

Biden sets out to supercharge industrial decarbonization

A conversation with Rebecca Dell of ClimateWorks and Evan Gillespie of Industrious Labs.

March 27, 2024



David Roberts

Hello, everyone. This is Volts for March 27, 2024, "Biden sets out to supercharge industrial decarbonization." I'm your host, David Roberts. On Monday, the Biden administration announced over \$6 billion in grants to industrial decarbonization projects in sectors ranging from cement to glass, metals, and chemicals. The money will go to early stage or first of a kind projects in these so called "difficult to decarbonize" industries and is expected to leverage a further \$14 billion in private capital. Heavy industry produces almost a third of us emissions, and the pathway to net zero is far less clear than it is for transportation or electricity.

But \$20 billion is real money. This could help the US innovate and compete in the next generation of clean technologies, rather than allowing China to dominate them. To discuss some of these grants and their implications, I am talking with Rebecca Dell, who leads the industry program at the ClimateWorks foundation and was a previous and much beloved guest on Volts, and Evan Gillespie, the co founder of Industrious Labs, the only nonprofit devoted entirely to industrial decarbonization. We talked about some of the winners of the grants, the implications they might have for decarbonization in those sectors, and what's needed next in terms of policy.

All right then, with no further ado, Rebecca Dell and Evan Gillespie, welcome to Volts. Thank you so much for coming.

Evan Gillespie

Thank you.

Rebecca Dell

Thanks so much for having us.

David Roberts

I rarely do timely pods, but I think we can all agree this is a very big deal what happened today and is worth, worth a little breaking news type pod out of character for Volts. So, Rebecca, I want to start with you. Maybe just start with why industrial decarbonization is such a big and relatively to date neglected area and where this money is coming from. And just give us a little bit of the context here.

Rebecca Dell

Sure. I'd be happy to. To start with "why industrial decarbonization?" So the industrial sector globally, depending on how you count it, is responsible for somewhere between a quarter and a third of all greenhouse gas emissions, all gases, all sources, all countries, everything, if you just count what we call the direct emissions. So you can think of that kind of as greenhouse gases coming out of smokestacks at factories. That's about a quarter. If you add in the emissions from generating all the electricity that's used at industrial facilities.

David Roberts

Scope 2, they call it. Volts readers are well educated on the scopes now.

Rebecca Dell

Oh, yes. Well, then your charmingly nerdy audience will know. If you add in the scope 2 emissions, you go from a quarter up to comfortably more than a third, if we're talking scopes, basically everybody else's scope 3 emissions are these guys scope 1 and 2 emissions.

David Roberts

Right, right. Because these are the – this is the supply chain and all that kind of stuff.

Rebecca Dell

Absolutely, yeah. So here in the US, the portion of greenhouse gas emissions that come from the industrial sector is a little bit lower. It's a little less than a third instead of a little more than a third, but that still makes it the largest end use sector in terms of greenhouse gas emissions. And we've made basically no progress on reducing those emissions since we started worrying about climate change as a nation. That actually puts us a bit ahead of our friends around the world, because in most places, industrial emissions have gone up sharply in the last 15 or 20 years.

David Roberts

Is that mostly just because of more, just more industry?

Rebecca Dell

Most of that effect is from just producing larger quantities of stuff, because more people have access to higher qualities of living. And that's wonderful. But more stuff is more emissions. However, there also are some concerning indications that in some of the most important industries, like in steel, we actually might have seen the amount of CO₂ per ton of steel also go up.

David Roberts

Oh.

Rebecca Dell

So, yeah, it's a problem. It's a big problem. So that's why we're having this conversation in the broadest possible sense. So what happened today that Evan and I are so excited about? And just to be clear, like, when I say that we're excited about this, we agree this is the most important thing that has ever happened in the history of industrial decarbonization. That might not be a particularly high bar, but it has no competition for that title.

David Roberts

I mean, I think there's a colorable case to make that this is one of the most consequential elements of the legislation that Democrats passed. You know, people have heard a lot more about other parts of it, but I think if you look back, you know, on the 20, 30, 40 year time horizon, you could argue that this is the most important thing in decarbonization that the administration is doing.

Rebecca Dell

Yeah. So what is the thing? So the Inflation Reduction act is, you know, this weirdly named law that has a bunch of stuff in it, but mostly climate. The Congressional Budget Office estimated it's almost \$400 billion of investment in climate solutions. Other estimates have said that it might be much, much more. The notorious hippies over at Goldman Sachs think that it might end up costing a trillion dollars. Or I shouldn't say costing.

David Roberts

Yes, I was going to say exactly. Thank you. Thank you.

Rebecca Dell

Of that vanishingly small percentage is specifically devoted to the industrial sector. Even though it's a third of emissions, only about \$10 billion is specifically for the industrial sector. I'm sure we'll talk in this conversation about how industrial actors can use some of the other parts of the law. But in terms of what's focused on the industrial sector, \$10 out of \$400 billion.

David Roberts

And just quickly, why? Is that because it's difficult to find enough things to spend money on? Or is it because it's not well appreciated enough in policymaker circles? Why is that?

Rebecca Dell

So there's a couple of things. So, the first is just as an empirical matter across the board, the work on industrial decarbonization is well behind where it is in other more prominent sectors like power and transportation. And that is, you know — you can kind of pick your metric and you come to that conclusion. It is behind in technology. It's behind in policy development. It's behind in coalition and political power building. It's behind in new business models. I often say that, like, where we are in the industrial sector is, like, where we were in power in the year 2000. We're kind of a generation behind.

And so I think when it came time to pass a big law, there just wasn't the same critical mass of ideas and coalitions behind industrial action. Now, this answer kind of begs the question, "Okay, so you're behind. Why are you behind?" I have a lot of ideas for what the answer to that is, but I think the most important one, weirdly, is you can see in the effect of the IPCC 1.5 degrees celsius report that came out five years ago in 2019. So, up until that report came out, the gold standard of climate ambition was 80% reductions by 2050.

David Roberts

Right. I remember those days.

Rebecca Dell

Yeah, that was what climate ambition looked like. And what happened was significantly more than 20% of the emissions, including all of the heavy industry emissions, the people responsible for that looked at the 80% requirement and said, "It's cool, we'll be in the 20%." And, you know, like, "Maybe we'll have to invest in some energy efficiency, but, like, no fundamental changes required." And when we shifted our conversation from two degrees to 1.5 degrees, and just as we learned more about climate change and as more greenhouse gases were emitted, we came to this place where, like, 80% was, like, not good enough.

We needed to have a conversation about zero. And zero is a very provocative number. It was only really when we started having a big global conversation about how we get to zero that people started getting serious about industrial decarbonization.

David Roberts

And then there was that big — I forget exactly when this was, but there was that big IEA report, right, that basically said, like, "If we want to get to zero, something like half the technologies we need to get there are not yet developed." Right, I mean, that sort of came out of this.

Rebecca Dell

Yeah. There's a broad range of reasonable opinion about sort of innovation versus deployment, but in heavy industry, there's definitely some innovation. There's no credible position that is only deployment.

David Roberts

Yeah, yeah, yeah. And I should say, just as a tidbit, I was talking with someone who was involved in the development of IRA, and he said that one of the things that's striking about this program in particular is that it wasn't really a response to the industry itself coming and asking for things like, it was basically like altruism. Like he said, the industry itself is weirdly disengaged and it's not really pursuing these things yet.

Rebecca Dell

Oh, my God.

David Roberts

It seems like industry itself is not really on it yet.

Rebecca Dell

Do you have any idea how overjoyed we would have been if any major incumbent firm would have wanted to join us in signing a letter in support of this program? It's not like we didn't try.

David Roberts

I know. And you're like asking — you're asking to give them money. It's a weird. Typically industries like getting money. I don't totally get it.

Rebecca Dell

You would think. But, so all of this is like a long lead up to say, what is this program? This program gives grants for commercial scale demonstrations of new clean industrial technologies.

David Roberts

The Industrial Demonstrations Program (IDP). Got to have an acronym.

Rebecca Dell

But it's an admirably direct name.

David Roberts

Yes.

Rebecca Dell

What is this program? It does industrial demonstrations. And so DOE, actually, they ended up with a little bit more than \$6 billion because they had some money from the Inflation Reduction Act and then some money from the Bipartisan Infrastructure Law. And they said, you know, "We want to focus on heavy industries. We want to focus on places where there's a real technology value add, and we will pay up to 50% of project costs for the best projects. Send us what you got." So they had \$6 billion. They got applications for \$60 billion of grants requested.

David Roberts

Interesting.

Rebecca Dell

And the law says you have to have at least a 50/50 cost share, but they ended up getting more than twice as much as that. As you mentioned in your intro, they got more than two to one cost share for these projects because there's just — for all that, you are correct that there's been some strange diffidence from some of the major industrial players, there is a huge appetite. Evan and I are not the only people who have noticed that this type of activity would be useful.

David Roberts

So maybe the industrial beast is awakening. You just had to shake \$6 billion under its nose. It's awakening. So we got this — an enormous number of applications, and presumably you had the team of smarty pants at DOE combing through them, and has selected 33 projects across more than 20 states. And we should add, 80% of these projects are going to be in disadvantaged communities, which is either, you know, the communities that are suffering from the effects of fossil fuels or communities that were part of the fossil fuel economy that are going to be hurt by the transition away from fossil fuels.

So this is a — this is a huge, among other things, a huge infusion of investment in the areas of the country that most need jobs and investment. So let's talk about a few of the specifics. I'm going to, I think, roughly in order of importance, but I want to start with steel. Iron and steel, because it's, you know, steel's a very big deal. Decarbonizing steel is not easy. As Rebecca, we've potted about before, and I've had occasion to mention on other pods. So maybe, Evan, jump in here and tell me of the iron and steel winners: who tickles your fancy here?

Evan Gillespie

Yeah. So there are two projects here that are quite exciting. I will note that there are more than two. But as you noted earlier, you have iron and steel. Iron transforms into steel.

David Roberts

Yeah. Just for anybody who doesn't know, iron ore goes into making steel. That's why we're clumping them together here.

Evan Gillespie

Right. And so with the two projects that caught our eye that I think we think are most exciting, really focus on iron making. Traditionally, it's a very coal heavy process, and you have two significant projects. The first is the first ever fossil free iron manufacturing facility in the country. This was proposed by a Swedish company, SSAB. Some of your readers may be familiar with their hybrid project, a project in Sweden that is also attempting to make.

David Roberts

Yeah, I've heard of that one.

Evan Gillespie

Yeah. So they are attempting to make fossil free steel, largely using hydrogen produced from clean electricity.

David Roberts

So, just quickly, what do they do to — what is it that is so carbon intensive in making iron?

Evan Gillespie

Yeah. Yeah. So there are two components to it. One, making iron requires massive quantities of heat, and then you also need carbon as a feedstock to produce the right type of chemical reaction to reduce the iron to produce pure iron. And so, all told, you're looking at anywhere from three to four gigatons of GHG emissions annually just from the iron making process. It's where you get the vast majority of the criteria of pollutants as well.

David Roberts

How is this project doing that in a decarbonized way?

Evan Gillespie

Yeah. So there's this technology that's been around for quite some time that uses natural gas to produce iron. Goes into something called a shaft furnace — "direct reduced iron" is the term that people use in the industry. It requires less heat than a blast furnace, and it does not melt the iron. It simply purifies the iron ore to produce iron. And where you have natural gas, you can actually replace that with hydrogen as the primary fuel. And so if you can make that hydrogen with clean electricity using electrolysis, you have eliminated the vast majority of the greenhouse gas emissions.

So RMI put out a report a couple of years ago. They looked at the different processes by which you can make iron and then steel. They noted that, on average, — if you follow the "blast furnace to basic oxygen furnace route," this is the traditional way you make steel — per ton of steel, you produce about 2.44 tons of CO2 equivalents. If you use green hydrogen, truly green, made with clean electricity, and you combine it with an electric arc furnace running on clean electricity, you eliminate up to 97% of the emissions.

David Roberts

Is the chemical reaction still a part of things? I know in concrete, that's a difficult part to eliminate. Is there any of that in iron or steel? Is it all just a different source of heat?

Evan Gillespie

Rebecca, you may want to tackle this specific question.

Rebecca Dell

Yeah, so, basically — totally happy to — basically, the idea here is like, so, what is iron ore? Iron ore is iron oxide. So it's iron atoms chemically bonded to oxygen atoms. People listening to this are probably more familiar with iron oxide by its common name, which is rust. We all know that rust does not have the same valuable material properties that steel has. So the heart of the steelmaking process, which is to say the heart of the iron making process, is that you have to break those chemical bonds between the iron and the oxygen. And you do that by giving the oxygen something else that it would prefer to bond with.

When you're using a blast furnace, that something else is the carbon that's in the coal. And so when you take your carbon and you bond it with oxygen, you get carbon dioxide. That's your waste product.

David Roberts

Right. So the oxygen leaves the iron, attaches to the —

Rebecca Dell

The carbon.

David Roberts

the carbon, it becomes carbon dioxide and leaves the iron pure. That's the typical —

Rebecca Dell

Yeah. With this hydrogen reduction process, the oxygen moves from the iron, and then it bonds with the hydrogen and so your waste byproduct that's coming out of the top of your furnace, it's not CO₂, it's just water vapor.

David Roberts

Cool. So, Evan, you said two projects. One of these is the Swedish company is going to be doing this with clean hydrogen. Where is that? Are these specifically located yet, or is there still some ambiguity?

Evan Gillespie

Yeah. So across the 33 projects, a number of them have specific locations. Some of them are still TBD. This specific project will be in Mississippi. What's notable there is that they have a letter of intent signed with the hydrogen hub Hy Stor to provide the green hydrogen – this is a Mississippi-based hydrogen hub.

David Roberts

And you said there were two. Is there, what was the other one?

Rebecca Dell

Yeah.

Evan Gillespie

So the second one is up in Ohio at a Cleveland-Cliffs facility. There are two major steel companies in the US. You've got Cleveland-Cliffs and you've got U.S. Steel. Cleveland-Cliffs is the larger of the two operators. They operate several blast furnaces across Ohio, Michigan and Indiana. And they're doing something that is pretty exciting from our perspective. They're retiring their blast furnace and they're going to replace it with a hydrogen-ready shaft furnace. And so I think the thing to just note here is that hydrogen-ready is a term that warrants a pretty big caveat.

David Roberts

What was it? It was David Hawkins used to say that his driveway was Ferrari ready.

Evan Gillespie

Yeah, exactly. So, some skepticism is warranted here. They're going to run it on gas for a period of time, and they have said very little about the timeline for the transition to hydrogen. But there are a couple of things here that I think are worth just pointing out. First of all, across the entire steel feet, globally, you have about 400 integrated mills that rely on blast furnaces to create iron and then transform into steel. Every single one of those furnaces has a decision point coming up in the next 20 years whereby the furnace requires a relining of the interior of the furnace.

This is a hundred million, multi-hundred million dollar expenditure that each of these facilities will have to make a decision about. Will they reinvest hundreds of millions of dollars in coal based steelmaking or will they pivot to something cleaner?

David Roberts

And so, the idea here is to make shaft furnaces cheaper.

Evan Gillespie

Well, so what you want to do, essentially is say, "Look, instead of investing hundreds of millions of dollars to extend the life of coal based steel, making your facility again for another 20 years, reinvest on site in a new way of making iron through the direct reduced iron process, or using a shaft furnace, pivot away from coal, move to clean." As a campaigner you know, we look far and wide for venues and decision points where we can have impact. And this is a single decision point that will be replicated hundreds of times over the next 20 years. And so, going back to Middletown, Ohio, where you have the Middleton works facility, this is one of two facilities in the US where Cleveland-Cliffs had announced previously they had planned to reline their furnace.

And with the announcement today, they are moving away from that and making the exact kind of decision that we need to see replicated across all 400 of these facilities. The other, I think, really exciting thing to note, and you hear a lot about political economy making the politics here work. This is great for the workers at that facility. I think there's been a lot of anxiety over the last several years that this transition in industry would require the retirement or closure of a lot of facilities. And what we're seeing here instead is a reinvestment inside the fence line of the facility that's going to preserve the union jobs and actually going to expand the union jobs at the facility, and it's going to pivot away from coal, which is very exciting.

David Roberts

Very cool. Rebecca, is there stuff to add about iron and steel? Is switching from a blast furnace to a shaft furnace, is that sort of the state of the art in decarbonizing steel, or are there other things worth mentioning?

Rebecca Dell

That's a great question. So, I think Evan summarized this really well. Like, there are these two huge projects. Both of them are slated to receive the maximum award under this program, which is \$500 million.

David Roberts

Good grief.

Rebecca Dell

Yeah. Well, you know, what can I say? A steel mill costs billions of dollars. You know, that \$500 million may be significantly less than the 50% cost share.

David Roberts

Wow.

Rebecca Dell

But so the hydrogen steelmaking process, the way I often think about it, is it's the smallest increment of new technology to get to clean steel.

David Roberts

Right.

Rebecca Dell

And because we have this direct reduced process that already exists that uses methane and we can modify it to use hydrogen instead, there's a lot of questions about kind of the details of how the manufacturing process will work, how it will scale up — those types of things. But, like, will it work? People are pretty confident it will work. There are other kind of more far out there ideas for how to make iron and steel, which might, in the end, turn out to be better. But we still, we don't really know whether or not they're going to work.

And so I think, like, the best thing we can do now to demonstrate that green steel is real. It's a possibility, it's a commercial possibility. Not just a technical possibility, is to get facilities like this built.

David Roberts

Got it. So, that's iron and steel. So we're kickstarting, boosting the shift from blast furnaces to shaft furnaces, showing that it can be done. Trying to intervene in the same decision that's going to be made at a lot of other steel furnaces across the country.

Rebecca Dell

Yeah. One other thing I'll add also is, so SSAB, this Swedish company that's doing one of these projects, it is not like other steel companies. Almost ten years ago, it set a net zero target for 2045. And then about two years ago, the executives of this company went back to their board and were like, you know what? We don't need 2045. We can get fossil free by 2030.

David Roberts

What?

Rebecca Dell

Yeah. That is their official goal. That has been, like, signed and sealed by their board of directors.

David Roberts

Does this switch from a coal based blast furnace to a hydrogen based shaft furnace get you to zero or just kind of close?

Rebecca Dell

So, just for clarity, SSAB is the one that's building, like, a greenfield hydrogen plant.

David Roberts

Oh, right.

Rebecca Dell

Cleveland-Cliffs is the one that's replacing an existing blast furnace. But SSAB has its own blast furnaces back home in the Nordics.

David Roberts

But does a green field — I mean, is that zero? Is that genuinely zero carbon steel that's going to come out of that greenfield project?

Rebecca Dell

So not zero, but as Evan said, best case scenario, you can get more than a 95% reduction.

David Roberts

I got it.

Rebecca Dell

So it's pretty close. It's within hailing distance. But I think it's really exciting also to have SSAB, this new company, come into the American market and with this extremely provocative set of ideas about how steel can be made and how quickly this transition can happen. Because, you know, there's a lot of people in the steel industry who might say, "Yes, we know that the climate is an important problem for our industry and we need a transition. But you're just going to have to give us lots and lots and lots of time."

David Roberts

That's what all the industries are saying, Rebecca. That's what the oil and gas industry are saying.

Rebecca Dell

So I think it's going to be very exciting to have a new steel company in the United States out there saying, like, "No, we don't need that much time. We got this."

David Roberts

2030 that's mind blowing.

Rebecca Dell

Yeah.

Evan Gillespie

One other point on SSAB and this sort of American market, so we don't know everybody who applied for these for a grant, but there is one steel maker that was left out, or that is left out, and that's U.S. Steel.

David Roberts

Isn't that the one that may or may not get bought by the chinese firm? Am I mixing up stories in my head?

Evan Gillespie

Close. So it's a japanese firm. It's Nippon Steel. So they are right now in the process of selling U.S. Steel to Nippon. Although both the president and the guy on the other side have said that they have major concerns that they do not support the deal.

David Roberts

Right. I thought Biden was trying to stop them.

Evan Gillespie

Yeah, but what's interesting there is that you have Cleveland-Cliffs, who is now communicating clearly that moving away from coal is part of their future. You have this new player with a radical view on the pace of the transition, the kind of technology. And then you have U.S. Steel, which operates a set of very old, pretty dilapidated facilities that are in massive need of reinvestment. And what will that investment look like? They've been pretty silent on that so far. Their sort of decarbonization pathways looked at electric arc furnaces, which are important, but do not get at the carbon problem the way that cleaning up iron does.

So I think there are big questions about how far U.S. Steel falls behind and how they market themselves going forward. You have companies like Ford and GM who stepped up and said they're going to be part of a buyer's commitment to buy clean steel. And it remains to be seen what happens to your steel at this point. But they are definitely on the outside looking in.

David Roberts

Interesting. All right, well, we're falling behind. I can talk about any one of these for an hour, but let's move on to aluminum, because this is a really interesting story that I was not really, I don't think, cognizant of the sort of state of the aluminum industry and what this will do for it in the US. So, Evan, let's talk a little bit about, well, A, the projects that grabbed your eye and then sort of, kind of the larger context on aluminum in the US.

Evan Gillespie

Yeah. So what was announced today is the first new aluminum smelter in the United States in 45 years.

David Roberts

45 years?

Evan Gillespie

45 years. Last time we built this smelter, I was not alive. I think the significance here is a fewfold: One, it will double the production of US primary aluminum. And when you step back and you look at where the industry was when we built our last smelter, we made about 30% of the world's aluminum. Today, we make 1%. We have four smelters left. We had six about a year ago. Two of them have since curtailed, including one in January.

David Roberts

And the others are hanging on by a thread as I understand it.

Evan Gillespie

Hanging on by a thread. And the problem here is that aluminum requires high watering amounts of electricity. And when these smelters were built, they were built near cheap, dirty power. And we know now that power remains dirty, but it is no longer cheap. And they operate in states that have made it harder to access clean electricity. And so these smelters are hanging on by a thread and are in bad need of investment themselves.

David Roberts

Oh, and we should just say, let me throw in here, like, aluminum requires a ton of electricity, but it's also the case that clean electricity requires a ton of aluminum. Like, the reason aluminum is significant is that it's a huge part of solar panels and a bunch of clean energy technology.

Evan Gillespie

Yes, that's right. So that's the thing that has a lot of us very worried about the future of aluminum. BlueGreen Alliance put out a great report a couple of years ago, right after the IRA was passed. And they looked at, as you scale out clean energy, what does the demand look like for a number of really important materials, including aluminum? We will use more aluminum to make wind turbines, solar panels, and the rest of the clean energy infrastructure use more aluminum in 2035 than the economy uses today.

David Roberts

Wild. And so we would be buying all that from overseas if we did not have a domestic aluminum industry.

Evan Gillespie

Yeah, I mean, today we import about 80%. And historically, the large producers of aluminum are countries like China and Russia. And we have a very far flung supply chain, which puts our economy at risk. But there are also other global factors at play right now that make it particularly at risk. So it's really, really important that we get aluminum back on track in the United States. A couple of other things to note about the sector, about 40% of the cost of making aluminum comes from its electricity costs and about 80% of the emissions. And so when you think about, like, hard to decarbonize, hard to this, hard to that.

This is a sector where we know how to replace dirty electricity with clean electricity at a facility. We know how to do it. It's not always easy, but it's clearly possible. And one of the exciting things about the smelter is that we'll require new clean electricity in a part of the country that has not benefited from clean electricity so far.

David Roberts

A couple of questions. Where is the smelter? Is the capacity of the smelter large enough that it's going to make like a material difference in that 80% import number? And what does that mean "will require new clean electricity"? Like under what authority? Sorry to jam all those questions together.

Evan Gillespie

No, that's a great set of questions. So on the location: TBD. They have identified a region of the country with — they set a preference for Kentucky. And that makes sense. You have, if you look at the Kentucky Ohio border, you've got three smelters right there, one of which is curtailed at the moment. The other two are just kind of hanging on. You have a trained workforce, and it makes a lot of sense to the supply chain. I think the flow of aluminum out of those plants to EV facilities, battery manufacturing facilities, things like that are all kind of in that region.

That part of it makes sense on the clean electricity side. So I looked this up this morning. Kentucky, according to the governor's energy report from last year, it's about 30 megawatts of installed solar. Megawatts.

David Roberts

That's like a large project.

Evan Gillespie

I mean, not even a large. Not even a large project.

Rebecca Dell

Yeah. I don't know if I would call that large.

David Roberts

One small project.

Rebecca Dell

That's a field full of solar panels.

Evan Gillespie

Yeah. So a project of this scale is going to need at least a gigawatt of clean electricity.

David Roberts

Good God. So, but my question is, what is this? Like, what's to stop it from using dirty electricity? Is this by law, is this part of the contract with DOE? Like, we are only going to give you this money if you use clean electricity?

Evan Gillespie

Yeah. So the details on the project are still slightly sparse, but that appears to be one of the stipulations that they're calling it a green smelter, and the company is committed to powering it with clean electricity. So that seems to be one of the details that will get finalized.

David Roberts

So correct me if I'm wrong, then, but if it's located next to the other smelters, any clean electricity you build that's going to go into the one smelter is also going to benefit the other smelters, will it not?

Evan Gillespie

It depends on the details of the contract, I think whether you have it, a power purchase agreement, whether it is a behind the meter, a hookup. I think there's still a number of questions there, and I think for Kentucky, there's a real question of how are you going to provide this clean electricity?

David Roberts

This is a little petty, but it's like, you guys can have \$500 million, but you're going to have to embrace clean energy. He's really got them over a barrel there.

Evan Gillespie

Well, right. I think that there is — I mean, this is one of the exciting things about industrial decarbonization more broadly, is you have these big companies that can increasingly see, I mean, particularly for the aluminum industry that see their future tied to clean electricity and the politics: I think it'll be very interesting to see how the politics shift when you have a company like Century Aluminum who is going to Kentucky but probably also Ohio, maybe Indiana, maybe a couple other red states, who knows Oklahoma and saying, "Hey, we need a gigawatt of clean electricity. Who's got it for us?"

That's a great competition to set forth in a number of states.

David Roberts

The final question was what's the capacity? Is this like, is this going to meaningfully affect the amount we import versus create domestically?

Evan Gillespie

What the company and the Department of Energy has said is that it will more than double the total capacity today. That's the ballpark of a million tons, maybe a little bit less. I will tell you that the projections for aluminum demand for solar and wind alone according to BGA are about 7.8 million metric tons in 2035. And so this is a great start. But we need a few more of these projects and we need to ensure that the existing smelters have access to clean electricity to clean up their production. But it's a start. We have a lot of work to do.

David Roberts

Got it. The political economy around aluminum is really interesting.

Rebecca Dell

Yeah. On that, one of the other details DOE has released about this project is that it will employ 1000 people.

David Roberts

Now is that construction or ongoing?

Rebecca Dell

No, they said over 5000 construction jobs and 1000 permanent jobs.

David Roberts

And then there's all the indirect jobs and the whole region will benefit.

Rebecca Dell

So, to your point about kind of like having that, having that, let's call it healthy competition among states about how do we attract these projects with our available clean electricity? 1000 manufacturing jobs in a company that has a strong relationship with the United steelworkers. That's a very, very attractive offer.

David Roberts

Yes. Politically, very significant, right squarely in the part of the country where this reactionary backlash is happening, where it's been hollowed out by globalization, et cetera, et cetera, et cetera. These are good jobs right where you'd want them, politically speaking. You know, aside from all the other considerations, politically this is extremely significant. Rebecca, let's talk about cement and concrete, the kind of third big player here. We've done a pod on clean concrete here on Volts. We did a pod on Sublime Systems, which is to my great delight one of the recipients here. What projects here — ?

Rebecca Dell

David, I think you sealed the deal for them.

David Roberts

I did. Oh, well, I'll look for my check in the mail.

Rebecca Dell

Being on your pod, I think that that really materially contributed.

David Roberts

Sweet. Well, to talk about what's exciting you in this area.

Rebecca Dell

So I feel like a big theme of this whole thing — so Evan and I, obviously have been having a lot of conversations about this big, exciting day, and most particularly the early ones, all kind of revolved around the theme of, "Oh, my God, they're doing all the things." And I think that that particularly applies in the cement industry. They have a bunch of good projects, and they're kind of, like, they're doing all the things.

David Roberts

Yeah. Correct me if I'm wrong, but it seems like perhaps a little bit more so than steel and aluminum. There's still a pretty wide variety of technologies on the table here. Right? Like, it's not clear which direction to go here.

Rebecca Dell

Yeah, well, and it's also like, the technologies aren't all mutually exclusive, as these projects, I think, show. So we talked — I talked a little bit at the top about industrial emissions overall and how big they are. Let me give you a number to kind of really bring that home. So we talked about steel. We talked about cement. Those are the two highest emitting greenhouse gas industrial activities.

David Roberts

Steel and cement.

Rebecca Dell

Steel and cement. And they're each responsible globally for, like, something in the neighborhood of 8% of emissions.

David Roberts

Yeah.

Rebecca Dell

You know what else is responsible for something in the neighborhood of 8%? All the cars and all the light trucks on all the roads in all the countries put together. So, like, if we can pull off something, like, if we can show that cement can be decarbonized, like, that is at least as important as everything we've done on electric vehicles. Because all the electric vehicles in the world, like, if we are fully successful with the effort to electrify light duty vehicles, that gets us about the same amount of emissions as the cement industry.

David Roberts

That's wild. So are these projects going to do it?

Rebecca Dell

So there's, like, three different things that these different projects are doing, and they're all good ideas. The first is that there is one ingredient in cement, which we call clinker, which is, like, all the greenhouse gas emissions are in the clinker. And the most traditional kind of cement is 95% clinker. There is no need for that. We use 95% clinker cements all the time throughout the United States. But you can get cement that is just as good, it's cheaper, and in certain circumstances, it's actually even stronger and more durable and with 50% clinker. So first thing we got to do on cement is, like, just blend it differently with less clinker.

So we have some projects to pursue that mostly in the form of something called Limestone Calcined Clay Cement, which is exactly what it sounds like. You have less clinker, and then you mix in some ground limestone, and you also mix in some, what's called calcined clay, which is basically like clay you cooked in an oven. So they want to build facilities, and the thing you need a facility for is cooking your clay. This is a smaller and cheaper facility than the one that you make your cement in, but you still need the thing. And there's a whole, we know a bunch of technologies that will successfully calcine clay, but there are some projects here where they want to try out some new technologies that would be more energy efficient and then produce these low clinker cements.

So that's like first step decarbonization, and you definitely should do it. And it can be combined with anything that you want to do to try and reduce the amount of CO₂ that's emitted when you make the clinker. Because we're still talking lower clinker cements. We're not talking no clinker cements. So then on the "how do we make clinker without greenhouse gas emissions?" Then there's two sets of projects. There's two large cement companies. Both of them are actually European companies. So Heidelberg Materials, which is a German company, and National Cement, which is a subsidiary of Vicat, a French company.

Both of them are just like: "We have kilns that we think are appropriate to do CCS on. We think we can do high capture rate retrofits of our existing kilns. That is what we want to do. Nobody has done that yet before. Let's make it happen." One of them is in Mitchell, Indiana, and it has the very delightful characteristic that it is sitting on top of an appropriate geologic CO2 storage formation. So no pipelines, no infrastructure, no CO2 transportation. If you can capture the CO2, you can bury it in the backyard.

David Roberts

And the CO2 capture here is standard.

Rebecca Dell

Yeah, I think they're planning on doing just like normie amine scrubbing. But here's the thing. Outside of the fertilizer industry, it's actually remarkably difficult to find examples of normie amine scrubbing that is deployed at commercial scale and used consistently with high capture rates.

David Roberts

Indeed. And do we not have a giant tax credit for that? Are these projects going to be able to also exploit the problem?

Rebecca Dell

They will, yeah, very much like we were talking about some hydrogen steel projects who also get a hydrogen tax credit.

David Roberts

Right.

Rebecca Dell

There are a few specific examples in the IRA where the lawmaker said if you claim this money, then you can't claim this other money. But, by and large, if you can figure out a way to claim more than two benefits, you can claim more than two benefits.

David Roberts

God, some of these projects are just going to get buried under a flood of money. It's just —

Rebecca Dell

Well, so I did a little back of the envelope calculation, and if you are making a million tons of steel a year with hydrogen, and you make some kind of reasonable assumptions about what is the use efficiency of the hydrogen, and you say that this is the cleanest possible hydrogen, so you're getting \$3 a kilogram. That's worth over \$300 million a year.

David Roberts

Good stuff. Wait, so you said three: so there's lower clinker?

Rebecca Dell

Yes. So lower clinker. There's, like, normie cement making, plus normie CCS.

David Roberts

Right, right.

Rebecca Dell

And then you already mentioned there's, like, the new chemistries for making cement, and those come in the form of two companies, both of which, I think, have gotten previous DOE support. So DOE must be feeling quite chuffed about that. Which are, you mentioned, Sublime, and then the other one is Brimstone.

David Roberts

Yeah, yeah, I saw Brimstone got a huge —

Rebecca Dell

Yeah. And basically, the idea here is that in order to make cement, the most important ingredient in cement is calcium. You need just, like, a lot of calcium atoms, and the easiest place to find calcium on the surface of the earth is in limestone, which is a calcium carbonate rock. So it's calcium bound with carbon. And the way you get the calcium out is you cook it and you break that chemical bond. And like we were talking about before, the carbon goes up into the atmosphere as CO₂. But actually, that's, like, a minority of all the calcium.

That's the easiest calcium to get out. But most of the calcium is in a different kind of rock, which are calcium silicates. And so both Brimstone and Sublime are trying to get the calcium out of these different kinds of rocks, which is probably going to require more energy, but won't produce any of these byproduct CO₂ emissions.

David Roberts

So if this third route wins out in the end, then concrete is going to end up just like aluminum, needing a giant amount of clean electricity.

Rebecca Dell

Yes.

David Roberts

I just, I would just notice as we go through this list, like, a lot of clean electricity.

Rebecca Dell

Yes, but, like. Okay, so the amount of clean electricity per unit of cement is going to be way, way, way lower than per unit of aluminum.

David Roberts

Got it.

Rebecca Dell

But we use so much more cement than we use aluminum. I mean, we use a few million tons a year of aluminum as a country, we use 100 million tons a year of cement.

David Roberts

Okay. Yeah. Throwing it out there could sure use a lot of clean electricity these days.

Rebecca Dell

Don't forget about where all the hydrogen for the steel mills —

David Roberts

Yes.

Rebecca Dell

what's coming from.

David Roberts

And the hydrogen.

Rebecca Dell

The reason that you're getting \$300 million a year for your hydrogen is because you're making so damn much hydrogen.

David Roberts

Yeah.

Rebecca Dell

And all of that requires electricity.

David Roberts

Okay. So that's three different routes in concrete that we're funding.

Rebecca Dell

So we've got all of them. I'm excited about all of them. And I think that we were talking earlier about how SSAB is, like, this provocative company in the steel space, and their very existence is kind of an affront to complacency.

David Roberts

Yes. Same with Sublime, right? Same with Brimstone.

Rebecca Dell

Yeah. And I think there's a similar role that's being played by these technology upstarts here where, you know, you and I were joking a second ago about how, how many, like, damp squibs of there have been in the history of CCS projects where, like, they built it, but it didn't really work, or they didn't — maybe they didn't try that hard to make it work.

David Roberts

They never finished it.

Rebecca Dell

Or. Yeah. Or it had low capture rates, or it was, like, offline for maintenance all the time. You know, like, there's so, so much of that. And having these alternative technologies in the mix and receiving really significant grants to actually scale up their process. It's really a moment, I think, for the cement industry to say, "Okay, if we're going to do this CCs thing, now's the time to show it actually works."

David Roberts

Right, right. Awesome. Okay, we got to move on. Evan, I'm throwing to you the food category. This is the one that's getting all the cutesy headlines where we're gonna make decarbonized snacks and decarbonized ice cream, as I understand it, a Biden special and then a bunch of other sort of electrification projects. What's there to say in that bucket?

Evan Gillespie

Well, these are exceedingly fun categories of decarbonization projects. Don't forget mac and cheese and whiskey, because those are also now apparently carbon free.

David Roberts

Full decarbonized meal.

Rebecca Dell

I definitely saw a "holy macaroni" headline.

David Roberts

Inevitable.

Evan Gillespie

So, a couple of things to say about this sector. So, first off, when you look at the industrial sector writ large, about half the problem is how we make heat. And we just spent a lot of time talking about materials that require very, very, very high temperature heat. And in some ways that is a little distracting from the overall heat picture for industry where two thirds of the heat requirements are low or medium temperature.

David Roberts

Right. That's mostly steam. Right, that we're talking about in that, in that bucket.

Evan Gillespie

Yeah. So, David, this tees up to your favorite topic, which is heat pumps.

David Roberts

Heat pumps.

Evan Gillespie

Heat pump nation.

Rebecca Dell

Whatever your question, the answer is heat pumps.

David Roberts

Exactly, it all comes back.

Evan Gillespie

Yeah. So a huge portion of this sector and across just industry writ large could be addressed by heat hubs. The Renewable Thermal Collaborative had a great report recently: They noted that about 300 million metric tons of CO2 equivalents could be avoided with industrial heat pumps. It goes beyond the food manufacturing sector to a lot of other smaller manufacturing places. Paper and pulp is another place where you can use heat pumps. But this is a category where, you know, it's not the quote unquote "charismatic megafauna" of industry. It's not these big steel mill, or — these are just your factories that you see along the way.

They don't use a lot of methane individually, but when you add them up, it's, you know, it's about 75 million tons of greenhouse gas emissions in the food sector in the US. And this is a sector that we don't have to wait. We have the technology today.

David Roberts

Almost more difficult in some ways, though, because, like, you can build one aluminum smelter and you've, like, changed the entire aluminum picture, but just reaching dozens and dozens and dozens of smaller facilities where they might not even have, like, an energy manager or whatever. You know what I mean? In a sense, you have to do this through the market just by making something so cheap that they all want it.

Evan Gillespie

Or regulation. So —

David Roberts

Yes, thank you.

Evan Gillespie

We can talk about regulation for a second. I mean, that is true. So each of these facilities may have a slightly different setup. The layout of the facility may be different. You know, there are, I think, challenges when it comes to, can you work with your utility to get the electrical upgrade and things like that? We work with regulators in a number of places, looking at this sector in particular, and what I think is exciting about these announcements is that we just haven't had the proof of concept yet. Similar to steel and aluminum or cement, we need examples of facilities doing this.

You see some of it in, like, you'll see again, cutesy headlines around a brewery getting an electric boiler or removing their gas boiler and doing something different. But we need more of these examples to learn from so that you can start to achieve the economies of scale where you have that there's installation is a little bit more plug and play.

David Roberts

Yeah.

Evan Gillespie

I think we'll also need to better understand how, again, how to hook up these little facilities to clean electricity. The cost difference between gas and electric is a little bit overstated, but it's real.

David Roberts

Yeah. I mean, it's just like, for most of these, it's going to be more expensive to use a big industrial heat pump, at least today, than it is burning gas.

Evan Gillespie

If you're doing the investment wisely, if you're pairing with energy efficiency upgrades, if you have access to clean electricity. I think the cost concern is a little overstated, but it's not nothing. I think the other thing to point out is that in the building space or PUCs around the country right now, there's a big conversation around gas transition. You've got these gas transition dockets. These are facilities that are oftentimes connected to the gas distribution system. And so they are going to be impacted as buildings electrify, as demand for gas overall goes down, the cost of maintaining the system is going up.

The California Energy Commission, for example, they just projected 40% increasing gas prices. So the cost difference, I think, is going to go away. And this is the time to start planning for these smaller facilities to make sure that they don't get left behind.

David Roberts

So when we're talking about the mac and cheese and the ice cream, these are relatively small projects and those are mostly just switching from furnaces to heat pumps. Is that mostly what is going on in this category?

Evan Gillespie

Yeah, it could be a number of things. It could be an oven, it could be a dryer. The kind of — the obvious thing about food is you got, you need low heat because you don't want to burn it. Yeah. So it'll be a range of equipment, the categories, you know, a credit to you, by the way, Kraft Heinz, who labeled their project "The Delicious Decarbonization."

David Roberts

Thank you, someone in industry, for having some small germ of a sense of humor.

Evan Gillespie

Yeah. So they say they will electrify and decarbonize the process at ten facilities. They'll be using heat pumps, electric heaters and electric boilers. They're combining it with solar thermal, solar photovoltaic. You've got thermal energy storage involved. You've got a range of equipment on site, all planted at electrification.

David Roberts

Yeah, awesome. And so the last category, then it goes under the heading chemicals and refining. Chemicals are something that I have at once sort of avoided because the whole thing just seems dreary as hell but also been haunted by guilt because of how much I avoid it. So, Rebecca, tell me, because my understanding and this could be completely wrong, but my understanding is that there's a lot of process emissions in this category as opposed to just different sources of heat. Or am I wrong about that? Tell me what's going on in chemicals and what projects grabbed you?

Rebecca Dell

Okay, so maybe the first thing to do is just, let's take a second to talk about what chemicals are.

David Roberts

Yeah.

Rebecca Dell

Because that's a legitimate source of confusion. So chemicals, like, big picture: You know, two thirds of the chemicals from a greenhouse gas perspective are from two products or two families of products, fertilizer and plastics. So it's a lot of fertilizer, it's a lot of plastic. And when we say plastic, we don't just mean, like plastic water bottles, we mean all kinds of plastics. So industrial resins, what goes in fiberglass, all your polyester blends in your clothing. So really, most of the clothing that gets manufactured around the world.

David Roberts

Plastic is ubiquitous.

Rebecca Dell

Yeah. And then in addition to that, there's a bunch of other things that are like solvents and explosives and pharmaceuticals and paints and dyes.

And so if you just, like, think about the products that you encounter in the world, if it's not made out of metal or wood or ceramic, it's probably a product of the chemicals industry.

David Roberts

Right. And I will say I once visited a plastics recycling place: just gross. One of the grossest industrial facilities I've ever witnessed close up. It really made me think, like, it made me think what a horrible category this is. But go on.

Rebecca Dell

What was so gross about it?

David Roberts

It's just like loud and smelly and, like, I always want to picture, like, clean, sort of like digitally run, you know, assembly lines and things like that. But it's just like big, gross buckets and baskets of random plastic crap getting, like, melted and remelted and remelted. It's just like, it's not fancy. It's very brute.

Rebecca Dell

Yeah, well, and I'll say recycling plants tend to be much more like waste processing plants than like, factories.

David Roberts

Yeah, yeah. Just kind of brought it home to me.

Rebecca Dell

So you are not the only one who doesn't want to think about the chemicals industry. And so we talked a little bit at the beginning about how the industrial sector is, like, behind some of its sector friends, like power and transportation. I would say the chemical sector or the chemicals industry is behind some of its industry friends, like steel and cement.

David Roberts

At the back of the pack, you might say, overall.

Rebecca Dell

Yeah. And so the consequence of that is when I was talking about cement a few minutes ago, I was able to kind of lay out for you, a coherent set of technology pathways. And I was sort of like, here are the buckets. Here's how they fit together. Everybody who works in this space kind of understands this. And so DOE was able to, like, build a portfolio of projects that covers the real estate in a sensible way. There is not that same, like shared consensus about what are the technology pathways for the chemicals industry. And the consequence of that is that there's some interesting projects here, but they're a little bit all over the map.

So, you know, there's like one that's for making methanol that could be used for like, sustainable shipping fuel. There's a couple that are doing recycling related projects. One that's like doing CO₂ utilization for making batteries. So like I said, they're a little all over the map, which I think reflects a need for more work to understand the landscape and the pathways better. But I also want to be clear, like doing a bunch of projects, any one of which could like, has a reasonable business case behind it. That's part of what we mean when we say doing the work of figuring out what our successful decarbonization pathways here are going to be.

For example, you mentioned the recycling plant: There is a lot of reasonable disappointment among the American people and frankly, the entire human family about plastic recycling.

David Roberts

Yeah. I feel like we all just saw a bunch of headlines.

Rebecca Dell

Yeah. This was a thing that we were all told as children that, like, you put your plastic in the bin and then it magically turns into new plastic, and then there's a unicorn for everybody.

David Roberts

It turns into a fleece at Patagonia.

Rebecca Dell

Yeah. And, you know, and this was a narrative we were all fed. And fast forward 50 years and we're still looking at a situation where 5% of plastics actually get meaningfully recycled in the United States at the end of their life.

David Roberts

Well, that's another thing the recycling plant really brought home is you can't just throw a bunch of different plastic junk into some big processor. You really have to sort it out. So it's a very narrow, very uniform kind of plastic, and they're just like, there's just a limited set of circumstances where you can extract from the waste stream a large volume of very consistent one type of plastic.

Rebecca Dell

Yeah. And I sort of feel like — so in response to the growing disappointment among the population at large with like, how plastics work in our economy, the obvious bill of goods that we were sold about traditional plastic recycling, the plastic or the chemicals industry, I should say, has really pivoted to, to in recent years to this narrative about advanced recycling, which is sometimes also called chemical recycling. And this is the idea that you don't just melt down the plastic and then, like, reform it into a new object, you actually break the plastic molecules down into their constituent parts.

So you try to go back to basically the precursor chemicals that come out of the big chemical plants. And then if you do this correctly, then you should be able to make new plastics of first quality. There is a lot of reasons for skepticism about this claim, but, you know, the largest project in this category, it's \$375 million to the Eastman Chemical Company, a leading American chemical company, to build a plant to do this kind of recycling.

David Roberts

Interesting.

Rebecca Dell

And I think of this very similarly to what we were talking about with the cement CCS, that you're sort of like, "Okay, calling the bluff. You guys say that this technology pathway is materially different and better than what we have been doing so far. Well, this is your chance to show us how."

David Roberts

Put up or shut up.

Rebecca Dell

Yeah.

David Roberts

What happened to bioplastics? Speaking of hype cycles past, is that a thing at all?

Rebecca Dell

There's a real problem with biomass availability. So currently, the plastic industry globally uses something in the neighborhood of 35 or 40 exajoules of energy per year globally. For an easy basis of comparison, the United States economy uses like 100 exajoules. And all of the biomass that we currently use for energy on earth is something like 60 exajoules.

David Roberts

So we would need all the earth's vegetation to make —

Rebecca Dell

That is just the biomass that we're currently extracting for energy use. But, like, there's not great tracts of arable land that nobody's doing anything with, like. You know, the amount of bioenergy we have right now is not dramatically different than how much bioenergy we're going to have in the future. So there's just not enough of it to go around.

David Roberts

So it sounds like chemicals, as I intuited, is a dreary story. But there's at least, at least we're going to call this one main bluff. At least we're going to find something out about plastic recycling and the sustainability of chemicals. We've gone over, as I strongly suspected we would, because all of this is so fascinating. So maybe, Evan, let's just wrap it up with some thoughts here. I guess sort of one of my broad questions about this — it's easy to look at the figure: \$20 billion sounds like a big number to me because I don't even have any billions. But in the context of —

Rebecca Dell

David, that's the wrong number of billions. You have no billions?

David Roberts

I have zero billions. But in the context of the global industry, that's a drop in the bucket. So I guess I just want to leave maybe listeners with a little sense of scale here. This is clearly not enough to brute force sustainability across industry. Is it big enough to meaningfully kickstart that process? How should we think about scale here, I guess I'm wondering?

Evan Gillespie

I would start by just saying it is an awesome first step: \$20 billion is not jump change. We are getting real significant projects. It will vary a little bit by industry: I think on steel, this is, you know, we have now jumped to the front of the pack when it comes to the green steel transition. On aluminum, it's a really, really big deal. Chemicals is obviously more complicated. I think we've got a "prove it" moment for cement and the different technologies. But it's a great start. To put this in context, though, what the Department of Energy has said is that they need upwards of a trillion dollars to move the transition in the United States.

And so this is about 2% of what we need going forward. A lot of the success of these projects, I think, will be predicated on a couple of things. First, a theme throughout this entire conversation: Where are we going to get the clean electricity from? It's a huge need.

David Roberts

Yes. All of these in one way or another, like almost every category in one way or another comes back to that. And that's alongside all the hydrogen, as we said, alongside all the data centers and all the AI, which also wants all the electricity. This is really getting, like, I'm getting to like desk pounding stage of things on this. Like, we really need to take this more seriously.

Evan Gillespie

Yeah. And by the way, what a great place for intentional industrial policy to direct the clean electricity to certain more advantageous industries that provide public benefit.

David Roberts

Yes. Thank you. Thank you, DOE.

Evan Gillespie

Yeah. So clean electricity will be a big part of it. Another, I think, question that I think will emerge is the demand for greener products. And so you have something like the First Movers Coalition, which John Kerry and the climate team over at the state department have helped establish. You have companies like GM and Ford and other large buyers of cement and steel and aluminum and all these things that have said, "Yes, we will buy up to 10% of our material leads from clean products as defined by the First Movers Coalition."

David Roberts

We should just say this is a recent, this was just a couple of weeks ago that this was announced, guaranteed buyers for these green industrial products. That's a new, a new thing.

Evan Gillespie

And the First Movers Coalition has been around for a little while. It's been around for a couple of years. But what has been lacking is any type of meaningful plan from a lot of these companies to demonstrate how they're going to get there. And what we will hear from an individual buyer is, "Well, we would love to buy it, but where are we going to buy it from?" And so you get stuck in this sort of chicken and egg debate. And we personally, I think we find this argument to be a little insufficient. There's more for the buyers to do.

But with this new supply, we anticipate that there will be buyers who step up and purchase it. And then I think looking out to 2025, if we cross our fingers and end up on the other side of November with a favorable outcome on climate, Joe Biden has some very exciting opportunities in the next term. We certainly need a lot more money. And so IRA 2.0, 3.0, this is just a start. As Rebecca noted earlier, there was \$60 billion of demand in these applications. DOE was only able to issue six. It will be fascinating to see how other companies that are not participating in this grant program respond.

But then the last thing I will say is that you can only do so much to put money on the table for companies to go out, apply for the money and get it. Many didn't. And these are industries that have enjoyed lax regulation and even laxer enforcement for decades. And the result is unacceptable. You have thousands of pounds of lead being poured on communities in Gary, Indiana, thanks to steel operations. You have just horrifying NOx and SOx

and other criteria pollutants outside of Pittsburgh, to say nothing of the chemical industry's impact in the Gulf south and as much as this —

And we love, trust me, we love carrots. We'll eat carrots all day. The industry does need to be held accountable for the significant toll both on climate and on public health. And I think over the next few years, looking at the beautiful tool that we have in the Clean Air act to help force these facilities to account for their pollution, to internalize the cost, will only help make the transition seem more attractive.

David Roberts

Well, this is the two step we did on power plant emissions, right? We dumped a bunch of money on CCS and then we turned around and EPA said, "Hey, we just dumped a bunch of money on CCS. So it's a real possibility now. So we're going to regulate that you have to use it." Right? So these are synergistic approaches completely. Rebecca, what about you? Is there, is there, you know, assuming the world doesn't end in November. What's, what's kind of next for policy here?

Rebecca Dell

There's a lot of next things, but let's just take another, let's take a minute to just like, this is — I began this by saying "This is the biggest thing that has ever happened in industrial decarbonization," and I wanna land there, too. No other government has ever made a \$6 billion of announcements in one go across all of these industries, across all of these technologies. And like, Evan and I have highlighted some of the projects that we think are more interesting or that we're more excited about. But there is, like, you gotta look hard for anything to be angry about in this portfolio.

David Roberts

Yeah, yeah. I should ask you both, actually. Is there, is there a hole? Is there an omission? Is there anything to?

Rebecca Dell

Well, and on. Even omissions are hard because you don't know whether it's because they didn't get a good application or it's because they decided not to fund it. So, you know, for example, like, I would have loved to see some, like, Brimstone and Sublime type companies in the steel area, because there are some companies that are working on alternative iron making, that's not hydrogen.

David Roberts

Right. Boston Metal is one of them. Going to be on the pod in a month.

Rebecca Dell

That's an example. Yeah. But for any of those companies, I don't know whether or not they applied, and I don't know whether DOE chose not to fund them or just didn't get applications of the caliber that they needed. But the point is, these are nits we're picking. This is like — a combination of my personality and my chosen profession gives me very, very few opportunities to just celebrate policy successes. To just say, "that is great!"

David Roberts

I've never felt so seen. Yes, so few opportunities to genuinely celebrate and clap. So I —

Rebecca Dell

You know, I think that what, like, this is this incredible new wave of momentum for our work, and if all goes to plan, so much of value to humanity will come out of the work that gets funded in these projects.

David Roberts

Yes, yes. And so, looking down the road a little bit, we'd expect some of these technologies to prove out enough that policy will shift from grants and loans, maybe to something like tax credits, like for wind and solar, maybe, or more demand-side stuff. But this is what starts that cycle, I think, is getting the technologies, making them real.

Rebecca Dell

Yeah. There's a bunch of different ways you can think about structuring deployment policy, but before you can have a deployment policy, you need something worth deploying.

David Roberts

Right, right. And that's what we're doing. That's what we're creating here. Y'all, this has been great. As you say, Rebecca, I do not get a ton of opportunities, given our subject and my personality, to be excited. And this is a really big deal. So, I wanted to do a pod on this just to sort of, like, as I said, pound the table a little bit and get people a sense that, like, this is not a — there's a lot of announcements coming out of DOE, you know, because of the Infrastructure act and the IRA. There's just been a lot of announcements about, "Oh, we're funding this, we're funding this, a little bit of funding for this, a little bit of funding for that."

They can start to blur together. I just want people to understand that this is not just another thing. This is a very big deal. So, I really appreciate you both coming on at short notice to talk through this. Super fascinating. And maybe, you know, we can reconvene next year and see where things have landed.

Evan Gillespie

That would be fun.

Rebecca Dell

I would love that.

David Roberts

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