

**21ST CENTURY FOOD SYSTEMS: CONTROLLED
ENVIRONMENT AGRICULTURE'S ROLE IN
PROTECTING DOMESTIC FOOD SUPPLY
CHAINS AND INFRASTRUCTURE**

HEARING

BEFORE THE

**COMMITTEE ON AGRICULTURE
HOUSE OF REPRESENTATIVES**

ONE HUNDRED SEVENTEENTH CONGRESS

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21ST CENTURY FOOD SYSTEMS: CONTROLLED ENVIRONMENT AGRICULTURE'S ROLE IN PROTECTING DOMESTIC FOOD SUPPLY CHAINS AND INFRASTRUCTURE

THURSDAY, JULY 29, 2021

HOUSE OF REPRESENTATIVES,
COMMITTEE ON AGRICULTURE,
Washington, D.C.

The Committee met, pursuant to call, at 10:01 a.m., in Room 1300, Longworth House Office Building, Hon. David Scott of Georgia [Chairman of the Committee] presiding.

Members present: Representatives David Scott of Georgia, Costa, McGovern, Adams, Spanberger, Hayes, Delgado, Pingree, Kuster, Carbajal, Khanna, Correa, Craig, Harder, Axne, Schrier, Panetta, Thompson, Austin Scott of Georgia, DesJarlais, LaMalfa, Allen, Rouzer, Kelly, Bacon, Johnson, Baird, Jacobs, Balderson, Mann, Feenstra, Miller, Moore, Cammack, Fischbach, and Letlow.

Staff present: Josh Lobert, Ashley Smith, Ricki Schroeder, Patricia Straughn, Jennifer Tiller, and Dana Sandman.

OPENING STATEMENT OF HON. DAVID SCOTT, A REPRESENTATIVE IN CONGRESS FROM GEORGIA

The CHAIRMAN. Good morning. The Committee will come to order. I want to welcome everyone, and thank you for joining us today for this important and much-needed hearing entitled, *21st Century Food Systems: Controlled Environment Agriculture's Role in Protecting Domestic Food Supply Chains and Infrastructure*. After opening brief remarks, Members will receive testimony from our witnesses today, and then the hearing will be open for questions. Members will be recognized in order of seniority, alternating between Majority and Minority Members, and in order of arrival for those Members who have joined us after the hearing was called to order. And when you are recognized, you will be asked to please unmute your microphone, and each person will have 5 minutes to ask your question or make a comment. And if you are not speaking, I ask that you remain muted in order to minimize any background noise.

In order to get to as many questions as possible, the timer will stay consistently visible on your screen. This is a vitally important meeting. It comes at a time also, ladies and gentlemen, that we will have possible votes at 12:30. It is now 10:00. That gives us 2½ hours, and then it will end. We are going to have a long series of these votes, so I am just asking everybody—we have a lot of people,

a lot of interests, and we want to get everybody in, in time. And I want to start myself by giving a very brief opening statement.

Ladies and gentlemen, this is so important. The future of our food supply is at stake, and today's hearing comes at a very pivotal moment in our nation's history, the future of our nation's food security, and we have a panel of very distinguished witnesses who specialize in innovative ways to make sure that we keep our nation's food secure. And what we are talking about comes under a new category, controlled environment agriculture, using cutting edge technologies.

[The prepared statement of Mr. David Scott follows:]

PREPARED STATEMENT OF HON. DAVID SCOTT, A REPRESENTATIVE IN CONGRESS FROM
GEORGIA

Good morning, and welcome to all of the Members and witnesses we have here today.

Today's hearing is one that comes at a pivotal moment in our nation's history and is one that I am sure will provide critical insight on an important segment of our food supply system.

Recently, Secretary of Agriculture Tom Vilsack made an excellent point—he said, “In the pandemic, we found that our food system and our food supply system, while it is incredibly efficient, is not resilient.”

That exact point is something I hope we can cover today. I want to examine how we can better balance efficiency and resiliency and ensure that our food supply system is as abundant, affordable, and safe as possible.

Today's panel of witnesses are experts and entrepreneurs in an exciting area of agriculture that this Committee has not spent a lot of time discussing. These witnesses specialize in controlled environment agriculture, and I look forward to them educating the Committee about their industry.

While a global pandemic certainly magnified our food supply chain issues, one of the issues we can cover today is how to ensure a supply of fresh fruits and vegetables from all sources. Controlled environment agriculture has the ability to fill in gaps where there are food deserts, reduce emissions from transportation of produce, and very importantly, limit our reliance on imports to fill our needs for fresh produce.

We have an opportunity today to be on the cutting edge of technologies and the ability to provide affordable food to more households that need it—something I hope we can all agree on.

The CHAIRMAN. And so I definitely want to welcome all of you here, and with that I will turn it over to the Ranking Member for his opening statement.

**OPENING STATEMENT OF HON. GLENN THOMPSON, A
REPRESENTATIVE IN CONGRESS FROM PENNSYLVANIA**

Mr. THOMPSON. Mr. Chairman, thank you so much. Good morning, and thank you to our witnesses for making the time to be with us today. I am eager to learn more about your contributions to this sector of our agriculture industry. As I have said before, I hope our Committee will move to hold hearings that explore the issues facing production agriculture, provide opportunities for oversight of the 2018 Farm Bill, and receive updates from officials in the Administration, including Secretary Vilsack. A hearing to review the state of the rural economy and our agriculture industry is long overdue, and I appreciate the Chairman's commitment to hold this hearing with the Secretary following the August work period.

Thanks to innovation in agricultural technologies, American farmers, and ranchers, and foresters are not only conserving resources, but they are doing it while producing more food, feed, and

fiber. Productivity relative to resource use for agriculture is up 287 percent in the United States since the 1940s, while total farm inputs remain mostly unchanged, the most efficient and productive agriculture in the world. Our specialty crop producers have also been able to adopt innovative technologies over time to increase yields, while decreasing inputs. Examples of these innovations can include hydroponics, aquaponics, aeroponics, and other greenhouse production methods. While hydroponics, and these other methods of production in a controlled environment, are not new concepts, there is an increased interest in utilizing these methods to supplement traditional production agriculture to ensure Americans have year-round access to domestic fresh fruits and vegetables, and to decrease our dependency on foreign countries to supply those same products.

The diverse panel of experts before us represent all segments of our hydroponic and other controlled environment methods of production, and I think this hearing presents an opportunity to learn more about their work, contributions to agriculture, and where we go to from here. As I said earlier, I believe these innovative production methods are meant to supplement production agriculture, not supplant. It takes all sectors of our agriculture industry working together to ensure that the United States can continue to have the safest, most abundant, and most affordable food and fiber supply in the history of the world, and controlled environment agriculture is a piece of that larger puzzle.

I would like to thank our witnesses once again for being here with us, and I look forward to hearing your testimony. And, Mr. Chairman, with that, I yield back.

The CHAIRMAN. Thank you, Ranking Member, and, without objection, I would like to insert into the record this statement brought to me by our distinguished colleague, Representative Barbara Lee of California. Thank you.

[The statement referred to is located on p. 49.]

The CHAIRMAN. With that, I now would like to welcome the distinguishing panel that we have. Before I get to that, the Chair would also request that other Members submit their opening statements for the record so witnesses may begin their testimony, and to assure that we have ample time for all of our questions.

[The prepared statement of Ms. Schrier follows:]

PREPARED STATEMENT OF HON. KIM SCHRIER, A REPRESENTATIVE IN CONGRESS FROM WASHINGTON

Thank you, Chairman Scott and Ranking Member Thompson, for putting together this hearing on such an exciting and innovative sector of agriculture.

I recently had the opportunity to tour DeGoede Farms in my district and saw their Controlled Environment Agriculture (CEA) operation. DeGoede Farms is a greenhouse urban farming company that grows nutritious food, year-round, using greenhouse hydroponic farming systems in the Puyallup Valley in Washington State. Since 2016, they have been growing butter lettuce organically and hydroponically and they will soon be building a new 40,000 Square Foot greenhouse and expanding to more herbs and leafy greens.

I was particularly excited to learn about the ways DeGoede's operation is working to farm sustainably. Hydroponic technology reduces their consumption dramatically. DeGoede Farms was able to increase their production of herbs and lettuce while using ten times less water and eight times less land than with traditional farming methods. The reduction in land usage is crucial in areas like Sumner, where the amount of traditional farmland is declining due to a boom in population. It is also

vital in areas where zoning is a significant constraint on the development of CEA. While this is generally a local jurisdictional issue, I recently heard from Washington State University about the need for adaptive use zoning to convert old industrial and manufacturing spaces for highly efficient, sustainable CEA production.

I also wanted to highlight three issues that DeGoede farms raised as being necessary for the development of the CEA industry and that I want to work with my colleagues to address:

- (1) Access to labor.
- (2) Access to low interest loans via USDA rural development and FSA programs.
- (3) Better support in food safety programs through extension-education specifically focused on supporting CEA.

Finally, I want to take the opportunity to quickly highlight the innovative work being done at Washington State University to promote CEA in urban and peri-urban areas of Washington. WSU is working with new and beginning farmers and ranchers to lower barriers to entry into both CEA and traditional agriculture, developing urban and peri-urban agriculture networks, and conducting valuable research and extension throughout Washington state.

The CHAIRMAN. Now I am very delighted to introduce our witnesses. We are very delighted to have you here, our very distinguished panelists.

Our first witness today is Mr. Karim Giscombe. Mr. Giscombe is the CEO and founder of PLANT-AG, located in West Philadelphia—excuse me, West Palm Beach, Florida. He also serves as Chair of PLANT-AG—Plant for Tomorrow, and has extensive experience working in the investment banking industry, previously for Bank of America, and as a former Director for Merrill Lynch. Welcome to you, Mr. Giscombe.

Our next witness is Mr. Aaron Gadouas. Mr. Gadouas is the Managing Director of BC Ziegler and Company Investment Bank located in Chicago, Illinois, and has worked for 30 years in public and corporate finance, extensively in green and renewable projects. Welcome.

Our third witness today is Mr. Edward Verbakel. Mr. Verbakel is the CEO of VB Group, and co-founder of Atrium Agri Group, both located in the Netherlands. He has almost 30 years of experience designing and building controlled environment agriculture facilities in countries around the world.

Our fourth witness today is Mr. Jason Kelley. Mr. Kelley serves as Managing Partner to IBM Strategic Partners in Austin, Texas. He manages a global team at IBM that is responsible for over 750 client engagements around blockchain. In addition to serving in corporate America, he has served our country as a very brave U.S. Army Airborne Ranger. Thank you.

Our fifth, and final, witness today is Mr. Kevin Safrance. Mr. Safrance is the Executive Vice Chairman of Mastronardi, a fourth-generation family operated business in greenhouse productions located in Livonia, Michigan. Mr. Safrance has over 2 decades of experience in the fresh produce industry, and I am so pleased to have such a distinguished international group on this panel to deal with this urgent issue. There is nothing more important than maintaining our food security. As we all know, we can do without just about everything else, but we cannot do without food. So thank you all for your participation.

The timer will be visible on the screen, as I said, and it will count down to zero. And I know there are so many Members that want to get on, and we are going to move through this as quickly

as we can. So let us start first with you, Mr. Giscombe. You are recognized for 5 minutes. Please begin when you are ready.

**STATEMENT OF KARIM GISCOMBE, FOUNDER AND CHIEF
EXECUTIVE OFFICER, PLANT-AG, WEST PALM BEACH, FL**

Mr. GISCOMBE. Good morning, Mr. Chairman. I would like to thank the Committee for the opportunity to address you here today. My name is Karim Giscombe. I am the Chairman and Chief Executive Officer of Plant Agricultural Systems. Today I speak on behalf of the people, which you as a Committee, and the broader Administration, serve, the American people. People who represent multiple generations and races, and who share a common thread, the believe that we can be our best, achieve the most, and expect the best, here in America. I also speak on behalf of a broader ecosystem of industry participants serving the fresh produce supply chain, who collectively cover not only all the roles from seed to plate here in America, but do so all over the world, and can provide valuable context and insight to the delivery of a 21st century food system.

However, today those very things are at risk as COVID-19 and adverse weather instances, such as the droughts being experienced in the Colorado Basin, continue to force our collective appreciation of the fragility of the essential services which enable the people, who then enable the economy. I am here because my children, just as every child in America, deserves fresh, nutritious, contaminant-free fruits and vegetables they can trust. I am here because no parent should have to come face to face with their child's mortality, especially not from the simple act of eating a salad, the way Lucas Parker's parents have had to. I am here because it is critical that you, our trusted lawmakers, fully appreciate the threat that is facing our way of life, the clear and present danger to our agricultural system, and act to protect our domestic food supply chains and infrastructure while stewarding our collective environmental impact.

I am here because we can no longer ignore the obvious, no more than we can go back to simpler times, and we do not have time to over-think this situation. If we want to ensure no other country such as China, or Russia, or Mexico, or even Canada, can control our fresh produce supply, it is absolutely necessary to decrease our reliance on these imports, which currently top some 53 percent of consumption, and swiftly and with intention, increase the scale of controlled environment agriculture production in America.

Sometimes looking back is necessary as to see far enough ahead to understand what the choices made today mean for tomorrow. This country has never forgotten the value of our independence as we grill hot dogs and hamburgers every July 4, and I ask everyone here, and watching, to think and tell me what you see when you hear the word *hamburger*. Truth is, that image does not need to be verbalized because we all know exactly what it looks like. Two of the ingredients synonymous with that image, lettuce and tomatoes, are statistically the most commonly consumed and purchased products in America, and more broadly the world. Today, sourcing them has become more and more challenging across the globe. The USDA just issued guidance this week regarding increasing food prices, and that is in line with global trends. Later this year, when

lettuce prices skyrocket because of the California droughts, it is the American consumer, who you represent, that will be the ones impacted, again. This is but one of the reasons we are having and must continue this conversation.

This conversation is about choice. First, the right of every person who eats a sandwich, salad, taco, wrap, slice of pizza, bowl of cereal with fruit in it, or who drinks a smoothie, at home, or from a food service retailer in this country, to trust their choice of product and to trust their choice of outlet or restaurant to be fresh, nutritious, and safe. The actions of the FDA, through the recent Food Safety Modernization Act (111–353), are to date the best steps towards enabling the trust of the consumer, but it is, and will only be, as effective as the infrastructure in place to support the mandates outlined in the New Era of Smarter Food Safety Blueprint. This is about the choice you, as lawmakers, must make to understand and acknowledge the role of the underdog in this story, controlled environment agriculture, as not only a necessary contributor, but the most viable solution if the American people want to trust their food again. This is about the choice to build the infrastructure necessary to enable American producers to have a viable platform to grow and expand their businesses and be competitive in an open market where the consumer speaks with their dollar as they do with their vote.

So let us go back to where I started. This is about the people, the people you serve, everybody. Members of the Committee, you need look no further than the hard-working franchisees of Subway, the largest food service retailer in the world, with more than 30,000 locations, and listen to their highly publicized complaints about the corporation and the lack of quality and transparency of fresh lettuce they are forced to serve their consumers. How much longer before the other sandwich retailers encounter the same?

In closing, I respectfully ask the Committee to consider the following. With what you now know, the urgency to protect our fresh produce supply chain should be beyond question, and your first choice is whether the American consumer will pay for it with their tax dollars, or enable the——

[The prepared statement of Mr. Giscombe follows:]

PREPARED STATEMENT OF KARIM GISCOMBE, FOUNDER AND CHIEF EXECUTIVE
OFFICER, PLANT-AG, WEST PALM BEACH, FL

Today, I speak on behalf of the people, which you as a Committee, and the broader Administration serve; the American people, people who represent multiple generations and races, and who share a common thread—the belief that we can be our best, achieve the most, and expect the best, here, in America. I also speak on behalf of a broader Ecosystem of industry participants serving the fresh produce supply chain, who collectively cover not only all the key roles from seed-to-plate, here in America, but do so all over the world, and can provide valuable context and insight to the delivery of a 21st Century Food System.

However, today, those very things are at risk as COVID-19 and adverse weather instances such as the droughts being experienced in the Colorado basin, continue to force our collective appreciation of the fragility of the essential services which enable the people who then enable the economy. I am here because my children, just as every child in America deserves fresh, nutritious, contaminate-free fruits and vegetables they can trust. I am here because no parent should have to come face-to-face with their child's mortality, especially not from the simple act of eating a salad the way Lucas Parker's parents have had to. I am here because it is critical that you, our trusted lawmakers, fully appreciate the threat facing our way of life,

the clear and present danger to our agricultural system, and act to protect our domestic food supply chains and infrastructure while stewarding our collective environmental impact.

I am here because we can no longer ignore the obvious, no more than we can go back to simpler times, and we do not have time to over-think this situation. If we want to ensure no other country such as China, or Russia, or Mexico, or even Canada, can control our fresh produce supply, it is absolutely necessary to decrease our reliance on these imports which currently top some 53% of consumption, and swiftly and with intention, increase the scale of Controlled Environment Agriculture production in America.

Sometimes looking back is necessary as to see far enough ahead to understand what the choices made today, mean for tomorrow. This country has never forgotten the value of our independence as we grill hotdogs and hamburgers every July 4th, and I ask everyone here, and watching, to tell me what you see when you hear the word *hamburger*. Truth is, that image does not need to be verbalized, because we all know exactly what it looks like.

Two of the ingredients synonymous with that image, lettuce and tomatoes, are statistically the most commonly consumed and purchased products in America, and more broadly, the world. Today, sourcing them has become more and more challenging across the globe. The USDA just issued guidance this week regarding increasing food prices, and that is in-line with global trends. Later this year, when lettuce prices skyrocket because of the California droughts, it's the American consumer who you represent that will be the ones impacted, *again*. This is but one of the reasons we are having and must continue this conversation.

This conversation is about choice. First, the right of every person who eats a sandwich, salad, taco, wrap, slice of pizza, or a bowl of cereal with fruit in it, or who drinks a smoothie, at home, or from a foodservice retailer in this country, to trust their choice of product and to trust their choice of outlet or restaurant to be fresh, nutritious and safe. The actions of the FDA through the recent Food Safety Modernization Act (FSMA) are to-date, the best steps toward enabling this trust for the consumer, but it is and will only be as effective as the infrastructure in place to support its mandates as outlined in the New Era of Food Safety Blueprint. This is about the choice you, as lawmakers, must make to understand and acknowledge the role of the underdog in this story, Controlled Environment Agriculture, as not only a necessary contributor, but the most viable solution if the American people want to trust their food again.

This is about the choice to build the infrastructure necessary to enable American producers to have a viable platform to grow and expand their businesses and be competitive in an open market where the consumer speaks with their dollar as they do with their vote.

So let's go back to where I started today, this is about people; the people you serve; **every body**.

Members of the Committee, you need look no further than the hard working franchisees of Subway, the largest foodservice retailer in the world, with more than 30,000 locations, and listen to their highly publicized complaints against the corporation regarding the lack of quality and consistency of the "fresh" lettuce they are forced to serve their consumers. How much longer before other sandwich retailers encounter the same.

In closing, I respectfully ask this Committee to consider the following:

1. With what you now know, the urgency to protect our fresh produce supply chain should be beyond question, and your first choice is whether the American consumer will pay for it with their tax dollars or to enable the financial institutions representing private capital to utilize their experience supporting essential infrastructure to do their jobs within the socially responsible framework being presented here.
2. To reaffirm your commitment to protecting the American people and supporting the development of American industry.
3. And last, to realize that we cannot be afraid of new technology or the small-minded perceptions of those who do not wish to embrace progress, but must look at what is known as a baseline on which to innovate. Given the challenges we in America and the rest of the world now see as existential, and the benefit of being able to remember a time when people would have asked for faster horses instead of cars, and the fact that today major global conglomerates like GM and Mercedes are following in the stead of the once unknown upstarts like Tesla and making the shift to all-electric act in favor of progress.

Because this generation and the ones that follow are depending on you to do so.

The CHAIRMAN. I am sorry, your time has expired. We are going to be on a quick gavel today. Our Members are very anxious to get their questions in, and so much more could be added at question time. Thank you. And next we have Mr. Verbakel. And if I am mispronouncing any of the names, please forgive me, but I trust you, I am trying. Thank you.

STATEMENT OF EDWARD VERBAKEL, CHIEF EXECUTIVE OFFICER, VB GREENHOUSE PROJECTS; FOUNDER, ATRIUM AGRI GROUP, NAALDWIJK, SOUTH HOLLAND, NL

Mr. VERBAKEL. Thank you very much for this introduction. First of all, I feel honored to be present here today, although from a distance. I would have liked to be there, but I am somewhat limited to be there in person. I am from the Netherlands. The Netherlands is known for agriculture since a very long time. We have to be specialized in trade because of our favorable climate and our scarcity of land, so what our industry has been doing over the past decades is focus on optimalization of everything that can be related to growing of fresh produce.

I am second-generation in our company. My father founded it in 1966. He was one of the very first entrepreneurs in the U.S. market to start with greenhouse technology, in 1971 on Long Island, New York, and ever since we have been exploring your country, and been active in over 25 states, and what we see all the time is there is an immense production of agricultural produce, but the climate change is limiting you in providing an even supply of fresh food, and at the same time the consumer wants that fresh produce every day.

So what we have been doing is focusing on what plants to serve best, what do they need to optimize growth, and we have been able to replicate some of the climate challenges that we have. If there is a shortage of light, we can add light. If there is a shortage of humidity or cooling, we can add that within a controlled environment. Those are all high technological solutions by which we can produce fresh food 365 days, year-round.

At the same time, we are also active in other continents, and what we see is a very striking comparison between countries, is that other countries, with all respect, are a little bit more progressed in applying these controlled agricultural environments than compared to the U.S. So there are many opportunities to continue and focus more on controlled environment agriculture solutions within the continental United States, and limit the import of produce coming from the north or from the south where possible.

If we compare this to countries like China and Russia, we see that there is a high element of dedication to import technology and become more self-sustainable. We can do the same here on the U.S. side as well, but we need a bit more support also from government levels. And that is not only in effect making this possible in terms of financing, but also in terms of permitting, making available that—all of the local authorities involved are supporting those ideas.

I think that there are many opportunities in the U.S. market to continue to feed the world, more specifically within the U.S. We are coming from a tiny little country. You have almost 17 times more

inhabitants within the United States compared to our country, but at the same time our greenhouse surface, per capita, is much higher, and we see the same in other areas in the world.

So I would like to close this by asking you to be more in support of controlled environment agriculture, and help the U.S. population to have access to safe and healthy food, and cope with all of the challenges that we have both in climate, reduce transport distance, make food available local—for local in a sustainable way by focusing more on the use of energy, the use of water—fresh water, where greenhouses, for instance, have 15 times less water consumption than compared to open field production, and I think there are many opportunities that lie ahead of us, so I would like to ask you to make this—forward, and do this together. Thank you very much.

[The prepared statement of Mr. Verbakel follows:]

PREPARED STATEMENT OF EDWARD VERBAKEL, CHIEF EXECUTIVE OFFICER, VB GREENHOUSE PROJECTS; FOUNDER, ATRIUM AGRI GROUP, NAALDWIJK, SOUTH HOLLAND, NL

Good morning to you all, and thank you for having me. My name is Edward Verbakel and I am CEO of VB Greenhouse Projects out of The Netherlands, and I am also one of the founders of the Atrium Agri Group, which is a multi-scope Infrastructure as a Service (IaaS) provider, of Controlled Environment Agriculture (CEA) developments. The group is comprised of some of the leading companies in the CEA services space. Regrettably I cannot attend in-person today, but thanks to technology, I can still participate in this historic moment. I refer to this convening as historic, because with almost 30 years of experience designing and building CEA facilities in countries all around the world, this is the first time I have witnessed government and private sectors coming together in a proactive manner to coordinate efforts to develop this type of infrastructure. My father was one of the very first from our country to realize Dutch greenhouse technology right here in the USA, since 1971 on Long Island, NY. For me it is an honor to provide you with relevant information. For this I commend you all. What is more common, is state-driven projects in countries much like my own where necessity demanded a solution, and in other instances where farmers looking to innovate, became early adopters because of the contrasting benefits to their conventional practices. In either scenario, what is constant is the role my firm and those like us have, and continue to play in providing the development and construction expertise for all types of projects in all climatic conditions. We can provide the best climate for growth.

I have had the good fortune to see first hand the impact of this type of modern agriculture on countries and their economies. As we now find ourselves, a planet acutely focused on resource management and climate adaptation, I am certain that what I will share with you today will resonate and that the initiative taken thus far to advance this very important conversation, will culminate in your collective understanding and impetus to act to enable all participants in the fresh produce supply chain to work cooperatively to deliver a 21st Century Food System capable of meeting the demands of today, and tomorrow. I would be remiss not to speak to the skeptics towards the CEA segment, and say that the facts speak for themselves in all areas of consideration, namely Viability, Productivity and Sustainability.

1. Viability—the idea that CEA is a nascent industry segment is inaccurate. Producers all over the world have for many years (dating back to the 1970s) utilized varying levels of greenhouse structures to protect and deliver high-risk crops and delicate horticultural products. As with all industries, technology has enabled innovation and growth in all areas of greenhouse production. Additionally, the true benefit has come from the collective growth in widely varying geographies that have allowed for deeper understanding of the environment(s) and how to adapt structures and even products to optimize across all processes.
2. Productivity—when compared with other forms of conventional agriculture, what you will see is clear out-performance in all areas by CEA. These areas include, energy saving, water consumption, crop loss and yield per meter (or Square Foot, which is your unit of measure). And this is before taking into

account the removal of seasonality which limits traditional production cycles annually.

3. Sustainability—in this area, I like to start with the least acknowledged fact about greenhouses, which is that they are in fact reusable structures, and thus allow for transferability, and an elongated useful life. Very few industries can claim circularity of raw materials at such scale. If we then look at resource utilization, the highlight for many reasons is water use, which on average can be upwards of 50–60 percent less than conventional agriculture practices. Another key consideration is the use of renewable energy which then allows for even greater carbon offsets in relation to the use of artificial light.

I would like focus your attention to what I believe to be a key component of this conversation, which is the fact that CEA as a sector largely exists, and has grown exponentially over the past 2 decades in response to adversity related to agricultural production, and the necessity to develop new ways of meeting the demands of food systems supporting a global population that is already twice what it was at the dawn of the industrial revolution, and growing, fast.

We have entered into a new era of food production driven by developments in technology. This is particularly true in CEA. Whether be the engineering and introduction of new materials or the advances in climate management, crop monitoring or energy production, each have played a key role in making CEA production more accessible to supply chains and ultimately the consumers who they serve.

Levels of automation of operating processes have also risen greatly in some production types such as lettuce, where in many instances there is little to no human interaction with the actual product, ensuring even greater levels of food safety than ever before. This is of particular relevance to the broader fresh produce supply chain that is most susceptible to risks than other areas.

More so, it has become clear that the countries with the largest economies have or are fully embracing CEA as a core delivery mechanism to support their food systems.

Those of us that have been around long enough, like to think of this industry as currently coming of age. Seeing new entrants to the market on multiple fronts, is exciting and at the same time sobering, because it is clear that there is still a long way to go, and in reality, which you will hear or have heard from my colleagues, there is a lot that is still missing, which inevitably limits the true potential of this type of infrastructure. One such area is that of capital. There is no escaping the significant capital expenditure necessary to develop CEA facilities, but this is in fact true of all infrastructure. As stated earlier, the value of CEA is realized at scale and subsequently where projects have experienced the greatest success is where the capital has been made available to not only build facilities, but build them with the focus on integrity and sustainability. No industry is devoid of a spectrum of costs, and what is germane to all is that the long (or intermediate) term benefits often outweigh the short term costs when properly evaluated. These costs are not merely hard costs for the physical infrastructure, but both hard and soft costs of the supporting infrastructure, be it digital or human.

In closing, I would offer to this Committee one last attestation, which is that the factors driving the growth of Controlled Environment Agriculture have been consistent and the global outlook for future development is higher than it has ever been. Thank you again for the opportunity today.

The CHAIRMAN. Thank you very much, Mr. Verbakel. And now we will turn to, for 5 minutes, Mr. Gadouas.

**STATEMENT OF AARON Z. GADOUAS, MANAGING DIRECTOR,
B.C. ZIEGLER AND COMPANY, CHICAGO, IL**

Mr. GADOUAS. Thank you for inviting me to participate in the discussion today. I appreciate the opportunity to provide a perspective on how capital is being deployed to develop controlled environment agriculture facilities in food system infrastructure. I would like to address three topics this morning; first, provide an overview based on what we are seeing in the marketplace of food system infrastructure, how it is being financed today. Second, summarize the limitations that private investors face in deploying capital towards

this asset class; and third, suggest a path forward to unlock additional sources of capital based on our experience of what has worked in the past, and our knowledge on how these investments can be structured.

It is clear that innovations in technology and processes are transforming food production and supply chain infrastructure. What was essentially a land-centered platform has diversified into controlled environment agriculture. A confluence of recent technology and demand for food safety and sustainable production has put us at an inflection point, where scalable food systems require large capital expenditures that ideally are financed just the way any industrial project is, namely, with a combination of equity and debt. What we are seeing today, however, is a significant flow of private and public equity capital being allocated to ag tech and controlled environment facilities. Private equity sources typically fund 100 percent of the capital expenditures of an indoor facility.

Equity as a sole source of capital is an exceedingly expensive plan of finance for large scale projects. It is true that there are many traditional economic developed tools out there, but they are not sufficient to finance the scale of the production and facilities that are necessary. The heavy lifting is almost entirely done by equity. Private equity can't do it by itself to provide all the capital that is needed, nor can the public equity markets, particularly SPACs, which you have seen a lot of, Special Purpose Acquisition Corps. They have become subject to regulatory scrutiny, that will likely curtail their use in the future.

The financial institutions and capital markets clearly envision the promise of modernizing our food system infrastructure. In addition to food safety and accountability, the production of food on an environmentally sustainable basis is directly in alignment with integrating ESG values, that is environmental, social, and corporate governance values, into their investment portfolios. Investors want to participate in a systematic way. Why, then, are institutional investors, particularly fixed-income investors, staying on the sidelines? The reason for this is investors perceive the food system as a loosely defined jumble of food-related businesses. Institutional investors have difficulty organizing a credit framework because the food system is not currently viewed as an asset class.

Industry participants and government can play a role to better define and empower the food system sector. The development of the clean energy and waste-to-energy is a good analogy for this. 15 years ago this sector was viewed as fragmented, poorly defined, and risky. Today investments in renewables are considered an established asset class. The same can be done here for ag infrastructure. Designating controlled environment agriculture as critical infrastructure is a good place to start with this.

We can also identify a subset of investors within the fixed income capital markets that would be perfectly suited to be the lead investor in this new asset class. Certain mutual funds, managed accounts, and insurance companies that invest in high yield tax exempt bonds possess in-house expertise that can commit their capital to non-governmental projects that qualify for tax-exempt financing under the Tax Code. Perhaps more importantly, many tax-exempt investment funds have specific mandates to support

projects that have social impact, that are consistent with ESG values, or finance facilities that are deemed to be publicly beneficial. This group of investors has access to deep pockets of capital, and will commit their attention.

Here is an example. Credible investment candidates in the renewable space that are often too small to be of interest to corporate bond investors can be purchased by tax-exempt funds. Here is another very common example. An otherwise well-structured deal, with limited operating history, as a project that would be viewed as a risky startup by corporate bond investors could be purchased and evaluated by a tax-exempt fund. This tax-exempt marketplace serves as an economic development tool that is unique to the U.S. capital markets, and provides a source of debt financing where other alternatives may not exist.

Amidst the ideas and plans of innovators, industry participants, government, at the end of the day it is the financing that makes it all happen. We can accelerate the development of food system infrastructure in this country by establishing a platform to attract and unlock capital in this sector——

[The prepared statement of Mr. Gadouas follows:]

PREPARED STATEMENT OF AARON Z. GADOUAS, MANAGING DIRECTOR, B.C. ZIEGLER AND COMPANY, CHICAGO, IL

Thank you for inviting me to participate in the discussion today. I appreciate the opportunity to provide a perspective on how capital is being deployed to develop controlled environment agriculture facilities and food system infrastructure.

I am the co-head of our firm's General Municipal and Structured Finance practice. Ziegler is an investment firm with an established reputation for financing projects in renewable energy, solid waste and wastewater treatment, and infrastructure. We serve public and private clients, and we have decades of experience and expertise in financing projects with debt securities including tax-exempt bonds. Over the past 5 years we have witnessed tremendous growth in our business to provide private capital for "green" and environmentally sustainable projects such as waste-to-clean energy, recycling, and—most recently—food system facilities.

I will address three topics this morning. First, provide an overview, based on what we are seeing in the marketplace, of how food system infrastructure is being financed today; second, summarize the limitations and challenges that private investors face in deploying capital towards this asset class; and third, suggest a path forward to unlock additional sources of capital based on our experience of what has worked successfully in the past and our knowledge of how such investments can be optimally structured.

It is clear that innovations in technology and processes are transforming food production and supply chain infrastructure. What was essentially a land centered platform has diversified into controlled environment agriculture. A confluence of recent technology and demand for food safety and sustainable production has put us at an inflection point where scalable food systems require large capital expenditures that ideally are financed the same way as other industrial projects—namely, with a combination of equity and debt. What we are seeing today is a significant flow of private and public equity being allocated to ag tech and controlled environment facilities. Private equity sources typically fund one hundred percent of the capital expenditures of an indoor facility. One of the largest indoor producers of leafy green vegetables recently announced a merger with a Special Purpose Acquisition Corp—a "SPAC"—which is a transaction that involves the sale of shares in the public equity markets. At this time there are virtually no sources of capital other than equity that are teed-up and willing to move into food system infrastructure.

Equity as the sole source of capital is an exceedingly expensive plan of finance for large scale projects. It is true there are a handful of traditional economic development tools utilized by local public and private authorities that support food system projects. They include tax increment financing, revolving loan programs, small manufacturing industrial development bonds and tax incentives. They have financed food arcades and farmer's markets, retail outlets, farm loan programs, and some food processing and cold storage businesses. But none of these tools are adequate

to finance large scale food infrastructure projects. The heavy lifting is almost entirely done by equity. Private equity by itself cannot provide all the capital that is needed to build out all of the critical food infrastructure and essential services that will be needed. The same is true with the public equity markets, and SPACs in particular, as they have become subject to regulatory scrutiny that will likely curtail the formation of new SPAC entities, going forward.

Financial institutions and the capital markets clearly envision the promise of modernizing our food system infrastructure. In addition to food safety and accountability, the production of food on an environmentally sustainable basis is directly in alignment with integrating ESG values (environmental, social and corporate governance values) into their investment portfolios. They want to participate in a systematic way. Why, then, are institutional investors—particularly fixed income debt investors—staying on the sidelines?

The reason for this is investors perceive the food system as a loosely defined jumble of food-related businesses. Institutional investors have difficulty organizing a credit framework because *the food system is not currently viewed as an asset class*. Industry participants and government can play a role to better define and empower the food system sector. The development of the clean energy and waste-to-energy sector is a good analogy. Fifteen years ago, this sector was viewed as fragmented, poorly defined, and risky. Today, investments in “renewables” are considered an established asset class. The same can be done for food infrastructure.

Designating Controlled Environment Agriculture as critical infrastructure is a good place to start. We can also identify a subset of investors within the fixed income capital markets that would be perfectly suited to be the lead investors in this new asset class. Certain mutual funds, managed accounts and insurance companies that invest in high yield tax-exempt bonds possess in-house expertise to evaluate and ultimately commit capital to non-governmental projects that qualify for tax-exempt financing under the tax code. Perhaps more importantly, many tax-exempt investment funds have specific mandates to support projects that have social impact, are consistent with ESG values, or finance facilities that are deemed to be publicly beneficial. This group of investors has access to deep pockets of capital and will commit their attention and money to projects that may not attract the attention of other bond investors. Here is an example: creditable investment candidates in the renewables space that are often too small to be of interest to corporate bond investors may be purchased by tax-exempt funds if the project qualifies for tax-exempt financing. Here is another common example: an otherwise well-structured deal with limited operating history that is viewed as a risky start-up by a corporate debt investor may be evaluated as a project financing by a tax-exempt fund. The tax-exempt marketplace serves as an economic development tool that is unique to the U.S. capital markets and provides a source of debt financing where other alternatives may not exist.

The United States Code designates a number of private activities as “Exempt Facilities” that qualify for tax-exempt financing. Such activities include solid waste recovery, small manufacturing facilities, multifamily housing, certain forms of mass transit, among others. Including Controlled Environment Agriculture as an Exempt Facility would define and formalize a new asset class, incentivize private capital deployment into a desired essential service and critical infrastructure, and diversity and expand the pool of affordable capital to project sponsors. It would also target the most obvious natural buyers of food system project finance debt—tax-exempt bond investors.

Exempt Facility bonds have been acknowledged as an economic development tool in the United States for decades. Bond financing of qualified projects under the United States Code involves no financial outlay by any governmental or public body, no additional tax burden of any kind, and does not create an administrative burden on public resources or time. It is also noteworthy to point out that the standards will be high. Qualifying projects that are ultimately underwritten and purchased by debt investors are likely to share these characteristics: they may include a public-private partnership component; the project sponsors will incur financial risk, so that their interests will be aligned with investors and other stakeholders; the projects will have fully documented contractual support with creditworthy suppliers and customers; the production process and specifications of the physical plant will be thoroughly vetted by qualified third-parties; the business model will be validated by independent industry experts; and best practices for initial and continuing disclosure will be implemented. We have seen time and again the success of tax-exempt financing as an economic development tool. It can be utilized to develop a modern food system infrastructure as well.

Amidst the ideas and plans of innovators, industry participants and government, at the end of the day it is the financing that makes it all happen. We can accelerate the development of food system infrastructure in this country by establishing a plat-

form to attract and unlock capital suited to this sector by *designating* it as a critical asset class and *enabling* participation by sector-aligned investors to take a leading role.

Thank you for your interest and attention. I look forward to a continuing dialogue.

The CHAIRMAN. Thank you. You were right on time. And now we will hear from Mr. Kelley. Mr. Kelley, you are recognized for 5 minutes.

**STATEMENT OF JASON E. KELLEY, GENERAL MANAGER,
GLOBAL STRATEGIC PARTNERS AND BLOCKCHAIN FOR
GLOBAL BUSINESS SERVICES, IBM, AUSTIN, TX**

Mr. KELLEY. Thank you, Chairman Scott, and Ranking Member Thompson. I am IBM's General Manager for Global Strategic Partners and Blockchain. I manage teams around the world responsible for more than 1,000 blockchain client engagements, with large companies like Dole and Walmart, and small farms, such as those that Representatives Pingree, LaMalfa, and Hartzler are familiar with. Like a number of you Representatives, I am also a veteran, having had the privilege of serving our country as a U.S. Army Airborne Ranger. It is a pleasure today to testify on blockchain, and its potential to vastly reduce the cost and complexity of food safety, whilst adding trust and security. Blockchain can enable transparency, shared visibility, accountable monitoring of production and reclamation, with more effective food safety and sustainability practices. My testimony will further explain blockchain and share more about its value.

Blockchain is a secure, cloud-based technology. It is a shared, immutable ledger for recording transactions and tracking assets transparently among a trusted invited network. Each permissioned participant has an exact copy of the ledger. All information a member wants to share: the who, the what, when, and where, even the condition of a transaction, such as temperature of a food shipment is recorded as a data block on the ledger, which is propagated throughout the network. Each block is connected to the blocks before and after it, forming a chain of data blocks, if you will, that track an asset from its source to its consumption. Each block is linked together with encryption, securely preventing any alteration without detection and permission. With this, all permissioned participants, such as a supply chain, have trusted, up to date, transparent information.

Blockchain, however, is not a panacea. Instead, it can provide substantial improvements over the *status quo*, enabling greater trust and security, better efficiencies and resiliency, as well as improved sustainability. Today's partial digital and paper documentation across an increasingly complex network of food suppliers, distributors, and retailers makes accountability slow, security questionable, and threats increased. As a result, food recalls cost about \$30 million per incident, and compromises all those things that we like to have with consumer trust.

Blockchain provides immediate, shared, and completely transparent information to the specific person who is permissioned to see it. Simply put, it promotes trust. If a food safety issue is reported—if any issue is reported, those using blockchain would immediately know who is impacted, and the potential actions they

could take. This can improve efficiencies and resiliency. According to the UN, 1.4 billion tons of perishable food is wasted each year due to inefficiencies. That is $\frac{1}{3}$ of all processed food. Blockchain could eliminate time wasted in audits and reconciliations since participants know the origin, real time location, and status of their food products. Further, integrating artificial intelligence with blockchain provides retailers with insights to proactively remove products before an issue even occurs, and predict inventory needs, flattening the demand spikes and lulls. Enabling a blockchain that tracks product loss, waste, and expiration dates could save over \$150 billion annually in food waste.

As I close with sustainability, blockchain can enable sustainability practices to help reduce the ecological footprint and food supply challenges that we have day to day. Farmers, greenhouses, and producers could easily share audits, certificates, and documentation validating their sustainable and ethical practices. Distributors, transporters, and retailers could be better informed to make sustainable choices. With blockchain and AI, they can get suggestions on the most sustainable shipping methods, routes, and local sourcing opportunities. So, with blockchain, a trusted way to share data—which it is—consumers can confidently know the origin of their food, and how green and clean it just may be. Traceability, security, and sustainability go hand in hand. Blockchain can enable that, and even more. So thank you, Mr. Chairman, Ranking Member Thompson, and the Committee for this time I have had to speak with you today. I welcome your questions.

[The prepared statement of Mr. Kelley follows:]

PREPARED STATEMENT OF JASON E. KELLEY, GENERAL MANAGER, GLOBAL STRATEGIC PARTNERS AND BLOCKCHAIN FOR GLOBAL BUSINESS SERVICES, IBM, AUSTIN, TX

Introduction

Good morning, Chairman Scott, Ranking Member Thompson, and distinguished Members of the Committee. Thank you very much for the opportunity to testify before the Committee on this important topic.

My name is Jason Kelley, and I am IBM's General Manager for Global Strategic Partners and Blockchain for Global Business Services, and in addition to serving in corporate America, I've also had the great privilege and honor to serve my country as a U.S. Army Airborne Ranger. Today, I have the pleasure of managing a global team at IBM that is responsible for over 750 client engagements around blockchain. These transformative projects include supply chain, financial services, government, healthcare, travel and transportation, insurance, chemicals and petroleum, and more.

Within the food industry, IBM uses blockchain technologies to reimagine data transparency with a new level of digital interactions in the food supply chain ecosystem. Our partners today include not only household names like Dole and Walmart, but also small farms, like the ones in California where the majority of our leafy greens originate. These food suppliers share common goals: deliver fresher, safer food to consumers and ensure unsafe food is quickly identifiable and traceable. We are also pleased to work with others that share our vision for transforming food safety through responsible technology. PLANT-AG, who is also testifying here today, is one of those clients.

The challenges that have risen during this pandemic greatly heighten the need to enhance America's ability to adopt a more collaborative digital, traceable, and safer food system. That is why I appreciate the Committee's desire to explore blockchain technology—especially its applications beyond cryptocurrency and financial technology—because blockchain has the potential to vastly reduce the cost and complexity of food safety. With blockchain, we can enable open transparency for tracking the movement of food, monitoring the processes of production and reclama-

tion, and administering the enforcement of effective food safety and sustainability practices.

Today, I come before you to share those experiences and how the right digital infrastructure can enable a more resilient, sustainable, and safer food supply chain. My testimony will cover what blockchain is and what it is not; its key benefits, including greater trust and security, better efficiencies and resiliency, and improved sustainability; and, examples of it in use today.

What is blockchain?

Businesses—and government—run on data. The faster it's received and the more accurate it is, the better. Enter blockchain, a secure cloud-based technology that is ideal for securely delivering data when multiple entities need it, and where and how they need it most. Blockchain provides immediate, shared, and completely transparent information to the specific, trusted person who is permissioned to see it.

IBM defines blockchain as a shared, immutable ledger for recording transactions and tracking assets with transparency, which builds trust. Tracking assets is inclusive of the assets themselves, as well as the ability to have transparency in securely tracking orders, payments, accounts, produce, and the associated data across industries, geographies, and more.

Each member invited to be part of the blockchain network has an exact copy of the ledger. Any information of a transaction that a member wants to share—the who, what, where, when, how much, and even the condition of a transaction, such as the temperature of a food shipment—is recorded as a “data block” on the ledger, which is propagated throughout the network.

Each block is connected to the ones before and after it. These blocks form a chain of data that can track an asset as it moves from place to place or ownership changes hands. The blocks confirm the exact time and sequence of transactions, and the blocks link securely together to prevent any block from being altered or being inserted between two existing blocks.

Importantly, no participant can change or tamper with a transaction after it's been recorded to the shared ledger. If a transaction record includes an error, a new transaction must be added to reverse the error, and both transactions are then visible.

Therefore, all permissioned participants in an interaction have a trusted, up-to-date ledger that reflects the most recent transactions and these transactions, once entered, cannot be changed.

Blockchain's power to transform is that it enables co-development of a shared copy of the truth. What a group can achieve together far exceeds what any individual member can achieve by themselves. Furthermore, to speed this sharing of information, a set of rules—called a smart contract—can be stored on the blockchain and executed automatically.

Smart contracts are simply programs stored on a blockchain that run when predetermined conditions are met. They typically are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when conditions are met.

Blockchain is neither bitcoin nor a panacea

While most people who have heard of blockchain associate it with the cryptocurrency bitcoin, that use case is not what I'm talking about today. While bitcoin does run on blockchain technologies, it is important to understand that not all blockchain technologies are the same. For example, bitcoin operates with a network of pseudonymous participants, where shielding one's identity is the outcome.

The blockchain I am discussing is one built on open standards technology that is designed to be used as a trusted network to handle interactions between known parties. By way of comparison, the Internet uses a protocol (TCP/IP) to direct network traffic, which provides part of the backbone necessary to allow users to access the application layer (websites and platforms). Similarly, blockchains serve as the backbone protocol of new peer-to-peer network arrangements that allow for a wide range of uses, from cryptocurrency-based transactions, like those made possible by bitcoin, to supply chain management and verification.

While blockchain is not a panacea for all the challenges presented by food trust and safety issues, a digital infrastructure based on blockchain protocols can provide substantial improvements in value over the *status quo*. It can provide a trusted capability for transparency and timely sharing of secure data.

Furthermore, the sharing of trusted, secure data with provenance from multiple stakeholders that blockchain enables can also be critically helpful to accelerate trustworthy artificial intelligence (AI) applications. Blockchain's immutable, trans-

parent digital record offers greater insight into the framework behind the AI, reducing possible distrust and mystery that some ascribe to the technology. It also creates greater trust in the development of AI as the data used to train the AI models can be decentralized, verified, and transparent. Accordingly, integrating AI on a digital infrastructure built on blockchain can help unlock further value over the current status quo.

Blockchain benefits—greater trust and security, better efficiencies and resiliency, and improved sustainability

That value and the use case I am discussing today is how blockchain could help advance end-to-end food traceability and, ultimately, transparency to drive consumer protection and trust. It can do this by enabling:

1. Greater trust and security
2. Better efficiencies and resiliency
3. Improved sustainability

Greater trust and security

An ecosystem of trust is critical for all participants in the food supply chain, from source to consumption. This includes a very expansive and collaborative value chain of farmers to distributors, to logistic partners, to retailers, to the family sitting down at their table to eat. For example, food recalls are an immense safety problem and a threat to profitability. Last year, *Food Safety* magazine counted 337 food safety recalls in the U.S.¹ Companies surveyed put costs at up to USD 30 million per incident,² stemming from direct costs, plus such indirect costs as penalties, lawsuits, lost sales, and brand damage. In addition to the societal and business impact, huge stocks of food are wasted and consumer trust is crushed.

Tracing food across the supply chain takes days, if not weeks, as companies struggle to find and manage a mix of digital and paper-based food data documentation across a complex and growing network of suppliers and distributors.

With a digitized food system infrastructure, network participants could have access to tools and data to improve food safety and become proactive contributors to bettering the food system as a whole. Further, with permissioned blockchain, the members of this members-only network can rest assured that they are receiving accurate and timely data and that their confidential blockchain records will be shared only with network members that have specifically been granted access. And, consensus on data accuracy is required from all network members, and all validated transactions are immutable because they are recorded permanently. No one, not even a system administrator, can delete a transaction or make an edit without their action and identity being known.

This means that if a food safety issue is reported, it would immediately identify who is impacted and who should take action. One example would be our work with PLANT-AG, where our blockchain platform could capture and share seed and farming level data for fresh produce with PLANT-AG's instrumented greenhouse facilities to enable better visibility and trust.

Better efficiencies and resiliency

Inefficiency in the food system is a pervasive problem worldwide, made more apparent by the COVID-19 crisis, which has stressed the global supply chain.³ With so many participants, there are endless opportunities to lose efficiency and profits. Inefficiencies negatively affect consumer pricing, the carbon footprint, food waste, and expected freshness. According to the United Nations, 1.4 billion tons of perishable food is wasted each year due to inefficiencies found with the food supply chain.⁴

With a distributed ledger that is shared among members of a network, time-wasting record reconciliations are eliminated. While one unexpected event could cause a cascading array of supply chain disruptions, blockchain can mitigate this through "smart contracts." As shared earlier, a smart contract can be automatically triggered when pre-defined business conditions are met. This gives near real-time visibility into operations and the ability to take action earlier should there be an exception.

¹ FOOD SAFETY MAGAZINE: A Look Back at 2019 Food Recalls—<https://www.food-safety.com/articles/6487-a-look-back-at-2019-food-recalls>.

² SF&WB: Evaluating the real costs of a food product recall—<https://www.snackandbakery.com/articles/92105-evaluating-the-real-costs-of-a-food-product-recall>.

³ BCG Henderson Institute: Tackling the 1.6-Billion-Ton Food Loss and Waste Crisis—<https://www.bcg.com/publications/2018/tackling-1.6-billion-ton-food-loss-and-waste-crisis>.

⁴ Supply Chain Digital: Billions of tons of food wasted in global supply chain—<https://supplychaindigital.com/logistics-1/billions-tons-food-wasted-global-supply-chain>.

Using blockchain, all food system participants could know the provenance, real-time location, and status of their food products. Further, integrating AI on the blockchain, retailers could receive recommendations on what products to recall from store shelves because of expiration and maintain inventory visibility during demand spikes, for example by automating re-ordering when certain demand thresholds are met. Armed with better data on a blockchain, companies could also use AI to develop more accurate supply and demand forecasting models, localize the sourcing of ingredients and restructure contracts. Enabling a blockchain system that tracks product loss, waste, and expiration dates could save \$150 billion annually in food waste.⁵

Improved sustainability

Across the globe, consumers are demanding to know more about their food—where it came from, the effect of its production methods on the environment, and how workers and animals were treated in the process. In fact, 54 percent of consumers say it's at least somewhat important that the food they buy is produced in an environmentally sustainable way.⁶ Sustainability is no longer a bonus; it's imperative for both the consumers who demand it and for future business models.

A digital food supply chain powered by blockchain enables new levels of trust and transparency across the food ecosystem, increasing awareness of sustainability opportunities and practices during each step of the food chain. For example, farmers, producers, and other food actors can automatically digitize and easily share audits, certificates, and other records, proving that they utilize and promote sustainable and ethical practices. And, distributors, transporters, and retailers can be better informed to make sustainable choices. Using AI on the blockchain, applications can suggest the most sustainable or cost-effective shipping method and recommend local or alternative sourcing.

Furthermore, the cost of unsustainable food practices creates unnecessary investment and expenditures. “True Cost Accounting” sheds light on the price of unsustainable food practices. Unsustainable sourcing and biodiversity loss, due to unsustainable production methods, result in hidden costs. Research shows that consumers unknowingly pay twice as much for their food due to such costs. With the global population expected to boom from seven to ten billion by 2056, companies are looking for ways to decrease their ecological footprints and blockchain can help.⁷

Blockchain at work—examples of improved supply chains

In 2017, IBM built digitalized supply chains or “food trust” for our clients based on blockchain technologies. This experience has shown that when using blockchain, we can track Walmart’s leafy greens, Nestlé’s Gerber-branded sweet potato, apple and pumpkin baby foods, and more. We can trace these foods to their origins in seconds *versus* traditional methods that can take a week or longer. This trust now includes more than 100 growers, producers, and sellers, including grocery giants Walmart and Albertsons.

Look at the seafood supply chain—it’s rippled with inaccuracies. According to research by the environmental advocacy group Oceana,⁸ as many as one in five of the fish samples tested were mislabeled.

Blockchain is helping to bring order and transparency to one of the world’s most complex supply chains—as close to 80 percent of the seafood Americans eat is either imported out-right, or it has been exported and re-imported for processing. Working with Hampton Bays, New York-based Manna Fish Farms, IBM is building a traceability network for sustainably-raised aquacultured fish and shellfish on blockchain.

Furthermore, this digital platform could help reward the fisherman, sustainable aquaculture farms, and their trusted networks for their efforts. Before blockchain, there was no way to prove that you got your catch onto ice a little faster than your peers, or that you used more sustainable methods. Now, there is.

Blockchain can help advance end-to-end food traceability and, ultimately, transparency to drive consumer loyalty, protection and trust.

⁵ IBM: 7 Benefits of IBM Food Trust—<https://www.ibm.com/blockchain/resources/7-benefits-ibm-food-trust/>.

⁶ Food Insight: Interest in Sustainability, Plant-Based Diets Among Trends in IFIC Foundation’s 2019 Food & Health Survey—<https://foodinsight.org/interest-in-sustainability-plant-based-diets-among-trends-in-ific-foundation-2019-food-and-health-survey/>.

⁷ IBM Focus on Sustainability—<https://www.ibm.com/downloads/cas/R8VDMJ4Y>.

⁸ NATIONAL GEOGRAPHIC: What is seafood fraud?—<https://www.nationalgeographic.com/environment/2019/03/study-finds-seafood-mislabeled-illegal/>.

Conclusion

Let me close with my appreciation again to this Committee for exploring how digital infrastructure can accelerate improvements in our food supply chain. I have also spoken to leaders at the U.S. Food and Drug Administration and support their efforts to find and implement tangible strategies to modernize the food industry. The U.S. Department of Agriculture is also making positive strides, including a blockchain traceability “farm to store” pilot with Walmart and IBM.

We applaud all of these conversations and many others we are having with farmers, fishers, distributors, transporters, retailers, regulators, and other stakeholders in the food supply network. We are happy to support these conversations as we believe blockchain is a game-changer for food safety.

Again, thank you for the opportunity to discuss such an important topic.

The CHAIRMAN. Thank you. Thank you very much. And now Mr. Safrance, you are recognized for 5 minutes.

STATEMENT OF KEVIN SAFRANCE, EXECUTIVE VICE CHAIRMAN, MASTRONARDI PRODUCE LIMITED, MASTRONARDI PRODUCE—USA, INC., LIVONIA, MI

Mr. SAFRANCE. Good morning. Thank you, Chairman Scott and Ranking Member Thompson, for holding a hearing to discuss this extremely important topic of controlled environment agriculture, or CEA, and for inviting Mastronardi Produce to appear before you and share our perspective story.

Mastronardi Produce is a fourth-generation family operated business devoted to providing high quality fresh fruits and vegetables to people across North America and beyond. As a pioneer and industry leader in greenhouse farming, Mastronardi prides itself on producing consistently flavorful produce in an environmentally and worker-friendly manner. We are the largest CEA farming and distribution operation in North America. Our direct workforce represents approximately 4,000 jobs across the U.S. We have farms in five states—Michigan, New York, Maine, Ohio, Colorado—and cooled distribution facilities in another five states—Pennsylvania, Michigan, Texas, Florida, and California. You have called this hearing today to examine the contribution CEA farming can make to protect domestic food supply chains and infrastructure. We believe CEA farming is the key to sustainably and efficiently strengthening America’s food supply chain and would like to offer several key thoughts on this.

First, because of the unique way in which a range of fruits and vegetables can be grown indoors, CEA farming enables more produce to be grown closer to stores and retailers that serve American consumers. Increasing domestic CEA farming would significantly help to address the problem of relying on more and more imports to feed America. Currently more than $\frac{1}{2}$ of all fruits and nearly $\frac{1}{3}$ of all vegetables are imported to the U.S., including 61 percent of all tomatoes. To balance this trend, the U.S. must embrace CEA, which is widely used in Europe, Canada, and Mexico, to meet growing consumer demand. Much of the rest of the world is far ahead of us in achieving domestic food security through CEA acreage, as there is approximately 520,000 acres of CEA in Europe, 50,000 in Mexico, compared to only 6,000 in the United States.

Second, CEA farming permits the grower to control and monitor virtually all of the elements of the environment, from the nutrients that plants receive to advanced computer systems, with hundreds of thousands of data points to control and adjust humidity, tem-

perature, light, climate, and other environmental factors. Environmental sustainability is at the forefront of many conversations these days, and it is always a primary consideration of CEA farmers. CEA greenhouses use ten times less water and require ten times less land than conventional farms. They also significantly reduce the produce sector's carbon footprint since they can be built in specific areas to shorten distances from greenhouses to customers. They use integrated pest management systems to minimize the use of pesticides and have pioneered a traceback food safety system to reduce food-borne illnesses.

Third, the primary barrier to sustaining and expanding CEA operations in America is that we, like many other firms, lack a stable workforce to help us with operations and harvesting. Despite our farms being climate controlled, and the day-to-day work being done without being subject to harsh elements, CEA farms, again, similar to many other farms, struggle to attract and maintain a stable workforce, despite our efforts to eagerly seek out and hire qualified domestic workers. Whenever we are unable to find those qualified workers, we are forced to turn to contractors or the H-2A Program. The program, however, has grown cumbersome and unreliable for this modern and sustainable type of farming, that, frankly, wasn't contemplated when the H-2A Program was first developed. In fact, during the pandemic, we grew more food than we were able to even harvest with our current workforce, which meant we were forced to throw food away, rather than harvest it and sell it or donate it.

The U.S. has an opportunity to meet growing consumer demand with expanded U.S. production of fresh produce, and Mastronardi is proud to add its name to a long list of businesses and organizations asking Congress to act on the issue of agricultural labor, which will in turn help our domestic food supply chain. We urge Committee Members to continue to work with your counterparts in the Senate to pass the Farm Workforce Modernization Act (H.R. 1603), but also to address the unique needs of our segment of the industry as part of that reform legislation. This will unleash a new era in American agriculture, one that grows far more of our produce domestically on environmentally controlled farms that provide lower cost, higher quality, and, most importantly, reliable produce that American consumers demand to live healthier lives.

I want to thank this Committee for the chance to discuss our business, and the remarkable opportunities controlled environmental agriculture presents to the United States. CEA farms and the fruits and vegetables they produce will allow us to meet the challenge of feeding a growing population with healthier foods.

[The prepared statement of Mr. Safrance follows:]

PREPARED STATEMENT OF KEVIN SAFRANCE, EXECUTIVE VICE CHAIRMAN,
MASTRONARDI PRODUCE LIMITED, MASTRONARDI PRODUCE—USA, INC., LIVONIA, MI

Good morning. Thank you, Chairman Scott and Ranking Member Thompson for holding a hearing to discuss this extremely important topic, and for inviting Mastronardi Produce to appear before you and share our perspective and story. My name is Kevin Safrance. You may be familiar with our company's main fresh fruit and vegetable brand, *Sunset* and sub-brands, *Campari*®, *Wild Wonders*®, *Flavor Bombs*®, *One Sweet*®, *WOW*™ berries, and others, found on the largest retailer shelves throughout the U.S. These and many other fruit and vegetable varieties are grown right here in America in sustainable, state-of-the-art, highly efficient indoor

farms, using modern farming technology many now refer to as Controlled Environment Agriculture, or CEA.

Along with my brother-in-law our Chief Executive Officer and President, Paul Mastronardi, the Mastronardi family has the honor of appearing before this Committee today to discuss the benefits of Controlled Environment Agriculture. As became painfully clear over the past year and a half, the United States has a fragile domestic food supply chain and infrastructure that require investment, not just to carry us through challenges but to take care of Americans in good times and bad. Currently, more than half of all fruits are imported to the United States and nearly $\frac{1}{3}$ of all vegetables are imported. This, while American farms—especially highly efficient CEA farms—have the ability and desire to increase America's food supply from farming done right here in our country. In fact, during the pandemic and at other times, we grow more food than we are able to harvest with our current workforce, which means that we are forced to throw food away rather than harvest and sell or donate it. We believe CEA farming is the key to quickly, sustainably, and efficiently strengthening America's food supply chain. We simply need more workers to help us get the job done. With an enhanced workforce, we are confident we can make a rapid and significant contribution to the strength of the nation's food supply.

Mastronardi Produce is a fourth-generation family operated business devoted to providing high-quality fresh fruits and vegetables to people across North America and beyond. As a pioneer and industry leader in greenhouse farming, Mastronardi prides itself on producing consistently flavorful tomatoes, peppers, cucumbers, berries, and leafy greens in an environmentally and worker-friendly manner. Our direct workforce represents approximately 4,000 jobs across the United States making Mastronardi the largest CEA farming and distribution operation in North America. This includes farms in Coldwater, *Michigan*; Oneida, *New York*; Madison, *Maine*; Wapakoneta, *Ohio*; and Brush, *Colorado*. Mastronardi is also proud to have approximately 1 million square feet of cooled distribution facilities throughout the country located in Jonestown, *Pennsylvania*; Livonia, *Michigan*; Laredo, *Texas*; Lakeland, *Florida*; and Castroville, *California*.

Our geographic footprint allows us to reach American consumers within hours of our farms and distribution facilities. Mastronardi serves the top retailers and major food service companies in the United States. This supply chain provides consumers with a consistent and reliable supply of flavorful, nutritious produce.

In the 1920's, Paul's great grandfather, Armando Mastronardi established Mastronardi's farming roots when he moved to North America and purchased a field farm. It was Paul's grandfather—Umberto—who traveled to the Netherlands and witnessed first-hand the benefits of growing produce in a protected greenhouse environment. This led to Umberto constructing the first commercial greenhouse in North America. Umberto's son—Don—unexpectedly took over the Mastronardi business at age 25 and expanded its distribution operations into Detroit, Michigan in the early 1970's. Paul, grew up in the business learning how to make boxes and harvest fruit from an early age. Paul soon realized that consumers sought after more readily available flavorful tomatoes, which greenhouse farming methods provide. Mastronardi's innovative realization led to the first greenhouse grown grape tomato. We pride ourselves on innovation in all aspects of the business, including industry leading advancements in top-seal packaging that reduced plastic use more than 20%, and increase use of sustainable compostable packaging.

You've called this hearing today to examine the contribution CEA farming can make to Protecting Domestic Food Supply Chains and Infrastructure. We would like to offer several key thoughts on this.

First, because of the unique way in which a wide range of fruits and vegetables can be grown indoors, CEA farming enables significant amounts of fresh fruits and vegetables to be grown closer to the stores and retailers that serve American consumers. This is vitally important considering the transportation and shipping issues experienced by many during the pandemic, as well as the damaging effects of climate change and inclement weather. Security of the domestic food supply can only be accomplished with a significant expansion of CEA farms in the United States. Much of the rest of the world is far ahead of the U.S. in achieving domestic food security through CEA acreage. There are approximately 520,000 acres of CEA in Europe and 50,000 in Mexico, but only 6,000 in the U.S. most of which does not contain updated advanced technology. As we see a drastic imbalance of CEA produce acreage, we also find the U.S. relying more and more on imports to meet the present and increasing consumer demand for fresh fruits and vegetables. Nearly $\frac{2}{3}$ of fresh fruits and $\frac{1}{3}$ of vegetables are imported into and consumed annually in

the U.S.¹⁻² For certain categories of vegetables, like tomatoes, more than 60% are imported. To balance this trend, the U.S. must embrace CEA, which is widely used in Europe, Canada, and Mexico, to meet growing consumer demand.

Second, CEA farming permits the grower to control and monitor virtually all of the elements of the environment, from the nutrients the plants receive to advanced computer systems with hundreds of thousands of data points to control and adjust, humidity, temperature, light, climate and other environment factors. Storm and irrigation water are collected, used, and then recycled resulting in a fraction of use compared to traditional farming. This means food production can continue even when nature might like to stop it.

Further, we use an integrated pest management system to minimize the use of pesticides. For example, we use ladybugs and other insects to control harmful pests, and we bring in bees to the greenhouse for pollination.

We also pioneered a traceback food safety system enabling us to identify the date, specific crop location, and team member who physically harvested the produce.

Environmental sustainability is at the forefront of many conversations these days, and it is always on the forefront of our minds as CEA farmers. Government agencies, companies, and non-governmental organizations need to embrace more efficient, environmentally sustainable systems predicated on technology. CEA is paving the way for the U.S. to maintain domestic food security in a climate conscience manner. CEA greenhouses use *ten times less water* and require *ten times less land* than conventional farms, and significantly reduces the carbon footprint as a result of shorter distances from greenhouses to customer. That means CEA farms don't just help us to secure the nation's food supply; they also help us to sustain the nation's water supply and land supply and care for our planet. At a time when many in our country are sadly facing water shortages on top of the nation's supply chain problems related to food, these additional benefits of sustainable CEA farming cannot be underscored enough.

As I mentioned earlier, however, the primary barrier to meeting the need here in America is that we, like many other farmers, lack a stable workforce to help us with the harvest.

Today's modern CEA farms are incredibly efficient. One greenhouse worker can harvest the equivalent to **37 traditional** field farmworkers. Despite our farms being climate controlled and the day-to-day work being done without being subject to the harsh elements, CEA farms struggle to attract and maintain a stable workforce. *We eagerly seek out and hire qualified domestic workers.* Whenever we are unable to find those qualified workers, we are forced to turn to contractors or the H-2A program. The program, however, has grown cumbersome and unreliable for this modern and sustainable type of farming that frankly wasn't contemplated when the H-2A program was first developed. For example, CEA farming requires facility cleanout, sanitation, and crop preparation processes that did not exist in 1986 when the H-2A program was created. A 50' tomato plant—which you can find any day on our farms during harvest—was not contemplated by the authors 35 years ago. These innovations beckon us to modernize and update the system, not just so we can partner with more H-2A workers, but so we can fix the domestic food supply chain and feed Americans with food grown right here in America.

The U.S. has an opportunity to meet growing consumer demand with expanded U.S. production of fresh produce, but only if the labor situation is addressed. Mastronardi is proud to add its name to a long list of businesses and organizations asking Congress to act on the issue of agricultural labor. We urge Committee Members to continue to work with their counterparts in the Senate to pass the Farm Workforce Modernization Act, but to address the unique needs of our segment of the industry as part of that reform legislation. By updating the rules that allow us to responsibly use the H-2A program, we will be able to unleash a new era in American agriculture. One that grows far more of our produce domestically, on environmentally controlled farms that provide lower cost, higher quality produce that American consumers demand to live healthier lives.

In closing, I want to thank this Committee for the chance to discuss our business and the remarkable opportunities Controlled Environment Agriculture present to the United States. CEA farms and the fruits and vegetables they produce will allow us to meet the challenge of feeding a growing population with healthier foods. Mr. Chairman, this concludes my opening testimony.

I look forward to answering any questions you might have.

¹ <https://migration.ucdavis.edu/rmn/blog/post/?id=2498> (tomatoes 61%).

² <https://migration.ucdavis.edu/rmn/blog/post/?id=2569>.

The CHAIRMAN. Thank you very much, and I appreciate all of the just simply outstanding testimonies that each of you have given. Now we will go to questions with Members, and I will ask a couple, then I will turn it over to the Ranking Member, we will go to Members.

First of all, let me ask Mr. Giscombe, what is PLANT-AG? How does it work?

Mr. GISCOMBE. Thank you, Mr. Chairman. PLANT-AG, as we like to call it—

The CHAIRMAN. You might want to move your microphone closer to your voice.

Mr. GISCOMBE. Can you hear me okay?

The CHAIRMAN. Yes, now we can hear you.

Mr. GISCOMBE. Sorry about that.

I was saying PLANT-AG is a distributed network production system based on the simple principle of bringing the production facilities for controlled environment agriculture near—more close to the population dense centers, metropolitan statistical areas. Because of this technology, as Mr. Safrance said earlier, we are now able to do significantly more with significantly less land space. By simply moving from further away, which is what the traditional distribution networks look like, to being in closer proximity to where people who are consuming this on a day-to-day basis are, we stand to not only increase production, limit the amount of natural resource depletion, and most importantly, increase the level of quality of that produce that is coming to the consumer.

The CHAIRMAN. And so would it be a good understanding of what PLANT-AG does that you are able to help us with food security by using technology, and the latest scientific processes, to be able to grow food inside, without the natural light, or rain?

Mr. GISCOMBE. Yes, Mr. Chairman. The beauty of controlled environment agriculture is that you are eliminating a lot of that variability. In fact, I would say statistically you reduce about 96 percent of the risk of the contaminants from the airborne pathogens and bacteria. You are also no longer susceptible to any kind of weather conditions, no more than we sitting in this room today are susceptible to the humidity outside in D.C.

The CHAIRMAN. Thank you very much. Now, Mr. Gadouas, in your testimony you mentioned something that I want you to explain a little further. We were talking about financial, and equity, and then you made this statement describing this financial situation in ag. You called it a loosely defined jungle. What do you mean by that? Please turn your microphone on.

Mr. GADOUAS. Is that better? Yes, here we go.

The CHAIRMAN. Yes. May—come a little closer. We want to really hear what you have to say here. Go ahead.

Mr. GADOUAS. What investors are really looking for is an asset class which has some institutional meaning, and right now the food system is not really widely known amongst institutional, particularly fixed-income investors. There is a combination of food production. There is food distribution. There is social-type programs out there which provide food to the needy. There is food research. All of this right now, because it is so little known with portfolio man-

agers, insurance company managers, pension funds, and so forth, it has been very, very difficult educating them.

So the point here is that by designating an asset class, particularly something which has an industrial capacity to it, something which is a capital expenditure, something that can be financed, as intangible, that would be doing the same thing that we did 15 years ago, with the analogy of renewable energy. It was just as little known, just as little defined, but by having examples where there are multiple sources of capital to provide that kind of funding for large capital expenditures, that will solidify in an investor's mind what a new asset class is called food infrastructure.

The CHAIRMAN. Thank you very much. And now, Ranking Member, I will turn to you for your questions.

Mr. THOMPSON. Well, Mr. Chairman, Thank you very much. Thanks for this hearing. One of my most recent visits—well, actually, it was probably in 2020, now that I think about it, at this point, to a farm operation, farm market, was Yarnick's in Indiana County. They are traditional agricultural production, but they are able to supplement it and extend their season using hydroponics, and also having a controlled climate right in the middle of that production agriculture. It was pretty impressive, actually, very impressive. So I appreciate all of our witnesses here today.

Mr. Safrance, as we know, through adopting new practices and innovative technologies, our farmers, ranchers, and producers have made it possible to have the safest, most abundant, most affordable food and fiber supply in the history of the world. And while there is always room for improvement, and that with agriculture, I think we all agree American agriculture is science, technology, and innovation, always has been. Kind of rude and crude and rudimentary at first, but very sophisticated today. I strongly disagree with those who say the only way to fix our food system is to completely start over. Mr. Safrance, as the Executive Vice Chairman of one of the companies really leading greenhouse growing in North America, what are your thoughts on that statement?

Mr. SAFRANCE. Yes, I don't believe the supply chain is broken at all. I feel that we should focus on what we are not doing correctly and celebrate what we are doing correctly. I think the biggest problem we have in our supply chain right now is availability of product. Currently, in our industry we are importing a lot from different countries, and if there are border issues, or other issues in other countries, then these products don't show up on time, and that creates empty store shelves.

I can tell you, from our experience, we have five distribution centers across the United States. If we have the product in our building, we can get an order in the morning, we can ship it out that afternoon, and have it delivered the next day almost 100 percent of the time.

Mr. THOMPSON. Very good. As I was listening to testimony, I heard a few witnesses mention how getting access to capital is one of the biggest limiting factors of entry into controlled environment agriculture. I think access to capital, obviously, is a big issue across all aspects of the food supply chain, certainly for those young and new and beginning farmers we know it is a big issue as well. So getting access to credit and capital is not just an issue in a con-

trolled environment agriculture industry, but it is something that producers experience across the entire agriculture industry. Mastronardi Produce has been involved in the greenhouse growing industry for four generations now. Mr. Safrance, how has Mastronardi been able to gain access to the capital needed to build not just the greenhouses, but the distribution facilities across the United States without the use of exempt facility bonds, like our other witnesses were calling for today?

Mr. SAFRANCE. Yes. In our history, everything we have done has been just traditional bank financing and/or equity off our balance sheet.

Mr. THOMPSON. Very good. I think, just because we are on a tight timeframe, Mr. Chairman, I am going to yield back the balance of my time.

The CHAIRMAN. Very good.

Mr. THOMPSON. Keep it efficient.

The CHAIRMAN. Thank you. I appreciate that, Ranking Member. You are a good man. Now we will recognize Mr. McGovern of Massachusetts for 5 minutes.

Mr. MCGOVERN. Well thank you, and thank you to all of our witnesses, and Chairman Scott. Sometimes, talk about supply chains and efficiencies quickly become jargony, and I worry people may lose the forest for the trees. I appreciate that our witnesses for today did a great job explaining what may be a new topic for some people, in that vein I would like to take a minute to kind of center the conversation.

We are talking about building a resilient food system. That means strengthening local food systems, expanding opportunity for farmers, ensuring justice for farmworkers, and guaranteeing access to nutritious food essentially as a human right. And I think it is really important that we take a holistic approach to food security so that we can fulfill the goal of trying to end hunger in this country once and for all. In fact, and my colleagues maybe are tired of me talking about this, but I have been pressing this Administration, the Biden Administration, to convene a White House Conference on Food, Nutrition, Health, and Hunger, because we need to tie everything together. It is not just one thing, it is a whole bunch of things.

And, Mr. Giscombe, I appreciate that you put things in perspective in your testimony. You said that you were here because your children, just as every child in America, deserves fresh, nutritious, contaminant-free fruits and vegetables that they can trust, and I couldn't agree more. I would like to ask you to expand on this a little bit. How can CEAs help end hunger in America? And, one of the most important things about food security is realizing that any hunger is not just about quantity, it is about quality as well. And the second question would be, can you elaborate on how CEAs could expand access to fresh food?

Mr. GISCOMBE. Thank you, Congressman. First and foremost, I would say CEA cannot end hunger in America. What CEA can do, as you so appropriately stated, is supplement the other elements of agricultural production in the United States of America to better equip the overall supply chain to be more efficient and effective in

the delivery of fresh, high quality, contaminant-free, and nutritious products.

One of the key things about controlled environment agriculture is the last comment I just made. By moving indoors, you eliminate the majority of the risk to airborne pathogens and bacteria, which are the leading causes of food-borne illness in America. Every year—actually, going back to 2011, there has been more than six million cases of outbreaks—I am sorry, of contaminations and illnesses caused from that, and it is devastating. So when you think about—if we have the opportunity to simply leverage this specific kind of platform as a part of the broader collective of agricultural production, that is the first step, in our belief, to moving towards being able to address hunger. Did I answer your question, Congressman?

Mr. MCGOVERN. Yes, thank you. Yes, I know, and I know we are on a tight schedule here, so I want to be very quick, but we talk a lot about food insecurity, but we also have to add that there is nutrition insecurity as well, and as we battle issues like food insecurity and hunger, we also have to pay close attention to the importance of nutrition as well. But, I appreciate the perspectives that all of you have presented here today, and this is an important hearing. Yes, Mr. Giscombe?

Mr. GISCOMBE. I just wanted to add one more thing. Going back to nutrition, it is probably not commonly known that when a fresh produce item travels more than 4,500 miles, it loses upwards of 50 percent of its nutritional value. So when you think about it, if what we are focused on is delivering higher quality, more nutritious products, one of the first steps has to be to limit the distance that item has to travel to get to its consumption.

Mr. MCGOVERN. I think that is a good point. Somebody, one time, explained to me that a tomato coming from the West Coast to Massachusetts, where I live, and with all the shipping, and the refrigeration, and all the stuff that it went through, I felt bad for the tomato that was in the grocery store. But in any event, I think that is a very good point, and I thank you. I yield back my time.

The CHAIRMAN. Thank you very much, Chairman of our Rules Committee, Mr. McGovern. Thank you, and you are right, you have been a longtime champion of fighting hunger, now I will recognize Mr. Austin Scott of Georgia.

Mr. AUSTIN SCOTT of Georgia. Thank you, Mr. Chairman, and I appreciate you having this Committee hearing. I do think it is good that we are talking about the number of miles that a tomato, or any other fresh fruit or vegetable travels before it is actually able to make it to the shelves of our local grocery store. I want to ask, if I could, Mr. Safrance, you have greenhouse operations in Canada, the U.S., and Mexico, if I understand your testimony correctly. Is that accurate?

Mr. SAFRANCE. We own greenhouses in Canada and the United States, and a small partnership in Mexico, and we have growers that work for us in all three countries on a supply basis.

Mr. AUSTIN SCOTT of Georgia. Okay. And you have greenhouses that are as large as 4 acres, is that correct?

Mr. SAFRANCE. Yes. We have some that are much larger than that.

Mr. AUSTIN SCOTT of Georgia. Really? So how large would your largest greenhouse be if you don't mind?

Mr. SAFRANCE. In a single facility, 64 acres.

Mr. AUSTIN SCOTT of Georgia. Sixty-four acres? And that is one greenhouse, or is that multiple greenhouses on 64 acres?

Mr. SAFRANCE. That would be one facility composed of two ranges of 32 acres.

Mr. AUSTIN SCOTT of Georgia. Wow. That is a big greenhouse.

Mr. SAFRANCE. Yes. Yes, it is large.

Mr. AUSTIN SCOTT of Georgia. So where I come from in south Georgia, most of my fruit and vegetable growers, they have greenhouses, and they grow out the plant, but then you take this plant, which is, as you know, would be significantly smaller than one tomato, and you transplant it then into the fields. If I understand your operation, though, you are actually growing the whole plant, and the vegetable, out in your greenhouses, is that correct?

Mr. SAFRANCE. Yes, that is correct.

Mr. AUSTIN SCOTT of Georgia. So do you do any transplanting, or is all of yours totally internal to the greenhouses?

Mr. SAFRANCE. Yes, no, everything we do is indoors.

Mr. AUSTIN SCOTT of Georgia. Okay. Well, my kids love your Sugar Bombs—is it Sugar Bombs?

Mr. SAFRANCE. Yes.

Mr. AUSTIN SCOTT of Georgia. Yes. And my wife makes me buy them when I go to the grocery store too, so I eat them too, so you have great products.

Mr. SAFRANCE. Thank you.

Mr. AUSTIN SCOTT of Georgia. I guess my concern is, when we talk about the fact that we are importing, if you will, 61 percent of the tomatoes that are eaten in this country. What is your wage rate in Mexico *versus* your wage rate in the United States?

Mr. SAFRANCE. Yes. I don't operate the greenhouses in Mexico, so I am not 100 percent sure. I believe the wage rate in Mexico is probably around \$14 or \$15 a day. Our greenhouses in the United States pay roughly a base wage of \$13 to \$15 an hour, and with the piece rate, many people are achieving more than \$20 an hour.

Mr. AUSTIN SCOTT of Georgia. All right. So you are \$14 to \$15 a day in Mexico?

Mr. SAFRANCE. I mean, that would be an average of all the growers in Mexico, I would say.

Mr. AUSTIN SCOTT of Georgia. Okay. And so this is something that I think, when we talk about the sustainability, and the food supply chain, why are 61 percent of the tomatoes that we consume in the United States actually transported thousands of miles to make it to the grocery store? And one of the things that concerns me, that our growers are fighting in the U.S., is that \$15 an hour wage in Mexico *versus*, as you said, most people that are working in the fields make a good bit more than that because they are paid by production, and so there is a reason that they come to America to work. And they work very hard. I have worked in the butterbean fields myself when I was a younger man, and I didn't make \$15 an hour back then. It was whatever the minimum wage was at the time. But the wage disparity between the U.S. and Mexico, to me,

seems to be one of the reasons why our produce has to travel so far to make it to the shelves. Would you agree with that?

Mr. SAFRANCE. No, I don't agree with that, actually. I think a lot of it has to do with growing seasons and proper growing climates.

Mr. AUSTIN SCOTT of Georgia. Okay.

Mr. SAFRANCE. Some of the areas in Mexico have the best areas of climate to grow, much like California, year round.

Mr. AUSTIN SCOTT of Georgia. I am almost out of time. I apologize for interrupting you, I really do. So I am in south Georgia, so my growing season is effectively the same as portions of Mexico, and—Mr. Chairman, my time has expired, but I appreciate the hearing. I am concerned about the U.S. producers, and what they have to compete with coming from foreign countries, and the lower costs of operations in foreign countries.

The CHAIRMAN. Thank you, Mr. Scott. And now I recognize the gentleman from California, Mr. Costa, for 5 minutes.

Mr. COSTA. Thank you very much, Mr. Chairman, for your leadership, and for this hearing today. I think focusing on protecting America's domestic food supply chain, as you and I discussed before, is a national security issue, and therefore it is critical that the House Agriculture Committee indicate how we need to focus on innovation as we move forward. The sustainability of our domestic food supply is critical, and I, for one, believe that we should take an all of the above approach, and I appreciate the testimony of our witnesses here today.

Let me make a note, the Chinese Government, and our last colleague talking about remaining competitive, they spend \$3 billion a year on innovation to modernize their agriculture. We have \$3 million, \$3 billion for China, we do \$3 million for our support within the USDA. That is not being competitive. Put simply, America is not keeping up on research and development, our capacity for these investments that are absolutely necessary, and we are neglecting, as a result, our food security.

President Lincoln, in 1862, July 2, signed the Morrill Act to create land-grant universities. That was infrastructure. That was boldness. That was vision. In California we are utilizing some of this cutting-edge technology on innovative agriculture using our research universities, but also the private-sector. I want to highlight Plenty, a company in California, which I visited their vertical agricultural investments. Plenty, so named because they want to produce additional food supply to America. Plenty, meaning plenty more food for America. I would like unanimous consent, Mr. Chairman, to submit their testimony here for the record.

[The statement referred to is located on p. 49.]

The CHAIRMAN. Unanimous consent granted.

Mr. COSTA. Thank you. In highlighting this effort, I want to note that they have developed a pilot project effort that I witnessed last year, and this year they are building a very large project in Compton, California. And their plan is, like other of our witnesses here today testified, to create these kinds of vertical growth facilities in major cities in America that will provide jobs, and provide additional high-quality food that—because you control the environment, and I farm some, and farming is risky. And, there are some factors you just can't control out on the farm, and that is the weather. But

the ability to grow these products in a controlled environment I think is critical, and that is really what controlled environment agriculture stands for, CEA, controlled environment agriculture. And so these technologies are critical for the future sustainability of putting food on America's dinner table every night, and that is the goal.

Now I have a couple of quick questions, because this effort—and I urge all my colleagues to view in your area where vertical growth agriculture is taking place under controlled environment agriculture circumstances, because I think there are public-private partnerships that are critical. Mr. Gadouas, you talked about exempt facility infrastructure to help fund significant capital expenditures. We are talking about market tax credits. Where do we help provide the financing to encourage more of this effort?

Mr. GADOUAS. Well, to your point, Congressman Costa, there is so much that is needed. There is so much infrastructure. It is critical to the country, and it is going to be distributed all over the country. In order to make that happen, we need to diversify as much capital as—available as possible. And in addition to tax credits, tax increment financing, and some of the other economic development tools that are out there—and they are out there, but the truth is, and we have seen this, is they are all for relatively small projects. They simply do not address the type of scale of the capital expenditures that are going to be necessary here.

So in looking at what has been successful in the past, we think that an obvious source of capital, because so many investors are just natural buyers, naturally aligned with this type of infrastructure, a new classification of exempt facility bonds would go very, very far in diversifying that kind of capital that is—

Mr. COSTA. My time is almost expired here, but, Mr. Chairman, I think in our next hearing we need to look at more tools to try to help provide financing in these public-private partnerships, and our universities throughout the country.

The CHAIRMAN. Certainly, Mr. Costa. Thank you. The gentleman from Georgia, Mr. Allen, you are recognized for 5 minutes.

Mr. ALLEN. Thank you, Mr. Chairman, and thank you to our witnesses. We are talking about something here today that is growing in interest in our country. Controlled environment agriculture is important not only because it diversifies production methods for existing farmers, but it also serves as a testing ground for many new technologies before traditional farmers actually incorporate them.

We need to understand the limitations of this industry as well. Food security is a national security issue, and our primary responsibility must be always to ensure that our country's food supply remains secure. I believe that these production methods we are discussing today do have a role in the potential of allowing more of our food to be produced domestically.

In my district I toured, in October 2020, the Better Fresh Farms located in Metter, Georgia. These CEA farms are built inside of mobile containers, and so are able to be relocated easily. The ability these farms have to bring fresh produce right to a population center is an inventive method by which we might eradicate many of the food deserts throughout America.

Before I begin my questioning, I would like to draw attention to an important matter that Mr. Safrance made in his opening statement. He stated that the primary barrier his farms face is the lack of a stable workforce, and this is exactly the number one issue that farmers tell me they face as well. This Congress I introduced a bill that would move administration of H-2A programs from the Department of Labor to the USDA. The Department of Labor is fundamentally cross purpose with the H-2A Program. That Department is also out of touch with the particular needs of the ag industry, much of which arise from timing sensitivities due to planting and harvesting schedules, as well as the weather. And I hope that the Agriculture Committee will hold a hearing this Congress where we can look at my bill in greater detail and can have expert witnesses testify on how we can improve our H-2A program.

Mr. Safrance, in your testimony you brought attention to the fact that nearly $\frac{2}{3}$ of fresh fruits and vegetables are imported into and consumed annually in the U.S. You explained how Mastronardi Produce is able to remain competitive in this market. How are you able to do that?

Mr. SAFRANCE. From a labor perspective?

Mr. ALLEN. Yes, sir.

Mr. SAFRANCE. Well, when it comes to controlled environment agriculture, they are much more efficient from a labor perspective. We have a lot of automation, and also different things in the greenhouse where it is very ergonomic, and there is a lot of different pieces in there that can help us get the labor done at a faster rate than in a field, without having to bend over, and things like that. So that is how we try to stay competitive, but at the end of the day, we just really struggle with the actual numbers of people that we get in the greenhouses, and it has been a problem ever since we have been doing business here in the United States, which is many, many years. And that is the largest problem we have today, is just getting enough people.

Mr. ALLEN. I have about a minute and 30 seconds left, and I would like to ask all of our witnesses, what is your biggest challenge in controlled environment agriculture production? What are the biggest challenges that industry face? And I will start, could each of our witnesses comment on that very quickly. Any challenges?

Mr. SAFRANCE. No, I would just say our number one issue is quantity of labor. We try to hire and endorse all the American workers we can, and at the end of the day we just can't get enough people. We physically go out and promote, radio ads, all kinds of things, and just physically don't get the amount of interest that we would like.

Mr. VERBAKEL. For us at the moment there is a backlog in transportation, availability for trucks to get the containers out of port, so the material delivery from port to building site is a big challenge, but I think this will be solved within a year, and will not be the long-term challenges. We are looking for more collaborations within the U.S. market to be also domestically a supplier, together with more greenhouse and manufacturer in the United States.

Mr. ALLEN. All right. Well, I am out of time. I will mention that I did visit Vertical Harvest in Jackson Hole, Wyoming, and they

did something very creative. They used people with disabilities to harvest, and these folks were full of energy, and were amazing workers. And so maybe we can——

The CHAIRMAN. Mr. Allen, your time has expired.

Mr. ALLEN. Yes, sir.

The CHAIRMAN. Thank you. And now I recognize the gentlelady from North Carolina, Ms. Adams, the Vice Chair of the Agriculture Committee.

Ms. ADAMS. Thank you, Chairman Scott, Ranking Member Thompson, for hosting the hearing today. To our witnesses, thank you very much for your testimony. In my district in Mecklenburg County in North Carolina, nearly 15 percent of the population lives in what the USDA considers a food desert. Often found in low-income communities, these residents don't have access to a full service grocery store or nutritious food, and experts suggest that living in a food desert may put people at an increased risk of obesity, diabetes, and other weight-related conditions, which is why I am particularly interested to hear how applying controlled environment practices to urban agriculture could aid efforts to achieve food security, and improve access to healthy foods in food deserts across the country. Already urban agricultural technologies are increasing the availability of food, which is especially important in communities with limited access to affordable fresh produce like my community.

Mr. GISCORBE, as I mentioned earlier, in my district 15 percent of the population lives in a food desert, so can you address how controlled environment systems help communities located in food deserts, and how can these systems mitigate food insecurity?

Mr. GISCORBE. Congresswoman, thank you, great question, and I appreciate it. As I said before, one of the biggest challenges is the location and proximity of where our agricultural production is today. What that leads to is significant costs in transporting the items that are produced to their area of consumption. Controlled environment agriculture has the ability to be located, whether it be in the metropolitan city areas, like we spoke about with our colleagues at Plenty, or Bowery Farms, or any of the others that are practicing vertical agriculture. But what you will see is there are no greenhouses that you can put in the middle of a city center, right? Real estate is extremely expensive, extremely valuable, and we are trying to address things such as employment, housing, which is a critical issue. So when you think about what is the best and most efficient use of real estate for agricultural production, and making that proximate to where the consumption is, there has to be some middle ground.

So by being within, let us say 6, 8, even a 10 hour radius of a metropolitan statistical area, you can eliminate up to 30¢ worth of logistical cost per item, which means that the retailers, the distributors who are subsequently delivering that produce to your retail outlet, and your food service outlets, now have a benefit. Their margins become larger. And, at the end of the day, economics is what drives businesses.

Ms. ADAMS. Okay.

Mr. GISCORBE. I would submit that if you are able to bring the cost of agricultural production within a certain level, you are going

to also be able to pass that on, and ensure that greater quality food gets to the people that you are speaking about.

Ms. ADAMS. Okay. So would the food produced in these controlled environments be as nutritious as the food grown in a field, and could there be micronutrient deficiencies in some crops?

Mr. GISCOMBE. That is a phenomenal question, and I will say this very matter-of-factly. It is absolutely as nutritious, and we can argue whether or not it is more nutritious. When you grow inside a greenhouse, or in a vertical farm, there is no use of pesticides or herbicides. That is number one. Because you are able to control every element of nutrient that that item is receiving, whether it be lettuce, whether it be tomatoes like we have displayed here today, or cucumbers, they are all in higher quality. So by the time they got to—and again, as I said, traveling a shorter distance—that preserve the nutritional quality.

Ms. ADAMS. Okay. So let me move on. Thank you so much. Mr. Verbakel, in your testimony you mentioned that there is no escaping the significant capital expenditures necessary to develop a controlled environment facility, so what are the potential infrastructure, resource, and energy costs associated with these CEA facilities, and how do they compare with traditional production agriculture systems?

Mr. VERBAKEL. Initially the capital investment costs are, of course, much higher compared to open field farming, but in the long run, the greenhouses can also serve as an asset. So, from an investment perspective, that is much more interesting than just investing in the pure land. And, to your point, from where you are from, one of our clients, Little Leaf Farms, from Devens, Massachusetts, is going to invest in Burnsville, North Carolina, where they will realize a 20 acre complete controlled environment agriculture for lettuce production. I see we are running out of time, and I want to give the word back to you.

Ms. ADAMS. Okay. Well, great. Well, thanks very much, and I am going to yield my 6 minutes back, Mr. Chairman, my 6 seconds, excuse me. Thank you.

The CHAIRMAN. Thank you very much. Now I recognize Mr. Balderson from the great State of Ohio, 5 minutes. Is he on? Mr. Balderson? You may want to unmute. If not, we will go to Ms. Moore of—or Mr. Moore of Alabama. Is Mr. Baird. Wait, what is that. All right. Mrs. Cammack from Florida.

Mrs. CAMMACK. There we go. Thank you, Mr. Chairman, thank you, Ranking Member Thompson, and thank you to our witnesses here today. The examples that we are hearing about today really speak volumes of the innovation and the growth in hydroponics and controlled environment agriculture that are really just the tip of the iceberg—I put a pun in there—of a long legacy of American agriculture innovation, which for decades has improved yields, conserved resources, preserved our environment, and helped feed the world. No doubt about it, American farmers feed not just our communities, our states, our country, but the world.

I am especially proud of PLANT-AG, there has been discussion about what it is and the exciting potential that it has brought to north Florida, bringing new jobs and economic development to the region. It is no secret that fruit and vegetable growers in my home

State of Florida and elsewhere are hurting right now. The few tomato growers left in my home State of Florida are under tremendous pressure from the unfair dumping of cheap Mexican tomatoes on our markets. I hear from witnesses and my colleagues alike that innovation is key to the future survival of American agriculture, and so I will just jump right in.

And this will be a question, really, for the entire panel. How can controlled environment agriculture—because I have heard a few facts and statistics today, how can it reduce our reliance on foreign imports, and preserve domestic production? And if you could keep it to the facts, because I know there has been a few that have been thrown out? I really want to make sure that I capture that for myself and my team, and I will start on this end over here.

Mr. GISCOMBE. Thank you, Congresswoman. First and foremost, we need to increase the amount of controlled environment agriculture production. If we do that, by whatever means necessary, whether we continue to look at it from a perspective as it is traditional, or we actually make the move forward and consider it infrastructure, and invest in that infrastructure, we will by default decrease the amount that we are importing. It is just simple math. By increasing the amount of acres under glass in America, which pales in comparison to that of Europe—and contrasting, Europe is significantly smaller than the United States is. And that is not just a country, it is the—it is Europe.

Mrs. CAMMACK. Do you—

Mr. GISCOMBE. So all we have to do—

Mrs. CAMMACK. Do you have a percentage of the difference between what is produced in Europe, as opposed to the United States?

Mr. GISCOMBE. Europe has over 500,000 acres under glass.

Mrs. CAMMACK. Okay.

Mr. GISCOMBE. The United States has significantly less than 10,000. Our colleagues, our Canadian colleagues at Mastronardi, have 6,000 themselves.

Mrs. CAMMACK. Okay. Thank you.

Mr. GADOUAS. I will address it from a cost of capital perspective.

Mrs. CAMMACK. Thank you.

Mr. GADOUAS. The more capital is out there, and the less expensive it is, is only going to make these facilities more competitive, and that is really what it comes down to. That will—it all comes down to price, and where demand is going to come from. The other point I want to make is the more data points you have with public capital, with bond financing, and the way that disclosure is done, best practices, that is for everyone to see, and the more of those publicly available data points we have, the more and more competitive our capital is going to be.

Mrs. CAMMACK. Absolutely. Thank you. Mr. Kelley?

Mr. KELLEY. Congresswoman Cammack, you grew up on a cattle ranch, I believe, right?

Mrs. CAMMACK. Yes, I did.

Mr. KELLEY. So you, and I am sure the rest of the Committee, can appreciate what is the good of good food with bad data? You have to have good data. And if you can control the variables, so control the amount of data, therefore it stands to reason that you

are able to control the output, and have good data about that produce, or outcome that you are producing. So, therefore, that should increase the value. Therefore, that could distinguish that product amongst all products by controlling that data.

Mrs. CAMMACK. Excellent. Thank you, Mr. Kelley.

Mr. SAFRANCE. I will go back to what Mr. Giscombe was saying about not having enough CEA greenhouses for controlled environment agriculture in the United States. The United States is significantly under-indexed compared to the rest of the world. I read a study a while back that said, if I have this correctly, and I believe I do, that there were—in Europe there were 700 acres per million population. In the United States, it is only about 16 acres per million population, so very under-indexed, and I believe that is what is driving the imports.

I think with a large expansion of CEA over the next decade that we can change that, and I think the biggest driver to doing that is not capital. I think that there are a lot of people that want to get involved, but I do believe that it has to do with proper labor supply. Because otherwise, putting that much capital in a place without the people, I should say, is just way too big of a risk for anyone.

Mrs. CAMMACK. Thank you. And I do have—I am running short on time. I do have a question, I can enter it for the record, and this would be to my friend here, Karim, about the role of the University of Florida, and the educational exchanges that you are working in partnership and concert with. And with that my time has expired, but thank you to the witnesses for being here today for this very important issue.

The CHAIRMAN. And now we will recognize Mr. Carabajal from California, 5 minutes.

Mr. CARBAJAL. Thank you very much, Mr. Chairman. I am honored to have one of my youngest constituents with me today, by the name of Elijah, joining me and asking this question. So, with that, let me just start. Thank you to all the witnesses that have joined us today. The first question is for Mr. Kelley.

Food security should be treated as national security, and that is why this Committee works to give individuals and families access to sufficient, safe, and nutritious food. Supporting the innovation and integration of controlled environmental agriculture is a tool we can use to protect domestic food supply chains and infrastructure, but it also has a substantial dependence on new technology, which could have unforeseen risks. Mr. Kelley, what can be done to prepare for cyberattacks on our food systems?

Mr. KELLEY. Congressman, thanks for the question. I think it is a very thoughtful question, and it—we have seen very recently the outcomes of cyberattacks, and those cyberattacks have been on a very fragile—and I will echo what Mr. Safrance said, fragile, but not broken, supply chain, I believe is what was stated. But that supply chain can be augmented, can be better supported, with greater technology, and with the ability to have greater visibility across that supply chain from source to consumption.

And so, Congressman, when we think about the way that we deal with data in that supply chain right now, it is very siloed. And if we think about from production to consumption, each one of the

passing of that product is just a handshake going from one step to the next. If we could implement technology that allows us to bring down those barriers, and share that data in a secure and very visible way, with transparency, such as I mentioned with blockchain, we can then understand who might be trying to tamper with that supply chain that we currently have. Not broken, but ready to be augmented with greater technology.

Mr. CARBAJAL. Thank you, Mr. Kelley. My next question is for all the witnesses. This Committee will eventually begin consideration of provisions that will become the next farm bill. This is a slow and deliberate process that does not seem to match your industry's sense of urgency. What steps can this Committee take in between farm bills to ensure that we are maintaining pace with these advanced technologies and production practices, and what existing USDA programs can be utilized to support controlled environmental agriculture?

Mr. GISCOMBE. I am sorry, Congressman, I didn't realize you were asking the question of me. First and foremost, what the United States Department of Agriculture can do is I think the conversation that we are having here with the Committee. There is an ominous need, as Mr. Kelley said earlier, to incorporate data management into our supply chain. We have the opportunity to do it, but also, going back to what Mr. Gadouas said, as well as Mr. Safrance, right, there are two sides to that coin. One is we need the capital to be able to make the investment in technology and innovation, right?

Going to the other side of it, with regards to labor, yes, that is a reality. It is not cheap. Economics drive all innovation, so by increasing the access to that capital, we will by default create the opportunity for all participants, not just in controlled environment agriculture, but agriculture broadly, to be able to leverage that. And a great example of that is Walmart, right? They are not a producer. Walmart made the investments because they had the access to that capital, but we are all aware they are the largest retailer in the world, so it is kind of a no-brainer. As such, what about the other participants in the supply chain that don't have the ability to do that because their capital is spread so thinly across their operations? We have to—the USDA, the Committee here, has to look at it from a very fundamental perspective. What are the economics of innovation? That is how we then leverage things like blockchain to be able to create this platform.

Mr. CARBAJAL. Thank you very much. I know I said to all the witnesses, but I seem to have run out of time. With that, I will yield back, Mr. Chairman.

The CHAIRMAN. Thank you very much. And now the gentleman from Ohio, Mr. Balderson. You are recognized for 5 minutes.

Mr. BALDERSON. Thank you, Mr. Chairman. Appreciate the time. My question is for Mr. Safrance. Thank you for your testimony. Appreciate that. My question is—the COVID-19 pandemic drastically changed many aspects of farming across the nation, as well as the way agricultural produce was delivered to consumers. As the only witness here today with commercial experience producing fruits and vegetables through hydroponics, what are the biggest challenges you face during the course of a yield cycle?

Mr. SAFRANCE. Yes, so in the course of a yield cycle, I mean, there is, every day is a challenge. The biggest challenge, as I said earlier, is the labor, and having enough people, because if the plants get far behind on crop work, then the quality suffers, and the yield suffers, and then a greenhouse would become unviable. And so the biggest issue we have on a day to day basis, without question, is dealing with the labor.

The CHAIRMAN. Is he muted?

Mr. BALDERSON. There I go again. I apologize, Mr. Chairman. Sorry, Mr. Safrance. Are there any crossover benefits that controlled environmental agriculture, or CEA, can learn from traditional agriculture?

Mr. SAFRANCE. I think the processes are similar, but different at the same time. I think they can learn from each other, and I think that there is plenty of space for them to coexist. But from a crossover benefit, I mean, if you look at growing an outdoor tomato crop and an indoor tomato crop, I mean, the premises are the same, but you have a lot more tools at your disposal indoors, obviously, and I believe that that is why we can get better yields and bring the cost down and be competitive by growing indoors.

Mr. BALDERSON. Okay. Thank you very much for your question. Mr. Chairman, I yield back my remaining time.

The CHAIRMAN. Thank you very much. And now I recognize the gentlelady from Virginia, Ms. Spanberger.

Ms. SPANBERGER. Thank you very much, Mr. Chairman, and to our witnesses, thank you so much for your fantastic testimony today. I know many of my colleagues and I have been in a mix of in here and virtual, so I have really appreciated all of your answers, and your opening comments. I am excited to have the opportunity to discuss the positive impact of controlled environment agriculture on our domestic food supply, and across my district I have had the opportunity to visit several farms that implement controlled agriculture technology, including Bright Farms in Culpeper, Virginia. And in Goochland, Virginia we have a new indoor growing facility opening soon that will utilize innovative technology and sustainable practices, including recirculation systems that use 95 percent less water than traditional growing methods.

I am encouraged by some of the recent growth in the controlled environment agriculture across my district, and certainly across the country, and over the last year the COVID-19 pandemic really has laid bare some of the challenges and fragility that we see in our food supply chain. I am hopeful that controlled environment agriculture can help increase supply chain resiliency, and decrease dependence on foreign growers, improve food safety and trust, and mitigate some concerns, like weather disruptions and drought. I am appreciative of you all being here today, and I am going to run through a couple questions.

Mr. Safrance, I would like to begin with you. You mentioned that many of the controlled environment agriculture facilities present in the U.S. contain outdated technology. Could you describe, briefly, some of the examples of outdated technology, and the better technology that is available to be leveraged?

Mr. SAFRANCE. Yes, absolutely. Going back over the years, and we will call it the last 30 years, say, there has been a massive dif-

ference in technology in these greenhouses. Going back about 30 years ago and beyond, they were short, A-frame type greenhouses, single-pane glass, where crops were growing in dirt, and usually heated with steam. And as time moved on, we got into the 1980s, and a lot of people went to what is called a double poly, or two layers of plastic, where they blow air in between the plastic layers for more insulation.

And then, soon thereafter, they got into hot water heating systems, and then soon thereafter that we got into what is called a gutter system, where we raise the crops up off the ground, and we use the gutters to recycle all the extra water. The water will go back to our irrigation rooms, and go through a cloth filter, much like you would see a coffee filter in a percolator. And then after that it will go through a UV sterilization system. So basically we take the water back with the leftover nutrients in it, we make the water completely sterile, and then we add more nutrients to it, and send it back into the greenhouse.

So in the newer greenhouses, like you were just saying about 95 percent less water, that is exactly what we do. And the only water that actually leaves these greenhouses, or should leave, is in the weight of the fruit, or the respiration of the leaves through the air.

Ms. SPANBERGER. Fantastic. Now, that—I was furiously taking notes because that was a tremendous answer. I really appreciate that.

Mr. SAFRANCE. Thank you.

Ms. SPANBERGER. And so, Mr. Gadouas, and I apologize that I am directly positioned, oh, I can see you. I am sorry, sir. How successful do you see current investments in controlled environment agriculture? So are people seeing this as a good place to invest? Certainly the technology is evolving, as Mr. Safrance just walked us through.

Mr. GADOUAS. Certainly, from the information that we have, and a lot of the information is still private more than public. But from an equity perspective, there have been successes. There have also been some tweaks, because it is an evolving asset class, and I think I mentioned earlier today that we are indeed at an inflection point. So the more information we have, the more and more targeted and effective investments we are going to have. But, generally speaking, as far as emerging asset classes go, it has been tremendously successful, and it is at a point where more and more people want to participate. It is certainly a lot of press.

Ms. SPANBERGER. Yes.

Mr. GADOUAS. The question is, can we unlock the other half of the capital that is available in this country to participate?

Ms. SPANBERGER. Thank you very much. And, in my limited time, Mr. Verbakel, I was wondering, could you speak briefly to some of the barriers that exist for development here in the United States, for those looking to invest in the United States in controlled environment agriculture development?

Mr. VERBAKEL. Well, the most important one, but that is something we cannot change today, is the weather. When it is too cold—when there is frost in the ground in the northern part of the U.S., we are limited to continue our construction work. But, over the past 2 or 3 years we have been forced with—or we have been con-

fronted with some limitations to import our agricultural components. We consider a greenhouse an unassembled system which is not physically possible to ship. If you compare it to the surface that Mr. Safrance compared it to, a 60 acre greenhouse cannot be shipped on one boat, and in one batch.

And we have been confronted with your port authorities, that they consider the greenhouse in loose components just steel or glass, and then we are confronted with quite high import duties. So one solution there could be to find collaboration with local sources, but they are somewhat limited. The greenhouses require quite a large light transmission. I see that we are running out of time, so I will give the word back to you. Apologies for the time.

Ms. SPANBERGER. Thank you, sir. I yield back, Mr. Chairman.

The CHAIRMAN. Thank you very much. And now I would recognize the gentleman from Indiana, Mr. Baird, for 5 minutes.

Mr. BAIRD. Thank you, Mr. Chairman, and Ranking Member. We appreciate the opportunity to participate in this hearing today. Really appreciate the witnesses being here, and your expertise. So my first question goes to Mr. Safrance. Your comments have been extremely interesting to me, and so one thing I would like to reflect on is your comments about storm and irrigation water, and using that in CEA farming. As we all know, regulatory conversations, especially surrounding water, have been on the rise. So could you elaborate on how different environmental regulations impact your business and the CEA?

Mr. SAFRANCE. Yes, absolutely. If you compare what we do to, say, field farming, it is completely different. In most cases field farms can spray as many pesticides as they want on the crop. As it rains, it goes into the soil, gets into the water stream. In our world, we are not allowed to do anything like that. We collect rainwater off the roof for irrigation. We store it in lined basis so it can't soak into the ground, and we use the rainwater for irrigation. All of the nutrients and everything, like I said, are recycled, so we are really 100 percent zero anything leaves the greenhouse that shouldn't be leaving the greenhouse.

But when you compare that to a field scenario, my office back home, there is an apple orchard next to it, and about every week there is a tractor go by spraying white chemicals on the fruit, and, I mean, that all ends up in the watershed and whatnot. So much more strict for us, much more sustainable, much bigger investment, but we feel it is worth it.

Mr. BAIRD. Thank you. If I may ask one more question, given the challenges that we saw during the pandemic, and the shortages at the retail level for certain products, can you talk about your distribution system just a little bit, and how you were able to service major retailers during that period, as well as how you are able to deliver to major stores fresh quality products just in a matter of hours?

Mr. SAFRANCE. Yes. So, for us, it is very just in time, high sense of urgency. We have distribution centers, especially east of the Mississippi, that are pretty much close—within 400 miles of each other, or of either end, so everything is pretty much within a 1 day drive or less. Today a truck can drive roughly 10 hours under its current log system. So our products come in the building this

evening, so to speak. We would get orders today and tomorrow morning for tomorrow's orders. We would fill the orders, and ship the trucks, and have them delivered the next day.

The biggest problems we had during the pandemic was having enough people to show up for work. There were some people that were concerned. Obviously, we are essential. We did all the proper things, including creating a shield program for COVID issues, but there were still a lot of concerned citizens, and a lot of people didn't show up, so that was a big challenge. But at the end of the day we still delivered all of our orders, and provided—the products are in the building when we need them. We had no problem delivering them.

Mr. BAIRD. Thank you. Mr. Kelley, first off, I want to thank you for your service. An Army Airborne Ranger, I assume you spent some time at Fort Benning, Georgia, as I did, so thank you for that.

Mr. KELLEY. Congressman Baird, thank you, because you are a very highly decorated veteran from the Vietnam War, so you paved the path for us brother and sisters in arms that came after you.

Mr. BAIRD. I never figured out why you would jump out of a good flying airplane, but anyway. I commend you for your service, and thank you.

Mr. KELLEY. Amen.

Mr. BAIRD. But anyway, you mentioned something about working with Walmart in a farm to store pilot program with USDA. I am not sure how much you can elaborate on that, but any thoughts you could give on that pilot program?

Mr. KELLEY. Thank you for the question, and—Congressman Baird. I would say when we think about what was done with Walmart, you talked about the supply chain, and I will stick with the same thought, as—the data, and what is in the supply chain. Very quickly, what we did with Walmart, and also was—work with the USDA was the thought that it takes so long to, when there is a food-borne illness recognized, to actually remedy it. Using technology such as blockchain, what used to take Walmart, and their use of this technology a full week to find a problem, that means a whole week of throwing away food, they were able to do it in 2.2 seconds. Find the source, remedy it, and move forward: 1 week to 2.2 seconds.

Mr. BAIRD. Perfect. Thank you.

The CHAIRMAN. Thank you very much. And we all, on this Committee, certainly congratulate you, and appreciate your great service, jumping out of that airplane. Takes a lot of nerve in and of itself. Congratulations. Thanks for having you. And now the Chair will recognize the gentlelady from Connecticut, Mrs. Hayes, 5 minutes.

Mrs. HAYES. Thank you, Mr. Chairman. My district in Connecticut is leading the way in innovative urban agriculture that makes our food supply chain more resilient, brings new and beginning farmers into the agriculture industry, and provides fresh local foods in areas that have historically lacked access to them. Among the other benefits discussed here today, controlled environment agriculture seems to provide an opportunity to address lack of access

to healthy food, local products, and for underserved communities, communities that have been deemed food deserts or food swamps.

The U.S. Department of Agriculture estimates that 54.4 million Americans live in these low-income areas, and have poor access to healthy foods. For city residents, that means that a person can live more than $\frac{1}{2}$ mile from the nearest supermarket, and when you add in the fact that many of these people are walking with groceries, or riding public transportation, that distance becomes even farther. So my question today is for Mr. Verbakel. Can you address how strengthening local food systems through controlled environment agriculture can improve access to healthy foods? And does the lower cost of produce from controlled environment operations translate into lower costs and healthy foods for consumers?

Mr. VERBAKEL. Thank you for your questions. I can say yes to both of your questions. I think they are—the last question is clearly something that is from a 365 day perspective, and the fixed cost that an operation carries can benefit into a lower price per pound, or per square foot, which makes the operation more competitive, opposed to similar operations, either from the outside, or from a much longer distance. At the same time, providing in labor a place is something that some areas appreciate. A greenhouse is a very nice area to work, especially in the winter times. In Connecticut, it can be very cold, so—from—working in an enclosed environment with good conditions, as Mr. Safrance stated, is something that is also much appreciated by the workers. I want to be careful with the time, so I will give the word back to you.

Mrs. HAYES. No, you are absolutely right. My district in Connecticut has more greenhouses—actually, it is the largest industry in my district, greenhouse growers, so thank you for that. As I discussed here before, UConn—my district is home to UConn Extension, which teaches students each year how to successfully become urban farmers, with controlled environment agriculture and other methods. Some projects conducted by the program were the funding of the USDA NIFA Beginning Farmers and Ranchers Programs. We have waiting lists for all of these programs in my state.

In your testimony, Mr. Safrance, you discussed labor shortages across the food and agriculture sectors over the past year. Aside from the updates to the H-2A Program that you discussed, are there other ways to incentivize domestic workers to seek opportunities in these types of facilities? And how do you encourage specialized education experience in controlled agriculture environments?

Mr. SAFRANCE. Yes. So definitely there is more we can do. I think something you touched on that is very important is what I would call the skilled labor side of the industry. When it comes to labor management, crop management, crop care, supervisors, growers, assistant growers, integrated pest management specialists, there are a lot of really good jobs in each greenhouse, and the industry is extremely short on skilled people in those parts of the greenhouse. So to put together an industry-wide, or a university, or college-type program for this would be an excellent idea to start to cultivate the next people in these jobs. They are all really well-paying jobs, and it is great industry to be in. It is basically recession-proof, so I would highly encourage as many programs as we could

to train the next greenhouse operators for sure. And when I say greenhouse, I mean CEA.

Mrs. HAYES. Yes, absolutely. I appreciate that. My other committee is the Committee on Education and Labor, and as we discuss higher education, I try to always remind my colleagues that that has to include career and technical training, vo-ag programs, any means for people to access economic opportunities, and that is not always a 4 year college degree. So I am really pushing to expand programs like the UConn Extension, and vo-ag training programs in my own district, so thank you. Mr. Chairman, I yield back, under time.

The CHAIRMAN. Yes, thank you very much. Thank you very much, Mrs. Hayes. And now I recognize the gentleman from North Carolina, Mr. Rouzer, for 5 minutes.

Mr. ROUZER. Thank you, Mr. Chairman. I appreciate that very much, and I appreciate you holding this hearing today. Very interesting subject matter. When it comes to greenhouses, I worked on our family farm during the summers, and the prospect of a 64 acre greenhouse just kind of blows my mind. I am used to the smaller version, where you were growing tobacco plants that were transplanted to the field. Same with sweet potato plants as well.

I have to ask, what kind of investment is that, a 64 acre greenhouse, and was that all at once, or was that over a long period of time, or if you could talk about that a little bit? I am just curious what kind of investment that is.

Mr. SAFRANCE. Yes, sure. That specific one was at one time it was the largest greenhouse ever built in one consecutive build in the United States, so it is at the high end of the spectrum. The investment for a facility like this, depending on the technology, for a vine crop—and when I say vine I mean tomatoes, peppers, cucumbers, things like that—are probably \$1.5 to \$2 million per acre. If you get into a fully automated leafy green facility, it could be upwards of \$5 million an acre. They are very expensive.

Mr. ROUZER. Wow. It strikes me that it would be a very natural environment to produce organically. Is that correct or incorrect, or how much more effort does it take to produce organically?

Mr. SAFRANCE. Yes. Essentially the differences for CEA organics *versus* conventional are basically down to the grow media you grow in and the fertilizer you use. We technically try to never—almost never spray any kind of pesticides or anything like that anyway, and we all use IPM pest management, so it just really comes down to growing in different media and organic fertilizer.

Mr. ROUZER. How much more does it cost, if anything, to produce organically?

Mr. SAFRANCE. It costs considerably more. The media is more expensive, it is much more labor to apply the fertilizers. The fertilizers are much more expensive. But when it comes to cost per pound, it is much higher because you get considerably less yield, so it drives the cost per pound up considerably.

Mr. ROUZER. Got you.

Mr. SAFRANCE. And I would say that the average is almost—probably 30 or 35 percent more.

Mr. ROUZER. How much of yours is organic that is produced?

Mr. SAFRANCE. In the United States we don't do any.

Mr. ROUZER. None? Okay.

Mr. SAFRANCE. Not currently, no.

Mr. ROUZER. I assume the answer to this is no, but is there anything that cannot be produced in a greenhouse, it is just a matter of the economies-of-scale, *et cetera*?

Mr. SAFRANCE. Well, I mean, technically we could probably grow orange trees in a greenhouse. I don't know if anyone has tried. But, I mean, they would grow fine, I just don't know that you would ever get your return on your investment doing something like that.

Mr. ROUZER. Right.

Mr. SAFRANCE. The majors are leafy greens, tomatoes, peppers, cucumbers, and then—now we are getting into berries indoors. We are doing a bunch of strawberries.

Mr. ROUZER. Got you. It is a very intriguing subject there, yes, because weather is one of the key variables in every growing season for every farmer out there. One day they could have a great crop, the weather has been super, and then a hurricane comes through, for example—in my district it happens all the time—and ruins everything. And, of course—then on the produce side, one state does well, the other state doesn't do well from a weather perspective, and you know how that dictates the price, *et cetera*, so it is a very interesting subject area.

Mr. Kelley, you mentioned in your testimony, with regard to the Food and Drug Administration, their efforts to implement tangible strategies to modernize the food industry. I am just curious to get more detail on that.

Mr. KELLEY. When we think about how we measure the success of the food industry, it is really are we getting food that is high quality where it should be when it should be there, right? And so when we think about those metrics and those measures, it is based on accuracy. And if we bring it down to what we know about accuracy, it is trust. Trust as consumers, all of us. It is easy to ask all of us, raise your hand if you eat food, back to the Chairman's point at the beginning of our session here. And the work that was done with the USDA, along with some retailers, such as Walmart, was based on looking at those measures, and them saying, look, how can we make sure that those measures of food safety, food quality, and the supply chain that surrounds all of that, how do we pull down some of those barriers that currently allow that data to sit in silos, and how do we do it with trust? And that is what we did with them. As IBM used to say, look, let us implement some technologies, augment it. Intelligence, some people call it artificial intelligence, but how do we do that with blockchain and make it safe?

Mr. ROUZER. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much. Thank you very much. Now I recognize for 5 minutes the gentleman from California, Mr. Panetta.

Mr. PANETTA. Great. Thank you, Mr. Chairman, I appreciate that, and obviously thanks to all of the witnesses that are here talking about a very important issue. As many of my colleagues know, and maybe some of you know who are testifying today, I represent the Central Coast of California. And as many of my colleagues know, and maybe some of you know, it is known as the Salad Bowl of the World. It is known that not just because I say

that, it is known with that appellation because we grow over 100 different specialty crops there in the Salinas Valley, San Juan Valley, and the Pajaro Valley on the Central Coast.

Now, many, if not all, of these crops are grown outside. We have the acres of land, we have the nutritious soil, but we also have the people, with the highest principles, that prioritize, and are very progressive when it comes to the food safety of the products. For example, most of the leafy green producers in my district belong to the Leafy Green Marketing Agreement, which actually holds its members to a more rigorous food safety standard than the FDA. Now, the LGMA is representing 90 percent of the leafy greens grown in the United States, and when it comes to those LGMA products, there is 100 percent traceback to the farm and date of harvest.

Even with that level of certainty, however, the growers that I represent continue to ensure an even stronger, safer, and more transparent food system. And that includes their close work, and yes even scrutiny, by the FDA. It also includes their work over the years now with their Congress Members and their Senators to secure strong language in our appropriations bills on food traceability and traceback, and partnerships under the Food Safety Modernization Act.

Now, most recently we were able to secure language in the Fiscal Year 2022 House Approps bill that provides an increase of \$9.5 million to facilitate traceability and enhance outbreak response. It is language like that in that bill which encourages the FDA to work in closer partnership with existing government food safety programs in the specialty crop industry, and also allows them to share and coordinate information and data with industry partners, and state and local governments, so that they can better coordinate before, during, and sometimes, yes, as we know unfortunately, after an outbreak occurs.

Now, my language that I got in that bill also directs the FDA to capture point of sale details, such as the lot number and product identifier throughout the supply chain. It also ensures that those details are maintained from the point of origination through the retail food or food service establishment. Now, I believe that we can continue to advance our food safety technology. We are going to get better. But, to do that, we must work closely with the specialty crop growers so that we can continue to build on the industry's decades of work and leading role in addressing food safety issues.

Now, Mr. Kelley, you and IBM have talked—you, in representing IBM, have done an amazing job, and you have talked a lot about it today, but I also want to basically talk about your work not just with the small leafy green farms in California, because you understand firsthand that these types of operations that are committed, absolutely committed, to delivering fresh, safe, nutritious food to consumers. And you know that these types of producers, they are willing to do what is necessary so that their products are identifiable and traceable, should any issues arise. You also know, though that we have some work to do when it comes to speeding up our traceability and traceback effort. So I know you have hit on it a little bit, but talk to me, as we look to the future, the need, and the need to further develop our capacity to trace our food products

more efficiently. What can blockchain technology do to continue to support these ongoing efforts? If you could, Mr. Kelley?

Mr. KELLEY. Thank you, Congressman. When we think about what you have laid out there, which I thought you did very well, with regards to talking about the source all the way to consumption, and you included point of sale, so there is a retailer in there, what has to happen is when we look at going forward, we know that safe food is a team sport, and in order for it to be a team sport there has to be this sharing, trusted sharing, of information. And that trusted sharing has to be something that pulls down the barriers that we currently have with regards to the accuracy of the data, the speed at which we can share that data.

As I called out, Walmart set a very high bar when they went from 1 week to just a couple seconds.

Mr. PANETTA. Great. Thank you. My time is up. Thanks to all of you. Thanks to all the witnesses. Thank you, Mr. Chairman. I yield back.

The CHAIRMAN. Very good. Thank you very much. And now I will recognize the gentleman from California, Mr. LaMalfa.

Mr. LAMALFA. Thank you, Mr. Chairman, I appreciate it. I will just dive right in here for Mr. Safrance on the labor issue. Several of us on this Committee have been working really hard on that, I see my friend Mr. Panetta nodding. We have put together pretty good legislation, I wonder if you have heard of it, the Farm Workforce Modernization Act.

Mr. SAFRANCE. What is that, sorry, I didn't hear the end of that.

Mr. LAMALFA. The bill we passed out of the House twice, actually, the Farm Workforce Modernization Act.

Mr. SAFRANCE. Yes. I am sorry, I didn't get the question, though.

Mr. LAMALFA. Have you heard of that yet, that we passed out of the House?

Mr. SAFRANCE. Yes, I have heard that. Yes, absolutely.

Mr. LAMALFA. Good, right on. All right. Because obviously ag labor has been an issue for quite some time, having a known size and legal workforce has become a very important issue. There is a lot of other outside politics. It is actually a tremendous effort, a tremendous bipartisan effort, to get that bill through the House, and it is waiting over in the Senate for action. But talk to us a little bit about, we've got everybody from the American Farm Bureau Federation to people in the labor industry side all trying to find a way on this thing. Tell us about what your struggles are with the greenhouses for staffing, and keeping a workforce together, and do you think what you have seen of our bill, or just in general, that see some kind of hope for a farm workforce that will be—

Mr. SAFRANCE. Yes. The biggest issue we have is getting enough local labor. It has always been a challenge for us, and I have talked to many other people in the farming space in the United States, including field farms, and everybody kind of seems to have the same sentiment. The biggest problem we have, and I think CEA will have, is when the—I guess the legislation was made in the 1980s for H-2A labor, they didn't contemplate greenhouses, and they have this provision that it needs to be seasonal, and greenhouses and CEA are actually seasonal, to a certain aspect. But, when we get finished with our crop, we have to literally take the

entire crop out of the greenhouse, take all the media that it grows in out, sterilize the greenhouse, re-plant it.

I mean, the equivalent would be an apple farmer shows a season by saying, hey, we need to put in some trees, we need to pick the apples, and then we are done for the season. While ours, if we were the apple company, would say, now we have to take all the trees out, we need to remove all the soil, bring all new soil back in, plant all new trees. So it is a seasonal issue, but it just looks differently than what normal people are thinking about in terms of field agriculture. So I think that we need to have a look at that for CEA, that it kind of, in some way, shape, or form, understands how our seasons work, compared to, and that they are not the same as a field-type scenario.

Mr. LAMALFA. So, yes, you have a lot more infrastructure, obviously, with the greenhouses. Our bill tried to pay close attention to seasonality, as well as the needs of some of our year-round ag issues, such as dairy, like that. So if you have more suggestions on how that could look moving along, I would certainly want that to be part of the discussion. What else do you think Congress can be doing? You brought that issue up. What other frustrations or issues do you think Congress should be addressing on that to make this go farther?

Mr. SAFRANCE. Well, I mean, I don't know that it pertains to the bill, but I think it is frustrating that we apply for H-2A, and occasionally sometimes we get it, sometimes we don't, but there is never a proper reason why, and it is very inconsistent. So I think we need to address the consistency of it so that people that want to invest in these expensive facilities can be assured that they are going to have the labor to operate them properly. Otherwise, nobody will ever continue to build these, because they won't be able to make money.

Mr. LAMALFA. That makes sense. So we were fighting for more flexibility on that program as well. So let me shift gears a little bit to Mr. Kelley over there at IBM. Can you follow up a little bit more on the food traceability? I mean, that is very amazing technology, to be able to track as closely as you can. Can you emphasize a little bit more on if there is a question about food quality or food safety on a recall-type situation, or what, I guess, recalls become pretty wide when they have an issue with some kind of a meat product or a vegetable product. Do you see this as helping to narrow the amount of product that would have to be removed from the shelves? Because they talk, like, in pretty broad amounts of product in tonnage, or packaging, or what have you. But what do you see the potential is for this traceability, maybe of narrowing the amount of food they have to take off the shelf, and it goes to waste?

Mr. KELLEY. So I think I may have to yield my answer based on the time.

Mr. LAMALFA. Okay. Sure.

Mr. KELLEY. With regards to food going to waste on the shelf, Congressman, what I think you are calling out is the ability to have increased data about the time that those SKUs, and—when we talk about numbers of SKUs, some of that—now, when we first started, it was some 6,000 SKUs. Now we are able to manage some

75,000 SKUs in a blockchain network that says look, let us look at all of that.

And if you can understand that very complex network of not just one ingredient—I mean, as we sit here, it is not just one tomato, but it is a tomato, and a sausage, and a grain product in a pizza, so now you are talking about when does that go bad? And if we could manage those timings of when something is really just ready to go bad before it does, and being able to then also move it from a shelf, perhaps to the food desert that was mentioned early by the Congresswoman, that is what we are talking about with timely data that is available and shared, and timely action that can be taken with that data. So when we start thinking about what we can do, that is what we are talking about, Congressman.

Mr. LAMALFA. Thanks so much.

The CHAIRMAN. And thank you very much. And thank you, Mr. LaMalfa, and our entire Committee. But before we adjourn today, I want to invite our distinguished Ranking Member to share his closing remarks. Ranking Member Thompson.

Mr. THOMPSON. Mr. Chairman, thank you so much, and thank you to all of our witnesses for really contributing to a great discussion in this hearing. American agriculture is, once again and it always has been, science, technology, and innovation. And as I said before, early on those first farmers were just trying to survive a winter. It was probably pretty crude and rudimentary. Today it is very sophisticated. One of the statistics I shared in my opening statement just rings true, the fact that our productivity of American agriculture has increased 287 percent since the 1940s, and today's hearing showcased a great example of this. So I really want to thank our witnesses.

I want to build off what our mutual friend from California, Mr. Costa, talked about, the importance of innovation investments.

The CHAIRMAN. Yes.

Mr. THOMPSON. And I couldn't agree with him more. That is what we do with the farm bill. That is what we do in this Committee. We continue that tradition of American agriculture, increasing the productivity, and continuing to develop, in terms of the science, and technology, and innovation. And that is good for everything. Not just nutrition, not just the rural economy, it is the environment. You know, that is the positive outcomes we get. So in that spirit, I would just like to close my remarks that, I just want to recognize, in terms of investments and innovation, this Committee's unified work to invest \$43.2 billion in rural broadband, which is needed for our continued innovation?

And I would like to certainly encourage all of the Members of our Committee to join the Chairman and I in calling on leadership to put what we passed unanimously, which was a great reflection of innovation and technology, on the House floor, the Broadband Internet Connections for Rural America Act (H.R. 4374). Rural America needs this, and I always say that without a robust rural economy, all people, including those in the cities, are going to wake up in the cold, dark and hungry. And so I will just—I guess I won't say anything more. I will just yield back. Thank you, Chairman.

The CHAIRMAN. Well thank you so much, and you are absolutely right. And I know the attending physician told me to keep my

mask on. Tell him I did for the entire meeting. But because you brought up our bill, folks, if we do not get rural broadband, connection to the internet, much of what you are talking about, controlled environment, how can we accomplish any of this indoor farming if our farmers, if our agriculture producers, are not connected to the internet?

And, Ranking Member, you are absolutely right. If there are those of you under the sound of my voice, please call your Members of Congress, call the leadership, call the White House, call everybody. This Committee has passed a very good bill to finally bring rural broadband to our rural areas. We passed it bipartisan. Every single Republican and Democrat came together. It is the only bill, as we are moving for the infrastructure, that the Congress has to address this.

So in order for us to make this hearing meaningful, in order for us to be able to have controlled environment agriculture, which you all stand for, using cutting edge technology, we can't do it unless our rural communities—that is where farming is. That is what our pioneers, the shoulders we stand on in 1936—when our rural communities did not have electricity, they called on us. It was agriculture. It was our Agriculture Committee back then joining forces with our United States Department of Agriculture that brought electricity to rural America.

This is the foundation we are building on. But yet our bill sits in the House and does not have a vote. And we are asking, we are pleading, with the bipartisanship of this Congress to please pass our bill. Because this is the only way we are going to be able to make real the advocacy, the programs, the promises, to fulfill our true destiny, to make food available and secure for the American people for generations and centuries to come. We have to move it indoors. Climate—and not only that, there is just so much land. Everything is there on the table, but we have to get rural broadband into our rural communities. Thank you for your partnership on that and thank you for giving me the opportunity to back you up. And if you see the attending physician, please tell him that I did put my mask back on at the end, but I had to say it. Thank you.

And so I want to thank Mr. Giscombe, PLANT-AG, thank you. Mr. Gadouas, Mr. Verbakel, Mr. Kelley, and Mr. Safrance, thank you all for this brilliant, and intensive, and very good testimony. And we are going to build on this foundation. This is why we have the hearings. And we will pull this in, and there—then we are coming back so we can give you the legislative help that you need to complete your task of bringing controlled environment agriculture into real time and real life for our great nation. With that, our hearing is adjourned. Thank you.

[Whereupon, at 12:10 p.m., the Committee was adjourned.]

[Material submitted for inclusion in the record follows:]

JOINT SUBMITTED STATEMENT BY HON. DAVID SCOTT, A REPRESENTATIVE IN CONGRESS FROM GEORGIA; HON. JIM COSTA, A REPRESENTATIVE IN CONGRESS FROM CALIFORNIA; ON BEHALF OF MATT BARNARD, CO-FOUNDER AND EXECUTIVE CHAIRMAN, PLENTY, UNLIMITED

Chairman Scott, Ranking Member Thompson, and Members of the Committee:

Thank you for the opportunity to participate in such an important discussion. My name is Matt Barnard. My cofounder Nate Storey and I started a company called Plenty in 2014 with one simple mission: to improve the lives of Plants, People, and our Planet. We are united behind this mission to nourish plants, people and planet to vitality with a low water, carbon and land footprint and to convert agriculture from an extractive industry to a generative one that underpins societal prosperity.

Today, our technology-rich vertical farm in South San Francisco produces a range of pesticide-free leafy greens for customers across the Bay Area, and we are currently building a facility in Compton, Los Angeles that will be capable of servicing grocers across California. Our plan is for the wave of farms that follow Compton to produce not just leafy greens, but also strawberries and tomatoes—bringing to market the groundbreaking work in which we have invested at our Plenty Plant Science, Flavor and Sustainable Farming Center in Laramie Wyoming over the last 7 years.

Americans are paying attention—not only to where their food is grown—but to how it is grown. The rapid expansion of organic produce in the U.S. is a clear expression of the importance we now place on food that minimizes the chemicals laid on the land and ingested into our bodies. Indeed, as Americans show more interest in their food sources, they are demanding lower pesticide use, a sustainable and perpetual food chain, and nutrient-rich rather than calorie-rich foods. These are encouraging trends, and they speak to the demand for a comprehensive look at how we grow our food in America.

America has run out of Farmland and Water is Close Behind

America last acquired farmland in 1848—following the Mexican American War. Since that time, the United States has been losing irreplaceable farmland at a rate of ½ million acres per year while the U.S. population continues to grow. We ran out of fruit and vegetable farmland decades ago and our import dependence has been growing ever since—from under 10% to about 40% and growing. We are now import-dependent.

Additional “farmland” is needed now in order to simply maintain America’s food chain, and even more so to grow it in line with our population. Far from threatening existing and incumbent farms, the United States needs controlled environment production to supplement supply of fruits, vegetables, and other specialty crops that have become the purview of importers—outside of the concentrated production in select regions like my native California (the most prolific fruit and vegetable growing region in the world).

In order to sustain America’s and the world’s continued growth—we must have more production capability. This leaves us with two basic choices—raze and industrialize a plot of land nearly the size of the Amazon Forest and prepare it for planting, or to change how we grow the food we eat. Industrializing that much land would increase humanity’s total carbon footprint by 10–15%—clearly not a viable option in a world that is in the midst of a rapid warming cycle that is disrupting our food chain and exposing its stressed fragility.

Vertical farming’s revolutionary ability to grow plants in three dimensions and in a fraction of the time allows us to now grow a massive farm’s worth of food in a structure the size of a Walmart. Vertical farming maximizes space utilization—allowing for scale-level production in facilities that can be placed nearly anywhere there is water, people, and power.

To that end, vertical farming consumes a minor fraction of the water that is utilized by traditional agriculture. Our current agricultural water consumption has reached an unsustainable point—with farms sitting an entire telephone pole lower because the aquifers beneath them have been sucked dry.

Plenty’s farms are designed to run at industrial farm-scale production levels while 90% less water than a traditional farm.

Addressing the Climate

For the vast majority of human history—agricultural production has been at the mercy of the elements. The recent increase in severe weather events across the country has highlighted the fragility of our agriculture production, and the reliance that remains on elements beyond our control. The global systems upon which our food chain relies, water, climate, and interdependent ecosystems—are strained to

the breaking point and in urgent need of repair. Meanwhile, the global population continues to rise. This rapid growth (a doubling of the human population during our lifetime) has delivered us from abundance to a stressed fragility that necessitates the slashing of the water, land, and carbon usage of our food production.

As scientists expect the severity and frequency of these dangerous storms, flooding, and other catastrophes to continue increasing, America must look to ways to protect its food chain from these adverse events.

Thanks to the controlled nature of our facilities, we can now control all of the factors that account for plant development: light, climate, water, and nutrient loads are all carefully balanced to ensure that the produce is receiving exactly what it needs, and nothing that it does not. This careful balance performs many important functions.

First, by providing the plant with everything it needs to grow, we do not need to expose it to the elements at all—thoroughly protecting the food from pathogens, pests, and even floods and hurricanes.

Second, it allows us to grow food faster and with higher nutrition density than with any other method. In fact, at my farm in South San Francisco, we can produce up to 40 seasons of produce in a single year—meaning nutritious food that was growing just hours or days before is accessible, 365 days a year. In fact, Plenty's plant scientists are now able to affect the flavor characteristics of our plants by controlling their nutrient, water, and light intake. Vertically farmed food really does taste better!

Vertical Farming Shortens, Simplifies and Hardens the Food Chain

In addition to protecting our food from the local climate and other stressors, Plenty's vertical farming operations are allowing for food production where there has never been farmland to begin with. As I mentioned before, Plenty's vertical farms are capable of growing food wherever there is water, power, and people. This flexibility allows us to bring our farms to the market and produce hyper-locally like our new facility in Compton, CA.

Currently, the average fruit and vegetable can spend around 2,000 miles traveling to its final market. This travel time means a larger carbon footprint for the food, and a shorter shelf life for the consumer. Plenty's farms address both of these issues by producing the food within the communities that purchase it. This localized production has the added economic benefit of opening up what are essentially high-tech manufacturing jobs in communities where economic opportunity can be as scarce as access to healthy foods.

Food Safety

I've mentioned that controlling the environment allows vertical farms like Plenty to control for flavor, environmental stressors, and water consumption, but the most important aspect of vertical farming's controlled infrastructure is the safety benefits provided by our Food Safe Certified production facilities. By certifying our entire production facility as food safe—we are able to forego pesticide and fertilizer production. This, in turn, allows us to forego chemically treating the produce and means that our plants are up to one million times cleaner than chemically treated food from the field.

Congress Has a Role

I reach out to you today because, while the vertical farming industry shows incredible promise, it remains a very new and fragile industry. Our farms require significant capital expenditures to build, and traditional agriculture capital financing is simply not available to innovative producers like Plenty. Instead, we are forced to seek out venture capital funding at a detrimental rate that involves forfeiting ownership of our companies. I ask you to consider opportunities for backstopping funding opportunities so that our industry can continue to scale and grow to fit the demands of American consumers. Thank you for your attention to this important matter, and I look forward to working with you to advance these important objectives.

SUBMITTED LETTER BY DAVID ROSENBERG, CO-FOUNDER AND CHIEF EXECUTIVE
OFFICER, AEROFARMS

August 9, 2021

Hon. DAVID SCOTT,
Chairman,

Hon. GLENN THOMPSON,
Ranking Minority Member,

House Committee on Agriculture,
Washington, D.C.;

House Committee on Agriculture,
Washington, D.C.

Dear Chairman Scott and Ranking Member Thompson:

Since 2004, AeroFarms has been the pioneer and leader for indoor vertical farming, and we were very excited to see you convene the hearing on “21st Century Food Systems: Controlled Environment Agriculture’s Role in Protecting Domestic Food Supply Chains and Infrastructure.”

COVID has put a spotlight on how fragile our food system is, and we fundamentally need a more resilient approach. Vertical farming is highly relevant to address climate change challenges, enable local production, and create new year-round jobs with fair wages and benefits.

Indoor vertical farming companies like AeroFarms are able to bring the farms to the cities right where the consumers are, by-passing what is typically a very long and complex supply chain. Through our cutting-edge growing platform, AeroFarms is able to grow with up to 390 times greater productivity per square foot annually vs. field farmers while using up to 99% less land, up to 95% less water, and zero pesticides, fungicides, herbicides, or insecticides. Another key benefit is that our totally controlled growing approach from seed to packaging is also setting a new standard for traceability and food safety to give our consumers better, safer choices than ever before.

AeroFarms has been leading the way not only for vertical farming, but agriculture overall. Our expert team of plant scientists and engineers are focused on helping the broader agricultural community with state-of-art innovation and breakthroughs including the latest in speed breeding. In fact, AeroFarms is the principal investigator for the Foundation of Food and Agriculture Research (FFAR) and their Precision Indoor Plants (PIP) Consortium, a group of multi-national companies focused on next-generation crops and solutions. In addition, AeroFarms has partnered closely with USDA on key grants to enhance product quality and shelf life.

AeroFarms is a great example of public-private partnerships working in concert to drive innovation and impact in the community.

We look forward to future additional hearings and more importantly, the opportunity to share directly with the House Committee the work that we are doing to help agriculture overall.

All are welcome to come visit our global headquarters in Newark, NJ as well and see first-hand our transformative work, and even better, taste our difference.

Please advise on any questions or comments.

Best,

David Rosenberg

DAVID ROSENBERG,
CoFounder & CEO,
AeroFarms.

SUBMITTED LETTER BY JONATHAN WEBB, FOUNDER AND CHIEF EXECUTIVE OFFICER,
APPHARVEST

July 27, 2021

Hon. DAVID SCOTT
Chairman,
House Agriculture Committee
Washington, D.C.

Dear Mr. Chairman:

I was excited to learn that on Thursday the House Agriculture Committee would be conducting a hearing on, “21st Century Food Systems: Controlled Environment Agriculture’s Role in Protecting Domestic Food Supply Chains and Infrastructure.” AppHarvest¹ is based in Appalachia and uses Controlled Environment Agriculture/CEA to grow a climate smart, sustainable, year-round, food supply. In the last year, AppHarvest has expanded from 25 employees to more than 500. We began operating in October in Morehead, Kentucky, where we produce tomatoes. Our facility in Morehead is 2.76² million —a full 60 acres under glass—and sold 3.8 million pounds of tomatoes in the first quarter of the 2021. We have four more sites under

¹<https://www.appharvest.com/>.

construction in Kentucky and they will soon be opening to create even more permanent jobs in transitioning coal communities.

The plentiful rain in the region enables AppHarvest to rely exclusively on recycled rainwater. Because of that and our proximity to East Coast markets—70% of the U.S. population is within a day's drive—we expect to play an essential role in protecting America's domestic food supply and infrastructure. I would welcome the opportunity to show you and your colleagues on the Committee how our state-of-the-art facilities operate and share the insights that we have gleaned over the last 2 years.

One issue that I hope you will raise during the hearing is the need for CEA crop insurance. We know that USDA and RMA embarked on a study in January of this year and will be working over the next few months to develop a policy that covers "diseases" that might impact the sector. Given how important CEA will be to America's future food supply, that initiative is important and timely.

I would be honored to confer with you or your staff at any time, whether prior to the hearing or after, and welcome all of you to plan a site visit to our facility in Morehead.

Sincerely,



JONATHAN WEBB,
Founder & CEO,
AppHarvest.

SUBMITTED STATEMENT BY BOWERY FARMING INC.

Bowery applauds Chairman Scott and Ranking Member Thompson for holding a hearing on the role Controlled-environment agriculture (CEA) plays in protecting our national fresh food supply.

Bowery Farming is the largest vertical farming company in the United States. Founded in 2015 by Irving Fain, our mission is to strengthen and fortify our national food system by building smart indoor farms close to the cities we serve. We grow local, pesticide-free produce 365 days a year. We transform non-arable land into warehouses that become incredibly productive farms and create green jobs in the communities where we operate. Our farms stack vertically, leveraging hydroponics and using LED lighting that mimics the spectrum of the sun. Our operations are run by our proprietary BoweryOS that integrates sensors, vision systems, robotics, automation and data that orchestrates the entire farm operation from seed to shelf and provides our plants with exactly what they need when they need it.

We grow in a completely controlled environment, and we hold our farms to the highest food safety standards. Each farm is SQF Certified. Our produce moves from harvest to store shelves within a few days, which means we are reducing our transportation footprint, extending shelf life (reducing waste at the store level) and maximizing the nutritional density of produce. We are 100X more productive on the same square foot of land as traditional agriculture and we are 90% more efficient with our water usage. Bowery is also committed to reducing our carbon footprint and is pulling our farm energy from low-impact renewable sources. The result is a vertically integrated fresh food supply chain that offers a fresher, safer, more transparent, resilient and sustainable approach to growing our produce.

Bowery currently has two commercial farms in Kearney, NJ and Nottingham, MD serving the Tri-State and Mid-Atlantic regions in over 850 stores with retail partnerships that range from Whole Foods Market to Albertsons to Giant to Amazon to Walmart. We are preparing to open our third farm in Bethlehem, PA in early 2022 with line of site to two more farm openings at the end of 2022 that will expand our footprint nationally. In addition to our commercial farms, we also have a major R&D facility in Kearney, NJ focused on plant sciences and breeding programs that will enable us to accelerate our work in product development to continue optimizing quality and yield within lettuces and herbs and to drive innovation in the indoor space beyond leafy greens including strawberries, fruiting crops and root vegetables.

Most recently, Bowery closed our Series C funding, raising \$300M in additional capital with Fidelity joining as our lead investor, bringing our total capital raised to \$475MM.

This capitalization in our business will enable us to accelerate building our farm footprint throughout the U.S. In addition to lead agricultural and tech investors like Temasek and GV (formerly Google Ventures), we are fortunate to have advisors who

are at the forefront of shaping food policies that champion a more equitable future including Chefs José Andrés and Tom Colicchio.

As discussed in the hearing, our food system sits at the heart of so many of our most pressing issues and opportunities, such as climate change, national self-sufficiency, safety, health, equity and labor. Although not the only solution, we believe CEA is a critical part of strengthening and fortifying our national food system. We look forward to supporting and helping shape the future of our U.S. fresh food supply chain.

SUBMITTED QUESTIONS

Questions Submitted by Hon. Kim Schrier, a Representative in Congress from Washington

Response from Aaron Z. Gadouas, Managing Director, B.C. Ziegler and Company

Question. Mr. Gadouas, in your testimony you discussed the barriers for smaller CEA producers to access capital. I've heard from CEA farmers in my state about the difficulty in accessing capital, especially to overcome high startup costs. From your perspective, how can this Committee, Congress, and USDA be better partners in ensuring CEA producers have access to the necessary resources to enter and succeed in this industry?

Answer. As I described in my testimony, capital markets resources can be made available to finance large CEA projects, as they are most efficient at large economies of scale. Obtaining financing for smaller CEA producers will continue to be a challenge. Commercial banks and specialized lenders in the agriculture space usually require substantial equity and personal recourse. The real issue in this country is there is a dearth of food system infrastructure for all participants across the broad supply chain.

As local, state and Federal Governments have risen to the challenge of providing assistance to broad constituencies during the pandemic, this is an opportune time to advance salient public initiatives for food safety and food security and infrastructure by recognizing CEA as an asset class.

Response from Kevin Safrance, Executive Vice Chairman, Mastronardi Produce Limited, Mastronardi Produce—USA, Inc.

Question 1. Mr. Safrance, in your testimony, you said the primary barrier to the success of the Controlled Environment Agriculture industry right now is a lack of access to labor. I have heard about this from farmers in my district, both CEA and non-CEA, repeatedly over the last few months. Can you discuss the unique barriers CEA farms face in attracting and maintaining workers?

Answer. Representative Schrier, as you indicated, field and CEA farms often struggle to attract and maintain the workforce necessary to feed America, and not for want of trying. Both aggressively seek to hire U.S. employees and then turn to programs such as the H-2A program only if necessary. Then, both often struggle to secure much-needed workers through the program. The challenges with the H-2A program are especially acute for CEA farms, however, because of the unique high-tech growing processes and attendant labor needs of CEA farming. When the immigration law was last amended in 1986, no one could envision the technological and business innovations that have evolved to become a central part of the 21st-century controlled environment agriculture industry. As I testified to the Committee, there are two primary challenges that impact our workforce needs.

First, and most notably, a CEA hydroponic farming system requires each farm to undergo a significant cleanout and sanitation process at the end of every harvest and for preparation of the subsequent season. That means that as a part of each growing cycle, CEA farms clean, disinfect, and sterilize the entire growing facility, including its gutters, irrigation, heating/rail systems, and ground cover so that all plant material is fully removed, and the hydroponic growing systems are ready to plant for the upcoming season. This unique and vital process can take up to 8 additional weeks depending on the crop, which means CEA farms need to retain H-2A workers for slightly longer than the end of a field farm's typical harvest season, but in no event longer than the conventional 10 month maximum period generally permitted by the U.S. Department of Labor. Second, hydroponic CEA farming often includes multiple segregated, separately enclosed ranges for growing fruits and/or vegetables. Those hydroponic ranges are often specially tailored for growing one or more general types of fruits and vegetables, and as such may require separate H-2A workers for each range.

Because of the unique requirements of modern, high-tech CEA farming, and the lack of action by Congress to update the rules governing immigrant farm labor, the

Department of Labor has been forced to interpret the 1986 law and establish rules governing the admission of H-2A workers that have resulted in inconsistent application of standards that have often made it very difficult for CEA farms to avail themselves of the H-2A program. This lack of access impedes our ability to meet the domestic need for fruits and vegetables because we lack the workforce needed to timely harvest our crops, and at times, resulting in tons of food being discarded. CEA farms have specific needs for foreign workers and those needs fully comply with the intent of the H-2A program, which is to guarantee that no worker who gains employment through it is here longer than 10 months nor displacing any U.S. job. Our experience over the years is that the lack of statutory clarity as to what constitutes “*seasonal and temporary*” workforce needs for CEA farms leads to Department of Labor decisions that are inconsistent in their application. In many ways the decision making, and the standard setting vary so greatly that we find it difficult to plan accordingly. Not only does this limit the productivity of our existing facilities, it dramatically limits the potential investment to expand CEA so that we can reduce our dependence on foreign produce and acts as an impediment to achieving domestic fresh produce food security.

We believe a handful of clarifying technical amendments to the Farm Workforce Modernization Act would eliminate this inconsistent access of CEA farms to the H-2A program and address administrative barriers and make sure the H-2A program accounts for the technological advancements and unique temporary and seasonal workforce needs of CEA farming. Those modifications would: (1) Make clear that work on hydroponic CEA farms is classified as agricultural labor; (2) clarify that agricultural workers employed on CEA farms are seasonal workers for purposes of the H-2A program due to unique seasonal requirements of CEA farming like facility cleanout, sterilization, and future site preparation; (3) clarify that staggered end dates are allowed for CEA farms provided the period of employment in the job opportunity is no more than 10 months; (4) require the U.S. Department of Labor to establish special procedures for H-2A work at hydroponic CEA farms notwithstanding the traditional temporality and seasonality requirement; and (5) clarify that petitions involving segregated and distinct ranges submitted within a period of twelve consecutive months can be approved where the covered job opportunities are no more than 10 months in duration and the $\frac{3}{4}$ guarantee is met for each worker. We are readily available and welcome the opportunity to discuss and provide more detail on these proposed clarifications if you would like. Without these changes, we believe the business uncertainty caused by lack of access to the H-2A program will dramatically hinder investment in CEA in the United States and diminish the opportunity to onshore the production of fresh fruits and vegetables that have increasingly become dependent on imported crops over the last 3 decades.

Question 2. Mr. Safrance, I have also heard from farmers and stakeholders about the need for workforce development for the indoor agriculture industry. Can you comment on the differences in the training and technical expertise necessary for workers in CEA as compared to traditional agriculture?

Answer. There are unique workforce training needs for CEA farms due primarily to the advanced technological growing systems used on the farms. For example, as discussed above, CEA farming requires extensive facility cleanout and future site preparation, including disinfecting and sterilizing the facility, its gutters, its irrigation, heating/cool systems, and its ground cover—procedures and physical features unique to CEA farming. It also requires understanding and using inert medium Grow Cubes instead of traditional soil, carefully monitoring and controlling the use of natural and artificial light, capturing and recycling water, deploying an integrated pest management systems such as ladybugs instead of the ordinary significant use of pesticides, using ergonomic “white glove” harvesting methods, and generally using sophisticated computers and systems to assist the growing teams with management of critical aspects of CEA farming, which technology continues to be advanced inclusive of robotics and artificial intelligence. These features of CEA farming are different from field farming and require specific training. In our experience, however, training has not been the primary barrier to obtaining the necessary and qualified workforce to manage the harvest. Our primary challenge is an inadequate supply of labor, which was prevalent prior to the current pandemic and will remain unless steps are taken to update the H-2A rules to account for CEA farming, which we believe could be addressed through the previously mentioned technical clarifications to the Farm Workforce Modernization Act.