

Beyond Plastic

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Greg Dalton: Plastic is everywhere in our homes, offices, streets and oceans. Most plastic is made from fossil fuels that took millions of years to create. It's made into products used for just a few moments and then thrown away or recycled. Plastics made from plants are favored by health and environmentally conscious consumers but are they really any better for people or the planet? Over the next hour, we will look at petroleum and bioplastics as well as the generation of entrepreneurs cooking up new technologies that will move away from a fossil fuel economy. Along the way, we will include questions from our live audience here at the Commonwealth Club in San Francisco.

With us, Keith Christman is Managing Director for Plastics Markets at the American Chemistry Council and Co-chair of the Global Action Committee on Marine Litter. Adam Lowry is Co-founder and Chief Greenskeeper of Method Products, a maker of home cleaning supplies. And Bridgett Luther is President of the Cradle to Cradle Products Innovation Institute. She previously was director of the California Department of Conservation where she oversaw the state's recycling program and regulated the oil and gas industry. Also Molly Morse, CEO of Mango Materials, a start-up company developing technology to make biodegradable plastic from industrial waste. Her PhD at Stanford University focused on bioplastics. Please welcome them all to Climate One.

[Applause]

So Bridgett Luther, I want to begin with you. And tell us first how plastics resulted, it's a huge industry, something like \$400 billion in the United States a year, started as using a waste product.

Bridgett Luther: Yes. When I was at the Department of Conservation I learned a lot about plastics because we ran the beverage container recycling program and they recycle billions of containers, 18 billion containers a year. I thought, "Oh, we're going to eat this plastic before it's all over" but it was really thinking about plastic and where it came from that got me all engaged in the program at Stanford which Molly was a student at. And it was a waste product so the oil companies kind of said, "We have all this leftover waste from refining oil. What can we do with it?" and they've developed polymer. So now there are other things that are going on and other people are looking at ways to develop polymers like Molly and some of her colleagues and so we can use a different product for plastic that would be much more recyclable and we wouldn't be using a non-renewable resource.

Greg Dalton: So Molly, tell us how you went from your path developing a waste product to Mango Materials.

Molly Morse: So my background was actually looking at construction materials and we were looking at biodegradable materials that could replace timber for temporary applications.

And we became really interested in the different kinds of glues you can use in the construction industry. And one of the glues that is environmentally friendly is called PHA, polyhydroxyalkanoates. We became very excited about alternative ways to produce this because it's normally made by sugar, bacteria that are fed sugar. So instead of doing that, you can feed them methane, a waste gas or any form of methane. And so that was just part of the work that was going on at Stanford, it was part of my PhD as well as many other people's PhD's.

So after I graduated from Stanford, I actually consulted for a bit and then realized that although this idea was really in its infancy, it really could drastically change the state of plastics in the environment and the world. So I started Mango Materials with some of my friends from Stanford and some other colleagues that I had met, and we started the company to commercialize this. It's still very early stage but we're very excited about the potential.

Greg Dalton: Early stage, I think your current office is in a shipping container, is that right? Okay.

Molly Morse: Yes. So our field demonstration site is in a shipping container at a wastewater treatment plant.

Greg Dalton: Excellent. Adam Lowry, let's talk about -- you were a former climate scientist. How did you get into making soap?

Adam Lowry: Yes. I worked for Dr. Chris Field, he's a well-known -- world-renowned climate scientist and one of the lead authors of the IPCC reports, as sort of the low man on totem pole. I did a lot of the climate science that was supposed to lead to policy change, and this was over 10 years ago. And the reason I went into business and started a business is I was, well, firstly, not the world's greatest scientist, I learned. And then secondly, I wanted to find a way to really make mainstream ideas around sustainability and responsibility materials, and I was finding that by doing climate science, even though I was passionate about the science, we all know the uphill battle that climate science is in the political sphere. And so I decided to go different path, and that's what led me to starting my business much of the way you have fifteen years ago. And now we're the world's largest green cleaning product company.

In North America, we've got about 120 employees. Worldwide, we've probably got about 250 or so. I don't really keep count. We make probably close to 100 million bottles a year, almost all of which are completely free of virgin plastic altogether.

Greg Dalton: Okay. We'll get into more of that shortly. Keith Christman, tell us how you came to into the plastics industry, your background.

Keith Christman: I've worked at American Chemistry Council for, I guess, about 23 years on different policy issues. And today I work on plastic markets, things from building and construction where plastic is used for insulation and products like that, automotive where we're working on CAFE standards and increasing fuel economy with lighter weight cars with plastics and also with packaging products.

Greg Dalton: Now, I looked up -- in researching for this program, I looked up at a site 5gyres.org. And one of their tag lines there is that 'It's made to last forever, and designed to throw away.' We know that that's plastics, right? And so there's a lot of plastic pollution in the oceans. I think a lot of people have seen birds where their stomachs are full bottle caps, et cetera. So what is the industry approach to addressing that plastic pollution problem in the oceans?

Keith Christman: Well, first off, we know plastic doesn't belong in the oceans. We don't want it in the oceans. Our products are too valuable to end up there. We want to keep them from being in the oceans and other water ways. Our associations across the world have joined together, announced the public declaration at the Fifth International Marine Debris Conference, over 50 associations in over 30 countries committed to actions to reduce marine debris. And since that time in 2011, we've announced over 140 different projects to help reduce marine debris.

Greg Dalton: And a couple of the ones -- the biggest ones you think will be most effective.

Keith Christman: Well, here in California an example is we've worked with California State Parks and keep California beautiful to put over 700 recycling bins on state beaches. We're doing research with some UN organizations on microplastics and issues around that. We're also working with Keep America Beautiful on a nationwide campaign called I Want To Be Recycled. It promotes recycling and raises people's awareness about the ability and need to recycle more products and the benefits of doing so.

Greg Dalton: Bridgett Luther, you used to oversee California's conservation and recycling program. What do you think of that industry approach to marine water -- plastic pollution?

Bridgett Luther: It's great. It's just a small -- there are so many holes in the dike where you can put your finger. I guess for me at the Cradle to Cradle it's not just that the plastics are in the ocean, but they're toxic. And so the toxic plastics are getting into the fish and that's getting into our food stream. So it's not only poisoning marine life and it just looks terrible when you look at it and you look on the beach and it's a terrible thing, but wouldn't it be great if we had some innovators who actually invented a plastic that was good for fish? So if it was good for fish, it might be good for people. And I know that at Stanford they've also been looking at a plastic that has a salinity trigger. So then when it gets in the ocean it would actually disappear or it becomes something that would be valuable.

So I think we need to always talk about what are we actually doing with the stuff we make and is it having a positive benefit. And that's the whole philosophy behind the institute and our certification program. And I think that the innovation that's going on just in the two universities -- there's so much innovation going on in this area, at Berkeley Green Chemistry, at Stanford Woods Institute. I mean, there's a lot of things out there that would be super valuable if we could just have the demand for it.

For Mango Materials - she's going to invent this great stuff but we got to get it off the shelf and get it out there so that comes actually start using it. So I'd like to see the American Chemistry Council just have this whole innovation thing going on. I think it would be so fun.

Keith Christman: And innovation is part of the things we do. We have members who are making bioplastic. One of the world's biggest producers of bioplastics is one of our members. So innovation is something we certainly endorse and certainly promote. And one of the great things about plastic is it can be made from a variety of different forms of carbon whether it's bio-based carbon or other types. So that is one of the benefits of plastics and you can organize it in ways to make different products.

Greg Dalton: Adam Lowry, you're actually harvesting some of the plastic from gyres and making bottles out of them or from beaches anyways. Tell us about that.

Adam Lowry: Yes. We're making this product here which is - I'm holding a small gray teardrop shaped bottle that's 12 ounces that is made 100% from post-consumer material, a good significant portion of which comes from plastic we've harvested out of the oceans. Now, the reason we've done this product which is just two products amongst many that we have, Method branded products, is really to raise awareness. We're not trying to solve the ocean plastic problem by taking plastic out of the oceans and making bottles out of it, but by doing that we're demonstrating that what people say is impossible actually is possible. And I believe taking sort of the first most important step towards addressing the ocean plastic pollution problem.

The real solution is actually what Method does with the tens of millions of other bottles that we make which is - this is a bottle that's made out of 100% post-consumer recycled PET, the same plastic that's in a common water bottle. And this was something that not too long ago people said was absolutely impossible. You could not make a clear high quality bottle that looked this good that was made entirely out of post-consumer material.

And the carbon footprint of this plastic resident resin is 60 to 70, 75% lower than virgin plastic. And what I think is really important about that is there is a lot of exciting development going on in the bioplastics sphere but there's also some things that we don't talk about in terms of where this stuff really ends up. And using the plastic that's already on the planet is a solution that we have today. So I tend to favor solutions that we can employ right now rather than saying, "Yes. The technology is coming." Yes, we need to invest in technology and technology is going to help. That shouldn't stop us from doing what's right today.

Greg Dalton: And what about just sending big ships out to the oceans and suckin' that stuff up and - I mean, it sounds naïve. Is it too simplistic to go out there and suck all that up?

Adam Lowry: Yes. There are organizations that are working on that. As a chemical engineer I can tell you from just kind of energy standpoint, it doesn't really work. The plastic is too small, too spread out in order to practically do that. We gather the plastic for our ocean plastic bottle on the beaches of Hawaii because, it's sort of horrifying, but the beaches of Hawaii actually act as a natural sieve, and they collect the types of plastic that we can use to put back into a recyclable bottle. So we've kind of used that infrastructure and then partnerships within Hawaii with beach clean up organizations to kind of get the stuff.

But like I said, this is really done to raise awareness about the fact that we should use the plastic that's already on the planet. As consumers, we should demand products that come from recycled plastics because it's a solution we have today that works and, combined with other things, is a solution that I believe is not utilized enough.

Greg Dalton: Keith Christman, let's get you on that. Utilizing the plastic that already exist and is that economic?

Keith Christman: Oh, absolutely. There is more demand for recycled plastic than there is supply. People putting it in the recycling bin, that's the challenge we face. There are a lot of companies that want to use the material. There's a lot of recycled carpet. Recycled materials goes into a variety of different products and the demand in the United States exceeds supply today. So the key is really getting everyone to put their plastics in the recycling bin when they're done using it.

Greg Dalton: Let's get at that. There's demand -- because a lot of times we've heard the opposite about recycling, that people recycle their stuff and there isn't a demand for recycled materials, et cetera, and it ends up getting thrown away. Bridgett Luther, you've managed this process in California.

Bridgett Luther: Yes. The demand is getting much higher now because of the cost of virgin, the cost of recycles. There's more parity now. And a lot of this is by what's happening in China. So we're all affected by this "world is flat" syndrome that we face but I think with Adam - companies like Method - would actually demand the recycled plastic, more states would actually participate in recycling. I don't know, when you go out of California, what you see but I know what I see. There's not a lot of recycling going on in some of the other states. There's only 11 states that have what they call the Bottle Bill program where everybody gets a little incentive to take your bottle back because

you paid it a nickel at the store and now you want the nickel back.

So a lot of plastic is going in the landfills in many states around the country that we could actually help. If they could just be like California, it would be much better and there'd be plenty of recycled plastics for people like Adam.

Greg Dalton: Them's fighting words in some parts of the country.

[Laughter]

Bridgett Luther: Those are fighting words in some of the parts of the country but it's California so you can kind of put it right out there, right?

Greg Dalton: Bridgett Luther is President of the Cradle to Cradle Innovation Institute and former Head of the Department of Conservation in California. Let's talk about plastic bags. Started in San Francisco in 2007, there was a ban on plastic bags. Now, currently about 100 cities and counties in the state of California have either banned or put a price on plastic bags. Keith Christman, is that a good thing to do?

Keith Christman: Well, I think there are some challenges in that. One of the concerns we have about bans alone are that the infrastructure that we use to recycle plastic bags and other product wraps, wraps that go around cases of soda or a case of paper towels or diapers or other products, those things can be brought back to the grocery store. A lot of people don't know that. So that infrastructure to recycle those materials is mostly in the grocery stores around the country. There's more than 15,000 different locations that people can bring them back to.

We've been working with Sustainable Packaging Coalition in their How2Recycle label to get labels on those products so that people know to bring those things back to their grocery store. So one thing we are concerned about is the unintended consequences that that infrastructure at grocery stores to recycle other kinds of wraps. Today we recycle over 1 billion pounds of could be inadvertently lost. There could be an unintended consequence of that.

Greg Dalton: But what's the consequence for the members of the American Chemistry Council in terms of if those bags come back, do they make less money? Is it kind of a nuisance? Are there lots of other companies that are more interested in virgin plastic? What are the consequences for the members of that closed cycle, that supply stream?

Keith Christman: Our companies want to increase the recycling rate. It's a strong desire of our companies to dramatically increase the recycling of plastics. And that's why we're working on film recycling with groups like SPC in the state of Wisconsin with a new wrap program to increase plastic wrap recycling. We've got a program on rigid containers. And so that isn't a threat to our plastic companies. They want to dramatically increase recycling recovery.

Greg Dalton: Bridgett Luther.

Bridgett Luther: Show of hands? Who really misses their old bags?

[Laughter]

Okay. Just for the radio audience, not one person showed their hands.

So we can all make changes. And there's a lot of energy that goes into making bags and making just reuse bags over and over. And just think it's a great thing. It's nice that the infrastructure was there but in the end, it's not just about recycling but it's also about reducing our waste too -- because there's just a lot of stuff that we could spend our energy better on than recycling bags that we didn't need in the first place.

Keith Christman: I will say too that we do strongly support reducing, reusing and recycling. So people reusing their bags -- and using reusable bags is also something that we support.

Bridgett Luther: And that's a great thing.

Greg Dalton: But does the industry oppose putting a price on plastic bags, that sort of thing? It's been back and forth in California between a ban or a price. I think there's a bill in the state legislature, that is trying to get out to ban plastic bags. Obviously a lot of members think that's probably a bad idea, right?

Keith Christman: Well, we're not the organization that works on plastic bags any longer. So I want to be clear on that first off. The side we're working on is the recycling side of plastic bags and wraps. So there is also some concern when places that we've seen put in place attacks. Sometimes they've taken out their recycling bin because people would go into the recycling bin and pull out bags to use. So there are some concerns about that as well.

Greg Dalton: We're talking about plastics and carbon at Climate One at the Commonwealth Club. Our guests are Keith Christman from the American Chemistry Council, Adam Lowry, Co-founder of Method Products, Bridgett Luther with the Cradle to Cradle Products Innovation Institute, and Molly Morse from Mango Materials. How about plastic bottles, that's another thing that's a topic here in San Francisco? We don't allow them or like them here at the Commonwealth Club. The City of San Francisco is trying to ban them. Keith Christman, let's talk about plastic bottles. Is it the same thing as bags or are they different?

Keith Christman: Well, plastic bottles are highly recycled in California. The recycling rate is over 80% for CRV bottles. So they can be recycled, reused, made into a variety of new products, fleecjackets and other products. Reducing, reusing, recycling is something we strongly support.

Greg Dalton: Adam Lowry, what do you think about plastic water bottles?

Adam Lowry: Personally, I think that the way we use plastic needs to change along with the infrastructure to recover it and reuse it. So using plastic the way we do now which for many single use applications where the plastic is only there to keep something pristine until you take it home and either throw it away or recycle it. We should try to move away from that as a use of plastic because while Keith's got some nice stats about how much does get recycled, the national average for PET recycling is 24 percent. So every pound that gets recycled, three of them are in the landfill for water bottle plastic. And water bottles are very large user of those things. And California is a great example but it's not like the rest of the world.

So I think we should adapt -- we should find new ways that is both technologies as well as consumer behaviors to move away from single use plastics. I'm not one to demonize plastic however. I think plastic, as everyone here would agree, is a high value material. We just need to make sure that we use it correctly and then pair it with the ability to get it back whether through a technical cycle like a petroleum-based plastic or biological one through a bioplastic.

Greg Dalton: Let's talk about bioplastics. Molly Morse, you've done your dissertation, a lot of research on this. A lot of people think that that salad fork made out of corn or potato is better, that compostable salad container is more virtuous than one made of big bad oil. Is that really true?

Molly Morse: That's a complicated question actually. So it depends on a lot of factors. I mean, some plastics, bioplastics as we call them, could be made from certain sorts of -- use agricultural lands in their production. For instance, maybe they use a lot water.

There can be all sorts of different concerns with the way they're made. Yes, I think there's a lot of different types of ways to make bioplastics from different sorts of plants. What we're doing at Mango Materials is using methane gas which can be a waste gas from wastewater treatment plants or landfills or agricultural facilities. Using methane gas is a really different story than using corn. Maybe you're converting the corn into sugar into some other chemicals that you ultimately make a plastic out of. It's really hard to compare those two materials. And at the end of the day, the plastic that you make is often different as well.

So the common bioplastics that people often are familiar with such as this cup that Adam has that's made by NatureWorks, it's a polylactic acid, a corn-based plastic, that's really different than the type of plastic than Mango Materials is producing. It's a different polymer, it has different properties, it has different end-use properties. So the way it breaks down in different environments is different. For instance, that material needs industrial compost, it needs oxygen, it needs certain infrastructure to break down.

The type of biopolymer we're currently producing actually can break down under anaerobic conditions if no oxygen is present. It can break down in the ocean. That plastic is not going to break down in the ocean.

Adam Lowry: And I think Molly is bringing up a really good point here which is bioplastics as a whole can give people, consumers, a false sense of responsibility, and I think that's very important. This plastic that I'm holding in my hand which is an ordinary drink cup made out of a bioplastic, PLA in this case. When people use these things at a concert or a place like this and then throw it in the trash, people think that this thing is going to biodegrade. And it doesn't. It's going to be there decades or centuries later just like the red Solo cup because, as was said, it needs an industrial compost. It needs heat and moisture in order to break down.

And so I think that's really dangerous because there are millions of these things around right now. And people think "Oh, it's biodegradable. I'm just going to chuck it." And it perpetuates the single use behavior of using plastics and chucking them away when really what we've got to do is we've got -- if we're going to use something like this, we've got to pair it with the ability to get all of it back so that we can reuse it, in this case, in a biological cycle, or do stuff along the lines of what Molly is doing which is recycling or using a technology that can actually degrade in conditions that aren't special.

Greg Dalton: So here, the plastic cup that Adam is holding up, the Commonwealth Club thought "Oh, this is better than [crosstalk]." Similarly, I went into a -- we have composting in San Francisco so it's totally fine. So Bridgett Luther, when we put that in the compost stream in San Francisco, is that plastic cup going to get broken down in an industrial kind of composting way or is it going to be there in 30 years? You worked with Recology, which is the recycler trash collector in San Francisco.

Bridgett Luther: Yes. Just like Adam said, we're super lucky but I think we are fooling ourselves so that's kind of -- I was really excited when I got up here because you said, "Oh, there's going to be a

water bottle next to your chair.” What's next to my chair is something that's reusable. And that was just a great thing to see. How often you don't see that. You go to these environmental conferences and then they've got all these water bottles everywhere and we're all like “What's happening here?” It's kind of crazy.

Adam Lowry: Yes. Greg, the Bay Area is pretty --

Greg Dalton: So we're batting 500 here tonight.

Bridgett Luther: Yes. [Laughter]

Adam Lowry: I mean, the reality is that the Bay Area is the only place in the country that has industrial composting on any sort of scale.

Keith Christman: I think Seattle is the only other one but yes.

Adam Lowry: Yes, but not nearly the scale that we have here. So hopefully that's going to grow but we need to make sure that we use these materials along with that growth so that we don't get things out of balance and inadvertently end up just exacerbating the problem with plastic pollution.

Greg Dalton: So how can an average consumer keep up with all this stuff? It's so confusing. I mean, I do this for a living and I learn stuff that we're doing the wrong thing. Bridgett Luther, this is too complicated for an average citizen. Molly has a PhD in this and it's hard for her. So the rest of us are just in trouble, right?

[Laughter]

Bridgett Luther: I think we should all become designers. One of the things we talk about at Cradle to Cradle is design for the end of use. And so when you're thinking about your own use of something, really think before you buy it. What's going to happen to this at the end of use? In San Francisco, the compostable thing is a good thing but you have to make sure it gets into the right container. And I think a lot of what we do, where is it going to go next because there is no “away,” and so how are we using things in our own life and then what does that look like at the end of it whether it's a refrigerator or a car plastic cup. And I think that's one of the things I love about Cradle to Cradle so much because it really takes you to that higher level of “Where am I going next with my stuff?”

Greg Dalton: So the idea is that something at their end of the life can be made into something of equal or greater value, upcycling, that sort of thing, right?

Bridgett Luther: Right, right.

Greg Dalton: How much of that is really -- Bill McDonough who founded the institute you head, has been talking and writing about that for a long time. How much of it is actually happening today?

Bridgett Luther: Well, part of it is the infrastructure need -- one of the things I was just writing about because there was a lot of talk about this at Davos, in the circular economy, the infrastructure has to be there. So we've got all this stuff and it could somewhere else. Who's actually going to get it there? And California made a big investment in recycling 40 years ago. They put the infrastructure in place. We're seeing the payoff in that now. What about all the other things that we have that don't have a place to go, the used hair dryer, the old vacuum cleaner, your cell phones, whatever? Is the infrastructure in place to make sure that all that material gets back not into the ocean, into

something that's really valuable at the end of use. So I think there's got to be a real thought now about what's the next series of infrastructures that we need to build so that we get stuff back and we don't keep mining and we don't keep destroying forests and all these kinds of things, and rivers because, really, there's enough aluminum in, probably, landfills around the world.

I see Mike Biddle right here on the front row -- to build a whole fleet of airplanes. We wouldn't have to mine any aluminum at all. So California has really got to put themselves out there on the sort of take it -- sort of beating the drama on the infrastructure to get stuff back and really start thinking about what's the next round of infrastructure that we need, whether it's industrial composting or a collection facility for all electronics so they're not just shipped to California.

Greg Dalton: Adam Lowry, you talked earlier about policy failure and the role of business but do you think policy needs to happen? And if so, what kind of policies in California to move this along, to move us toward more of a circular economy where things are reused rather than just chucked in landfills?

Adam Lowry: Yes. Like a lot of people, I'm not generally optimistic about our government's ability to create progressive policy right now but, yes, policy would help. I started my business because I believe that business can and is the primary force for leadership when it comes to creating benefit for society and the environment. And because frankly I was sick of banging my head against the wall trying to create policy that never happened.

So the reality is that policy could really help us if it helped to level the playing field for more responsible materials versus less responsible materials, and help us make choices about the types of infrastructure that we want to build so that we can recover materials responsibly but that shouldn't stop us. There are millions of business opportunities that come from recovering and reusing materials that regardless of any policy that may come down the pipe, that still exists.

Greg Dalton: Adam Lowry, is co-founder of Method Products. We're talking about plastics and carbon at Climate One. I'm Greg Dalton. Molly Morse, let's ask you. What are some of the companies out there, other than your own, that are really exciting, that you think are creating really cool things, taking waste and making it into an input that will really kind of change the way waste is handled and products are made?

Molly Morse: One of the companies, I think, that's actually pretty interesting is called Harvest Power. They do dry fermentation of compost. So this is thinking very far into the future of what a sustainable society could look like. And rather than compost as we conventionally think of it where there's a lot of oxygen present, you can do anaerobic compost so there's no oxygen present. And in those cases you actually collect the gas. So you collect the carbon that's coming off of that material. And then you can reuse that for other things. You can use it for electricity, heating, you could make it into more plastics. So I think that's one of -- sort of like making materials sort of far thinking technologies. And if we think of where recycling was 40 years ago and we think of how far we've come on that front, how far compost still has to go, I think things like dry fermentation is really interesting.

Greg Dalton: Molly Morse is CEO of Mango Materials, a start-up company here in the Bay Area. Bridgett Luther, we talked a little bit about carbon being not a villain. A lot of people think of carbon as the enemy. We got to get it out. We got to beat it down. Paul Hawken was here recently and said, "Carbon is a friend. Carbon should not be our enemy." Tell us about how carbon could be an input and a foundation for making products?

Bridgett Luther: Now, we've been hearing a lot of companies now who are trying to pull carbon out of the air and make it into materials. I'm not sure how likely that is but I love that people are thinking about it. How do you take carbon and pull it out of the air and make something amazing? I mean, just the whole idea of methane-based polymer makes me so happy and I'm so excited for Molly.

And the one reason I love it is it keeps going around. One thing about recycling plastics every time you recycle it, the polymer gets a little different so that can't happen in perpetuity but with a methane-based polymer, it can. So you would actually make something if you kept it. It could just keep going around just like aluminum, it just keeps going around and around and around. It's just such a strong bond that it's reusable over and over and over again. So those kinds of activities need to be incentivized.

Greg Dalton: And let's ask Keith Christman, how many of your member companies are looking at those sorts of thing? There's the innovator's dilemma which is well-known which is large companies often don't innovate because they protect, defend the franchises that they've built that are so profitable. You've looked at the Mango Materials, et cetera. Do you think they might eat the lunch of your members one day?

[Laughter]

Keith Christman: Well, many of our companies are looking at bio-based materials and other kinds of plastics. Some of the largest companies are leaders in bio-based plastics in the world. High density polyethylene, it's made from sugarcane, is one of the largest uses today of bioplastics in addition to bio-based PET. So many companies are looking at and making many innovations to deliver new products along those lines.

Greg Dalton: Adam Lowry.

Adam Lowry: Yes. I was disappointed when Coca-Cola shut down the largest PET recycling plant in the world in South Carolina, and decided to do bio-based PET instead because here was an opportunity to actually make a market for recycled material and instead they went a bioplastic route that, without going into the science, isn't quite as good from an environmental impact.

Greg Dalton: This is the plant bottle that's [crosstalk]?

Adam Lowry: Yes, so that they could put a green triangle on the bottle and say plant bottle. Now, the reasons for that are obvious, right? Consumers who are mostly uneducated about plastic issues say "Oh, plant bottle. That's great. Awesome. They've solved my water bottle dilemma. And I can just keep using it." And I don't pretend to know the reasons behind that but I wish that we would make more use of the technologies that we already have rather than keep pointing to the technologies that we could have tomorrow.

Bridgett Luther: A lot more recycling needs to happen. That's the thing. There's just not enough of it going on. We're not capturing these materials in good cycles. That's why I say more states have to be like California. They have to start investing in the infrastructure to get this stuff back so that we can actually recycle it so that getting a piece of recycled plastic won't be any big deal. It will be your first choice instead of your second choice. You would just do it. It will become natural for you to say "Oh, it's going to be recycled. I'm just going to do this and this is part of my business plan now." So I'd like to see just more states following California's lead.

On the other hand, on some of these people making the bioplastics, they ought to be also investing in compostable facilities so that they know at the end of use that compostable, whatever it is, gets back into something that's valuable and doesn't become a piece of waste that's just sitting in a trash can in Georgia.

Keith Christman: Can I add something on the -- I think there are a lot of exciting things happening in recycling across the country. And one of the things we've seen happen just in the last four years or so is a dramatic increase in the number of communities that have the ability to recycle non-bottle rigid containers locally. You look back just five years ago, only about 30% of people could recycle that stuff at their home. Today, the number is over 60% and it's growing very, very fast. And we've seen, as a result of that, the recycling of non-bottled rigid plastics go from 300 million pounds to over a billion pounds in just a few years. So it's tripled since 2007.

Greg Dalton: And non-bottled hard plastic, what's an example of that?

Keith Christman: Yogurt tubs, butter tubs, large five-gallon pails, so a variety of rigid containers that people can now recycle at home that they weren't able to before. And I think that's something that we are seeing is more opportunity to recycle those materials.

Greg Dalton: Bridgett Luther, does industry obstruct recycling plans and laws? Only 11 states have laws, you said earlier. Is the industry sort of --

Bridgett Luther: Well, yes because they have to pay a little bit into the front and then they get the money back on the backend. So it starts to disrupt their business plans. So they don't like it. So yes, they fight it. Wouldn't it be great if we just had a national bottle bill and somebody just stood up and said, "We're all going to recycle, and that's going to be the end of it." They do it in Germany. They do a lot of it in Europe. So it would be really fun.

People are pretty -- they get really excited when those things happen but if we can sort of -- we could learn from what's going on in California. We could see -- it was really interesting to be in Sacramento. And we went from four cents on a bottle to five cents. The recycling rate went from 62% to over 80% just with the addition of the penny. People just wanted to get that nickel back. Four cents didn't seem like enough. The nickel seems like a lot. And everybody started recycling a lot more. It was amazing to watch that happen in 18 months. So it was pretty amazing to see how quickly that nickel started incentivizing consumers. But also the infrastructure was there so we could get the stuff back and put it into the recycling stream.

Greg Dalton: And we should clarify. You were a Republican serving in the Schwarzenegger administration when that happened.

Bridgett Luther: Yes.

Greg Dalton: McDonalds recently --

[Laughter]

Bridgett Luther: One little thing.

Greg Dalton: One penny. It's amazing what one penny can do.

Bridgett Luther: Yes. Amazing what a penny can do.

Greg Dalton: McDonalds recently announced that they're going to move from polystyrene to paper cups for hot beverages in their 14,000 restaurants in the United States. Is that a good move or is that another one of those unintended consequences? Well, it sounds good, it sounds better but maybe not so much. Bridgett Luther, do you think?

Bridgett Luther: Whenever you can rid of Styrofoam, I'm all for it because there's nothing you can do with it much at the end of life. So I think it's a good move.

Keith Christman: Ironically there's more ability in the State of California to recycle polystyrene foam cups than there is to recycle or compost paper cups. Fifty percent of people in California can recycle polystyrene cups in the top 50 communities in California. And only 15% of people can either recycle or compost paper cups.

Greg Dalton: How many people know they can recycle Styrofoam cups?

Keith Christman: Well, it's not in San Francisco but you go in Southern California and L.A. and other areas around there, they do.

Greg Dalton: Okay.

Keith Christman: It needs to be put with your infrastructure that you have locally. So that's the important part.

Greg Dalton: Before we go to audience questions, I want to come back to consumer confusion in labeling because all this is so complicated. How can consumers be educated? There are lots of attempts to have some kind of simple label for what's recyclable, recycled. Is there any hope there, Adam Lowry, for some simple logos or is it all at the brand level which is where you do it?

Adam Lowry: Yes, exactly. I mean, what we do is we try to use our brand to carry a message. We call this ocean plastic bottle "message in a bottle." And it's really that we're just trying to raise awareness about think about it before you buy it whether you're talking about a cleaning product or any other type of product. And that really is as simple of a message as we go with because it is super confusing. We can't expect consumers to be plastic scientists. That is just unrealistic. And until such point that we have a system, which I hope we do, where we can clearly identify plastics and those plastics are matched up with the ability to recover them and recycle, and ultimately reuse them, unfortunately we're going to have to rely on people like everyone here to know or at least seek out something that's a little bit more responsible. (0:46:01)

Keith Christman: Yes. I think the Sustainable Packaging Coalition's new How2Recycle label will offer a lot in that regard because it will make it easier for consumers to recognize things that are recyclable and it will inform them what to do with things. An example is the film that goes around a case of soda or the film that goes around a case of paper towels. People don't know that material can be recycled but this new label will tell them they can recycle it and tell them they could bring it back to the stores and put it in the recycling bin at the front. So that's a real opportunity we've been working with them in the State of Wisconsin to promote that and make more people become aware of that. It's an easy thing to do. Dry cleaning bags and other products like that as well.

Adam Lowry: Greg, ultimately it's going to be a multifaceted and multilateral solution. I think one other really key component is the business community should take the onus on itself to make things out of the materials that are already recycled because if they do that, then they're also sending a

message to consumers when they buy those products. This is already made from a recycled material so you should recycle it again so we can keep that going.

Greg Dalton: Just one thing on soap. Wouldn't it be better to use a bar of soap with no plastic bottle at all?

Adam Lowry: From a plastic standpoint, it certainly would. Unfortunately, a bar of soap has fairly limited applications, if you've ever tried to use it to clean your laundry or clean your floors, you'd [crosstalk].

Greg Dalton: But hand soap. I mean, some environmental groups say, "don't use plastic bottles for hand soap, use the old fashioned bar."

Adam Lowry: Yes. You certainly can do that. I think one of the things that is important to recognize is that there are many different consumer habits out there. And it's harder to change consumer behavior than it is to redesign products. And so if you can actually redesign products, you can get people to adopt a more innovative and more sustainable format, you can keep people moving along to progressively more innovative and sustainable products. So you got to do both.

Greg Dalton: Pumping hand soap is more fun when it comes to --

[Laughter]

Adam Lowry: Well, I mean, to many consumers, it is. And it's also a better experience on your hands and things. So there are a lot of reasons why people use liquid hand soap. You've got to work with that, not against it necessarily.

Greg Dalton: Molly Morse, then we'll go to audience questions. Molly.

Molly Morse: I was just going to say I think there are two confusing issues in terms of labeling. One is where did this material come from? Where did the carbon originate, that's in the packaging? And the other is what's going to happen to this material when you no longer need it? So those are two issues that can really confuse consumers. And clearer labeling is definitely needed.

Greg Dalton: This is Climate One. You just heard from Molly Morse, CEO of Mango Materials. Our other guests today are Bridgett Luther, President of the Cradle to Cradle Products Innovation Institute, Adam Lowry, co-founder of Method Products, the cleaning products company, and Keith Christman with the American Chemistry Council. I'm Greg Dalton.

Male Participant 1: Good evening. Great presentation. Thank you. You mentioned that there's enough aluminum on the planet to not have to mine anymore. Is there enough plastic on the planet to do the same thing?

Greg Dalton: Adam Lowry.

Adam Lowry: Well, nearly every single pound of plastic that humanity has ever produced is still here. Most of it is in the ground. And we can't practically get it back.

Plastic use is growing so it's growing a little bit. So no is the simple answer but the vast, vast majority of it, we actually could do with the plastic we already have on the planet if we have better ways of getting it back.

Greg Dalton: Let's have our next question. Welcome to Climate One.

Female Participant 1: Thank you all very much. It's been quite interesting however every time we hear these panels, we hear one thing; lots of plastic in landfills. Has anyone considered mining the landfills for all this plastic? It seems like that's where most of it is.

Greg Dalton: Bridgett Luther, you used to oversee the department. Is that economic?

Bridgett Luther: [Laughter] I'm laughing because we've had this conversation over and over again that there's this -- we actually call our recycling program urban mining because I also oversaw all the mining industries in California. And there are ample opportunities to try to get stuff out and reuse it. We have lots of experts in the room who could talk about this much more than I can. And I would just encourage you to look at Mike Biddle's Youtube video. And he's done a lot of study on this, and he's with us here tonight. He's with MBA Polymers and he's probably one of the world's great experts on where we can get the next round of resources. So I would just encourage everyone here to look at Mike's Youtube video.

Greg Dalton: Welcome to Climate One.

Female Participant 2: One of the things I've heard quite a bit about is infrastructure. And you mentioned that the rest of the states in our country really need to get onboard with an infrastructure like we have in California.

How can we make the responsibility on those folks who are making these products to create the infrastructure to recycle these products and maybe focus our policy on requiring them to use the recycled material that they're creating?

Greg Dalton: So Bridgett Luther, there are some things where producers have to take back, computers, there's a charge for consumer electronics, et cetera. There are some closed loops there but plastic is so ubiquitous.

Bridgett Luther: Yes. Plastic is the hardest thing because they're so small and there's not that much value in it. But one of the things you do with the Cradle to Cradle certification program is when you design the product, you're actually thinking at the end of use. So have I developed the system that gives back whatever it is, whether it's a refrigerator or a car or a plastic bottle?

And the businesses start to get really involved with the getting back of these nutrients because it's really important because they want them back to put them into their next material. See, if Coke had been smart they would have said, "We should get all our bottles back so we won't have to make new bottles," and they would have just sucked up all the recycled plastics on the planet. But they're not thinking about that. They're just thinking about getting you to drink that drink. They're not thinking about what's going to happen to that.

Greg Dalton: Let's have our next question.

Female Participant 3: My question is directed for Mrs. Luther. I'm a huge fan of your work and Cradle to Cradle mission. And I read *The Upcycle* in which William McDonough discussed stripping products of their plastic packaging and instead including displays in these stores so that people can simply get the product and leave. Have you done any of this work with the companies that you're currently working with?

Bridgett Luther: We don't do the work with the companies. We just give them the idea. They do the work and then they tell us what they've done. But lots of companies are starting to think about this; what's going to happen at the end of use? So we have to start talking about end of life. And when you start doing that as a designer like the Method team has done, it just gets to be really dynamic and all kinds of fun things can happen.

The Herman Miller chair, the Aeron Chair, actually got developed because Herman Miller didn't want to put foam in their chair. So they developed one of the fastest selling office chairs ever, the Aeron Chair, because in their designs -- so what's going to happen in this? Well, now we're going to end up with all this foam. We don't have anywhere to go. The end of use of that Herman Miller chair was a lot of super valuable materials that can be easily recycled.

Greg Dalton: Adam Lowry.

Adam Lowry: I think one of the keys to moving towards progressively more sustainable formats, and to your question, getting entirely out of plastic packaging altogether, is serial innovation. So I always say that the key to the innovation process is not necessarily technology and creativity and all of that. That's important but actually the most important part is adoption. You've got to get people to use it. And if people use that thing, that's cool, that's more sustainable, then that wave of consumer adoption gives that company the license to innovate again. And it's through a couple of steps like that that you can actually change entire industries. I don't have time to go into it but we've actually done that with a couple of categories that we compete in and radically changed industries that are very stodgy in a very short period of time just through a couple of innovation steps but adoption is the key.

Female Participant 4: Yes. I don't know if there's anything going on right now about -- businesses, they seem to be making an awful lot of products that are single use and small. An example is the little coffee cup things that you get. They're all over the place, you go to a dentist's office, anywhere, and the whole concept of just making a pot of coffee, the whole concept of refills. And I don't see anything in our government or in our environment that's encouraging that. I see the opposite. I see mops. It used to be, like 10 years ago, you can just get a mop and mop the floor but now you've got to get Swiffer and throw things away and buy new things.

Greg Dalton: Thank you. Yes. Bridgett Luther, we live in a disposable society.

Bridgett Luther: We actually -- the espresso -- not plug it, but they're actually recyclable, we could actually take them back, and they thought that through. That's what makes it so neat. What's going to happen to that little coffee thing at the end of use? You can actually take your little coffee things back to the espresso store and they're recycling them and they're made out of aluminum which is highly recyclable.

Greg Dalton: I wonder how many really do but okay. Adam.

Adam Lowry: All I was going to say is that's just evidence that convenience can often produce behaviors that aren't necessarily the most sustainable. I don't think we can try to make our lives a whole lot less convenient. I don't think that's actually practical. I don't think that that would create mass adoption. But what we can do is redesign those products to be more responsible which is, I think, the example you get.

Greg Dalton: We're talking about plastics and carbon at Climate One. Let's have our next question.

Welcome.

Female Participant 5: Thank you. This has been an excellent forum. Something that's very frustrating to me and to my family when I go out of state to visit them, they very much want to recycle and they do their due diligence collecting the newspaper, collecting cans and bottles, and then they drive them once a month to a recycling center that they get a certain amount of cash for, pennies on the dollar. So I think they are probably indicative of people throughout the United States and that they're -- I think the people want to recycle. Why can't we make a stand here tonight, now with Climate One, to get all the other states onboard and recycle?

Greg Dalton: Bridgett Luther.

[Laughter]

Greg Dalton: We're going to march to [crosstalk].

Bridgett Luther: March to D.C. to start the national recycling bill. Yes. Actually driving your stuff to recycling center is a way that started in California. So the fact that people are starting to see value in this and getting paid for it is really important. But there are lots of businesses in it too. It's not a trash truck, it's a resource truck. There are lots of valuable resources in those trucks. As more companies demand recycled plastic, then somebody in those states will actually say, "Oh, I should get that plastic back because Method will want it and whoever else will want it."

Adam Lowry: Financing is key. The facility at Pier 96 here in San Francisco cost \$40 million, the machine cost \$40 million. Now, it's producing product that is now being sold but financing is key. You've got to find ways of creating long term income streams to defray the upfront investments.

Greg Dalton: And there are also commodity prices. Dave Steiner, the CEO of Waste Management was here a couple of years ago. And he realizes the economic value that he hauls away in those trucks everyday but it's largely dependent on commodity prices for aluminum, paper, et cetera. When those fluctuate the economics are favorable or not and they're so volatile that it's tough to build a business. Let's have our next question at Climate One.

Male Participant 2: I wanted to address, shall we say, the short term economic incentives. Keith, you mentioned that there's basically more demand and supply for recycled plastics. And I guess part of that is that, as you say, there are films that can be recycled. Very few people know that. Bags can be recycled at stores. Yes, you can bring your bag back and maybe you get to feel good but you don't get any money back for it. You do get money back if you bring your bottles. And so the people who roam the streets are picking up bottles but they're not picking up film, they're not picking up the other stuff that could be recycled.

So I guess one comment would be that recycling is third in the order for reason, that reduce is better and reuse is second, then recycle. But what is your stance on basically paying people to bring stuff back to have a usable return program for all the other stuff that they're not currently recycling?

Greg Dalton: Keith Christman.

Keith Christman: Well, I think there are some potential downsides to having everybody bring their stuff back instead of having a truck that goes and collects multiple recyclables rather than just one. And that downside is that there is a lot of carbon emissions with people making special trips to drop stuff off. However, some states have actually gotten rid of the Bottle Bill.

Delaware, for example, had a bottle deposit legislation in place and they found that they didn't have other recycling programs as a result. So instead they got rid of the statewide bottle program and replaced it with statewide curbside recycling. That is another thing to consider because right now you have people bringing back one product, and that sometimes brings one of the more valuable materials out of the recycling bin that people have at their house and can make it harder for recyclers to be profitable.

Greg Dalton: Keith Christman is the Managing Director for Plastics Markets at the American Chemistry Council. Let's have our next question at Climate One.

Stiv Wilson: Hi. My name is Stiv Wilson. I'm the Policy Director for the 5 Gyres Institute. And a lot of what we're talking about tonight is recycling. And when I look at our policy agenda with 5 Gyres, we're looking at what solution is actually going to address the problem. And recycling is a very small part of that. If we look at generation in this country, the average footprint of plastic per person in the U.S. is 326 pounds per person per year. That's set to be upwards of 500 by 2020.

We talked about modest gains in recycling. Well, as a percentage of generation, that's actually really, really minimal. And if you talk about things like low density polyethylene or high density polyethylene, these have flat lined, or gone backwards. So when I look at our policy agenda, we say, "Yeah, ban the bag." We say container deposits because do you know the number one barrier to a Cradle to Cradle strategy for the PET bottle is? It's container deposits. You can actually make a water bottle, a food grade water bottle out of a water bottle. And you have people like Nestle Waters looking at this now. And they say, "Yes. We have 50% recycled content." The barrier to 100% is a container deposit. We could solve this problem overnight.

So I'm wondering we talk about recycling as a solution, are we really talking about the big picture solution or are we talking about a very small part of it? And shouldn't the conversation be more focused on source reduction? Thanks.

Greg Dalton: Thanks. Keith Christman.

Keith Christman: Absolutely. Actually that's a great point. I mean, the hierarchy is reduce, reuse, recycle for a reason. And we strongly support reducing, reusing and recycling plastics as well as other materials. I think one of the things that people should also recognize is when you look at plastics, one of their major benefits is reduction in the amount of material you use for plastic product compared to the alternative. You look at a truck, for example, a replacement of a running board from a metal running board to a plastic running board reduce the amount of material by 50% and results in just that one part in saving 2.7 million gallons of gasoline. So reducing is an important factor. And actually plastics can help achieve that both in automotive applications and in packaging. Reusing and recycling are also very important.

Greg Dalton: Let's have our next question. Welcome to Climate One.

Female Participant 6: Thank you. This is sort of a follow on to the last question. I'm really encouraged to hear the discussion about redesigning products to hear about starting from the beginning of the product because what we're seeing in the marketplace right now is a growth of unrecyclable products and a growth of products that are either designed for the dump or what I would call built to be burned. It's not happening in much places in California but in many places around the U.S. a lot of wastes still gets burned. And the American Chemistry Council and other industry actors push really hard for an increase in plastics and other parts of wastes being burnt. And that's a real problem for the communities who have to live with the toxic pollution from the

burning of plastics and other wastes.

So my question is we're hearing that we have a lot of policy solutions. We're hearing that industry doesn't want them. What's it going to take for us to get to a place where we can actually achieve the types of policy solutions that we need? We know we need them.

Greg Dalton: Keith Christman, does the industry support burning of plastics?

Keith Christman: Well, I think that there are a couple of things that are really exciting on the energy recovery front for plastics. Today, it's not just about burning when it comes to energy recovery. There are new processes to take plastics, put them into a system where it's not burned but you're able to recapture the fuel from it or recapture the raw materials and make them back into new fuel or new plastics.

A company in Oregon is doing that, for example, called Agilyx. And there are other companies around the world pursuing those processes. It's not burning technology. It's taking the plastic and breaking it back down to its original raw material so it can be reused again. And that's part of a solution. I think what we need is a wide range of solution including reducing, reusing, recycling, composting and energy recovery. All of those together would be a healthy part of the solution.

Greg Dalton: I think we actually reached out to Agilyx in building this program. We got a couple of minutes left for two more questions. Welcome to Climate One.

Male Participant 3: Adam, you mentioned that the onus to promoting change is on businesses. And I'm wondering what's different for Method as a certified benefit corporation in terms of how you conduct your business.

Adam Lowry: Yes. Just a quick background. We're a certified benefit corporation. We're also a benefit corporation. We're incorporated as a benefit corporation in Delaware which just means that our directors and officers have fiduciary -- their fiduciary duty is expanded to include social and environmental benefit as well as economic. For us, it means that through everything that we do with the business, that we're making sure that we're trying to accrue value economically, socially and environmentally.

And so from a material basis, we put our material choices through the lens of what is going to maximize all of those things. That's why we look to technologies that are available today so that we can deploy them at scale because we're a consumer products company that has a reasonable amount of scale. And then, of course, we're constantly looking towards new technologies to say, "Is there a better one available?" If so, we migrate to it.

Greg Dalton: Let's have our last question. Welcome.

Female Participant 7: I'd like to follow up with some of the questions that I think the audience has brought up and just sort of the overall theme that has been coming up relating to infrastructure and the kind of lack of any hope of there being policies made on a national level or, I mean, could we say international level, to make these things happen.

And it's so amazing what you guys are doing to have the certification process for manufacturers. However, is there any discussion on generating policy that does require end of use responsibility on the manufacturing side? I think it was a really great question that the woman in the green shirt brought up about governments being so strapped at this point.

Greg Dalton: So Bridgett Luther, if you could wave your magic wand, one policy in Sacramento that would help this, what would you want?

Bridgett Luther: All the products have to get Cradle to Cradle certified.

[Laughter] [Applause] [Crosstalk]

Bridgett Luther: Well, if they did, they'd design, reuse and they'd designed with materials that won't kill us and they'll pay everybody a fair wage and they'll care about water and they'll move to renewable energy. And that's one of the reasons I wanted to do this work because I was sitting at Sacramento and I said, "We're not going to get there the way we're doing it" because as a regulatory community we sit at the end of the pipe all day long and we say, "How much stuff can we have in our air, our waters, ourselves before it will kill us.?"

And we will not get there with the regulations that are now because that's the way they're designed and that's the way they're implemented and that's the way the companies get fined. And Cradle to Cradle goes all the way up and says, "Let's design products with systems and processes that don't harm people and planet." It's really up to businesses like Adam's because he's right there with us and he's designing this incredible products that not only cleans like crazy but it's got this social benefit as well. And he's designing it with processes and he's completely renewable energy and he's done all this great stuff. You can't imagine the stuff he's done with his company.

And Molly too, I mean she's just -- she's got a Cradle to Cradle polymer and I just can't wait for it to scale because I'm going to push it out in any way that I can. And I just want the American Chemistry Council to say, "I'm with you Bridg." So anyway --

[Laughter]

Greg Dalton: Sound like a proud mama there. Okay. We have to end it there. We've been talking about plastics at Climate One. Our guests are Bridgett Luther, President of the Cradle to Cradle Products Innovation Institute, Adam Lowry, Co-founder and Chief Greenskeeper at Method Products, Molly Morse, CEO Mango Materials, and Keith Christman, Managing Director for Plastics Markets at the American Chemistry Council. I'm Greg Dalton. Thank you for coming and listening to Climate One today.

[Applause]