EVs) show every sign of being **poised at the bottom of their own S curve**. They were an obscure, expensive product just a few years ago; today, companies like Volkswagen are pledging to go all-electric.

There is no guarantee that these trends will continue, or that they will spread to other sectors of the economy as quickly as they need to, but they do show that large, rapid changes in energy technology can grow out of modest beginnings. “The world of the future grows from the niche markets of the present,” Grubb writes. Such changes are not impossible; they are familiar.

“Optimism would be rooted in the potential for new industrial processes and niche examples to be so attractive as to rapidly grow and spread,” he writes. “Pessimism is rooted in the evidence to date that policy—renewable incentives aside—is more timid and more resistant to change than technology itself. But in neither case, I would argue, do the statistics of past aggregate trends really indicate the constraints on what is possible.”

In other words, our future is not yet fated. There is room for conditional optimism.

Opti-pessimistic hopeful realism, or something

As I said at the outset, when it comes to climate change, there is no such thing as “game over” or “too late” or “screwed” or “no hope.” It is certainly not the case that, as the latest slogan has it, “we only have 12 years to act.” That is nonsense, even if, in some cases, it’s motivational nonsense.

The fight to decarbonize and eventually go carbon negative will last beyond the lifetime of anyone reading this post. That is true no matter how high the temperature rises. The stakes will always be enormous; time will always be short; there will never be an excuse to stop fighting.

That said, if there is reason to hope that we can limit warming to non-catastrophic levels, that we can hit the target we’ve set for ourselves, it lies in the possibility of non-linear change — change that begins slowly and then radically accelerates. It lies in the possibility that we are on the lower slope of not just one but several S curves, that change will fuel more change and the lines will soon start rapidly rising.

To some degree it is true, as Schröder and Storm write in a **reply to Grubb**, that his conditional optimism represents “a triumph of hope over experience.” By definition, unprecedented carbon reductions are unprecedented. There is no easy assurance to be found in history that they are possible.

And I’m with Schröder and Storm that, contra Grubb, market developments will never be enough. “Radical change within a limited time span is what we need,” they write, “and this needs collective action and a strong directional thrust which ‘markets’ or ‘private agents’ alone are unable to provide.”

But rapid change is not just possible in technology. It is also possible in politics. In both domains, there are “tipping points” after which change accelerates, rendering the once implausible inevitable.

We are rarely able to predict those tipping points. Relying on them can seem like hoping for miracles. But our history is replete with miraculously rapid changes. They have happened; they can happen again. And the more we envision them, and work toward them, the more likely they become.

What other choice is there?