SOLVING THE CARBON PROBLEM TOGETHER

ROGER SANT
Before we get into the story, I'd like to say thank you. If you are reading this, you likely already know we’re facing a problem—a carbon pollution crisis—and I’m grateful for the time you’ve invested so far. I’m grateful because we’re in this problem together. And working together is the only way we are going to solve it.

We can solve it, though. In my 40 years in the energy industry, I’ve seen us tackle and solve some big problems, and while the carbon pollution problem is not very different—we can’t solve it without engaged, informed people like you.

In this document, I’d like to discuss a few different topics:

1. Over the last 40 years, the U.S. has an impressive record of cleaning our air and taming our energy crisis
2. How these successes inform our approach to the carbon pollution crisis
3. The recipes we tend to use to solve large, complex problems

These are pretty big subjects, so I’d like to start by talking about something that’s a little closer to the ground—the white rhino.
THE RHINO CRISIS

The rhinoceros is the second largest land mammal in the world, second only to the elephant. And the big challenge in protecting rhinos is their horn. You probably already know that rhino horns are both extremely valuable and severely illegal to buy or sell. But let me give you a little more context: a rhino horn is actually worth more than its weight in gold.

So, if you imagine all of these rhinos running around Africa with gold bullion attached to their heads, you start to see the problem a little clearer. How do you stop people from taking something so valuable?

Since the 1970s, we’ve* been trying to prevent the sale, trade, or purchase of rhino horns around the world, with varying degrees of success.

*And when I say “we,” I’m referring to the world as a whole, not just one country or organization. When we talk about an entire species, a threat to its existence affects all of us equally.
There are two species of white rhino: northern and southern. And by the 1950s, poaching and overhunting put both populations at risk of extinction. Each region approached conservation differently, though—and got very different results.

With the northern white rhino, governments and organizations took a regulatory approach, commonly known as “ban and enforcement,” cracking down as heavily as they could on poaching and horn trade. Sadly, it didn’t work very well—partly because of bad government, partly because of regional wars—and the northern white rhino population continued to decline. Today, there are only three of these animals left on Earth, all living in captivity in a preserve in Kenya, under 24-hour armed guard. And the only bull rhino left is too old to reproduce.

However, we tried something different with the southern white rhino. Rather than rely only on poaching bans, governments introduced incentives that made a live rhino worth more than a dead one. And gave people reasons to keep them alive. They made limited trophy hunts legal again, transforming the rhino into a valuable tourist attraction. They changed ownership laws to allow private animal reserves to own rhinos and participate in sales and auctions. This introduced competition to the black market where poachers were making most of their money. These incentives made conservation valuable, giving ranchers a reason to breed rhinos. Today, there are more than 20,000 southern white rhinos, making it the most numerous rhino on earth.

*Sadly, poaching of this species is increasing, so this success is not something we can take for granted.*
# WHITE RHINO CONSERVATION

The difference between these two outcomes is astonishing. Both populations were protected by poaching bans, but one important difference saved the southern white rhino population—market incentives.

This difference will be important to our story later.

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<tr>
<th>APPROACH</th>
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<tr>
<td>Northern White Rhino</td>
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<td>Over 20,000 and growing</td>
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**Approach**
- Regulation
- Voluntary action

**Result**
- Market incentives
THE 1973 U.S. ENERGY CRISIS

Back home, we’ve faced our own challenges. In 1973, the country faced a pretty frightening energy crisis. That year, Arab members of OPEC cut off oil exports to the U.S. and several of our allies. Some of you might remember the long gas lines and spikes in prices. People were scared. They thought we risked economic and geopolitical disaster if we couldn’t get things under control.

President Nixon started a number of initiatives aimed at bringing back our energy independence, one of which was to create the Federal Energy Administration to, among other things, spearhead conservation. And, to avoid any appearance of a conflict with the oil companies, Nixon appointed me, a Stanford professor with virtually no experience in energy, to head up the Office of Energy Conservation and Environment.

When I say “no experience,” I mean I wasn’t sure I knew the difference between a BTU and a kilowatt hour. But I wasn’t alone. As an agency, we were plowing completely new ground. And, over the coming years, some of our solutions totally failed, some helped a little, and some of them wildly succeeded. Let’s look at just three of them.
SOLUTION 1: Lowering the Speed Limit

Solution:

One of the first solutions we tried was lowering the speed limit from 70 to 55 mph, hoping to save 28% on our gasoline bills. We accompanied it with a “Tips for the Motorist” booklet, which included 30 ways to make gas go farther. We made bumper stickers that said “DON’T BE FUELISH!”

Result:

It had little effect. People didn’t slow down much, and the ones who did weren’t very happy about it. It was not a wild success.
SOLUTION 2: Energy Efficiency Labeling

Solution:

We thought the best way to get people to conserve energy voluntarily was to give them information to make more energy efficient choices. So we started requiring energy efficiency labeling for most home appliances, like washers and refrigerators.

Result:

Immediately, people started buying more efficient appliances. The program was so successful, in fact, that it’s still in effect today, 40 years later.
**SOLUTION 3: Fuel Efficiency**

**Solution:**
We decided to try to reduce oil consumption by making cars more efficient. Unable to pass a gasoline tax, we got Congress to legislate fuel economy standards. We knew we could do better, even if American car makers didn’t.

**Result:**
This initiative succeeded in doubling fuel efficiency in only about 10 years. But, once we reached that level, we didn't improve standards for more than 20 years. That is, until 2008, when we got our nerve back again and began increasing standards, with a goal of doubling mileage standards by 2025.
Today’s most urgent energy crisis is dealing with carbon pollution. Like the energy crisis in the 1970s, and the Southern White Rhino, effectively addressing carbon pollution will require a combination of voluntary actions (e.g. labeling), regulation (CAFE Standards), and Market Incentives (rhino auctions).

This topic has become politicized in recent years, but I don’t think it needs to be. I’d like to focus on just a few aspects of the problem. First, there are many things we don’t know about carbon pollution, but we can all agree on one thing: more carbon in the atmosphere is not good.
THE CARBON THRESHOLD

History of Atmospheric Carbon Dioxide

In 10 years we’re expected to be somewhere around 425 parts per million. Now, experts say we need to hold CO₂ emissions at or below 450 ppm in order to keep warming to only 2 degrees Celsius. Beyond that number, we don’t really know what will happen. But even a 2 degree increase could have profound impacts on the planet.

For 400,000 years, CO₂ concentrations in the atmosphere ranged between 200 and 300 parts per million (ppm).

200,000 years ago, Humans arrived. Since then, we’ve experienced a variety of climates, including ice ages and warming periods.

Since the Industrial Revolution, with the increase in fossil fuel consumption, the line has gone straight up.

We just recently passed 400 ppm- that’s one third more CO₂ in the atmosphere than mankind has ever experienced.

Source: Petit (-400,000 to 0), Etheridge (1000 to 1970), NOAA (1970 to present)
RESPONDING TO DOUBTS AND FEARS

So, we think that 450 parts per million is the ceiling—the number we don’t want to hit. We also know that the cost of doing nothing, just adapting to a hotter and more volatile climate, is likely to be several times more expensive than the cost of reducing emissions since once the CO2 is in the atmosphere, it is there for hundreds if not thousands of years.

Right now we’re not doing nearly enough to solve the carbon problem. Why? Part of the answer is that our doubts and fears can be paralyzing.

But, we’ve felt similar fears before. In 1973, the energy crisis was called a “crisis” because of how frightened we felt. But what we did then was to act in response to those doubts, which sound a lot like the ones we have today.

I think the outcomes of those actions should give us the confidence to act in response to this new set of fears. So I’d like to look at what we thought then, what we did, and what happened.
A FEAR OF SCARCITY

In 1973, we thought that energy was scarce, that our reserves would run out.

Did it turn out that way? No. Even today, fossil fuels remain abundant. We thought then that we had 30 years of global oil reserves, based on then current consumption. Today, we have over 50 years of reserves, despite the growing global demand for oil. The same has been true with natural gas. We have more years of natural gas reserves now than we did during the energy crisis.

Because of how we responded — our fears of scarcity never came true.
Another fear that drove us during the energy crisis was that energy costs would only get worse. Was it true?

Well, it surprised me (and it may surprise you) to learn that energy prices have been relatively stable since the 1970s. Prices did rise fairly quickly after the embargo. But that rise in prices gave producers an incentive to increase reserves and consumers the incentive to conserve.

And since then, retail energy prices have remained fairly stable in constant dollars. Though there has been volatility in prices over short periods of time, over 40 years, the record shows that actual energy prices have been much lower than we feared they would be.

In fact, one of the most amazing things about this chart is that electricity prices are actually lower in real terms today than they were in 1973.

Source: Energy Information Administration, Bureau of Economic Advisors
CONSERVATION SLOWS GROWTH

I’ll share one more common fear that I noticed in the seventies. It was a belief that energy conservation and economic growth were at odds with each other, which is simply not true. In fact, energy conservation has turned out to be immensely successful.

Today, we’re using almost half the BTUs per unit of economic output as we were using in 1973. And, as you can see on the right side of the chart, economic growth has continued.*

*Some of this is because of globalization, but a lot of it is related to the economic truth that reducing waste—which is another way of expressing energy efficiency—is good business, not just good policy.
FEAR CAN BE A CATALYST FOR SOLUTIONS

The fears and doubts we had about energy back in the 1970s could have stopped us. But we didn’t let them. And the truth is that our doubts and fears led us to try things, most of which have worked very well. And because of this, few of our fears were realized.

In fact, over the last 40 years, we have been very successful in building energy reserves, improving energy efficiency, and maintaining fairly stable prices. We would not have achieved this had we not been willing to act in spite of our fears. I bring these up because I think we’re looking at very similar doubts and fears around climate change today.

- We can’t afford to fix this problem
- We’re not capable of fixing this problem
- It’s not our fault, so it’s not our problem

We were wrong about our beliefs during the energy crisis. Are we wrong about these same doubts today?

We need to decide how much longer we want to act (or not act) based on those beliefs. For some time now we have been stuck—not really acting at all. Happily, that is starting to change as consequences of not acting are becoming apparent.
MANY CITIES MUST INCREASE THEIR RESILIENCE

Tidal Flooding

You’ve seen stories of how rising temperatures are causing ice sheets to melt and glaciers to recede, leading to a rise in sea levels. Additionally, sea levels are rising because water expands as it gets warmer. If these trends continue, we’ll eventually see the loss of communities to the sea. But even today, the effects of rising sea levels are making themselves felt in the form of more frequent, and costly, tidal flooding.

Days with Flood Events

Boston

Norfolk

Charleston

Tidal flooding isn’t the dramatic flooding that comes with severe storms, like we experienced with Hurricane Sandy. Rather it is just the regular fluctuation of high tides over the course of a year. Except now, those high tides are reaching farther inland, destroying critical infrastructure, even temporarily isolating communities.

Since so many people live near coasts, in fact nearly a third of all Americans live in coastal counties, building coastal resilience in the form of upgraded infrastructure is becoming imperative. We’ll also have to reconsider the land use practices that have led so many of us to live near the sea in the first place.

More worrying, though, is that the dramatic rise in coastal flooding we have witnessed has occurred over a fifty year period when sea level rise has been measured at only a few inches. Imagine what will happen if we were to stay on our current path, when sea level rise will be measured in feet. Rather than a nuisance, extensive coastal flooding will be the norm and certain coastal areas will become uninhabitable.

Source: Union of Concerned Scientists (2015)
Some Communities Must Adapt

Northwest Alaska

Alaska has warmed twice as fast as the world average over the past half century and the effects for coastal communities there are devastating. The drastic loss of sea ice has left the mainland vulnerable to massive erosion and melting permafrost has led to the literal collapse of critical infrastructure. As a result those communities must seek to migrate elsewhere, ultimately abandoning homes and businesses to the encroaching sea.

In the last 50 years, Alaska has experienced a rate of warming that is about twice as fast as the global average and winter temperatures have risen by 3.5 degrees Celsius. As a result, sea ice coverage is nearly 50% lower today than it was in the period of 1979-2000. This loss of sea ice not only has effects on marine mammals (like polar bears), it removes a critical buffer for the land from the effects of powerful storms that roar ashore from the Chukchi and Bering Seas, causing significant erosion. In combination with melting permafrost that destabilizes or destroys critical infrastructure across the Arctic, several coastal towns in Alaska, comprised of mostly native-American populations, are active in efforts to relocate themselves entirely.

And what is true for communities in Alaska is true for communities all over the globe in places like Mozambique and Vietnam and Uganda. As global temperatures continue to rise, more and more such displacements will come too.

Source: Robin Bronin, Climate-Induced Displacement of Alaska Native Communities, Brookings 2013

Photo Credit: Shishmaref Alaska Erosion & Relocation Coalition, supplied by the National Snow and Ice Data Center, University of Colorado, Boulder
So, how do I maintain my optimism in the face of all these terrible examples? Why do I think we can move from fear to the confidence to act?

I think, as humans, we have a natural inclination to solve problems. I was born during the Depression. As a young man, I saw how we rallied as a nation during World War II. And in my early professional life, I saw how we responded to the Energy Crisis. These were all unprecedented crises, but we met each challenge successfully. I can see now, more than ever, how much we’re capable of achieving together.

Ultimately, I think problem solving is part of our DNA.

Given the right conditions, we come up with unbelievably innovative solutions to large and complex problems. And I believe that problem solving is not only innate, but meeting those challenges is exciting. It’s fun. We thrive on getting in the midst of something difficult and figuring it out. I believe that drive is what’s going to save us.

I’d like to share a couple more recent examples of our problem solving—one small, and one big.
MAKING THE RIGHT CHOICES

Thames River coal plant in Connecticut

When I started an energy company—the AES Corporation—we were looking for the cheapest ways to make electricity. At the time, that was to burn coal. One of our first projects was a power plant in Connecticut on the Thames River. In 1988, it was destined to be one of the cleanest coal plants in the world, though it would still emit plenty of carbon dioxide.

Back then, I was also increasingly convinced that climate change was going to be an important issue and, though we were a tiny company, I felt we had a responsibility to make good choices for the environment. So I asked my colleagues if we should reconsider being in the business of developing and operating coal plants. Should we do something else? Was there a way to supply power to people who needed it and meet our obligations to society?

52 Million trees in Guatemala

We went around the room sharing ideas and one woman named Sheryl Sturges said, “Well, trees sequester carbon. We could plant enough trees to offset all the carbon emissions of this plant.” I thought this was a novel idea and asked, “How many trees, Sheryl?” She did some research with the World Resources Institute, came back to me, and said “52 million trees. Oh, and it would cost two million dollars.”

Two million dollars was all of our earnings that year.
A SOLUTION WITH ROOTS

But you know what? We did it. We committed two million dollars that year to planting 52 million trees through a CARE program in Guatemala. We were a private company at the time, so we didn’t have as many challenges as a public company would—but it was still not an easy decision.

And we got some attention for it—not all of it good. We were lampooned in The New Yorker. (But, still, we were in The New Yorker.)

Today, the plant has completed its planned operating life, but the trees are still working hard, sequestering carbon. I like to think our Thames facility was the first carbon neutral coal plant in the world.

It was all voluntary, and obviously it didn’t catch on.

“It’s great! You just tell him how much pollution your company is responsible for and he tells you how many trees you have to plant to atone for it.”
THE CLEAN AIR ACT SUCCESS STORY

52 million trees was the small, but voluntary example. Let me tell you about the big one.

Remember all our doubts and fears about solving the air pollution problem in the 70s? The Clean Air Act of 1970 was our principal solution. Both Democrats and Republicans agreed it was important to clean up our air, so it passed with nearly 90% approval in Congress and leadership from a Republican president. (That used to be how Congress worked!)

The Clean Air Act was designed with both regulatory and, later, market-based tools to help us improve air quality. And it was passed, by the way, not just so we could see better, but to protect ourselves and our children from the very real human health effects of pollution.

So how did it work out?

Well, we began with regulating the emissions of the first four pollutants on these charts: particulate matter (PM10), sulfur dioxide (SO2), carbon monoxide (CO), and volatile organic compounds (VOC). The final two, nitrogen oxide (NOx) and smaller particulate matter (PM2.5), came later.

By 1990, we’d started to make real progress. Another Republican administration, led by George H.W. Bush, pushed through tighter emissions legislation and (importantly) introduced additional market incentives. Instead of only setting strict limits, the new laws gave polluters the opportunity to buy and sell allowances. And, since it was often cheaper to buy allowances than to install pollution controls, many polluters opted in.*

*The allowances market also acted as a backup to pollution control systems, greatly reducing the cost of compliance.*
THE CLEAN AIR ACT SUCCESS STORY

The results by 2012 are astounding. All six pollutants are down between 60-80% while we’ve experienced 3.5x growth in the economy. Pollution is going down while the economy is going up. A combination of effective regulation and proper market incentives produced an amazing result.

Let’s think about this success for a moment. Passing this law was something we did as a nation, beyond partisanship, beyond vested interests. We passed this law to give our children cleaner air to breathe. And we succeeded beyond what anyone even thought was possible in the beginning. We should celebrate these results as an American triumph.
THE MISSING POLLUTANT

Our work is far from finished, though. While the Clean Air Act has been a resounding success, you might have noticed that one important pollutant is absent from our charts: carbon dioxide.

In 2007, the Supreme Court finally gave the EPA the right to call CO2 a pollutant and the responsibility to regulate it. So carbon dioxide is now covered as a pollutant under the Clean Air Act.

But atmospheric CO2 levels are troubling, as we’ve seen. In fact, you’ll notice that the CO2 level on this chart starts at 1.20. That’s because all the other charts started at their 1970 levels, and in 2013, the US emitted 20% more CO2 than it did in 1970. While the other pollutants were going down, CO2 was still climbing. And lowering that number may be our toughest challenge yet.
PROGRESS ON THE CARBON CHALLENGE

Since the Supreme Court’s ruling on carbon dioxide, some exciting initiatives have been launched all over the country, and momentum is starting to build. It’s exciting to see the different approaches already happening as we start to take up this challenge. Let’s take a look at some of the major initiatives.

EPA’s Carbon Reduction Plan:
Released by the EPA, it proposes emissions rules for existing power plants, specifically a 30% reduction of CO\textsubscript{2} from 2005 levels by the year 2030. This is encouraging, even for people (like myself) in the power business, who need a regulatory framework to replace uncertainty. The EPA approach creates important flexibility for the power industry and allows states or regions to create their own solutions and work together. For instance, if Ohio, Indiana, and Kentucky want to come together as one region, they can. The EPA’s plan is an important demonstration of U.S. leadership.

Other Carbon Initiatives:

Fuel Economy
Standards are set to double motor vehicle mileage to 55 MPG by 2025. This will result in a huge reduction in carbon emissions from the highway fleet.

The C40
Former New York City Mayor Michael Bloomberg founded this group of mayors from across the globe who have made an extraordinary commitment to reduce carbon emissions in their cities. They call their plan “80-50” and pledge to reduce 1990 level carbon emissions by 80% by 2050.

Renewable Portfolio Standards
New standards are in place in many states requiring significant additions of renewable energy such as solar and wind into electricity generation portfolios.

Cap and Trade Programs
California has implemented its own cap and trade program that is starting to see results, and the Northeast states have launched a similar program called the Regional Greenhouse Gas Initiative (RGGI).

Paris Agreement
185 countries made commitments in December 2015 to lower carbon emissions.
THE PROBLEM SOLVING INSTINCT

Lowering CO₂ pollution is an extremely large and complex problem for us to solve. But experience has taught me that humans have a deep instinct for problem-solving; it’s built into our DNA. We’ve repeatedly banded together to solve large, complex problems. And while there’s no formula or prescription for this kind of problem-solving, I have noticed some common attitudes and behaviors that are critical elements of success.

1 Stick Together

We all agreed in 1970 that we had to clean up our air. So we found ways to compromise and act while never losing sight of our goal. The result was an astonishing success.

2 Try Multiple Solutions

During the energy crisis, my colleagues and I had no idea what solutions would work... so we tried everything—from bumper stickers to speed limits—which ultimately led to some very successful outcomes.

3 Fail Often

Similarly, we were willing to fail in our pursuits. Without being willing to fail and still keep trying, you won’t have the courage to try new and innovative ideas.

4 Never Give Up

Perhaps most importantly in each of these pursuits, we persevered. Whether it was rhinos or rockets, we faced the problem—and stuck with it—for the long haul.

An explosion aboard Apollo 13 created a life-or-death problem for the three astronauts aboard. But it also created a large, complex problem for the support people on the ground. By sticking together, trying multiple solutions, being willing to fail, and not giving up, they brought all three astronauts safely home.
THREE ESSENTIAL ELEMENTS

In addition to the right behaviors and attitudes, we need to create the right overall environment for problem-solving. Whether it is rhinos, clean air, or the energy crisis, the most successful approaches contain all three of these elements.

Government Regulation

Clearly, some problems require the types of rules and boundaries that only governments can provide.

The success of both the Clean Air Act and CAFE standards have shown that governmental regulation can be an important and influential part of solving these complex problems.

Individual Actions

Government, however, will never be able to solve these problems alone. Innovative solutions and widespread participation will only come from the voluntary actions of individuals and companies as seen with appliance labeling.

Market Incentives

Yet regulation and volunteerism alone won’t get us where we need to go.

If government regulation is the stick, then we need a carrot to spur voluntary responses. Market-based economic incentives align the best interests of people and companies and help them optimize their activities within a set of rules.

The Clean Air Act, as we’ve seen, put a price on SO2 pollution, enabling power plants to find the most efficient way to meet tough new standards. OPEC gave energy developers a price incentive to find more reserves.

In fact market incentives have been a necessary piece in solving most complicated problems.
EVIDENCE THAT ECONOMIC INCENTIVES WORK

We’ve examined two different approaches to the Rhino poaching problem, and we’ve seen how market incentives changed the game.

In my forty years of energy/environment experience, I’m convinced that market incentives played an essential role in our successes—regulations and voluntary actions weren’t enough. Economic and market incentives motivated people and companies to innovate and make better choices.

Unfortunately, when it comes to the climate crisis, we’re only using regulation and voluntary action—and it’s not enough. We’re taking the same approach that failed to save the northern white rhino.

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WE CANNOT SOLVE THIS PROBLEM WITHOUT A PRICE ON CARBON

That’s the market incentive we’ve been missing with climate change. I was a government bureaucrat for part of my career and a power plant developer for the rest of it, and I can tell you that every action the power industry takes was, is, and always will be based on a combination of regulations and voluntary choices spurred on by markets.

To solve this problem, we need regulatory confidence and a market in which energy companies can compete. Market prices motivate commercial activity and organize resources behind a profit motive in extraordinarily effective ways.

By introducing a carbon tax, we’ll be taking away the free right to pollute and activating the force of markets to help create clean alternatives. And it doesn’t need to increase our tax burden since the revenues could be used to reduce other taxes or be refunded.

We have to make it attractive for people and companies to invent new ways of doing things. We have to activate that problem-solving DNA and put it to work for us. And we can’t do that without a market incentive—in this case a price on carbon.

The bottom line is this:

I don’t think we can solve this problem without a price on carbon—a carbon tax.
A WINNING FORMULA

I’ve been called an energy optimist. And that’s true! In fact, I’m kind of an all-around optimist. I grew up believing in people and in their innate goodness.

And I’ve always believed that with our drive to innovate, we posses the power to change—even to save the world.

When we combine good people with the right rules and market incentives, we are capable of amazing solutions.
SAVING THE CAPSULE

The recovery of the Apollo 13 astronauts is symbolic of many great things that happened in 1970.

1970 was the same year we passed the Clean Air Act.
It was the first year we celebrated Earth Day.
We saved that capsule in order to save the three astronauts.
Today we need to save our planet in order to make it safe for us to live on it. While the planet’s breathtaking places, plants, and animals deserve our care, much of our imperative is to preserve the environment that allows human beings to thrive.
Climate change isn’t just an environmental problem; it is a human problem.
I have observed that each generation is presented with a challenge to solve. There will always be those whose doubt but progress belongs to those who are determined to find a solution.

I’ll say it again: we have the recipe to solve this problem — together.

Because we’re in this together. We share this earth. We need one another and so its time for us to act. And what we need to do is to create the right incentives.

• If we can rescue astronauts in space – as we did;
• if we can restore the southern white rhino – as we did;
• if we can solve the energy crisis – as we did;
• if we can clean up our air – as we did;

then surely we can solve the carbon problem – together.
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