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STATE of CALIFORNIA

CALIFORNIA ENERGY COMMISSION

In the matter of:	)	
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Policy Report (2021 IEPR)	)	Re: Industrial
	)	Decarbonization
_____	)	

IEPR COMMISSIONER WORKSHOP

TO ACCELERATE INDUSTRIAL DECARBONIZATION

REMOTE ACCESS ONLY

Tuesday, August 3, 2021

Session 1 Of 2 - Programs and Policies

Reported by:
P. Petty, CER

APPEARANCES

Workshop Leadership:

J. Andrew McAllister, CEC Commissioner
Patricia Monahan, CEC Commissioner

CEC Staff:

Heather Raitt, Program Manager of the Integrated Energy Policy Report, Meeting Moderator
Dorothy Murimi, Public Advisor's Office

Panel 1:

Kevin Uy, CEC, Food Production Investment Program, Moderator
Mark Sippola, California Air Resources Board
Elizabeth Dutrow, United States Environmental Protection Agency
Melissa Jones, CEC, Energy Assessments Division
Heriberto Rosales, CEC, Existing Buildings Office, Efficiency Division
Virginia Lew, CEC, Energy Efficiency Research Office, Energy Research and Development Division

Panel 2:

Eleanor Oliver, CEC, Food Production Investment Program, Energy Efficiency Research Office
Bob Gemmer, United States Department of Energy, Technology Manager, Research and Development, Advanced Manufacturing Office
Patrick O'Shei, New York State Energy Research & Development (NYSERDA), Director of Market Development
Derek Okada, Southern California Edison (SCE), Senior Manager, Business Public and Finance Energy Efficiency Programs
Ahmad R. Ganji, Ph.D., P.E., San Francisco State University, Professor of Mechanical Engineering, Director of Industrial Assessment Center
Asfaw Beyene, Ph.D., San Diego State University, Professor of Mechanical Engineering, Director of the Industrial Assessment Center

Public Comment:
Michael Yee, SoCalGas

I N D E X

P R O C E E D I N G S

August 3, 2021 9:30 o'clock a.m.

MS. RAITT: Good morning, everybody. Welcome to today's 2021 IEPR Commissioner Workshop, To Accelerate Industrial Decarbonization. I'm Heather Raitt, the Program Manager for the Integrated Energy Policy Report, which we refer to as the IEPR.

This workshop is being held remotely, consistent with Executive Order N-08-21, to continue to help California respond to, recover from, and mitigate the impacts of the Covid-19 Pandemic. The public can participate in the workshop consistent with the direction in the executive order.

Today's workshop has a morning and an afternoon session, with separate logins for each.

To follow along, the schedule and slide decks have been docketed and are posted on the CEC's website. All IEPR workshops are recorded and the recording will be linked on the CEC's website shortly following the workshop with a written transcript available later, in about a month.

Attendees have the opportunity to participate in a few different ways. For those joining today through the online Zoom platform, the Q&A feature is available for you to submit questions. You may also upload a question

submitted by someone else. Click the thumb's up icon to upload. Questions with the most up votes are moved to the top of the queue. We will reserve a few minutes after each panel this morning to take questions but will likely not have time to address all the questions submitted.

Alternatively, attendees may make comments during the public comment period at the end of the morning and afternoon sessions. Please note that we will not be responding to questions during that public comment period. Written comments are also welcome and instructions for doing so are in the workshop notice. Written comments are due on August 17th.

And, with that, I'll turn it over to Andrew McAllister, Lead Commissioner for the 2021 Integrate Energy Policy Report.

Thank you, Commissioner.

COMMISSIONER MCALLISTER: Well, thanks a lot, Heather.

Hopefully I have adjusted my camera here properly. Great. So really great to be here. Oh, great, I see that Commissioner Monahan is on, so thank you for joining as well.

I have been looking forward to this workshop. And I want to thank Heather and your team, you and your team for organizing it as usual, you know, a great job and

just -- we have a good couple sessions in the morning and afternoon here in store. So really looking forward to that.

In the morning we're going to talk about kind of what's happening. Some of the, you know, industries that we have, the important industrial sectors in California that we have today and what sort of kind of support they have, what they're doing already, what kind of support they have in terms of programs. We will look across to, well, in the second panel this morning, going to talk to some of those about the policies and programs that might help industries.

And then in the afternoon -- oh, I'm sorry. The second panel this morning, looking across the nation and kind of setting the stage for what's happening in other places and helping to build bridges between other jurisdictions in California, the U.S. DOE, the federal perspective, and also at NYSERDA.

And then in the afternoon we'll look at sort of what's needed, so talking directly to some of the key industry sectors in California and talking to some of the leaders in those efforts.

So industry is a key part of our economy, obviously, and it's responsible for around a quarter, a little more than a quarter of our emissions in the state.

And it, honestly, is a place where the State I think has some catch-up work to do. And we know a lot about our buildings. We've been working hard on transportation; there are a number of initiatives there. You know obviously buildings are a quarter of our emissions, transportation -- transportation is more than 40 percent of our emissions. And, you know, the industrial sector is -- I think it's been a little bit difficult for policy, for State policy to engage with the industrial sector and there are a number of reasons for that.

It's -- you know, our industries, each industry has its own dynamic. Each industrial sector has, you know, a relatively few number of large loads and so the context varies really industry to industry, you know, company to company and process to process. And I think as sort of a one-size-fits-all approach that the State might typically do doesn't work so well in the industrial sector. And so we need to be creative in how we engage with the industrial sector, to help partner to reduce emissions and maintain and increase competitiveness, because, after all, industrial activity is a core driver of California's economy.

So we've managed to do some creative and interesting things in the industrial sector -- I mean, I'm sorry, in the agricultural sector with the FPIP program

and initiatives that really have begin to build those kinds of partnerships between the State and the sort of private-sector economic drivers of California. And we need to replicate that in some way in the industrial sector. And that's part of what we want to talk about today, is to begin that conversation or deepen that conversation.

And it's really an opportune moment for this because with the May revise, it looks like it's highly likely we'll have the opportunity to channel some resources into this sector. So that is very, very positive, and I think we're lucky to be at this moment to have this conversation and really have some muscle behind it and, in earnest, really focus on the policies that we need in the various industrial sectors across the state to move the needle on decarbonization. And that in part could mean electrification, but it also means decarbonization of thermal loads and there are a number of possibilities for that.

So, again, you know I think today will begin that conversation. We're going to start to build a record. We're going to take this through the IEPR cycle and really go from there. And then when we are in a position, which we are very likely to be in by the end of the year or so, to develop a program to implement some of

these policy directions that we'll begin to talk about today, I'm sure we'll reconvene and we'll build on the work today to get the specifics right.

So that's the hope for today, and I want to again thank Heather and the team and also the EPIC team for all they're doing on industrial decarbonization. We already have some efforts going on that are very valuable and hopefully those will be expanded again with some of the resources that hopefully will be coming our way. So with that I think I will wrap up my comments and see if Commissioner Monahan would like to make some comments.

COMMISSIONER MONAHAN: Thanks, Commissioner McAllister. You basically said everything I was thinking and more. I will just -- you know, your comment that we have to play catch-up I think is correct. You know, historically I think we thought transport was the sector that was behind and really needed focus and now there is a big focus, the Governor has announced a policy that we're basically zero out emissions from all transportation over the next 15 to 25 years. And now we have these harder -- now the hard-to-electrify -- the hard-to-decarbonize or reach-carbon-neutrality sectors are shifting. And I think industrial is definitely an area that we -- buildings and industrial are two areas that we really need to focus on.

Yesterday I met with some energy leaders in

Germany, socially distanced in my backyard, and it was very fascinating to hear them talk about the industrial sector and how they're thinking about decarbonization. But basic there has been a big partnership. And industry, once the EU announced their carbon neutrality goals, there has been a big focus of companies about how to reach carbon neutrality. And I think that's a conversation that we need to happen, we need to deepen here in California. It's really working in collaboration with industries to figure out a pathway for reaching a carbon-neutral economy and reducing -- significantly cutting emissions from the industrial sector. So really looking forward to today's series of workshops.

I should be here for most of them. There are a few things that I need to step out for, but mostly I'll be here.

COMMISSIONER MCALLISTER: Very well. Thank you very much for joining us, Commissioner Monahan.

I will follow up, you know you made a good observation about Germany and how they do things. And it brings up some issues that typically we don't talk about at the Energy Commission because we're so focused on energy and programs, but you know we are the State's energy policy and planning Agency, so it's appropriate in this case, I think, to bring -- to frame this discussion

today as a matter of industrial policy. You know that's a term that really doesn't crop up very much these days. It sort of sounds a little bit throwback, but that's really what we're talking about, is an industrial policy, the part of the political economy of California. And Germany has historically had a very -- kind of a tripartite between labor, industry, and government. And they have been kind of very -- very consist in that. They tend to be able to talk together and find forums to talk together in a way that gets deals done.

And I think the U.S. economy generally is a little bit more fractured than that. And it makes it a little bit of difficult to engage in this kind of -- that kind of a conversation, where you really kind of just have the right people at the table and you're able to sort of forge ahead and kind of make a deal in that way, right? and so I think we -- I think that is actually possible in California, if we -- if we have this conversation sort of in the right way and we involve the right players and begin to show success. I mean I think that's the key, right, is we've got to have a program, decide what we're trying to accomplish, resource it properly and show success, build that trust, and then move on from there. And I think we've done that in other sectors and, you know, it's actually possible.

But industrial, I have a lot of experience actually in industrial energy optimization. That was a chunk of my career in the day. And processes really need -- the details matter. You know, industrial processes are -- they tend to be fairly contextually specifically and it's all about production. You have to understand that -- the getting production, you know, optimized and maintained, and not having shut down for long periods and keep all your lines of production in whatever your industry might be open is paramount. And so that's the economic imperative they face, and we need to kind of meet each sector, each particular industry where they are.

So a little bit of a tall order, but I think it's doable and certainly if we start the conversation and resource it keep at it, I absolutely think we can make a lot of progress here on decarbonization.

So, anyway, sort for the soliloquy, but you brought up a great -- a great topic in terms of comparing to some of the Europeans because we can learn from them.

So that I will pass it off to Heather to get us started with the first panel.

MS. RAITT: Great. Thank you, Commissioner.

So I'd like to introduce our first panel which is: Setting the Stage for Industrial Decarbonization in California and the moderator is Kevin Uy. Kevin is a

supervisor for the Food Production Investment Program in the Energy Commission's Research and Development Division.

So, thank you, Kevin for being here, and I will turn it over to you.

MR. UY: All right. Can you see me and hear me okay?

MS. RAITT: I can hear you and see you. Thank you.

MR. UY: All right. Thank you so much.

So welcome, everybody, to today's first panel. The purpose of this panel is to provide some background and context on the industrial sector. The industrial sector is the second-largest contributor to greenhouse gas emissions in California, behind the transportation sector. And in this session, panelists are going to provide some additional background on the industrial sector and how state and federal agencies are helping to decarbonize.

As a reminder, if you have questions during the session, please enter them into the Zoom Q&A box. And we'll respond to as many as we can at the end of the session.

So with that, we'll jump right into it. First up we have Mark Sippola. Mark is the Manager for Allowance Allocation for the Cap-and-Trade Program at the California Air Resources Board.

If we could go to the next slide, Mark, you can go ahead and start your presentation when ready.

MR. SIPPOLA: Thanks so much, Kevin.

Good morning, everybody. And thanks to the Energy Commission staff for including me on the panel. It's really nice to be with you all here today. Next slide, please.

So the California Air Resources Board is the lead agency that sets the State's emission standards for a range of statewide pollution sources, including vehicles, fuels, and consumer products. CARB also coordinates across agencies to lead California's efforts to reduce climate-change emissions. 8032 requires CARB to adopt a scoping plan every five years that charts our path to meeting future emission reduction targets.

This slide is showing key elements of the comprehensive strategy about that in 2017 to meet our 2030 emissions target. The State takes a portfolio approach. We don't rely on just one program. This portfolio approach includes policies to increase building efficiency, renewable power, renewable fuels, zero-emission vehicles, cleaner freight options, and to protect our natural and working lands.

In June, CARB formally kicked off the process of updating the scoping plan for 2022. This plan will assess

paths for achieving statewide carbon neutrality, including scenarios for carbon neutrality by 2035 and by 2045. The scoping plan public process is where we'll be assessing progress in any sector of the economy, including the industrial sector; and considering approaches to ensure that emissions from all sectors are on course to support carbon neutrality by 2045. Next slide, please.

Focusing in on industrial sector measures, CARB has longstanding regulatory relationships with a wide variety of industrial facilities in California. Over the past 15 years, CARB has adopted and implemented a suite of measures that worked to reduce industrial sector GHG emissions and the major measures are listed here. The Cap-and-Trade program places a steadily increasing carbon price throughout the economy, including on industrial facilities. It includes provisions to minimize industrial leakage. The Cap-and-Trade Program auction proceeds are invested to further reduce GHGs. For example, the Food Processor Investment Program administered by CEC is providing over a hundred million dollars in auction proceeds to industrial food processors to encourage decarbonization.

The Low Carbon Fuel Standard incentivizes efficiency in producing transportation fuels. The oil and gas regulation reduces methane emissions from the

production, processing, transport, and storage of oil and gas. The regulation for energy efficiency and co-benefits assessment of large industrial facilities requires the largest industrial facilities to conduct energy assessments and implement certain efficiency improvements.

It's also important to recognize the State's long history of adjusting local air pollutants from industrial sources. California's air quality programs are responsible for significant public health improvements through statewide and regional air quality planning requirements, advancements of technology-based solutions, and risk-reduction efforts near industrial facilities. Next slide.

This slide shows the statewide GHG emissions by sector from 2020 through -- excuse me -- from 2000 through 2018. We have been below the 2020 target of 431 metric tons since 2016. Last week, CARB released data for 2019 and that shows even further reductions below the 2020 target. Oh, we also know that much more will need to be -- will be needed to reach our ambitious 2030 target.

In blue, at the bottom, transportation continues to be highest-emitting sector, about 40 percent of total emissions. Industrial emissions are the green portion in the middle. Annual industry emissions are about 90 million metric tons, 21 percent of the statewide total.

They have been relatively constant over the past decade. Next slide, please.

This is a closer look at onsite GHG emissions during 2013 through 2019. From bottom to top, each bar shows emissions from: Refining; oil and gas production; cement plants; industrial use of steam from cogeneration; and the gray portions at the top are emissions from remaining industrial sectors, like glass, metal, and paper manufacturers, mining operations, and food processing facilities like: Food and vegetable canners, milk and cheese producers, and breweries.

Direct emissions from within each of these sectors mostly remains steady from year to year.

So these emissions are associated with making products that we rely on. As a society, we will continue to rely on industrial products, so we will need to produce and use these goods as efficiently as possible. Many have noted that certain industrial emissions can be especially challenging to abate due to cost and availability of technology. This is the case throughout the world and not just California.

So recognizing the challenge that this sector presents for carbon neutrality, CARB held public workshops in 2019 and 2020 to discuss what with a variety of stakeholders the role of the industrial sector in meeting

our mid-century targets. These workshops have forwarded a broad range of tools for decarbonizing industries that are currently being deployed around the world. We were pleased to have Eric Stokes from the Energy Commission to serve as a panelists at one of these workshops to discuss the State's technology support. And recording and ships materials are available on the CARB webpage from those workshops.

I'm pleased to continue those discussions at today's workshop. And I expect all of this will be feeding into our scoping plan process, in addition to the IEPR process moving forward. Next slide, please.

So also relevant to today's workshop, CARB contracted with E3 to model pathways for how the State could reach carbon neutrality by 2045. This preliminary modeling assessed emissions from buildings, transport, industry, and non combustion sources. It looked at various scenarios with different levels of electrification, low carbon fuels, and carbon capture and sequestration, among other technologies. Across all scenarios evaluated by E3, the initial modeling tells us that industrial sources must significantly increase use of low carbon fuels including electricity, biofuels, and green hydrogen.

So this is informing our thinking for longterm

industrial transformation. In the scoping plan, California will be assessing approaches to promote adoption of alternative fuels in the ideal sector through adjustments to existing programs and through new measures.

We also know we won't be able to eliminate all emissions through new technologies. Carbon neutrality will mean increasing carbon sinks, and that means assessing the role of carbon capture and sequestration at industrial facilities. Our scoping plan will also discuss the role for CCS to meet carbon neutrality in California, and the measures that might support that. For those interested, on August 17th CARB will hold a workshop focused exclusively on new scoping plan modeling that will build on this initial modeling. Next slide, please.

So, again, the scoping plan needs to be updated every five years, so the next version needs to be adopted by the end of 2022. This slide depicts time lines and major milestones for that process. Legislatively-mandated reports on electricity, transportation, and workforce development have been completed, and these serve as building blocks that will inform charting the path to carbon neutrality. Members of the Environmental Justice Advisory Committee have been identified and they will convene and provide input regularly. Public workshops covering specific topics and sectors have already begun.

Just yesterday there was a technical workshop on engineered carbon removal. Workshops will continue through next year. I anticipate multiple workshops related to the industrial sector, so there will be many opportunities to engage.

We will release a draft scoping plan in spring 2022 and a final version in the fall of 2022. We anticipate our board adopting the final plan by the end of 2022.

Some of the context and process. Significant direction exists in statute for the scoping plan, for emission targets, and for climate programs. There are also executive orders and directives issued by the Governor to CARB. We must be consistent with these, and partnerships across agencies will be crucial for consistency.

When considering the role of the industrial sector, labor groups must be part of the conversation. The transition to a clean economy can't come at the cost of well-paying jobs.

So we really need a thorough public process with input from the private sector, frontline communities, labor, industrial, academics, legal governments and state agencies for a robust and balanced pathway to carbon neutrality. Next slide.

This is just giving some links to CARB's scoping plan and neutrality pages. Again, we're looking for broad participation and partnerships for success. So I'm encourage you to engage on the scope plan process for the rest of this year and through 2020 [sic]. Thank you very much for your time. I'm looking forward to the discussion with the other panelists.

Kevin.

MR. UY: Excellent. Thank you so much for that presentation, Mark.

As a reminder, if you've got questions please enter them into the Q&A box.

So next up we have Elizabeth Dutrow. Elizabeth is the team leader for the ENERGY STAR industrial partnerships at the U.S. Environmental Protection Agency. If we could please pull up Elizabeth's slides? There they are.

So, Elizabeth, please go ahead when ready.

MS. DUTROW: Thank you.

I'm pleased to talk with all of you today. I am going to report on an evaluation that we did for the potential of carbon dioxide emissions from U.S. manufacturing by the year 2050. And I will make the point that you should be aware that carbon dioxide is often a process byproduct of several heavy industries as well; and

we did not include this in our study except for the process cement -- from cement manufacturing. Next slide, please.

So who we are. We are part of the ENERGY STAR program. Team Ion manages -- is a team that works directly with the industrial sector in the U.S. We promote energy efficiency and decarbonization strategies to more than 32 industries and more than 800 corporations. We provide tools that help them make decisions about benchmarking the efficiency of their plants, energy guides which identify opportunities for promoting energy efficiency. We work directly with unique sectors. And we certify plants that perform with the top quartile nationally. Finally, we have a network of -- nationally of energy managers who help to inform the strategies that the program has. Next slide, please.

I'd like to acknowledge my co-authors. It would not be possible without the work from Gale Boyd, who is an associate research professor at Duke University and Ernst Worrell, also a professor in the Copernicus Institute at Utrecht University, along with Josh Smith of ICF. Next, please. Advance, please.

So why are we considering the industrial sector? You've already pointed to them, we've already had discussions about this, but the industrial sector in the

U.S. is responsible for about 29 percent of the emissions, when you look at electrical consumption and related greenhouse gas emissions and apportion them to the major sectors of the economy. Industry is compromised of: Manufacturing, agricultural, mining, and construction. And when you look at manufacturing specifically, 77 percent of the greenhouse gas emissions come from that part of industrial. Of these, 85 percent are carbon dioxide. Next slide, please.

Now why this evaluation? There were many studies that we looked at and they looked at specific technologies. Other looked at specific sectors. Industrial is diverse. So we didn't see anything that looked across the entire industrial sector and examined it for its potential. So the question we looked at in this evaluation is what is the full impact when we consider opportunities for increased energy efficiency, electrification, renewables, and grid balancing. We really wanted to understand how much decarbonization is feasible. Advance, please.

So the scope of the evaluation was very basic and simple. We looked at the North American Industrial Classification Code system for manufacturing sectors. That's from 31 through 33. That covers everything from sewing of clothing to production of brooms. And what's in

between all of that are these energy-intensive industries that many of us are paying attention to, such as cement and steel and refining. All of them are encompassed.

We look at the opportunities for energy-related emission reductions. And we looked at four main pillars that could contribute to substantial decarbonization by the year 2050. These include energy efficiency, electrification, renewables, and grid balancing. And of course there was additional consideration given, as we got into this, to technologies such as: Hydrogen; carbon capture and storage or use; CHP was interesting; and also something known as the circular economy or, as we'll call it later, material efficiency. We had to start somewhere, and the best information we have for looking at the industrial sector nationally comes through Department of Energy's Energy Information Administration, so we used the Annual Energy Outlook that they issue each year. And it has good estimates through modeling of where we believe the industrial sector starts, in 2018, our baseline, and grows through 2050. Advance, please.

So the sectors that we looked at include iron and steel, cement, chemicals, pulp and paper, petroleum refining, aluminum and glass -- even though these are smaller, and then something we can call "light" industry because it is everything else in industry. Advance,

please.

I'm going to show you just two industries. We didn't want to go in today to everything about industry, but just taking a look at paper, for example. To come up with a zero-carbon paper industry there are large technical potentials still remaining in industrial energy efficiency. We believe there is a great opportunity there. Material efficiency also will create an opportunity in this industry if we move from plastics, an extensive investment in plastic. Still important, but we become material efficient, paper may pick up some of the slack. There will be increased recycling in our view of the future for papers.

Renewable energy is also an opportunity. This is an industry based on a renewable resource. There is great opportunity there. There are new process designs under examination. Water-free papermaking is one opportunity.

And then electrification will present a good opportunity for paper, the paper industry as well. One example of a technology is microwave-drawing technologies. Electrification will also be important for currently -- current fuel processes as well, and I think there are opportunities there. Advance, please.

We look at the cement industry. We believe that

there are opportunities still remaining in efficiency, but those improvements that have been made need to be made sustained. We can't lose any ground on that.

On material efficiency, there are great opportunities for blended products, which we reduce the amount of carbon dioxide from the process, because we don't need as much clinker if we can blend more materials in, on order of what we see in Europe. We can improve design and concrete recycling and other types of process in the concreting end of things.

For renewables, there is the opportunity for alternative fuels. Carbon capture and storage is under study. And of course new processes and raw materials are also being examined as the industry moves forward. Advance, please.

So if you look across all these sectors, what did we come up with? Across the top of this table you can see the main sectors of bulk chemicals, lime, and so forth across. And down the side you can see the main opportunities from the pillars of energy efficiency, material efficiency, some of those specific technologies.

The greatest opportunity is still energy efficiency. It remains a large opportunity for everyone. Material efficiency is also very important as we learn to make things that are made differently but still viable and

useful for us.

The opportunities of carbon capture and storage and hydrogen, when we did this evaluate, they're there, but we now have the Earth shots that the Administration has announced. And those hopefully will change the trajectory for all of these opportunities of hydrogen and carbon capture and make things affordable and more prevalent and useful, in which case many of these industries will have more opportunity to make use of them.

Electrification is important and we believe there are opportunities now that can come across for industry and longterm there will be some others. Next slide, please.

So the number is 86 percent. That's our estimate of how much industry in the U.S. can reduce CO2 emissions by the year 2050 on a feasible basis. Next.

The reduction potential is seen in this slide. We started with the 2018 base year, AEO shows the growth in industry to a little over 1200 million metric tons of carbon dioxide. Our estimate is we can reduce through direct industry action down to 649 and additionally down to 184 when the grid greens and provides the benefits that come from that electrification. Next slide, please.

The important thing to note about this is you will see the same bars on this slide, the black and the

grays. Look at the second bar, by 2050, there is a blue chunk above it. That is an estimate of current energy efficiency programs and policies that are in place right now in this country, and those must continue. They are built in to what the AEO looks like. And if we stop those activities, we will grow industry emissions to over 1600, close to 1700 units of emissions. So those efficiency activities still continue, and that's why we have placed those on the direct industry action bar. There is an additional chunk of energy efficiency still yet to be had. We believe that material efficiency and the light around 175, for those of the -- you can see the peach. And carbon capture and storage and hydrogen can also provide opportunities.

The final bar, what's interesting here is we see electrification's potential beyond just when the grid greens. Of course anything that's used electrically by industry will be greener, but there is a great opportunity for industry to do more in forms of electrification. Next slide, please.

So I'd like to just give a little insight here. Energy efficiency, great opportunity, needs to continue. It's going to buy down the price of capital investments in other things that will come. It's low cost relative to other opportunities and it's prevalent across all of

industry. Next slide, please.

And material efficiency is going to be very important. We need to incentivize consumer demand. Electrification is very important. And, finally, the last comment I'll make, is we need to make sure that we have all opportunities available and we need to move things now. Thank you for your time.

MR. UY: Thank you so much for your presentation, Elizabeth. That was great.

So next up we have Melissa Jones. Melissa is a Senior Energy Policy Specialist in the CEC's Energy Assessments Division. If we could please pull up Melissa's presentation?

All right, Melissa, I will let you take it away whenever you're ready.

MS. JONES: Great. Good morning. I am Melissa Jones and I am a Principal for the Energy Commission on electricity and natural gas issues. I am going to provide some context for industrial gas use in California, which, as you've heard, presents some challenges for decarbonization. Next slide, please.

So gas demand in California. Residential and small commercial, there is major gas use for space and water heating. In the commercial sector, we have restaurants, educational facilities, commercial laundries,

healthcare, food processing that all use gas.

For the industrial sector, natural gas is used as a fuel for process heat and feedstocks. We in California also use quite a bit of natural gas for electric generation; to help with system reliability; and, more recently, to help integrate renewable resources on the electrical grid.

And then, finally, we have transportation fuels that consume a large amount of natural gas in the state. And that includes oil refineries as well as CNG and RNG fueling stations.

And we use the utilities gas system to deliver gas to all these different customers. They have an extensive gas infrastructure in the state.

Just some context here, the gas world classifies customers as core and noncore. Industrial customers are noncore customers. They are longer users of gas who purchase their gas supplies from marketers and other gas suppliers and then they use the gas utilities transportation services to deliver their supplies to their facilities.

In Northern California, industrial customers also have the ability to buy storages services to balance their supplies and to hedge against prices. In Southern California, storage services for noncore customers have

been suspended with limitations on storage volume at Aliso Canyon. Next slide, please.

So this shows gas demand in California from 2001 to 2020. As you can see, demand for residential, commercial, and industrial has been relatively flat, while electric generation demand varies substantially on an annual basis. There is some variation in residential and commercial demand, mainly due to weather and also due to economic conditions. The electric generation is the one that varies the most and it is most variable based on weather conditions, that’s both hot and cold conditions, and it's also sensitive to hydro availability. It is the swing fuel when there are droughts and hydro availability is limited.

Overall gas generation, as you can see from this, has been declining as we have been brought on increasing amounts of solar and wind. This has had a fairly dramatic impact on natural gas and then for electric generation in recent years. Electric generation of gas is going to be needed, at least in the nearterm, as we continue to integrate more and more renewables onto the system and we deal with these large increasing ramps on the electric system. Okay, next slide, please.

So in terms of percentages of total consumption, the residential and commercial, industrial, and electric

generation are split about 33 percent each. So it varies somewhat and has been declining, as I mentioned, for electric generation from about 36, 37 percent back in 2000, to about 30 percent in 2020. And the green, -- so that's the yellow on the top.

The green in the middle is industrial consumption. And, as electric generation demand has declined some, industrial has become a little bit larger share of gas use in the state, increasing from about 32 percent in 2000 to about 35 percent in 2020. And industrial demand has been relatively flat, so you can see that. Industry -- I mean commercial and residential has also remained flat, although there has been some decline. And it's roughly the same percentage, 20, 21, 22 percent. And most of the savings that have been achieved there have been from energy efficiency inputs. Next slide, please.

So this slide shows a breakdown of industrial demand by the North American Industry Classification System, or NAICS. The orange band -- oh, let's -- no, start with the blue band at the top, is the NAICS code for logging, wood, paper or pulp, paperboard, printing, petroleum chemicals, plastics and rubber, and nonmetallic metal. And I would -- okay. So I was looking at a message there.

If you look at blue, at the blue you can see

that it has increased some over time. And up until about 2018, it started to decline. There was a decline especially last year associated with Covid. The blue band is -- the blue hatchmarks are for nonmetallic minerals, and this is primarily for oil and gas, tertiary oil recovery in the Kern County area. The black is primary and fabricated metal, machinery, computer electronics and semiconductors, electrical and transportation equipment, furniture and miscellaneous manufacturing which in California includes pharmaceuticals manufacturing. The red is construction materials.

And this is a forecast of gas demand from -- let's see. So we are basing this off 2019. The IEPR forecast, which is our most recent forecast, right now in our process we are still developing our 2021 IEPR released later this year and will be subject to workshops in this IEPR process.

For the residential and commercial sectors, we do see some decline, but it's still relatively flat. At this point, forecasts for the -- the Energy Commission's forecasts as well as for the gas utilities, hasn't really incorporated building electrification. We will be trying to build in some of the changes in demand in this year's forecast. I should note that the gas utilities both forecast similar energy demand declines at about one

percent per year.

And, let's see, electric generation, as I said, is expected to decline. And transportation and communications and utilities are expected to grow some, but it's still a fairly small portion of natural gas in the state.

So that's my overview. Thank you very much for listening, and we'll move on to the next presentation.

MR. UY: Great. Thank you so much, Melissa. That was great.

So next up we have Heriberto Rosales, or Eddie. Eddie is an Energy Specialist II in the CEC's Existing Building Office in the Efficiency Division.

So, Eddie, whenever you're ready, please go ahead.

MR. ROSALES: Thank you, Kevin.

Good morning, Commissioner McAllister, Commissioner Monahan. Good morning, attendees. I will be providing an overview of the state's industrial sector energy profile relative to Senate Bill 350, Energy Efficiency Savings Doubling Goals, and its relationship to the state conversation.

So SB 350 requires the CEC to set annual targets to achieve a statewide cumulative doubling of energy efficiency savings in electricity and natural gas end uses

by January 1st, 2030. So data in this presentation is taken from the CEC's SB 350 Doubling Energy Efficiency Savings Report and the 2019 California Energy Efficiency Action Plan, and other sources identified here. The data will show a significant energy savings potential on the industrial sector. Next slide, please.

California's industrial energy sector usage accounts for about 20 percent of the state's total energy usage, with natural gas as the dominant fuel. About 70 percent of energy consumed by the sector is in the form of natural gas. Industry is the second-largest natural gas consuming sector in the state. Petroleum refining, cement, glass, and the gas-consuming sector in the state -- I'm sorry. The petroleum refining, cement, glass, and chemical industrial subsectors are high fossil fuel users. The industrial sector emits 21 percent of statewide GHGs and is second behind the transportation sector. So reducing the energy consumption in the industrial sector will help the State meet its SB 350 energy efficiency objectives to reduce GHG emissions. The data show that the industrial sector has untapped energy savings potential. Next slide, please.

This chart from the 2019 California Energy Efficiency Action Plan shows a forecasted 20-percent gap between all combined energy efficiency efforts, and the SB

350 2030 doubling goals. The industrial sector is the second sector wedge here on the top, shown here in magenta. It's circled with the arrow on the graph.

Though the industrial sector is a large user of energy, it's 2030 projected savings are small relative to residential and commercial expected savings. Next slide, please.

We cover some industrial sector energy efficiency barriers on this slide. So one barrier of the industry subsectors, as Commissioner McAllister had commented in opening remarks, are very diverse. They range from oil and gas to cement processing, assembly plants, water and wastewater treatment plants, and food processing. Unlike the building sector, each subsector uses energy in totally different ways.

Another barrier is the industry processing are equally diverse, so developing a one-size-fits-all solution is not practical. This makes identifying and implementing energy efficiency measures in individual subsectors really cumbersome and expensive.

A third one is energy upgrades often necessitate shutting down industrial processes, thereby disrupting goods production. So narrow time windows for installing upgrades means that energy efficiency efforts must be well planned ahead of time. Production delays and financial

losses associated with shutting down industrial processing inhibit taking on energy efficiency projects.

Yet another barrier, according to the Department of Energy Report "Barriers to Industrial Energy Efficiency," industrial businesses compete internally for capital. Financial officers often don't see the value in energy efficiency. Without an external energy efficiency focus of financial support, efficiency upgrades are often overlooked.

State and federal energy codes are also barriers, and they don't exist for the industrial sector. In addition, the industrial sector doesn't participate in traditional ratepayer-funded energy efficiency models. As a result, in California industrial energy savings are listed as nonutility programs.

And the last barrier listed here on the slide is lack of information. So the DOE "Barriers to Industrial Energy Efficiency Report" also notes that some manufacturing plants lack information on the benefits of modern energy management systems. These plants fail to capture the value of cost-effective energy savings that can be achieved by these systems. Next slide, please.

I will cover some energy efficiency opportunites and strategies on this slide. Industrial energy efficiency cohorts facilitate exchange of energy

efficiency best practices and lessons learned among energy managers from similar industries. One example is the Marine Clean Energy. It's currently sponsoring a small industrial cohort that shares in reduced energy management practices and systems. Another opportunity is the Strategic Energy Management programs which are designed to support industrial companies by focusing on several high-level objectives. For example, implementing energy efficiency projects and saving energy primarily from savings in operations and maintenance, establishing the energy management system, or business practices, to help facilitate and manage -- helping to facilitate and management and continuously improve energy performance. Normalizing and quantifying and reporting facility-wide energy performance is also included in SEMs.

Another opportunity is research, development, and better technology demonstrations, to strategically identify, evaluate, and demonstrate innovative strategy that reduce energy usage, encourage fuel switching when possible, and reduce GHG emissions in the industrial sector.

And last here, the utility and state financing model will help spur and encourage industrial actors through active grant or loans to target energy efficiency upgrades. Next slide.

So we'd definitely like to hear from attendees here today. Some key questions here: What key policies or ideas or suggestions would support the industrial sector in reducing energy consumption and GHG emissions. What industrial subsectors lend themselves to short-term market transformation. What best practices would you recommend, for example, energy efficiency investments, decarbonization strategies. Next slide.

This is my contact information and this will conclude and wrap up my presentation. So thank you for your time.

Kevin.

MR. UY: Thank you, Eddie.

Next up and lastly we have Virginia Lew. Virginia is the Manager of the CEC's Energy Efficiency Research Office in the Energy Research and Development Division.

Virginia, please go ahead when you're ready.

MS. LEW: Hi. Good morning, everybody. My presentation today will focus on some of the Energy Commission's investments in clean energy innovation in the industrial sector. Next slide, please.

Our programs invest in technologies and strategies to catalyze change that will be needed to meet our State energy policy goals. For the industrial sector,

our investments have focused on energy efficiency, renewable energy, storage, and other areas. Our goal is to bring breakthrough technologies from the lab to the market through demonstrations and actual industries while documenting technical and economic performance and other benefits.

This slide shows the three programs that are applicable to the industrial sector. The Electric Program Investment Charge, or EPIC, focuses on electric -- electricity-related research to benefit electric ratepayers.

Our Natural Gas Research and Development Program emphasizes natural gas related research to benefit natural gas ratepayers.

Commissioner McAllister mentioned the Food Production Investment Program, or FPIP. This program focuses on demonstrating advanced commercially-available technologies that can reduce greenhouse gas emissions in the food processing industry.

And each of these programs provide funding through competitive solicitations that we have released periodically. Next slide, please.

This slide highlights a few of our R and D projects. Capturing waste heat was a key way to reduce energy use. Some of our projects have demonstrated

innovative heat exchangers for capturing waste heat and also waste cooling. Also we focused on the development of plastic heat exchangers to reduce costs. And also development of heat exchangers that can capture low temperature waste heat.

Membrane technology has the potential to reduce fossil fuel use. Natural gas fired evaporators are used to make fruit, vegetable, and juice concentrates. Membranes can be used to replace energy-intensive evaporators. Membranes also have the potential of recovering waste water from industrial processes for onsite reuse.

We are also looking at different electrification technologies, such as infrared heating to replace gas heaters.

And, lastly, on the lower right here, many industries do not know how energy is used in their facility and how they compare with others. We had an energy management project that focused on compressed air, which is commonly used in all industries. This project showed that by installing sensors to monitor compressed air operation, we can identify anomalies and inefficiencies, and we did this in over a hundred industries in California. Monitoring energy use just in this one area resulted in a 17-percent average decrease in

compressed air energy usage. This project led to the creation of a new business, to offer energy monitoring of compressed air and energy using systems as a service to industry. Next slide, please.

In our food production program, we have funded renewable microgrids that can provide food processors with energy reliability, especially during critical processing times in the summer. Solar thermal systems can provide processed heat for food processing to reduce natural gas use.

Installation of boiler improvements, heat recovery systems, refrigeration systems, use of low- or no-global-warming potential refrigerant and other energy efficiency measures have also been able to reduce both natural gas use, electricity use as well as greenhouse gas emissions.

The FPIP program has funded 51 companies. And there is the potential to reduce greenhouse gas emissions by over 160,000 metric tons. Next, please.

We've also created a free networking platform that enables subscribers to connect with potential project partners, search for funding opportunities, view curated resources and databases, as well as message others. The entire innovation network is a great way to connect and build strategic partnerships, and you can sign up on the

link shown here.

This slide also shows other webpages to get more information about our programs. In fact, there is an epic workshop tomorrow focusing on our potential research initiatives for the next four years. Check it out on the CEC calendar link or by going to -- by going to energy.ca.gov/EPIC4.

And that concludes my presentation. Thank you.

MR. UY: Thank you, Virginia.

So I believe now we'll transition to questions from the dias from the Commissioners and discussion from panelists for about 10 minutes and then we'll move onto the Zoom Q&As and get through as many as we can.

And, you know, when you're doing your Zoom Q&A, if you wouldn't mind saying who your question is addressed to, that would be helpful. Otherwise we can likely infer it from the question itself.

So if the panelists would like to turn their cameras back on? Okay, I see we've got everybody.

So, Commissioner McAllister, would you like to ask any questions of the panelists?

COMMISSIONER MCALLISTER: I would. Thank you, Kevin. I really appreciate that.

And thank you, all of you, for being with us, you know, both our internal staff, who I know are always

excellent -- so thank you, all -- but also Elizabeth and Mark as well. I just really appreciate your being here.

I will say just by way of kind of context, in this IEPR cycle, you know given the sort of hubs of synergy now between the federal direction and energy decarbonization in our state, we're doing everything -- we're really making a lot of effort to build bridges with the federal agencies that we want to partner increasingly with.

So, Elizabeth, I just want to thank you for being here.

And we also have Bob Gemmer of the U.S. DOE later. And then also partnering across with other states, who are leading in these various areas, and so I just wanted to thank in advance Patrick O'Shei for being here from NYSERDA.

So what -- so you know there are a lot of things about this discussion I think get my blood pumping because I think there is so much potential. And, Elizabeth, your presentation just pointed out how deep the decarbonization possibilities are.

I wanted to ask each of you -- not all of you have to comment on this, but in terms of something that you really, Elizabeth, and I'll ask the same question in the rest of the panels today probably, in terms of

implementing new technologies, you know, whether they're incremental or kind of truly new transformational, what are your thoughts about the workforce piece of this? And so the ability to actually conceive and implement, you know, if I'm an industry and I'm a CFO or I'm, you know, sort of a plant manager, what challenges do I face in actually getting access to the kind of knowledge that I would need to actually do a project that's successful and saves energy in terms of just engineering resources that I would need to identify and contract and get on my sight?

MS. DUTROW: So I'm not a workforce specialist, but so many of these sectors have specific technologies. So if you're talking cement, you're going to have a staff that will have to implement something. And those technologies may be very specific for a plant and require the engineers of this -- they will learn it.

But there are a lot of things for light industry that are general technologies as well. Efficiency is something that we need education. We need a workforce that's educated, and good management of these plants. A lot of the industries know things. So as new technologies come about, that's going to happen. If you're going to put something on a steel mill, you're going to have staff that will learn it, but for general technologies education is important to help the workforce, so certainly that's

important.

We'll see what others might want to say about that.

MR. SIPPOLA: If I might just chime in --

COMMISSIONER MCALLISTER: Oh, go ahead.

MR. SIPPOLA: -- if I may. Excuse me. If I may just chime in and point to I mentioned a couple of the legislatively-mandated reports feeding into the CARB scoping plan process, one of those is the AB 398 report from the California Workforce Development Board, which, you know, is substantial. I think it's well over 600 pages. So I think it came out last year, but really talking about what's needed for a just transition. It's really taking a broad scope, but looking at things like workforce development strategies and workforce policy levers to protect and really empower the current workforce and future workforce to have the tools that they will need for these types of technologies. So I would just raise that as a potentially good source of information on this.

COMMISSIONER MCALLISTER: Thanks, Mark. I appreciate that.

And, Virginia, I guess maybe I'll tweak the question a little bit. You know you've been sponsoring over the years some really interesting work on data of monitoring and sort of data gathering and best practices

there. Do you feel like there is enough knowledge to really replicate that approach and go to scale relatively quickly in terms of the kinds of services that industries can avail themselves of out there in the world, or is it still very specialized?

MS. LEW: I think there are some specialist. But like our compressed air project where it's a common type of system that's used in a lot of industrial facilities, and in that project and you know we're trying -- artificial intelligence combined with energy management systems provide plant managers with information. And so I think that's going to be a common thread too that plant managers are going to be looking for ways on how they can reduce energy.

Right now I think the industrial sector for the most part many of them pretty much are kind of tight. They don't share a lot of information. So even when we did an audit of some cheese factory, they didn't know what other cheese factories doing were in terms of energy use, so there was no benchmarking. And so I think that the opportunity to provide more energy management data is going to enable plant managers to better understand whether they are operating -- you know, using more energy than their competitors or not.

And with that project we found out that once

people found out that they were using more energy than a competitor, --

COMMISSIONER MCALLISTER: Yeah.

MS. LEW: -- then they wanted to do better. So I think that whole process of, you know, knowledge is power is going to help.

COMMISSIONER MCALLISTER: That's great. I really like the cohort approach and hopefully we'll get to hear something about that from our panelists later this morning/in the afternoon.

Elizabeth, go ahead.

MS. DUTROW: Yes. And I will add, just as she said, at the beginning of my slides I quickly said that we have worked with industry to benchmark. That is a key activity that needs to happen. We create tools ourselves that allow just what she said. And when you enable industry to see what its performance can be, because of a curve that doesn't reveal information about individual plants, the confidentiality things, create a forum to actually enable progress. And we have seen that with ENERGY STAR.

COMMISSIONER MCALLISTER: Yeah. Great. And I will just thank you on behalf of all of us for ENERGY STAR's Portfolio Manager which we use tremendously in the state as a basis for some of our programs.

MS. JONES: Thank you.

COMMISSIONER MCALLISTER: Is there any -- maybe this is to you, Elizabeth, first and others as well. You know in that study that you gave us the summary of and other work, is there any particular conversation with industry or industrial sectors that gets you particularly excited about the potential for decarbonization?

MS. DUTROW: Well, for us the energy efficiency side is still completely relevant. I mean it's very relevant. I think some strategies are going to be harder than others, but energy efficiency needs to continue. And we need industry to really pick up everything it can. We have work that we do with our partner companies. And we had someone recently certify a plant, which means they achieved top quartile performance for their industry, and the answer that came back from one of the fellows who did it said they said it couldn't be done. He was the first in that industry to achieve it, so we know there are opportunities out there.

I know that there are also companies that still don't have corporate energy programs, which is very --

COMMISSIONER MCALLISTER: Right.

MS. DUTROW: -- and that tells me that there is still a lot of room where we can improve in that regard.

And the other area that I find interesting is

electrification. Two years ago when we started all of these far -- far-reaching strategies, we brought up electrification, and some in the chemical industry looked at us and said, 'No, what?' And so we're now hearing people talk more about it, so they're not so far flung now. It's like this is now we need to be looking at what we can do now.

COMMISSIONER MCALLISTER: Great. Thank you very much. I completely, completely agree with that.

We do have a few questions on Zoom, but I wanted to -- so we'll get to those eventually, just heads up, everyone.

But, Commissioner Monahan, did you want to ask any questions?

COMMISSIONER MONAHAN: Yes, I do. This is a fascinating panel. And I actually -- Elizabeth, I really appreciated that loading order announcement and just the emphasis on efficiency, efficiency, efficiency. It's like we cannot say that enough.

And I was also struck with Mark's emission inventory and how much of the sector from refining and hydrogen production on -- and I'm assuming, Mark, that it's mostly refining? Is that -- refining of petroleum, that is the big user; is that correct?

MR. SIPPOLA: Relative to refining and hydrogen

being lumped together was your question?

COMMISSIONER MONAHAN: Um-hum.

MR. SIPPOLA: Yes, that's true. I don't have the numbers right at the top of my head, but it's also true that nearly all of the hydrogen production goes into the refining process.

COMMISSIONER MONAHAN: Right.

MR. SIPPOLA: I'm guessing the hydrogen -- you know, if that was around 30 million, I think the hydrogen might be around eight or nine million metric tons --

COMMISSIONER MONAHAN: Oh, so pretty significant.

MR. SIPPOLA: -- of that, so it's a pretty substantial portion, yeah.

COMMISSIONER MONAHAN: Interesting. Well, I'm wondering --

MR. SIPPOLA: But I want to go back and check just to make sure.

COMMISSIONER MONAHAN: Well, Mark, this might be a question for you but maybe for anyone on the panel, it might be that we don't have the right expertise on this, but, you know, the Low Carbon Fuel Standard, which is -- which is a standard that requires each gallon of fuel used for transportation reduce its carbon intensity on a lifecycle basis, and that includes actually the upstream,

so it's a way to sunlight some of the efficiency possibilities. Do we have any information on how much the Low Carbon Fuel Standard is driving efficiency in the upstream? And I'm wondering if there are any lessons learned for thinking about other sectors, right. This benchmarking that we're talking about doesn't currently exist. You know, the LCFS is the only policy I know of that is looking at that upstream potential.

MR. SIPPOLA: Well, we do have the additional, you know, industrial policies like the carbon pricing that do affect those utilities also.

COMMISSIONER MONAHAN: Um-hum.

MR. SIPPOLA: And it can be a little challenging to disaggregate exactly which programs might be driving, you know, emission reduction specifically --

COMMISSIONER MONAHAN: I think the LCFS because it's so much higher on a dollar-per-ton basis so that you get -- you should theoretically -- I don't know if it's working, --

MR. SIPPOLA: Yeah.

COMMISSIONER MONAHAN: -- but theoretically it would work.

MR. SIPPOLA: And I will also preface my response by saying it's not a program that I work on specifically, but it is, you know, adjacent to the efforts

that I work on.

There are a couple provisions like the Innovative Crude Provision within the Low Carbon Fuel Standard and also a Refinery Investment Credit, which do incentivize those types of onsite emission reductions for oil production in the case of innovative crude and at refineries in the case of the Refinery Investment Credit that are also providing additional incentives. And there -- the application process for those incentives I believe is public, so there is public information, I believe, on the CARB website related to the applications themselves and comments that have been received on those applications.

COMMISSIONER MONAHAN: Um-hum. So maybe this is for next year's IEPR really to explore whether the policies that we currently have to improve efficiency, how effective they are and what are lessons learned for other applications, industrial applications.

I have one last question on carbon sequestration. So it's kind of the last in the loading order. Elizabeth, are you assuming that at some point CCS becomes -- or what do you see in terms of the carbon -- the carbon capture efficiency of CCS? Are you assuming it gets better than whatever we're at now? It's like 80 percent, I think.

MS. DUTROW: Well, we didn't get into the technologies of carbon capture. We assumed it would be a relative tool that could be -- or a tool that would be relevant and usable. So we looked at everything else first. In this case that's how we approached it. It doesn't mean it needs to be that way.

COMMISSIONER MONAHAN: Um-hum.

MS. DUTROW: But the idea was that there are other things that don't cost much to start out. Energy efficiency is, you know, just basically cutting an electron or, whatever, a Btu. So the bottom line is, is do all cost-effective things, do these other things that save money pay for your opportunities and then capture what's left with the tools like carbon capture and storage.

COMMISSIONER MONAHAN: Yeah.

MS. DUTROW: Now that doesn't mean it has to happen that way with -- if things get the -- the new programs get the price down.

COMMISSIONER MONAHAN: Great. Thank you.

COMMISSIONER MCALLISTER: Thank you very much, all.

We're going to move on to the Zoom Q&A. So, Heather and crew, I pass that to you for that.

MR. UY: So I will go ahead and read some,

Commissioner.

COMMISSIONER MCALLISTER: Okay, go ahead. Go ahead, Kevin. Thanks.

MR. UY: So I will try my best to direct it at certain panelists and we'll just go in order. And the first one I believe is directed to Elizabeth. And it's from Sean Armstrong asking: What is the remaining CO2 sources from industry after all action -- I think in reference to the fact that in the 2050 goals you had an 86-percent reduction, what is the remaining CO2?

MS. DUTROW: Oh, so I'll answer this briefly, and I'm happy to talk with anyone privately offline later, but we looked across many different sectors. And some of them, you know, in some we may assume a certain percent of efficiency, so much material efficiency pick up, and so forth. But when you look across all of the sectors, we didn't get to zero for every sector, and that's because hydrogen may not be reasonable for some. Carbon capture and storage, because of the small source of an industry may not be reasonable, so there will always be some remaining, and that's with that.

MR. UY: All right. Thank you.

So the next question is for Mark, from Jennifer Haley. And to -- to paraphrase, to shorten it a little bit here, they're asking how -- how can we create a

unified space for the right folks to collaborate on a roadmap to carbon neutrality that is sustainable and appropriately balances competing interests, by anticipating and mitigating the inevitable unintended consequences; looking for a discussion of both who as well as where for this kind of collaboration.

I think you were talking about the scoping plan process earlier, but if there are others you have in mind, please go ahead.

MR. SIPPOLA: I really think the forum, the right forum for that is the scoping plan. It looks like she's, you know, getting at a little bit of the workforce development aspects. I did note the AB 398 report from the Workforce Development Board, which I think is important for informing the process.

I can also point out that I mentioned our Environmental Justice Advisory Committee which is convened to provide input on the scoping plan process. The members were appointed just recently and there was -- the committee was slightly expanded to incorporate a few additional members with labor and workforce development perspectives. So there is sort of some of that baked right into the process right now in a formal way.

The Environmental Justice Advisory Committee is legislatively mandated for the scoping plan process. And,

you know, I think it's up to us to cast a wide net for including labor and workforce in the scoping plan discussions, but I would really direct to the scoping plan discussions and encourage -- encourage folks to recruit and bring them to that conversation.

MR. UY: Great. Thank you, Mark.

And then I think we've got time for one more. Sorry for those folks we didn't get to. And from Walt Tunnessen: The U.S. EPA's ENERGY STAR program has been convening industrial-sector specific energy efficiency cohorts with corporate energy directors for many years. Decarbonization is also a focus for many of these groups as well. These types of forums are very helpful for transferring best practices between organizations. I'd be interested in knowing if similar types of cohorts of industrial energy managers are being convened in California.

Maybe -- maybe, Eddie, if you might respond. I know that you talked about SEM and some other programs in your presentation of what's being done in California.

MR. ROSALES: Yeah. This is -- that's a good question and that's a very good concept for -- the Commissioner had laid out at the beginning. This sector is an area where, you know, there is still a lot of potential and a lot of ideas are still valid. So the

Marine Clean Energy, which is a local energy utility, has actually been sponsoring that for medium industry facilities in their jurisdiction. And everything is a volunteer basis. So some of the folks who have been participating have actually been sharing best practices.

Most organization -- or businesses, I should say, have already adopted SEM strategies, but they're still learning from each other. And really that was the purpose, to be very light-handed, share information, increase sort of ideas, and inspire cohorts in the area without having to have a greater authority present or greater authority towards direction. So that's one example I know, at least in Northern California. I'm not aware if there's one, I haven't heard of one in Southern California. But, anyway, yeah, that's been a very promising practice. And it's on a contract, so most of the work is going to wind up early next year.

COMMISSIONER MCALLISTER: I wanted to -- Kevin, if I might, I will jump in. So there has been within the efficiency portfolios that the investor utilities fund, there have been starting maybe not quite a decade ago but perhaps that long there have been cohorts, industrial cohorts that the utility programs that have convened. And those have -- I think they're really positive things in terms of best sharing, best practices. So there have been

convenings. And I believe SDG&E, I'm not sure about the investor owned utilities, but there have been efforts along these lines for quite a while in California. I don't know that they have scaled, and I think that's one thing we could talk about in this track today.

MR. UY: Thank you, Commissioners.

So I believe we are out of time. I wanted to thank all of the panelists for joining us on Panel 1 today for your great presentations and discussions.

I will now turn it back over to the IEPR team so they can start on Panel 2. Thank you, everyone.

MS. RAITT: Great. Thank you, Kevin.

And again thank you, Mark and Elizabeth, Melissa, Eddie and Virginia, really appreciate those presentations.

So this is Heather. And so next we'll move on to the next panel which is on Programs Focusing on Industrial Decarbonization, and the moderator for the panel is Eleanor Oliver. Eleanor works in the Food Production Investment Program, in the Energy Commission's Energy Efficiency Research Office.

Go ahead, Eleanor.

MS. OLIVER: Thank you. I just wanted to welcome everyone to the second panel. I just wanted to thank the dias and the panelists for being here and

bringing their unique perspective to this topic.

As you can see from the title of this panel, we will be broadly going over what programs are focusing on decarbonizing the industrial sector and their opportunities and results.

A reminder that if you do have any questions, please submit them to the Q&A box.

So first is Bob Gemmer. He is the Technology Manager of the R and D Advanced Manufacturing Office at the U.S. Department of Energy.

So, Bob, if you could please turn on your video.

MR. GEMMER: Okay. Thank you very much. I'd like to thank the Commission and my other colleagues for this opportunity to give a presentation of what's going on in the Department of Energy's Advanced Manufacturing Office.

Just very briefly, the Advanced Manufacturing Office, or AMO as we like to call it fondly, is the DOE program that aims to improve energy efficiency broadly in the manufacturing sector. This has focused historically on what you might call heavy industry, but we have expanded it to include other aspects of manufacture and also concerned with the downstream energy consequences of what is manufacturing. In other words, we pay attention to the fact that cars do better if they're built with

light materials, and we focus on light materials.

I also should give a shout-out, rather, to my colleague from EPA about energy efficiency because energy efficiency is the first and most critical aspect of reducing our carbon footprint.

Almost two years ago Congress in its wisdom directed us to take a roadmapping effort to examine the opportunities in the industrial space for decarbonization. This was despite the prior administration's reluctance to consider these issues. And the report for that workshop, which was held over a year, is in the process of being reviewed right now. Needless to say, holding it over the bridge between two completely different administrations has delayed it somewhat, but what I'll be speaking to are basically the outcomes of that workshop. And then I will have some comments about the things that -- some of the things that we're doing, just a very small snapshot, but honestly of what we're doing in the area. If I could have the next slide, please.

So one of the things that really came out of the workshop is we need to be doing everything we can. It's not just focusing on what element of the overall opportunities that are out there. And, as a consequence, it's kind of promoting an all-of-the-above solution. This ranges from: Working on the various aspects of

decarbonization, and I will get to some of those in a moment, to finding ways to invest in low carbon technologies to change the way industry does its business; to look for low capital investment approaches. Energy efficiency is a great solution. Many times people don't understand how much money they're actually spending on the energy they use. And educating them actually has been a central part of my own career, is really important. And also aligning expansion of renewable energy and other -- other low carbon assets to help industry do its job.

The medium portfolio needs to include new technologies integrating those into process systems and supply chains. And, finally, we have already mentioned the importance of developing a workforce that can support this kind of change in industry. And, again, I want to give kudos to two following speakers in this panel from the Industrial Assessment Centers, because that's a very active program that we have, educating people, students, on how to look for and identify opportunities to save energy. Let's move onto the next slide, please.

Well, this is a really complicated slide but it summarizes the outcome of the workshop. And, first of all, I mentioned the pillars. Those are: Carbon capture, utilization, and storage in the upper left; low carbon fuels; electrification; and energy efficiency. And each

of those corridors, if you will, to 2050 has in it a number of specific activities that were developed over the course of the conversations by the workshop members.

And I will let people look at them as I'm talking, but I think the two important aspects to consider as we're moving forward, and, first of all, we use the term "technology readiness level" to determine where in the development cycle a technology might be, whether it's a high TRL, which means it's closer to use, or is it a low TRL, meaning it's essentially at the very beginning of the process.

And the important point here is that we have activities across the full spectrum of the opportunities that we're looking for in terms of a national solution to decarbonization. This I think emphasizes for me the complexity but also the capability of doing the right thing to solve the problem. Let's go onto the next slide.

Now if I tried to show you all of our activities in the space of decarbonization, it would basically be the entire program currently, but I'm going to highlight a couple. One is near and dear to my heart and that's Combined Heat and Power. I am the principal lead for the Department of Energy's Combined Heat and Power Activity, so I picked two examples from that space.

And one of the challenges we have CHP is it's

largely driven by fossil fuel, natural gas, and so what we're looking for is to change the paradigm from being a fossil fuel-fueled technology to an energy conversion technology. And there is a program we're just starting in collaboration with Caterpillar at the St. Paul, Minneapolis District Energy System. It's a biomass-fueled district energy system. And we're bringing in a combined heat and power system that's intended to support not only that district energy system but also to connect with the local grid to mitigate some of the consequences of variable power provided by renewable resources, like solar or wind.

The other point I'd like to raise is that we are very interested in the intersection between water and energy. And that's -- my time is up, so just at the top emphasizing that deployment. This is where workforce development comes in. And then we maintain a collection of assistant partnerships across the country for a supply of information about CHP. I am sorry I ran a little long.

You're up.

MS. OLIVER: Thank you, Bob, for that.

So just as a reminder, if you do have any questions please put them in the Q&A.

So next up we have Patrick O'Shei, who is the Director of Market Development at the New York State

Energy Research and Development Authority.

And with that, I will give it off to you, Patrick.

MR. O'SHEI: Thank you, Eleanor.

And good morning, Commissioners McAllister and Monahan.

As mentioned earlier by Commissioner McAllister, the true industrial decarbonization solutions are industry specific. And New York's industrial program priorities are driven by two things: Our policy, most notably the Climate Leadership and Community Protection Act, which requires a carbon neutral economy by 2050, with a goal that 85 percent of that will come from carbon emission reduction and 15 percent of that will come from offsets.

And by our industrial profile, so we go to the next slide, on an emission basis, this is our net energy consumption of our industrial sector. And I want to point out a couple of things because they're key -- they're key differences. So upstate New York has a large amount of hydro. And so we have a 90-percent carbon neutrality grid already, 90-plus percent carbon neutrality grid already upstate between our large hydro and nuclear. But the low cost or low-priced hydro attracted certain types of industries to upstate New York.

The other thing is bio energy. Most of that bio

energy is biomass associated with the forest products industry. So you will see that in New York state as well. Could you go to the next slide where we switch to emissions, please.

And then New York state, I just want to -- like top line, California has more of its energy and emissions associated with industrial, the industrial sector, than New York state does. So in terms of this sector, it represents about nine percent of energy consumption and about ten percent of emissions when you're looking at carbon dioxide. If you fully consider methane leakage and refrigerant leakage, it drops down to about five complaint of the greenhouse gas potential in New York state. It's still a very important sector. It provides a lot of good-paying jobs.

And as we have been standing up the CLCPA, one of the advisory panels that my team has been working with on the Working Group is the Energy Intensive and Trade Exposed Industry Panel. And we are really trying not to export emissions and jobs from New York state but, rather, to decarbonize our economy in a way that we decarbonize industry and keep it in New York.

Additionally, the CLCPA requires 40 percent of all benefits to occur in disadvantaged communities, so we're also focused on how we can focus our efforts and

interventions on industrial sites that are adjacent to low-income neighborhoods and reduce the emission impacts.

So I want to just switch to a couple of examples that are industry specific related to the slide. So the largest source of industrial emissions in New York right now is associated with Portland Cement and the manufacture of concrete. We have plentiful deposits of Portland Cement along the Hudson River and it's inexpensive to ship to New York City for construction. The primary effort at this point in time is really focused on formula change. And we recently passed legislation requiring a lower -- a lower carbon formula in New York State purchases of concrete. And then future opportunities in this area involve carbon sequestration, so that you can actually sequester carbon in concrete. Other efforts focus on the design or use of concrete, where we're looking at reducing the amount of concrete used in construction in New York.

And then if we go down to the pulp and paper products sector, the next contributor, the pulp and paper industry, as I mentioned earlier, is a -- they use a high amount of biomass for their energy already, and they're looking for further opportunities. I will say that the actual programmatic efforts that are going on in New York already really are mostly focused still on efficiency and heat recovery, and have not thus far gone into the realm

of some of the process energy changes.

And then the last industry-specific example I want to mention really has to do with aluminum. We have Alcoa, a large aluminum manufacturer based in northern New York, adjacent to the St. Lawrence Power Plant. And we are very interested -- so the electricity going to the plant itself is already carbon neutrality. And most of the carbon emissions are part of the smelting process itself.

There currently is a pilot that is going on in Quebec. It's a joint venture between Alcoa and Rio Pinto, and they're looking at a low carb and smelting process where they hope to be able to have that process available and available for sale to smelting facilities by 2024.

So different solutions and different focus in each of those sectors. Could we go on to the next slide.

So let me talk about the current programs and efforts, and I want to start off by talking about the utilities. In New York state the largest amount of funding that's available for both efficiency and electrification of thermal loads is available through utility programs. And NYSERDA works in the market in collaboration with the utility programs, but it -- because they exist and they have the bulk of the funding for buying down the cost of efficiency and electrification of

thermal load, NYSERDA has a very specific suite of programs getting after other opportunities in additional incremental opportunities.

So we do have emissions-reduction grants. I mentioned the utility grants. We have an effort that's in its -- currently in its third year of funding called The Carbon Challenge. And they're we're focused on demonstrations of -- demonstrations that get after electrification of thermal loads, reduction of thermal loads, reduction of peak temperatures, or other shaping of thermal loads so it would make them easier to electrify in the future. And then also that we have funding for process-based opportunities, so any carbon-emission reduction that comes from process changes, whether it's formula driven or process driven, we would have funding for that in the carbon challenge.

We have currently $15 million of funding, competitive funding in the marketplace -- well, I guess it closed two days ago, so we just closed our third round. We've already provided $30 million in funding for that.

In terms of ongoing funding, in terms of an open-enrollment program that as long as we have funding available and you're eligible, you can come in and access that funding, we have a group of programs under Technical Assistance. Flex Tech is focused on helping you develop

energy studies and look for both energy and beneficial electrification opportunities in your facility.

We have been using the ACEEE model, Strategic Energy Management Program, we launched that in 2017. And we offer that in several different modes. So we do have just open treasure hunts that are focused on looking for low-cost opportunities to reduce energy. We have done cohort groups. Those were impacted -- those are impacted by the Covid, and we have a self-pace one and we have Onsite Energy Manager. But that gives you an idea of the suite of our programs. Thank you.

MS. OLIVER: Thank you. Great presentation.

So next we have Derek Okada. He is the Senior Manager of the Business Public and Finance Energy Efficiency Programs at Southern California Edison.

MR. OKADA: I think this is the last presentation. If you could pull the presentation before this one.

While she is pulling that up, I'd like to thank the Commission for this opportunity to speak about SCE's Strategic Energy Management Program. And I can emphatically say yes, Southern California does have cohort-based programs through our SEM program.

SEM is a jointly-coordinated program -- what you've heard, the slide's coming up -- is a jointly-

coordinated program in the four investor-owned utilities, Pacific Gas & Electric, Southern California Edison, SoCalGas, and San Diego Gas & Electric. Each utility has similar SEM programs using shared program and energy guides with simply contracted third-party implementors.

MS. OLIVER: All right, Derek, one moment.

MR. OKADA: Sure.

Okay, if we can advance to the next slide. I think that's not -- yes, if you go to the next one. That's not my slide. Yes. Sorry. Go back. More. I think you're going toward the end. If you could towards -- right after the title slide. Slide 2. Right. Thank you.

So a little background on SCE. SCE is the nation's largest electric -- one of the nation's largest electric utilities. We serve over five million customers over a 50,000-square-mile service area. And we're focused on the state's carbon reduction goals through our Pathway 2045 Strategic Plan, which focuses on decarbonizing the electric sector by transitioning to 100-percent carbon-free resources by 2045, electrifying the transportation sector by transforming at least 75 percent of light-duty vehicles to electric vehicles, electrifying buildings by achieving conversion of at least 70 percent of space and water heating from natural gas to electricity, and using

low carbon fuels for the hard-to-electrify end uses. Next slide.

So a little background where energy efficiency is headed. Energy -- our programs are being transitioned over to third-party design implemented and led programs per CPUC regulatory decisions. So the IOUs have a goal to outsource a minimum of 60 percent of their respective EE portfolios to third parties by 2023. And the IOUs are actually involved in the solicitations.

SEM is categorized as a traditional third-party program, which was jointly developed by the IOUs in coordination with the CPUC, the CPUC consultants, and their third-party implementors. SEM has evolved from the former Continuous Energy Improvement Program that was initiated in 2017.

Some of the key benefits of SEM is that it offers energy coaching, energy modeling and analysis, incentives, and employee engagement, with a focus on operational improvements to impact the company's bottom line. Next slide, please.

So SEM in California follows a three-cycle approach, with each cycle comprises two years. The first cycle is focused on recruitment and educational awareness through workshops, treasure hunts, and other opportunities to get the participants to adopt SEM principals. Cycle

two focuses on further refinement and focusing more on IDSM. And cycle three is -- we haven't reached that point yet since we started the programs in 2018, so we will be looking at cycle three design guides in the near future.

I have listed some of the subindustries that we cover, including aerospace, beverages, packaging, construction, food processing, metal smelting, and water bottling. And the next slide.

And I'd like to just cover some of the results to date for SCE's SEM program. In the first year we achieved 8.1 million kilowatt hours. In 2020 we added two additional cohorts, but due to Covid-19 and other factors, we achieved a slight flattening, to 8.4 million kilowatt hours. And in 2021, we are hopeful that we will resume back to 17 and a half million kilowatt hours as cohort two and three kind of are at full speed and we add cohort four. Next slide.

So here are some testimonials from some of our customers. Sierra Aluminum is a metal extrusion company that began its SEM journey in 2020 and was initially attracted to the program's Free Energy Consultation and Rebates. And they enrolled their Riverside and Fontana facilities. The company quickly uncovered cost savings during its initial onsite treasure hunt by fixing leaks with this compressed air systems and installing auto

shutoffs of its superfluous air compressor.

And the company realized a five-percent reduction in energy use and saved more than $70,000 in energy savings, while receiving a $10,000 incentive check from SCE after achieving key milestones.

Glanbia produces nutritional products out of its Corona plant. And there is another participant that worked with an energy coach to quickly identify energy savings at the onset of its SEM program. The company saved thousands of dollars as a result of this treasure hunt by identifying 30 to 40 air leaks and using borrowed equipment from SCE's lending library. Overall, the company saved over $10,000 in savings but also engaged their team. Next slide.

So, in closing, SEM's approach to decarbonization begins with the commitment from participants from top management down to the line staff to employ operational and business improvement practices to reduce energy use while achieving operational savings. SEM helps customers increase their productivity, operational efficiency, and thus their profitability, which makes this a win-win for customers, IOUs, and ratepayers.

SEM also focuses on the highest-energy customers, so it helps reduce consumption for energy-

intensive businesses while helping participants and the grid. SEM builds strong partnerships between customers, energy services providers, and cohort participants, while offering training and technical support to participants through energy coaching and energy monitoring and analysis.

And, finally, SEM encourages the adoption of ideas and principles by taking a holistic approach to energy use and management.

That concludes my presentation. And if you have any questions, I have provided my contact information. Thank you.

MS. OLIVER: Thank you for that presentation.

Next we have Ahmad Ganji, who is a Professor of Mechanical Engineering and Director of the Industrial Assessment Center at San Francisco State University.

DR. GANJI: Good morning. I want to thank the Energy Commission for inviting me to this workshop. Next, please.

I want to provide data and information about the Industrial Assessments Center, which is a DOE program. That started before the DOE existed, actually in 1976. We are one of the -- there are two centers in California, 32 centers across the country. The centers in California have been serving the industrial establishments for the

past 30 years. The two centers, one in Northern California, San Francisco State, and the other center is at San Diego State University, we provide two basic functions: Perform energy and water assessment for manufacturing facilities, the manufacturing process at facilities, and also water and wastewater facilities. And during this process, we train energy engineers. Our trainee -- our graduates are working throughout the energy industry in California. Next, please.

We have served approximately 1200 plants, the majority of them are small to medium-sized plants, although we do serve larger plants with permission from DOE. We recommend projects in energy -- in electricity and gas efficiency, renewable energy measures, renewable energy projects, cogeneration projects, and also water-saving measures which has become very, very fruitful for our customers.

Approximately 60 percent of recommended projects are implemented -- that we recommend are implemented. The way we know is that six to nine months after implementation -- after preparation of the audit report that we -- that we sent to the plant, we do surveys to see which project they have already implemented or they plan to implement.

The overall implementation is even more -- more

than this because six to nine months is not sufficient time for making a decision and implementing the project or the plan or projects.

The majority of the plants that we serve are presently in California are food processors, which are, at least for the northern IAC, Northern California IAC, that's San Francisco State, we -- we serve the Central Valley, which is the -- you know, the most productive agricultural production areas in the country. Next, please.

I want to provide just an example -- an example of the many projects that we have done. This is for Crystal Creamery in Modesto, California. This is a large plant with production of approximately 500 million pounds of production, annual energy consumption of over 47 million kilowatt hour per year, average maximum demand of about over 600 kilowatts, over a quarter million MMBtu per year, a million Btus per year. And we identified 16 energy efficiency measures and one water-saving measures. Next, please.

Out of the 16 measures that we recommended or the 16 projects that we recommended, they opted to do eight, eight based on their financial situation and other provisions that they had. They implemented the water-saving measure that we recommended. Originally we had

recommended 11 percent. They implemented eight -- eight percent of their energy savings of their annual energy usage on electrical and all the gas measures that we had recommended.

The original energy savings was approximately over $600,000, and they opted to implement and achieve approximately $350,000, which had to pay immediate to 2.7 years of payback. So these projects are effective and the manufacturers, if they are helped with the process, they do implement projects. Next, please.

From our experience, there are major opportunities for energy savings in the industrial -- in the industrial sectors. And there are opportunities for renewable -- for renewables, mostly PV plants are implemented, implementing PV measures that we have recommended, and less of solar thermal measures.

There are a great deal of opportunities for heat recovery and electrification, especially in replacing gas flow, hot water equipment. But there are major challenges that exist for conversion of high temperature, large gas-consuming equipment in -- such as large boilers and ovens -- in the food processing sector.

Thank you. I will be available for any questions.

MS. OLIVER: Thank you for that presentation.

So last on our panel is going to be Asfaw Beyene. He is the Professor of Mechanical Engineering and Director of the Industrial Assessment Center at San Diego State University.

DR. BEYENE: Thank you, Eleanor, and thank you to the Commission and everybody. Quite an honor. And also thank you to my colleague, who, Professor Ganji, who talked about the IAC, which we have been leading for about 30 years.

If we go, we may go to the next, yes. This is a picture I wanted to show, industry in California, especially imports energy in two forms, the top stream, the power side, and the lower stream will be the thermal side. On the left side, I put only combustion, although I could have put up other sources, such as hydro or nuclear, but those are not important for the topic.

On the right side, also instead of industry I could have added transportation, residential, etc., but the topic restricted as to industrial decarbonization.

And the top side, which is the power side, goes through a power conversion and produces electricity that is delivered to industry, whereas the lower stream goes directly as natural gas to produce thermal energy. And both offer great opportunities. On the top side, there are two opportunities on the power side. The main one

being efficiency and some of that were mentioned, some of the efficiency opportunities were mentioned by several of my colleagues, and I mention in industry it is very complicated. It is a jungle. There is no one solution that fits all, we go out and start hunting, literally, for opportunities.

In the IAC, of lighting, efficient motors, resizing fans or blowers, insulation, and many, many opportunities. And on the power side, we have also several efficiency, which will reduce the need for combustion, we can also talk a little bit in that opportunity usually comes in the form of renewables, which comes with another problem of intermittency. That means a need for energy storage.

In other words, in my humble opinion, energy storage needs to be seen as part of the decarbonization effort. Not necessarily at the residential level, where the incentives are given and encouraged these days, but I think to make a big difference, energy storage at the utility at scale should be planned.

On the lower thermal side the main opportunity is if recovery comes a CHP or simply economizers. In the middle you see an arrow going from south to north, a small arrow. That is combined heat and power, which also can be considered part of waste heat recovery.

The efficiency, if I were to pick one great idea, emerging idea from the efficiency side, I would pick variable frequency drives. We had these 15, 20 years ago, they were very expensive. They were also troublesome, propagating some harm into the system. Those problems have been resolved. The prices have come really down. And the cross-cutting, meaning whether you're talking about compressors pumps, fans, injection machines, molding lines, cooling towers even, often operate in variable load. The problem being industrial sized equipment for one-point load, where there is a GAZ designed to operate in some degree, but we operate them to bring the temperature from 75 to 70. So the mismatch between these loads is quite abundant and widespread in industry. This is not a statistics. It's based on my studies of experience. So, in conclusion, I see it all the time.

So, for example, a 100-horsepower dust collector may need all the power at 10:00 a.m. because all the PT extensions need to operate, but in the afternoon it needs less because six or seven of the machines have been closed. And the BFD is ideal to match a load to the needs.

On the heat recovery side, where the Commission and DOE are doing an excellent job with CHP, but there are still great opportunities, especially in the low-grade

heat-recovery area.

I know I spoke a lot about this PowerPoint, but it really is the crux of what I wanted to talk about. If we may now go to the next one. Thank you.

And this metric is efficient. Number one, it's only for our center. Number two, even for our center, it is incomplete, and it covers only Southern California. But the point, the idea is in the point, or the point is in the idea, $1.77 saving for every dollar investment based on our center's initial calculation is a good investment. That's why energy savings still is a great idea for decarbonization to be employed. Continue, please.

This shows implementation for our center, from a minimum of 300, where just simply installing a thermostat is acquired over three million, where probably we recommended -- not probably -- for sure, a complex system. If we continue, please.

The total -- the average implementation rent over the 30 years, but that isn't complete but I don't think it would change it by much, is 1.5 years. Industry doesn't like more than two years of payback period, so we focus on ideas that have less than two years payback. But sometimes ideas are so great, we go out to five years.

We did this, for example, for BFD, knowing that the price will drop because while dropping every year, we still recommend it. And the timing was recommended. Some plants went back and implemented. Next, please.

This shows that including some audits within -- outside of the IAC program, the amount of saving, trivial maybe, is more a little bit more proportional to the total net energy cost. That's why we at the IAC like large plants where the utility bill is one million because we can go and save a hundred thousand, and we comprise about the large sum of savings. But quantitatively, there are more plants -- okay, next, please. Can you go to the conclusion? Conclusion. Yes.

In conclusion, and this is what the three last PowerPoints were just identifying, we want to re-emphasize variable frequency drives. The drives combustion reduction or elimination in the form of efficiency with the recovery and renewable, which will eliminate combustion from that, including carbon.

And with this, the last one, please. Thank you.

MS. OLIVER: Thank you for that presentation.

A lot of great information was given by our panelists. So now I believe we will move on to the comments and questions from the dias.

The public is still encouraged to submit

questions to the Q&A. So if I could have all the panelists turn back on their cameras, please. And then we will hand it off to Commissioner McAllister.

COMMISSIONER MCALLISTER: Eleanor, thank you so much. A nice job moderating.

And thank you, all five of you. This has been a great panel so far. I do have a number of questions. But, you know, first I just want to thank Bob and Patrick, Derek, Ahmad, and Asfaw. Just a really great breadth of experience on the panel, so thank you very much for being with us today.

I have a whole bunch of questions. I'm going to try to not ask them all and leave time for others. But I guess, let's see, I want to talk about sort of how, sort of pragmatically speaking upgrades happen in industries. And I think Professor Beyene -- well, both professors really, you know, have a particular audience of sort of maybe not the largest industries in the state but sort of medium and somewhat smaller industries. You know, Patrick, you talked about some of the large sectors that you're targeting, which is amazing. Lots of potential collaboration there.

But right at the end here, Professor Beyene, you mentioned just the need for quick paybacks, quick returns in the industrial sector, and I guess I want to explore

models, and certainly with this panel and probably this afternoon as well, how do we stretch that out? What's the opportunity to do sort of more muscular measures, presumably more capital-intensive measures to save more energy, to get deeper decarbonization by bringing sort of capital to the table with a longer timeframe of payback than one and a half years. You know, how do we do that in the industrial sector and kind of get around this natural -- you know, this natural tendency to really focus on the quick payback stuff? How do we get important shifts in industrial processes and get those investments to actually happen?

DR. BEYENE: That's a great question. Am I allowed to proceed?

COMMISSIONER MCALLISTER: Yes, please, go ahead.

DR. BEYENE: Apologies. I just jumped in. It's a great question. I think the implementations, those recommendations that we recommend and are implemented give us a hint. The most commonly-implemented ones are those that on which the Commission has incentives, especially in California. So the number one thing that we can -- we can do is to offer incentives.

I took a risk and I mentioned one, for example, of the three. I really think it's a great place where we can in a short period of time accomplish a great deal.

And it can be -- just like PV, cover of incentives for frequency drives, but I'm not saying that's the only one. I took a risk of using one because I see a mismatch with load and need all the time. So my short answer is: Incentives and training in industry. They know the bottom line, whether it's two years, three years, they still save money. We have to commit them, train them. And those are the two ideas probably that I control. Incentives still being the main situation.

COMMISSIONER MCALLISTER: Thank you.

Anybody else have an idea there?

MR. O'SHEI: Maybe I'll just give one. In the carbon challenge we although the submitters to bundle mixes of efficiency and energy reduction projects. And we allow them to bid in a price at which they would move forward with their project. And then we select, essentially, the projects where we are getting the most benefit for the dollars that we're investing. So we do help them work towards their investment hurdle in that design.

COMMISSIONER MCALLISTER: Are you aware -- let me just follow up, Patrick. Are you aware of any sort of public-private partnerships where, you know, the bulk of the capital for a deep retrofit like that or a process shift might be coming from the private sector with some

state support or, you know, how can we sort of get relatively low-cost longterm capital into these projects -- I guess is kind of where I'm getting at.

MR. O'SHEI: I mean we do have the green bank. The green bank has participated greatly in the -- in the generation and storage sectors. But so far I would say that our industrial customers have been reluctant to participate in that offer, but we -- you know, we are looking at trying to provide that type of financing.

COMMISSIONER MCALLISTER: Interesting. Thank you.

Anybody else, quickly, on that?

MR. OKADA: I can speak to this a little bit. So we offer on-bill financing for SEM participants.

COMMISSIONER MCALLISTER: Yeah.

MR. OKADA: Unfortunately we haven't had a lot of uptake on it.

We also designed a pilot similar to what Patrick shared about NYSERDA, which was a market-based incentive pilot, and we launched it last year to our participants. So I think some of the key is still the information and awareness. Because, at least speaking from SEM, which is looking at behavioral recognition and operational efficiency, there's a lot of low-cost, no-cost opportunities, and that seems to be the bulk of where

we're finding the savings in the industrial sector.

COMMISSIONER MCALLISTER: Thanks, Derek. That's super helpful. And congrats on the cohort stuff. I had sort of underplayed that at the beginning there. I didn't realize it had gone so well and for so long.

So, let's see, I'm tempted to talk about workforce, but I think I'm going to shelve that for now. I just want to acknowledge the Industrial Assessment Centers and what just a beautiful resource they are and how -- how responsible they have been for really the scale-up in the knowledge base of our engineering community in the state. And it's just really a tremendous resource that the Department of Energy has been funding for a long time, so it's really great. I've actually in the previous lives I've hired alums of the Industrial Assessment Centers and they're just quality, so congratulations on that.

Let's see. I want to just -- the last question I'll ask for now is on heat recovery, so several of you mentioned that. Could you talk more about the potential there? And CHP obviously is one form of that. It's pretty common. But do you see sort of, you know, the flip of that would be like a bottoming cycle, like for generation with -- with the waste heat or any other kind of balancing of thermal and electric along those lines?

MR. GEMMER: Let me -- let me step in here for a bit. Waste heat recovery is one of the biggest opportunities that we see from the Department of Energy's perspective and, in particular, the more challenging lower temperature waste heat recovery issues, I think are something we have been looking for solutions, and I have been with DOE now for a little over 20 years, and that's 20 years of searching. It's very challenging because we're faced with the physics of trying to do it. You know the physics is pretty uncompromising. Having said that, it's a subject that we're continually looking for.

And the idea of using waste heat recovery as a bottoming cycle is also very attractive.

And there is another point I'd like to raise in that we frequently get caught up with what you have to realize are sort of simplified models of energy cycles. And most common of those is the Carnot cycle. And that works fine for a closed-cycle heat engine, but it turns out it's not a very good cycle for what you would call a chemical engine, meaning something that uses up fuel, whether it's fossil based or bottom based.

I currently have a number of projects following on some work that was done by ARPA-E a couple of years ago to look for ways of making electricity in excess of 60-percent efficiency. And actually that's a pretty easy

target. Thermodynamically it's much more complicated where you try to do it at back. But that's the sort of thing that we need to think about out of the box.

I mean many -- I had a -- when I first posed the idea of making electricity in excess of 60 percent efficiency, I was told flat out you can't do it. You know, it violates Carnot. And, I'm sorry, the Carnot cycle is not relevant, so we should look at it with different thoughts. Maybe part of the reason is that I'm not an engineer. Actually I'm a scientist, and we are open to new ideas.

Any other thoughts?

COMMISSIONER MCALLISTER: Anybody else?

DR. GANJI: Heat recovery from air compressors and also refrigeration compressors in industrial facilities can be very fruitful. And we have started, actually recommending them more, although it is not a quick payback type of -- they are not quick payback time shares.

COMMISSIONER MCALLISTER: Thanks for that. That's actually -- I'll just point that out to the EPIC team, who is listening here, as maybe a subject, that kind of waste heat recovery from compressors and refrigeration, might be a place to -- might be something we can build into the investment plan. Great.

So, Commissioner Monahan, I just see that you have to bow out here soon, would you like to ask any questions? That was a fascinating panel. I could go on for a long time, but I'll restrain myself.

COMMISSIONER MONAHAN: So I do have a question. You know from the earlier presentation this morning, from the Air Resources Board, we saw that this combination of refineries and hydrogen production and oil and gas production were almost half of the GHG emission profile from industrial. And I think that's probably what makes California unique from New York in some way, is that we have so much emissions from just this ecosystem of fossil fuel extraction and processing.

And I didn't hear any of the panel speak to opportunities in those arenas. Has anyone done research or investments on the refinery or oil extraction, and gas -- I don't know how much gas extraction -- we have in the state, has anyone done that kind of analysis?

MR. OKADA: Well, I can't speak to the analysis, but we did have a former oil and production, a third-party program, but we have since closed those down in advance of our third-party solicitation for the commercial industrial space. So the implementor would have to target that sector.

COMMISSIONER MONAHAN: Um-hum. I mean maybe

this also a place for investments. I'm not sure. But the fact that there are so many emissions reductions from it -- I mean emissions, emissions from it, you know, highlights to me that we -- this is something we should be targeting.

I think this may be a question more on the utility side but, you know, benchmarking is also something that come up this morning, like how do we get data on benchmarking. What's your -- I mean it seems like at least SCE had a great experience, right, with customers really wanting to engage. What's your thoughts on the possibility for California doing a better job benchmarking different facilities and their energy use and energy-savings opportunities?

MR. OKADA: It's a challenge because, one, is I mentioned about the delivery channels changing, but I think also that each site is usually different, so this fits into the custom category. So the benchmarking may provide some awareness, but, you know, each refinery or each industrial site may be a slightly different operation.

I'll just say that's one of the strengths of the SEM model because we pair noncompetitors in the same cohort so they feel more openly to speak to opportunities and share, but -- yeah, so I think that's one of the

barriers that we have.

COMMISSIONER MCALLISTER: I'd also point out, Commissioner, if you can join us in the afternoon probably -- there are some representatives from the oil and gas sector and just more broadly that might be able to speak to this, I'm not sure but likely.

COMMISSIONER MONAHAN: Great. Well, thanks to all the panelists. This has been really fascinating. I have a hard staff at 12:15, so I'm going to be dropping off in a sec.

COMMISSIONER MCALLISTER: Thank you very much for being here.

Let's see, Heather, do we have -- or, let's see, who do we have moderating -- oh, Eleanor, you're continuing on to moderate the Zoom Q&A. Do we have questions on Zoom, just a couple?

MS. OLIVER: Yes, we have three.

COMMISSIONER MCALLISTER: Great. Great, go ahead.

MS. OLIVER: Thank you. So this one is directed at Dr. Ganji: Can you provide examples of the type of efficiency improvements implemented as a result of your recommendations? That is from the Bay Area Community Land Trust. You might be muted. Technology, I know.

DR. GANJI: Compressed air measures for the

compressors and as well as the leaks are the one. And the most common measures are lighting, especially for industrial facilities, that they work more than one shift, so they are commonly implemented.

Recently, PV, photovoltaics are being more implemented. in terms of for boilers, energy efficient boilers. VFDs are expensive to implement.

MS. OLIVER: Thank you for that.

Next I think is towards the whole panel from Robert Mullin: Dripping could be from skepticism about the energy and the economics efficiency of using renewable energy to produce green hydrogen as opposed to just storing that energy to achieve increased electrification. Do any of the panelists think use of green hydrogen might actually be necessary to decarbonize certain industries? Would that necessity potentially create the economic case for using renewables to produce hydrogen?

MR. O'SHEI: So I could just take New York's position. So we just launched our hydrogen effort last week. So I will say this: It appears that the European Union and Japan are going all in on a hydrogen economy as part of their strategy. If you believe the forecast, they believe that they can eventually get to green hydrogen at a cost of about five -- $4 per MMBtu. If you look at the spot market of natural gas right now, it's up near 3.75.

Now a year ago it was down near $2. So we don't know the quantity that makes sense yet, but we do believe that the technology will be there to put hydrogen in specific locations where a high thermal load is required and the electrification of that load would be prohibitively expensive because of what you'd have to build out on both the grid and the storage side.

One thing I would comment about is you can ship hydrogen through natural gas distribution pipelines, but you essentially can ship hydrogen through electric lines by shipping excess renewable energy that you're not using on the grid into -- into a facility that is essential creating hydrogen on site. So we think it's going to be a niche solution for some high-thermal temperature, high-thermal load industries.

MR. GEMMER: Let me add that one of my sister organization, the Fuel Cell and Hydrogen Program, is actively pursuing new technologies to drive down the cost and production capability of hydrogen based on renewable fuels, electricity. I'm not familiar with all the details on that, but I'd like to encourage anybody who is interested in it to check with the Hydrogen and Fuel Cell website on DOE's webpages.

COMMISSIONER MCALLISTER: I will just chime in there too. We actually in this IEPR, just for the

questioner's benefit here, we have had quite a bit of discussion about hydrogen in the cyber cycle and really actually beyond, and so it's very active conversation here in California. And many, many of the same themes that Patrick and Bob just brought up.

And in fact, Zenita (phonetic), Bob, your colleague Zenita was -- has been very present in those conversations, so checking the right dots.

MR. GEMMER: I'm sure. And I am connected peripherally. I get engaged in those discussions. So if they have any difficulties in contacting the Hydrogen, Fuel Cell folks, they can always come through me.

COMMISSIONER MCALLISTER: Great. Thank you.

All right. Back to you, Eleanor.

MS. OLIVER: Thank you for that.

So from Jennifer Haley: Can you speak to the challenge in funding oil and gas emission reduction because he prohibition against providing funding to obligated parties? For example, refineries are often ineligible for CEC biofuel grants because of their obligations under LCFS.

COMMISSIONER MCALLISTER: So I'm not sure this is the panel for that as much perhaps -- perhaps, Derek, you might have some insight on that. I'm not sure. LCFS being the Low Carbon Fuel Standard. That sounds like an

accounting, sort of a policy/accounting issue that probably needs some work. Thanks for the question.

MR. OKADA: Yeah. I really can't speak to it because our efficiency programs are really focused on kilowatt and hour and kilowatt. But you know with the change in EE policy that's going to look at total system benefit, we hope that there will be more of a focus on GHG. So right now I think, you know, the -- to the extent that it could be part of our goals, if it's seen as part of potential goals, then that might be an opportunity to go after. But I will say that one of the recognitions I think the CPUC found is that utilities are driven to resource acquisition because of the short-term nature to meet goals with limited cost-effectiveness. So we're in this conundrum of how do we get to our goals short term and still support the long term. So that's why I think market support and market transformation have been carved out.

COMMISSIONER MCALLISTER: Oh, I agree with you. Thanks for that. And that's also partly a conversation that needs to involve the Air Resources Board and LCFS. And, you know, I think there's an effort to not "double count" in the construction of all these programs across covered sectors of the economy in terms of the Cap and Trade Program. So I think that's one of the sticking

points at least there which probably needs some policy discussion.

Eleanor, any other questions?

MS. OLIVER: Not at this time, but we can go ahead and turn it back over to Heather.

COMMISSIONER MCALLISTER: Great.

MS. RAITT: Great. Thank you, Eleanor.

And thank you, Patrick and Bob and Derek and Ahmad and Asfaw, for your presentations.

COMMISSIONER MCALLISTER: Thank you.

MS. RAITT: So we'll move to public comment. And Dorothy Murimi from the Public Advisor's Office is here to moderate that.

Go ahead, Dorothy.

MS. MURIMI: Thank you, Heather.

So some instructions for everyone. One person per organization may comment. And comments are limited to three minutes per speaker. However, we may reduce the time to accommodate everyone. If you are using the Zoom platform, use the raised hand feature to let us know if you'd like to make a comment. We will call on you and open your line to make those comments. And if you're on the phone, dial star 9 to raise your hand and star 6 to unmute on your end, and we'll unmute on our end.

Just a note. If you are -- if we are not able

to accommodate everyone for this morning or this session, you can still make comments at the next session.

So I will move onto participants raising their hands. I see Michael. I don't see a last name.

But, Michael, you are unmuted. Please state your name, your affiliation, and give you comments.

MR. YEE: Good afternoon. My name is Michael Yee. That is spelled M-i-c-h-a-e-l Y-e-e. I am with SoCalGas. Do you need to write that -- and I will start my comments then.

First off I'd like to just say thank you to all the speakers today for giving us some really great information. We really appreciated that. And I also just want to thank the Commission for, again, this opportunity to just be able to provide a comment.

SoCalGas, we have had a long and successful history of partnering with our industrial customers to identify comprehensive solutions and provide technical and financial support to meet their energy efficiency goals. Over the past years, our industrial customers have saved 14.3 million therms. However, as has been noted, many industrial-related emissions can be challenging to eliminate. Some choices to mitigate those emissions exist, such as carbon capture and utilization; carbon dioxide can be efficiently captured, stored, and used as

end use for diverse applications. Also instead of carbon-intensive fuels used for industrial processing, both renewable hydrogen and sustainable biomass can be potential feedstocks for several industrial processes, including chemicals and food processing.

The 2018 report by the EU Commission points out that steel, cement, and chemical processing dominate most of the industrial emissions of the EU and state that in the next 10 to 15 years technologies that are already known will need to demonstrate that they can work at scale, and some of them are already being tested at small scale.

Thank you for allowing me to give these comments.

MS. MURIMI: Thank you, Michael.

Let's do another call for hands. Again, if you're on Zoom, use the raised hand feature, looks like a high five, it's at the bottom of your screen or device. And if you're on the phone, you can raise your hand by dialing star 9. Again, dial star 9 to raise your hand.

Going to give that one moment.

Seeing no more hands, I will hand the virtual mic back to you, Commissioner McAllister -- or Heather.

COMMISSIONER MCALLISTER: Sorry. Oh, here we go. My video was stopped. There we go.

Great. Thank you very much, Dorothy. Appreciate that.

I want to again just thank all of our presenters from both panels for this morning session. Really fascinating. I get the feeling there is a lot of creativity in the room on this. We're getting more and more data, which I think helps identify the opportunities and also assess how we're doing as well, along the way. And so a lot of tools in our toolbox and we're hearing about even more today, and I think these conversations are great to begin to flesh out where we want to direct policy, since I said this morning at the outset we have a really great opportunity that's approaching quickly.

With that, I think we're done for the morning. And here we go, there's the slide there for anybody who's only here for the morning and not the afternoon. And you do want to submit comments, which we very much encourage, they are due by August 17th, 2021, which is here in a couple weeks. And we look forward to getting your comments. We do read every comment and actually they do turn up in the IEPR document when they provide some substance that we want to build on which they invariably do. So please, please do submit comments. And with that I think we're done for this morning and we'll reconvene at 2:00 p.m. and we have a couple of really great panels to

get into really the nuts and bolts of industrial -- the industrial sector in California. We have a diverse set of panelists representing all of the major industries in the state as well as the associations and the Air Quality Management Districts, and so I look forward to that very much. All right. And pass it back to you, Heather, for wrapping up, and then we'll see everyone again at 2:00.

MS. RAITT: You covered it all. Thank you, Commissioner.

COMMISSIONER MCALLISTER: Okay, great.

MS. RAITT: Thank you, everybody.

COMMISSIONER MCALLISTER: Thanks, everyone.

(Whereupon, the Workshop was adjourned at 12:27 o'clock p.m.)

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I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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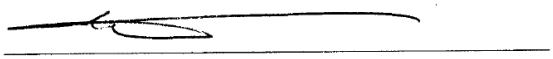

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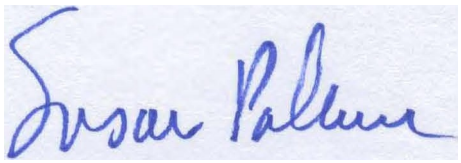

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