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CALIFORNIA ENERGY COMMISSION

JOINT AGENCY WORKSHOP

In the Matter of:	)	Docket No. 16-IEPR-02
	)	
	)	JOINT AGENCY WORKSHOP
	)	
2016 Integrated Energy Policy	)	RE: Methane Emissions
Report Update (2016 IEPR Update)	)	from California's
________________________________	)	Natural Gas System

JOINT AGENCY SYMPOSIUM/IEPR WORKSHOP ON

METHANE EMISSIONS FROM CALIFORNIA'S

NATURAL GAS SYSTEM: CHALLENGES AND SOLUTIONS

CAL/EPA HEADQUARTERS BUILDING

1 001 I STREET

BYRON SHER/SIERRA HEARING ROOM

SACRAMENTO, CALIFORNIA

TUESDAY, JUNE 7, 2016

9:00 A.M.

Reported By:
Kent Odell

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Joint Agency Participants

Carolyn Lozo, California Air Resources Board
Kathleen Kozawa, California Air Resources Board
Elizabeth Scheehle, California Air Resources Board
Luis Leyva, California Air Resources Board
Laurie ten Hope, California Energy Commission
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Panel Presenters (* Via telephone and/or WebEx)

Session 4

Martin Kurtovich, California Public Utilities Commission (Panel Moderator)
Tim O'Connor, Environmental Defense Fund
Robert Smith, U. S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA)
Cynthia Powell, National Energy Technology Laboratories
Keith Driver, Cap-Op Energy
San Gunawardana, Enview, Inc.

Session 5

Regulatory Panel:
Floyd Vergara, California Air Resources Board (Panel Moderator)
Elizabeth Scheehle, California Air Resources Board
Arthur O'Donnell, California Public Utilities Commission
Trina Martynowicz, USEPA Region 9
Brady Van Engelen, Division of Oil, Gas and Geothermal Resources, (DOGGR) Department of Conservation
Laurie ten Hope, California Energy Commission

Stakeholders Panel:
Arthur O'Donnell, California Public Utilities Commission (Panel Moderator)
Deanna Haines, Sempra Utilities
Briana Mordick, NRDC
Christine Cowsert, PE, PG&E
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I N D E X

I N D E X (Cont.)

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P R O C E E D I N G S

9:02 A.M.

SACRAMENTO, CALIFORNIA, TUESDAY, JUNE 7, 2016

MS. LOZO: Good morning, everyone. Welcome to Day 2 of our Symposium, Methane Emissions from California's Natural Gas System: Challenges and Solutions. I think yesterday we heard a lot of very informative discussion. I hope you think so too. And we're all looking forward to having you all engage in the discussion further today.

Okay, just a few reminders before we get started. This is a jointly-hosted symposium by the Air Resources Board, the California Energy Commission and the Public Utilities Commission.

It is also serving as one of CEC's IEPR workshops, so as a result of that we are recording today. And please note if you would like to submit some public comment for the CEC's IEPR workshop process there's going to be a period of time at the end of the day for those public comments. And if you would like to do that there's some blue cards at the back of the room, if you could please fill out a blue card sometime today.

The restrooms again are out the back of the auditorium to the left down the hallway. There's also a water fountain out that direction. We have some water and coffee available for you in the alcove to the right outside the auditorium. The cafe downstairs is also open till 3:30 today.

Also if the fire alarm sounds please go down the stairs out the front entrance, the main entrance, and then across the street to Cesar Chavez Park.

We will be posting all of the slides from both days of the symposium later on this week, so look on our website and look forward to those later this week.

Also this afternoon we'll be having a couple of policy panel discussions. If you would like to submit a question for one of those policy panels please write it down; either write it down on the white sheets that are at the back of the room at the table and submit it or go ahead and ask your question during the policy panel.

Oh, also we have a court reporter today. If you would like to make a comment or ask a question anytime today it's helpful to him if you can drop your business card by, so he knows who you are. It makes his job a little easier.

All right, I think we're ready to get started with Session 4. Big Gas, Big Data, and Methane: Building a Monitoring, Verification and Performance Management System to Meet Our Climate Change Goals. And I'd like to introduce Marty Kurtovich from the CPUC.

MR. KURTOVICH: Thank you.

Good morning, my name's Marty Kurtovich with the California Public Utilities Commission, we've been looking forward to this session for a long time. If you were here yesterday our Executive Director Tim Sullivan spoke about a current proceeding we're doing, SB 1371, in developing a methane-leak detection program to monitor and control methane emissions from midstream and downstream of the natural gas infrastructure in California.

And that's somewhat of a challenge for us, because we previously had a leak detection and repair program that was solely focused on occupational and public safety rather than on climate change or monitoring direct emissions. And the other challenge has been that that program is decades old and was created prior to the Internet and the digital tools that we just spoke extensively about yesterday.

So part of the challenge with that proceeding, and the working group that is involved in that, has been in how to best utilize today's technologies and science to create a regulatory framework that will meet the goals of that law.

So we're going to get started this morning with Tim O'Connor from Environmental Defense Fund. Tim is a Senior Attorney and Director at EDF in California. Since joining EDF in 2007, he has been engaged in state regulatory agencies in the Legislature on passage and implementation of climate and clean energy initiatives, with particular focus on natural gas and oil issues, market base emission reduction programs, transportation fuels and vehicles, clean energy and conservation.

During this time Tim has also managed EDF's participation in both state and federal courts on issues related to climate change, fuels and energy. And he further manages and participates in EDF's work before the CPUC and the CEC on issues related to natural gas utility rate setting, electric vehicles, and a whole host of other issues. So please welcome Tim O'Connor.

MR. O'CONNOR: Thanks Marty and good morning.

If there's one theme of the discussion that I'd like for folks to take away from the next 20 or so minutes it's the theme of risk, the theme of reducing risk associated with a whole host of factors whether it's climate risk or safety risk, investment risk, financial risk, legal risk, risk reduction, risk management. And what data can do for that process is really quite an important exercise to engage in.

And when we look at methane and what its impact on our climate and planetary system is we see that the science, of course, is becoming quite clear that methane is responsible for nearly 25 percent of the warming that we're seeing right now with emissions estimated at $30 billion in natural gas loss every year.

A report that we did with the Rhodium Group tries to quantify those global emissions and puts the total amount at about the gas production for the country of Norway, which is lost into the atmosphere every single year.

And Ramon Alvarez spoke a little bit yesterday about what this actually means to California when we think about the fact that we use so much natural gas. And this was sort of the first time some of these numbers have been presented in public.

This is a slide that Ramon gave yesterday, I thought it was worth repeating, is that when you look at all of the gas that California imports at a roughly 2.4 percent leakage rate on a 20-year time horizon that equals about 60 million metric tons of carbon dioxide-equivalent pollution. Or really, a shadow of a carbon footprint that California hasn't really paid attention to associated with the emissions equal to about 18 coal fire power plants.

And so what does all this methane data mean? The fact that we know how much is coming out globally, the fact that we know that it's contributing to climate change, the fact that we know that California has got a big footprint, well it has implications for a number of entities.

And the focus of risk is really where I like to put it. And this risk isn't just something that we're trying to minimize as we implement SB 705 here in California to reduce the chance of pipeline accidents from causing fatalities and safety issues. It's not necessarily just the risk that we try to confront when we helped to write and then pass SB 1371 on the climate side. And it's not just the type of risk that we would try to characterize when we helped to pass AB 1257 several years ago, looking at the life-cycle carbon footprint. This is risk sort of across the board: financial, reputational, regulatory, environmental, leakage risk.

And there's really no better way to look at this risk probably than looking at the repetitive set of comments, letters, filings from institutional investors across the planet. Starting back in June of 2012 we saw roughly $20 trillion worth of assets being represented to talk about the importance of reducing methane pollution.

And as we see this drumbeat continue we see global investors, U.S. based investors -- this October 2014 report or letter was written and spearheaded by the head of CalPERS and CalSTRS -- and as we see this drumbeat continue we see support for U.S. action, we see support for Canadian action and global action.

And some of the important statements coming back from earlier this year show that these pledges, these 40 to 45 percent reduction pledges, are not just because it's good for the planet, because it's about minimizing risk, minimizing methane emissions in a transparent manner, and providing investors and the public with better methane reporting. So it's like not just the "why it's important," but what to do with it.

And I think that some of the reasons of course, the reputational side of it, the asset loss side, we also see that there's a climate risk that's driving a lot of this with of course Co2 emissions ever-increasing, with global temperatures increasing, with actually this year in February, in March, in April, in May all beating climate records and surpassing the records for the highest jump from month over month.

And we see risks associated with world heritage sites. We see the Galapagos Islands being threatened in terms of changing food patterns and weather patterns. We see things such as the western forests and wildfire increases. And there's just no limit to the amount of risk that a climate change causes.

And in California actually, this is not just as a problem with our forests being threatened from pine bark beetles or we don't see this just as a problem with drought, we see actually that there's a potential legal issue here for Californians to not address some of these issues. California to not pay to attention to what happens in Texas actually opens the state up to a legal risk. Indeed, AB 32 itself says there is a legal requirement to minimize leakage. And leakage in the definition is an emission outside of the state, which has the potential to undermine activities in California.

And of course, over many years we have become very dependent on natural gas for our power system. We're using it as the new fuel source to reduce life-cycle emissions from the whole fueling system. And as we benefit from that use we see leakage of methane, that 60-million metric tons worth of methane or the Co2 equivalent, undermining the benefit that California has. And indeed we think this opens California up to a legal risk for not addressing imported natural gas and the upstream emissions associated with it.

So what happens in Texas as they say doesn't always just stay in Texas. It has a real impact here.

And as we look at where the risk lies we see that new data and new tools for accumulating data help us to sort of unpack what that risk is and address it. Starting with everybody's favorite topic when you go to a methane symposium, Aliso Canyon, showed how new data and new data collection analysis actually can help with event characterization and help in community and environmental protection.

We saw a massive sampling of the air in this local community during the release, making Porter Ranch probably the most monitored spot on the planet during those 112 days earlier this year.

We've seen the testing of new technology and new models after the release and new tools to embed that within the state's inventory.

And indeed we even see the data coming out of this actually moving regulatory efforts, moving regulatory filings in fact, because the Public Utilities Commission shortly after the close of the leak requested quantification of major pollution events within the SB 1371 implementation framework. And indeed there were some filings there. And here's some quotes from on the filings, it said, "There are no tools to actually quantify accurately the amount of emissions coming out of a major pollution event, such as this nature."

And then just three months later we see sort of a recanting of that statement by not only, of course, the company that was responsible for the leak but within an independently verified framework that looked at the prior estimates that were conducted by the state and that were published in peer review literature, such that I do think that there is a way that we can see these new data tools for risk management starting to come out for the purposes of quantifying and understanding the impact on the climate of an event of this nature.

And of course we have increasing utilization of data from mobile monitoring equipment, which is out there not just to find a leak and to try to direct a utility to go zero down and locate an exact point, but really for risk management and for higher-level data analytics that can be embedded within to distribution integrity management plans.

Such as what's being done by Center Point in Texas, is they use Picarro-based platforms to acquire more data, run it through spatial analytics platforms. And to look at where leak-prone pipes overlay with sensitive receptors, overlay with age of pipes, and the actual leakiness of those pipes to prioritize investment where they can get the best bang for their buck. And to actually start using methods that PG&E has also been using in terms of grouping repairs by geographic and not just by individual leak.

And we see of course also we can move from new data at the utility level, but also at major point sources. And as we've been able to have more and more data come in showing now the randomness of high leak events in oil and gas production sites, we see this now supporting the regulatory tool of frequent monitoring, a requirement for frequent monitoring.

And I think that even this year alone over the course of the next two months we're going to see this new type of data starting to feed into a regulatory process right here in California. And in fact what we see is a draft rulemaking that was released just last week, where the Air Resources Board, while they include a quarterly monitoring requirement for oil and gas production sites, within that requirement they also allow what's known as a step-down provision. And that provision allows for operators if they don't find a leak for a certain of number of quarters to move to an annual inspection requirement.

And now as we see, this new data and the new peer review literature, say the only way you can really manage these fat-tail leaks, these super-emitters, is by regular quarterly inspections. We think this new data is actually going to move the regulatory proposal to require permanent quarterly inspections. And that's what I think the environmental community feels that it needs, that's what the science supports and that's where we think the agency is likely to go.

And of course this is not just in the requirements, but also in evaluating the costs of all these requirements. And as more data on how much it costs to fix various pieces of equipment or to change out emerges -- this is a macro we did with ICF Consulting a couple of years back -- we can see that most methane reductions can be achieved at a penny per 1,000 center cubic feet are really -- essentially pay for themselves quite quickly.

And more data is coming out in stationary monitoring. This is some work that we've been doing to evaluate the idea for stationary methane detection and to look at automatic leak detection at well production sites. But really we sort of look at where the institutional, where the continuous monitoring, where the ground level monitoring, where this all takes us.

And we see that in a report we did called the Rising Risk Report earlier this year we could see that institutionally large oil and gas companies don't do very well when it comes to reporting methane emissions, when it comes to reporting methane reduction goals, and when it comes to talking about methane reduction as a part of their corporate policy.

And looking at the top 25 producers, and the top 15 midstream companies, we see that pretty much nobody reports quantitative reduction targets in the oil and gas space. These oil and gas majors they don't report on this in transparent investor-facing documents. And in fact, less than one-third actually talk about and report their emissions. And so if companies are out there not talking about emissions reductions or emissions in a transparent way it becomes very hard to actually work through the process of continuous improvement, of corporate management that actually yields reductions.

And this the last slide of the presentation. And here we talk about why we think all this important, why we think this new data, this new data on reporting both emissions, emissions reduction goals in a transparent way, is so critical. And it's because when we have emissions data we can engage investors and we can track progress.

And as we track progress and as we have engaged investors there's a feedback loop, the feedback loop of corporations and companies trying to do better because they care what their investors think. They care about their public perception of environmental performance. And they also see that methane, of course, is not just about looking green, but about actually saving the green. It's about reducing loss of capital. It's about reducing the loss of products into the environment.

And when we see statements such as $20 trillion worth of assets being represented saying, "We're particularly concerned about methane. High-methane leakage rates undermine the climate change benefit of using natural gas as an energy source," we see the questioning of major investments in new natural gas infrastructure, new pipelines, new investments in gas plants starting to have more scrutiny over the infrastructure they are managing.

And as we see higher and higher leak rates we think that these types of statements over investor concern and over the need for continuous positive improvement just start to move the corporate bottom line, just start moving this process. And this is only available, because of this increased data that's permeating through the value chain.

So thank you very much.

MR. KURTOVICH: Thanks, Tim.

Our next speaker is from the Department of Transportation PHMSA, and he will be providing his agency's perspective.

Robert Smith graduated from Penn State in 1997 with a B.S. in petroleum and natural gas engineering. He coordinated and managed the offshore pipeline in the Human Factors Research Program at the Bureau of Safety and Environmental Enforcement from '97 to 2003. And since 2003 he is currently an R&D Program Manager and leads several strategic initiatives for the Pipeline and Hazardous Materials Safety Administration.

MR. SMITH: Thanks for that. And thank you to the symposium organizers for the opportunity to speak. It's a pleasure to be here. I think I learned a lot yesterday, a very good discussion and presentations. And thanks to Martin for accommodating me. I have to leave right after this session unfortunately, so most of my presentation material seems to be better lent for the afternoon session, but I'll let you be the judge of that.

There was a little bit of a high-level discussion yesterday about what PHMSA's focus is and our mission, but I wanted to be able to give you a little bit more detail this morning.

We develop and enforce regulations for the safe, reliable operation of well over 2.6 million miles of pipelines, which I'll get more into in a little bit, with over 2,600 pipeline operators both for hazardous liquid, natural gas transmission, and distribution.

We also have a hazmat function. That's dealing with the shipment of hazmat by all modes of transportation.

It's important to know that we've been directed by Congress in a certain manner and that focus is primarily on safety. We do have an environmental authority when it comes to hazardous liquid pipelines. But for natural gas it sits limited compared to our liquid authority. We don't have an economics mission and we currently don't permit or site new facilities or pipelines.

You may have heard that Congress is considering a full statutory authority in underground storage. That's something that we'll have to see with the reauthorization that's occurring for our program right now. So here we'll definitely have some new authorities.

The infrastructure, 2.6 plus million miles, it's growing every week, month with new construction. As you see me circle there, our box for the gas transmission distribution, it's obviously largely gas distribution pipeline infrastructure in the country.

This is just the hazardous liquid transmission and gas transmission pipelines across the country that we regulate. It does not show the distribution pipelines. If we had the distribution pipelines on this map it would be blacked out in many urban areas, if not already as you see.

We begin to take a look at our rulemakings and follow the guidance from Executive Order 12866, which is to understand what are the net savings either -- our rulemakings. Does it create more leakage? Does it save methane from being released?

We have to now conduct an analysis to understand what we're doing in our rulemakings of course for safety, but to understand if there's going to be a savings that we can apply to the cost benefit that we're saving methane from being released into the environment. So it's something of a new area for us. We've applied it to the current rulemaking on gas that I'll talk about in a little bit.

This is kind of my catch-all slide. So what I can say is that we're obviously very closely following the developments. You know, the Whitehouse Action Plan, Congresses' interests. Of course the action from the EPA, who participated with the Quadrennial Energy Review. And of course following what many of the pipeline operators and trade organizations are doing across the country.

We've been coordinating with the EPA for a long time now. We've been having meetings that share data. Our data has a lot of thresholds of reporting, so there's not necessarily a large aspect of the data sets that we capture that's useful for the EPA in what they're trying to report.

We have participated in prior Gas STAR events for the EPA, which have been very interesting. They cited some of the technology that I'll talk about later, that we're able to fund and get out to the market.

We have a long history of coordinating with DOE, but we participated with ARPA-E and NETL. But when it comes to things like research strategy reviewing each other's research proposals and we're making sure everyone's invited to either a key technology demonstration. Particular if we're testing out new leak detection technology that's something that we want to be able to coordinate and invite, and I'll talk more about that later.

The Environmental Defense Fund, we've had several meetings with the EDF. They've come in and briefed us about many of their studies. We've also added, I think it's Mr. Bernstein, to our Pipeline Advisory Committee. Which that function, that's a congressionally mandated committee that overlooks all of our rulemakings. So it's an opportunity for the EDF to look at what we're doing and comment on the rigor of these rulemakings when it comes to methane reduction.

We've taken a hard look at our Part 192, our gas regulations, to understand leak paths and see if there's any actions that we can actually address in the future. I do want to say that however our case in safety has been largely been made with integrity management programs, which I'll talk about in a little bit, with the focus as hazardous leaks.

Non-hazardous leaks, once again we don't have an economics mission; are more of an economic issue in nature. So until our jurisdiction changes our focus will still be on hazardous leaks first. But we are trying to do as much as we can as an ancillary effect for smaller leaks as well. And it may be a charge for other bodies like the National Association of Regulatory Utility Commissioners or the FERC or for Congress to give us new authorities in that area.

So our whole regulatory program is about keeping the product in the pipe. That should be well understood. Our mission is safety and we want to prevent accidents from happening and that would prevent further releases to the environment.

We started with, on the gas side in 2004, with our gas transmission rule and implemented it in 2004, which created new programs to prevent leaks. And to remove anomalies before they reached an incident, which of course would release methane. We follow that up with our Distribution Integrity Management Program in 2011, which has requirements to find and fix leaks as well.

We added excess flow valves to residential service that will mitigate and minimize the amount of gas that's released if there is a rupture in the line in a residence past the meter.

For distribution in particular, excavation damage is probably the leading cause of pipeline failure. So we have a number of programs and policies to promote good best practices. You know, call the nationwide "Before You Dig" service, 811, to have that marked before you dig, and a number of other programs.

Research and Development, we've been funding research collaboratively with any interested party since 2002. We've brought overall about 26 technologies to the markets since 2002, so it's a very good success rate. We have a program of course in leak detection, but in also a lot of strategic areas of damage prevention, anomaly detection, and we've had successes in robotic inspections on piggable pipelines as well.

So once again I mentioned we took a look at our gas regulations so to understand where the leak paths are. So we've got into a number of things here and realized that in some cases some of the pressure relief devices and other aspects in the parameters in the pipeline system can be very difficult to take out. Perhaps we can have technology that will maybe capture the gas or to flare in the gas or something like that, so there is opportunities in the future for that.

The rulemaking, right now we have one rulemaking that's related to natural gas there. The main objective of this rulemaking is to address several mandates that have been given to us by Congress from a prior reauthorization.

And unfortunately that particular rule only begins to have a process to talk about things like leak detection, which the rule says will be handled in a separate rule. Valve spacing and rupture detection once again handled in a separate rule. And underground gas storage is going to be a separate rule, as well. But the rule also asks for comments about what's going to be important in these areas from the public. Any stakeholder has an opportunity to comment. We've reviewed those comments and we'll be factoring that into the aspects that we do with the separate rules for leak detection, valve spacing and underground storage in the future.

It was mentioned yesterday we issued an Advisory Notice after Aliso Canyon. We've worked significantly with the State of California from our technical services. We've learned a lot of things about this area, which is not an area that we had significant jurisdiction in however it brought to bear these reminders that we sent out in this Advisory Bulletin to the industry.

There will be more to come on this as we participate with DOE partnership on gas storage. We're going to participating also in their events next month in the Denver area that will identify gaps, perhaps, in technology needs and policy.

We're holding an event the next day at the same hotel that will get specifically into the safety focus of what type of requirements are we going to need, what standards are out there currently that we may incorporate by reference, what needs to be improved in those standards. And additionally, what technology needs.

Our R&D Program is there to serve our agency's mission. We're really in the near-term outlook on research. We're focused on safety and environmental protection and reliability of the infrastructure.

I'm just going to kind of focus on our technology objectives. We do have three objectives in our program, but the fostering and development of new technology has been a success area overall for us.

For our investment in methane leak detection we've had eight awards since 2002. We've had many other awards, but they were focused on liquid side. Eight awards since 2002, you can see our investment breakout there. Of that we've had three commercialized technologies I'll talk about next. And these have been in successes to detect methane.

Sorry for the small print. The first three were the ones that were earlier commercialized, one of them almost ten years ago. These were helicopter and fixed-wing based platforms for LIDAR to detect methane. We also had an in-service solution that can roll through the pipeline and find where, by sonic listening, where those gas leaks are in a system. So it's anything that will fit the type of technology, so it can be used in transmission and distribution along with just flow in the line.

The last three projects go beyond just detecting methane. And they focus on the quantification, which is where we need to be with technology research. In particular, Project Number 6 listed there, I was told indirectly from the EDF that that is the most important project that is needed right now. And what that project is, is we're working with technology and operators to come up with not only the flow-rate measurement solutions, but a framework on how to develop an action plan to remediate those. When you see 5,000 leaks in an urban area how do you get your arms around that as an operator? So it's really kind of getting into that. It's working with ConEd in New York City, a number of operators in other cities as well.

And the other two projects as well looking at different types of technologies to better quantify the leak by stand-off distances.

So research coordination, we're doing things like inviting people in to review our research proposals that are submitted. We're inviting people to debrief meetings, meetings, project meetings, tech demonstrations. We're working with all the states, the EPA and DOE as you see listed there. Just recently the ITRC, that's a very excellent organization, they just kind of share best practices and understand what's going on with technology.

We periodically hold an R&D forum. We're trying to secure a hotel right now. We're trying for the fall of this year. This will be announced in the Federal Register, it's a public event. Anyone can attend. Usually we have

200 to 250 people, several breakout working groups that are designed to come up with topics for us to solicit for, so we get a collaborative approach to identify the priorities. We don't duplicate that. And we invite in other organizations and DOE and EPA.

We had the EDF actually participate in one of our prior ones. They actually came up with the topic that I mentioned before that we funded. This particular one, we have one on leak detection. I think the focus is going to be a lot on liquid. However, when I think it comes to line break and valve detection we are going to still have a focus on gas. Underground storage, there's going to be a complete working group on that to come up with a number of topics as well as leak detection topics within that group. It's a little bit overlap there.

Our broad research suggestions, I think we kind of heard that we've reached the end of the road on detection research. Unless we're really trying to get that as cheap as possible, once again that's not our mission. We're trying to look at it as an effective technology, costs are a consideration. We should be leveraging the prior successes and collaborating together. ARPA-E of course, those projects are ongoing. And it should say DOE NETL's upcoming investments in leak detection, as well.

I think there's basically a broad roadmap that exists already between the EDF and ICF reports when it comes to areas that we could lower the costs and kind of get some low-hanging fruit and improvements and capture that gas now. And many of you are familiar with this. I'm not going to get into the details, but I think the goal should be to try to reduce costs as much as possible down to create even more of an incentive for pipeline operators to stop these leaks.

Okay, before I conclude I want to mention cast iron. We have a lot going on in cast iron. Our prior Secretary of Transportation issued a call for action to accelerate the replacement or rehabilitation of cast iron systems. As you can see by the information below, it's going to be quite a while yet before we can replace these systems nationwide, mainly in the northeast cities. We want to give operators more incentive to replace these lines, so we're developing technology to look for graphitic corrosion. So we can understand there's more reasons to replace that particular section or that entire system.

We are looking at liners too. We want to be able to understand if we can line these systems to quickly cease the leaks and then to come back at another point and replace them. Or have liners that have such an integrity they can be a carrier pipe for themselves. So there's still a lot of research going on to try to create further incentives to replace that infrastructure.

So final thoughts, uniform picture, I think we had a pretty good scientific discussion yesterday. I think we would argue that we're still kind of recovering from trying to merge a top-down and bottom-up approach, so I think we need a few more years of focusing on the bottom-up. But top-down definitely from a screening tool-type of approach.

Technology solutions I mentioned, I think we're pretty good on detection. But quantifying leaks is something of an area of stale research, and hopefully some of those projects I mentioned pan out.

Cost recovery, this is something that is a rate-constraint environment. There's really only so much money in the pie for operators to put towards their operations. And so if we see not a rate-recovery case made for methane, you know, that will have an impact on safety so that's definitely a concern that we have moving forward.

And I was just a little bit late, so I appreciate that. Thank you.

MR. KURTOVICH: All right, thanks Robert.

Next up we have Dr. Cynthia Powell. She is currently the acting Deputy Director for Science and Technology Strategic Plans and Programs at the National Energy Technology Laboratory where she leads a comprehensive research effort to discover, develop and deploy technology solutions that will make sustainable, affordable fossil energy production and utilization a reality.

Prior to this current appointment Dr. Powell led NETL's onsite research organization.

Material sciences by education, Dr. Powell has several decades of research experience in the micro-structural development of engineered materials at service conditions and the effects of these changes on materials performance. She received her Ph.D. in Material Sciences from Case Western Reserve University, preceded by a M.S. and B.S. in ceramic engineering from Clemson University.

MS. POWELL: Good morning, everyone. So I'm going to spend just 10 or 15 minutes talking to you about a new program within the Department of Energy's Office of Fossil Energy, which is a natural gas midstream research and development program.

So first of all I just want to pause for a minute, because Natural Energy Technology Laboratory, many of you know of NETL as a program and project implementer. But I also want to remind you all it's also one of the DOE national laboratories with a significant capability in research and development focused particularly on the fossil energy mission and particularly on the sustainable production utilization of those fossil energy resources. So more than a century of R&D expertise aimed with competencies that are of particular interest to this program in things like geological and environmental systems, big data analytics, life cycle analysis, material science and engineering where obviously I have a particular interest. So that is in NETL, but let's go on.

So we've heard over the last day plus a bit about the importance of understanding methane emissions and the importance of not just collecting data, but then using that data to take action to mitigate or to make changes in operations, best practices and in example.

The driver for the methane emissions program that I'll speak to in more detail in a few more minutes really came from President Obama's Climate Action Plan where that plan recognized methane emissions and the importance of methane emissions in contributing to overall greenhouse gases and global warming, really pointed towards a multiagency approach to addressing this problem.

We've talked a lot about the integration of efforts between the Department of Energy, which has a research focus, and between the other agencies that have more regulatory focus: DOT, PHMSA as part of DOT, EPA. And so everything that we're doing is very much organized and complementary in terms of effort and a lot of conversation going on per the President's request and his Action Plan. And really the goal here is by 2025 to reduce methane emissions by 40 to 45 percent relative to 2012 levels. So that's the end goal.

And the program that NETL is implementing on behalf of the Office of Fossil Energy is addressing two of the three pillars in that interagency methane strategy. One is to assess current emissions data and address data gaps. That is the methane quantification part of the program.

And then the other aspect is identifying technologies and best practices for reducing emissions. That is the mitigation piece of it.

The third pillar really speaks to policy, which is outside of DOE purview.

So we have been doing research in this space. This is not the first time we've recognized this is a problem. And so I just want to call folks' attention to the natural gas infrastructure R&D program that occurred between 1999 and 2005, which really had some good successes. It was a six-year program, all the way from technology discovery development to field implementation and actual commercialization of a range of technologies, ranging from aerial and point-source leak detection to sub-mitigation strategies with regards to pipeline repair and inspections. And also some improvements in things like compressor design.

So this program I think really laid the groundwork, planted some seeds. Many of the successful performers in this program are now participating in the ARPA-E, sort of revolutionary R&D efforts that are ongoing and are likely to continue to be partners in the emerging methane quantification and mitigation program that NETL is leading. So we're not new to this, we've been doing this for a while.

And even more recently before the onset of this program in the unconventional natural gas and oil program, NETL has been looking at trying to gather more data from field assessments recognizing that there really is a limited number of high-quality field data sets. And particularly focus in that case on shale gas operations.

So six projects ongoing, the list of performers are there, and really the goal here is to get data, to get high-quality data. And then to implement that data in modeling and simulations that can improve understanding and learning.

All right, so this is a rather busy slide. These are the six projects. And it kind of gives you an indication of what their focus is on. These are three-year projects. They are going to be ending at the end of fiscal year 2017. A range of performers or a range of different basins, a strong focus on the Marcellus, but a couple of other basins as well. And you'll notice that these projects are focused on a variety of sources in addition to just gas production. Many of them are focused certainly on methane, but other emissions as well and use a variety of platforms.

I'm going to speak just really briefly to two of those, those two that are highlighted. But you'll have these slides and have the opportunity to explore this in more detail at your leisure, so the first one that I just want to highlight here, is the work that's happening at the National Energy Technology Laboratory.

We're focused on the Marcellus and really focused on an understanding of the full life emissions of shale gas operations from predevelopment of a site, through development production, and then coast site emissions to really understand what is happening across that full life cycle.

We have a variety of capabilities that we bring to the table in that from ambient air monitoring. You'll see in the upper left a trailer that we can pull to a site and measure a variety of things: methane, VOCs and etcetera. We're also looking at aerial detection methodologies, a strong aspect of this program too is identifying where abandoned or legacy wells -- mostly abandoned wells that we didn't know existed, where they're actually at -- ground-proofing their location and then also understanding the emissions from those previously unknown sources.

A second project among those six that I just want to highlight is one I think we heard about yesterday being led by the Colorado School of Mines in collaboration with NOAA, which is looking at methane emission estimates from natural gas sources at the basin and the facility level, trying to reconcile the discrepancies between the top-down approach and the bottoms-up approach.

And again we heard a little bit about this project yesterday. In the fall of last year over 230 natural gas facilities were interrogated and preliminary results showed, not surprisingly, they did observe the fat tail. And really recognizing -- we're beginning to recognize importance of both measurements plus an understanding of what is being measured at the time the measurements occur to really get into quality data.

So now here in fiscal year 2016 we have funding to initiate and expand our methane quantification programs. I've already talked to you about how the unconventional oil and gas program is already taking a look at shale gas production sites. And now we are expanding the methane emissions quantification effort more broadly to explore the midstream. So what that means in terms of research elements is trying to gather more data and gather high-quality data from a variety of different sources. From gathering systems where data is scarce, so in some cases non-existent to also getting better information about those non-inventoried sources like the abandoned or legacy wells.

We're also going to begin looking at distribution centers as well as large-scale underground storage sites in terms of gathering information. And then once we have that information we want to take use of that, so we're beginning to input that data into life cycle analysis. And this data, this whole program definition has really been strongly in collaboration with EPA. And so our early emphases are in areas where they say they particularly need information in order to improve their greenhouse gas inventory.

And next I'll talk to you about how we're going to actually implement the partnerships that we speak about here in terms of the funding opportunity announcement.

So the second part of that program is really understanding emissions mitigation. And so this is all about you know you have a leak, what are you going to do about it, in essence? And so a couple of emphasis for this new aspect of the methane's mitigation program really focuses on understanding or developing sensors, so that you know what is happening in the field in real time. Point sensors that can do things like monitor corrosion rates in pipelines, so you understand pipeline health and have predictions for when you might have failure or when you might need to go and do service, also optical sensors that can interrogate pipeline health.

Other areas of emphasis will be in advanced liners and coatings. Of particular interest could be a combination of coatings that would be protective of the environment, so protect that pipeline infrastructure as well as the sensing and being able to provide data and information about what's happening in the system to further enhance and understand performance. As well as to be able to offer suggestions for when pipelines would need to be addressed and serviced.

So another aspect is the pipeline inspection and repair. And the emphasis here really is on let's be able to do that without having to vent methane. So we'd like to be able to make inspections and repairs with the methane in place in the pipes.

So those of you who follow this sort of thing will hopefully already be aware. There is a funding opportunity announcement out there to support these areas of research in this program that I just talked about. That

FOA opened on April 13th and it closes this Monday, June 13th. If you need additional information about that FOA you can go to the NETL website, look under "Business Opportunities" and you will find a link to that site. And you will find all the information you need to have in order to be able to respond to this funding opportunity. The one thing though again I want to emphasize, it closes on Monday all right, so time is short.

The only other thing that I wanted to just draw your attention to that we're doing right now is, really this Natural Gas Storage Task Force again was talked about yesterday that was developed in response to the Aliso Canyon event. And NETL is working with several other national labs with the wellbore integrity team.

And the thing that I really want to point out is -- Robert already mentioned this -- there is a link over on the mid-right of this slide for that workshop that's happening in Denver Colorado, July 12th and 13th. And that conversation will be all about wellbore integrity issues associated with long-term underground storage.

And really, DOE has a wealth of expertise and understanding of wellbore integrity for a variety of other applications to include oil and gas development and production, as well as Co2 storage. And our national labs have already been working together in something called a

National Risk Assessment Partnership, which really takes a look at what are the risks towards long-term storage of things like Co2, things like natural gas. And it does touch on wellbore integrity as part of that. So the labs are already well positioned, having thought about this for other problem sets to bring their expertise to bear in this conversation of underground gas storage as well.

So their work, the task force work is expected to be complete by the end of September. There will be some best-practices reports as a result of that. And like I said a good opportunity to leverage DOE expertise developed in other areas to this very relevant concern about wellbore integrity with natural gas storage.

And that puts me with 56 seconds left, so thank you very much for your attention. It's been a pleasure.

MR. KURTOVICH: All right, next up is Keith Driver. Keith is with Cap-Op. He has developed a broad skill set in experience North American regulatory and voluntary carbon markets, has been a key contributor and developer of Alberta's provincial offset quantification and trading system as well as other systems across North America. He co-founded Cap-Op Energy as a consulting and software company, with the objective of making sustainability, profitable for the oil and gas and bioenergy.

A serial entrepreneur, Mr. Driver has more than 13 years of experience in the environment industry. His current areas of interest include fuel and energy efficiency, bioenergy, carbon finance and clean tech development.

MR. DRIVER: Thank you, everybody. My experience in this space is -- I've been struggling with, it's a lot different than everybody else, the speakers we've had so far -- I started about five years ago getting very interested in this space at a very similar meeting in Banff, Alberta. We were talking about the difference between engineered leaks and fugitives and what we could do about those.

And so Cap-Op was eventually born from that, because what we realized or what I realized at the time is that one of the challenges is really about data. So we can do projects, but we don't know how successful they've been especially on the engineered leak side until we track the data afterwards. And so thus we ended up.

And so that's how I got into this space and it's how I got into this conversation, it was a conversation with Tim at EDF. And the objective of our conversation or what we were thinking about was how to really make sustainability profitable in California. Because the objective is reduce the carbon footprint intensity of natural gas delivered into California, not comes from places where I work, outside of California, nominally 90 plus percent.

And the things we needed was we needed tools, we needed things to make that possible so that it's not so much, "Oh well, it's a big system and it's integrated. And the sites are all over the place. And how are you going to go about doing this?"

And so these are the things we have. I going to come back to this slide at the end and I'm going to add two bullets where there's gaps. It's foreshadowing; work with me on this.

So Cap-Op Energy, what do we do? We build software tools and provide expertise consulting services and strategic thinking to help companies actually get to reductions. So not necessarily as many other speakers have been focused on finding them, in our world a lot of them are designed into the system. So if you tell me what your system is I can tell you where your leaks happen, because they are designed to leak and there's a rate at which they leak. And so we focus primarily on those.

And then those that might be more described as "fugitive," which is sort of the super-emitters of those that happen on occasion or they require other sampling methodologies.

It's the opportunity, the mandate that well we live in, in Canada as well in the U.S., is a 45 percent reduction in methane emissions in oil and gas sites. I for one believe this to be inherently possible. And I think we've seen some slides, maybe from Tim earlier, that talked about how there's technologies out there to get there. The question is 45 percent of what? If there's anything we learned yesterday is that the emissions are possibly underreported by 100 percent, so 45 percent of what number? Because one is 145 percent and one is 45 percent.

And those numbers are currently more difficult to comprehend and to get our act around.

We know in Canada from the work we've done that the cost of abating those emissions from engineered sources ranges from $2 to $160 at a time depending on how you plan for, identify, track, report those emission reductions. That's an 80 times difference in price, depending on which ones you go after, and which ones you go after first. If you're industry, $2 a ton isn't so bad. If you're a $160 a ton it's not a (indiscernible).

And to give you some sense of how big the pie is these numbers up here for Alberta, these are five technologies for which there are technologies off the shelf to replace previously engineered leaks. So for those that understand engineer leaks, some pneumatic devices release methane and it's part of how the system was operated. And it was always done, because methane is cheap or was at the time. It didn't have an impact.

So if we look at how many high-bleed devices there are in Alberta there is 370,000 of them. We think we could probably get to 115,000. And reasonably that's 46 megatons of GHGs that could be reduced just by going after something we know is there. So before we spend all our time going after the things we don't know are there yet there's stuff that we can go after right away. And there's five other technologies that are on there, adding up to about 300 million tons just in Alberta. Now we are not all of California's source, but we are indicative of California's source measurement of natural gas.

So the opportunity, again the more $2 projects we can find, the less $160 projects we can find, the more financeable, the more momentum we can get behind why energy efficiency is important.

We look at this as a continuum. I'd love to tell you we started out looking at this and knew left to right was the way to go. We started off at the far right-hand side of this thing, which was how to help people verify and report projects they had already done. That was the problem. They had no data, they didn't know if the project they'd done last year was worth doing again. So everything was a one-off. So we started doing that. We created this DEEPP platform and I'll get to that in a second, "Distributed Energy Efficiency Project Platform."

We then started working backwards, which is "Well, they don't know what equipment they have out in the field. Don't know where my compressors are, don't know where my pneumatics are. We don't keep those kind of inventories." So we have to go back, we have to move back. And we created the MAP tool, which is the "methane abatement platform," which allows them to go and do inventories of these emitting pieces of equipment further back.

It fits on your cell phone. I feel silly being up here and have people up here from NASA talking about satellites. And all I need to find emission reductions is my cell phone. It's a bit of a different perspective, both rooms (indiscernible) to be done.

On top of that if you know what those projects are going to do, because you've done them before and you know where those projects are you now know how to create an investment tool, a finance tool that allows projects to happen, allows multi stakeholders to get engaged. And that's where this innovative funding comes in and I'll talk about that in a minute. So the MAP tool, real simple, a bunch of drop-down menus on an iPhone app allows you to go out to a site, look at all the different types of equipment, and create inventories of methane-emitting equipment.

Once I know what equipment's onsite I can tell you what those emissions are. Not what they are by manufacturers' spec, because we know those numbers aren't right. It's why I know my car doesn't get the mileage that Honda tells me it's going to get. It's the emissions that we have seen in the field. We have gone and measured 2,000 pneumatic devices in the field to create statistical averages of what they actually are in the field. So we can look at that data set and if I have your inventory I can match it up and say, "Yeah, if you go up to this field over here" -- here's the drop-down menus, it doesn't make for a great slide but I'll keep talking -- is if I know where all those are I can tell you where to go. "In your truck take eight of these things. Go over into this field. These four well pads are the ones to hit."

The difference between a $2 project and a $160 project is how long it takes someone to drive around in the truck. How many times they have to go out to site. How many times they have to collect data. So if they can know where those things are and they can be efficient in how they operate those projects, make that work.

So we then layer that across where there's utilities, so can they tie that gas into pipelines? Can they work with partners that are operating on nearby sites? Can we look at how to manage a campaign to make this happen efficiently?

Once those projects are in place we have our distributed energy efficiency project platform. Let's take the data, the operating data in the field, the activity data that's there and pull that into the system GIS, so we can look at where we're seeing our emission reductions happen and how successful are they. We look up on the slide there on the right is the map of all the projects that are done in air-fuel ratio controllers on compressors, in reciprocating engines. So on the engines changing the air fuel ratio going in by putting a little computer chip on the front end that tells us how to manage that, we can then pull in vented gas from the site, put that into the compressor, run the engine more efficiently. You save fuel, save GHGs.

We can track which engine, so if you can tell which engine you have I can tell you which ones tend to respond better to this technology, which one has a higher rate of return. I can show you yours, I can show your mom yours, I can show you across the full data set of the ones that are out there. Particularly proud of this, because we touched two-and-half million emission reductions so far, just looking at stuff for which there is existing technology available.

How do we do it? Well, the flow chart on the left is meant to be confusing. It's to convince you to use our service, which says, "This is how you go out and get an offsite credit." You have to go out; you have to track all the data. These are onesy-twosies, these are little 50 ton projects, 100 ton projects. You've got to send someone to the site, it doesn't work.

We created an aggregation platform and system that says, "Great. We take all the data. We put it all in one system. And it's completely auditable. Aren't we wonderful?" The reason it works is we may charge $4 and something to get that out, which in Alberta the market price is $15, so we're a net ahead. But to do it on your own and to do it at one-offs can be at least twice that expensive.

This chart has two functions and I'm going to talk about them quickly, because I know my time is running out. I've only got six minutes left. We learned two things about this, about oil and gas. Is one, you can separate environmental attributes from the gas savings. So within the company you've got the folks in the field. Their jobs are safety, production, production, production, production, reliability. Those are their priorities.

"Environmental, cheap greenhouse gas, I don't care, I don't believe in it," whatever the case may be.

You have corporate who's got environmental compliance obligations. "Yes, we need performance and reliability. Yes we need health and safety, but we also need to comply or we need to show a movement on methane. We need to hit targets."

So you have these two cycles that are slightly different. On the right they just want reliability and operations. The other side of this is you can actually separate the emission reductions from the environmental benefit. Think of this like green electricity. We can sell RECs, we can sell power. We can sell them bundled and we sell them unbundled. We can do as we wish.

So we've looked at this and said, "Great. If I can create this program I can split off on the one hand the blue side of this where the field guys get the equipment they want. They can put it in, they get the gas savings they need. And that pencil's for them."

We're giving them that equipment or for giving them a rebate on that equipment. I'll take all the environmental benefits of that. I'll put it through my system, I'll quantify that. And I'll sell what is now a separate asset class. I'm investing with oil and gas, but not in oil and gas. So if you look at the $20 trillion that's looking to move away or looking to be thoughtful around what it's doing with methane and there's a subset of that that's looking to divest, it can't divest from energy. Functionally it changes the asset mix in the portfolio. But what they can do is invest in alongside -- invest in the environmental side of those companies as opposed to in the core assets.

So bundling all that back together we now have tools that are available today and scalable around the world that can help people build the inventories they need to understand what assets they have. Help them identify and plan projects, help them execute and track the savings. Once we've tracked those we can flow them around between all the stakeholders. Once we've cut that pie up we can then feed that pie separately. And that sort of allows us to create this separate pie as planned.

We're going back to the original question, which is how do we reduce carbon intensity of natural gas to California? Well frankly we need to get on the ground in places like Texas, Alberta, B.C, Four Corners, Colorado. We need to get on the ground. We need to do the basics of getting inventories. We can fly over them all we want and we should. Don't get me wrong, but there's also a list of everything that we could do that's already available from an engineer perspective. All of those solutions are there.

We have the tools and we have the ability to track them. We have experience in other things like renewable energy. We're in the low-carbon fuel standards that allow us to move these values around and track them appropriately, with or without functioning (indiscernible).

What we don't have necessarily in California at this point is what we were talking about yesterday, a breakout session was how do we create and support a regulatory framework? Do we put a price on carbon like Alberta where we have an offset system that reflects that? In California you can't get an offset for a pneumatic device installed despite the fact that that was written for California. We took that and used it in Alberta and we get credits and we get a functioning market and we get activity happening.

The other thing we have is how do we mitigate the risk of capital flows out of the state? If we can create value for creating those emission reductions, we've seen all the MAC curves that show that these projects can actually be profitable, can show that and we can demonstrate that and we can provide the tools to make those happen at those costs. In theory the net value to California is positive, because gas becomes cheaper, because it's cheaper to produce, because there are savings in the system that aren't being realized. So there is a transaction cost or a cost that's being lost. Fugitives are just lost that we talked about it in the earlier presentations.

So last message -- we have tools, we have data sets, and we have experience in how to take these projects or the methane -- the 45 percent -- out of that system. It's about linking the policy with the science to get us there.

Okay. Thank you very much.

(Applause.)

MR. KURTOVICH: Thanks, Keith.

Next up is San Gunawardana with Enview, which is a San Francisco startup. Now San, after finishing a PhD in aerospace engineering at Stanford went to Afghanistan where he combined data analytics and remote sensing to detect threats and prevent incidents. San is applying those insights to help the energy sector solve impactful problems. He's also done computer vision at NASA, built imaging satellites with the Air Force, and is an early employee at ICON Aircraft.

MR. GUNAWARDANA: Okay. So I'm going to be talking a little bit about big data and big challenges. So the pipeline industry and the methane industry is embarking on this very interesting big data challenge. And it's actually interesting, because there's a very analogous situation that the electric transmission industry went through a few years ago. And the story is very similar that there was a catalyzing event. There was a decision to embark upon a large, remote sensing data collection, and then many lessons that came out of that. And I think a lot of those lessons could be useful and insightful to the audience here.

To really quickly describe what we at Enview do, our mission is to turn massive data sets into operational intelligence that benefits safety and reliability. And there's three key components behind what we do. We're very much a big data analytics firm. The first component is the fact that we fuse multiple sources of sensory data, things like imagery, LIDAR scans, infrared visual imagery, satellite imagery, etcetera. And automatically find observations.

We also do a lot of big data analytics using machine learning to move to a predictive stance to identify threats. And the last key component behind all of this is the data visualization. And I think as you'll see when you talk about big data the visualization is very important, because this is the data is large enough that it's hard for people to really understand intuitively.

What sorts of things do we do at Enview? A couple of really quick vignettes, a lot of work on vegetation obscuration, a lot of work on third-party dig-ins, depth of cover, measurements for pipelines, structure counting, right-of-way encroachments, and then a lot of predictive analysis for things like leak and rupture prediction. And this is all being done automatically using big data.

We also clearly do a lot of work with power lines. And some of those discussions are going to form the core of my talk here. So what was the catalyzing event for the power line industry? Well, it was the 2003 Northeast Blackout. A tree branch hit a power line and knocked out power to a very large portion of the country for several days. And as a consequence there were a lot of outcomes. And the first was that there was regulation that came out for maintaining vegetation clearances, thermal ratings of power lines, etcetera.

And there was a previous manual solution that the industry used to assess these things. And that manual solution did not scale to the size of these new regulations. So the industry turned to this very powerful new technology, LIDAR. And just to clarify the LIDAR that I'm talking about here is a little bit different perhaps than some of the LIDAR sensors that may have been discussed earlier. This is a similar technology, but really the LDDAR here is being used to generate 3D models of the world. It's essentially a glorified laser range finder that builds 3D point clouds of the infrastructure. And a lot of this was collected aerially via helicopters and air mapped.

Now there's a problem with this. And the problem is that LIDAR data is massive, it's gigabytes per mile and it's petabytes per operator. And that energy that I'm showing there is a mile of lighter data that we've collected and classified. There's about 19 million points inside that one mile and it's about 5 gigabytes. All right, so extrapolate that to an operator with 10,000 miles of pipeline or power line in this case and you suddenly have a very large data problem.

And this position to go into LIDAR kind of pushed this entire ecosystem into a big data challenge. And it was the regulators, the electric transmission operators, the LIDAR surveyors and also the LIDAR sensors themselves. And I want to be very clear these four groups are all incredibly skilled comps and groups within their own areas of expertise, but nobody had ever gone and collected data this big at such a rate.

And so as a consequence there were many interesting painful lessons that were learned by this industry that as I said should be applied to what's happening now in the methane leak detection side.

So why is methane leak detection an analogous problem? Well, it's going to have the same impact for pipeline operators. It's a very big data challenge. The area is enormous. Those numbers, that 1.5 million miles, is just national gas. It does not include gathering lines, which are I would say an even bigger problem. The frequency is very different from what the electric transmission industry did. They did a kind of a one-time snapshot, which cost tens of millions of dollars per operator. With the methane leak surveys this is more of a continuous, ongoing process. So you're generating a tremendous amount of data.

The complexities are arguably much higher, particularly for the passive sensors where you're trying to identify the source point origin of a leak. You have to take a lot of physics and a lot of environmental factors into account to derive back to where that leak started. And the quantity to be frank is something that has yet to be determined, but it's very large. I think there's been a lot of fantastic work that has been done by the sensor developers to identify how much data they're collecting for that particular sensor. But when you deploy that scale and you take into account all the other geospatial data that has to be fused with that, it's very much an unknown at this point.

And I think we can all agree that methane remote sensing is kind of the future for this industry. It's something that we'll all have to deal with. And the pipeline operators can learn from some of these painful lessons that the electric transmission industry has been and is currently going through.

So I'll go through a couple of lessons learned and the first one is on data rights. And what's the problem here? Well, many operators are challenged to actually process and analyze the raw data, because of the quantity. And so they turn to third-party vendors who are experts in this area. And it's a very natural reaction.

However, what we have seen is many of these vendors used a proprietary data format. And there's some sound business reasons, perhaps, why they would want to do that. It kind of locks you into an ecosystem. But the challenge is that now as an operator you can't get your data out of that ecosystem. And this is painful, right? So the lesson is don't get locked out of your own data.

And this sounds kind of obvious, but the first time you're looking at a lot of this data you may not understand the difference say between a derived result, which is there is a leak here versus all the raw data that went into forming that conclusion. And I think it's really important to make sure that the deliverables include not only that end result, but all of the raw data. And this is incredibly important, particularly for big data, because all these machine-learning algorithms and approaches are very data-hungry. And they learn from different incidents in different places.

So as an example we do some work here in California. In California, it's very difficult to trim vegetation just due to the sensitivity of the society here. And so we developed techniques that enable our clients to see through that vegetation. And now if you go over to New Jersey it turns out they have a similar problem. And so we can take our lessons learned from California and then deploy those out in New Jersey.

And to flip that around, we some clients out in Appalachia that have a lot of landslides occurring in their pipeline network. And the machine-learning algorithms can take that data, learn from that, and then apply those lessons here in California. Now this is interesting, because you can only do this if the data is interoperable. So you really do have to make sure that you have access to that data and that's it's stored in open-source format that everybody can access.

A second problem or lesson is data retention. So the vendors, in this case I would say the surveyors, who were very qualified geospatial professionals were frankly unprepared in some cases to deal with this very large quantity of data. And so they did a few things to ease that transition. And one is they stored the data in traditional, let's call it small-data storage methods, which end up being horrifically expensive. On the order of we've seen as much as $2,000 per terabyte per year. All right, this adds up very quickly if you compare this to the cost of a modern IT infrastructure that -- an AWS with sensitive cloud infrastructure can deploy -- this is orders of magnitude bigger than what it should be.

But one of the things we've seen vendors do is that they threw out "non-essential data." And I'm showing two examples of that here from a power line company. In this case the vendor went out and they collected LIDAR data at a very high resolution. And they decided that it was so much data, and their client only really cared about the power lines, right? They didn't really need to know much about the ground, the buildings, the vegetation and so they decimated all of the other points except for the points of data coming directly from the power line. And they had a huge savings in data storage and processing.

Now the consequences, several years later this company now wants to do change detect (phonetic) from the ground to understand how their clearances have changed. They want to identify whether there's new structures and they don't have that data and that data doesn't exist anymore. And they paid a lot of money to go collect it. And this is a huge loss of information and there's a huge cost to this company, because they had to go recollect it now.

And so the lesson here is, once again, like don't throw out your own data and store all the raw data. And there are things that you can do to do this much more efficiently.

And just for comparison those two pictures, they're kind of small, but that is literally the same spot on the ground. The bottom one is the original data set. And then the top one is actually a data set that we collected at admittedly lower resolution, but because we're not throwing out the data, you can actually see enough resolution to see not only is there a house, but when you zoom in there's two cars to the left of the house. There's enough data to see that the car on the bottom is a Mustang, like a late-vintage Mustang. Whereas in that bottom image they've just thrown out so much that you lose all of that.

The third problem here is that to generate an insight is a very multidisciplinary problem. And it takes a lot of effort from a lot of very skilled people. And the big lesson here is to make sure that when you deploy a solution that all aspects of that value chain or analysis chain are covered. And I would say this definitely extends to the sensors experts. This is a very specialized skill set to develop these sensors, but it extends to the gas ops teams. And I think they play a very critical role as far as forming how the technology gets operational-ized. And then also how people respond to those insights.

Data collectors, I think have a very important role to play as far as collecting not only good quality data that is geo-registered well, all of this data is very geospatial -- like it has a physical location and meaning in the world. And it has to be referenced against all sorts of other geospatial data. And so it's important to get it in the right format. And then they have an obligation to do that in an open-data format.

And then lastly your big data firms are really needed to process, analyze, and extract these actual results. And one of the big takeaways here is that it's each of these groups are experts within their own domain, but it will be very rare to find a group that touches all of these at the same time. And so it's definitely something to watch out for.

So getting into the analysis of this big data, we've definitely seen a problem where a lot of analysis is done for the sake of analysis. And this is a terrible waste of people's time and money. And I think that the takeaway here is that really the operational need should guide and drive the data sites.

And another takeaway is that machine learning, which is really the techniques that are used to analyze big data, it's a very specialized skill set. If you look here in the Silicon Valley most of the people that do this are going off to work at Google and Facebook to serve up better ads. And so there is I think a challenge to find the right people that can do this sort of work. And the takeaway for us is that machine learning, it's a really impressive buzzword, but it's not magic and it's not a cure-all.

And so these solutions really do have to be custom-tailored for the energy industry. I think it's very important to note that when we talk about automation and fixed algorithms they do not replace people. They're just not that smart. What they're really good at is combing through a very large quantity of data and then pointing out specific findings for a person's review. And this gets really important when we start looking into how you visualize the data.

And so a recommendation and a lesson learned is to vet people that are doing your analysis, both for their analytical capabilities, but then also for their ability to deliver operational insights.

And this is I think a really interesting example from some our work. We get a lot of requests to do change detection. A client will come and say, "I want to do change detection to identify how things have changed." And a lot of vendors are more than happy to do that.

And the image on the left is essentially a changed section on a LIDAR survey done over the East Bay by San Jose. This is about 100 square miles. And the red/blue -- I know it doesn't mean a whole lot -- but that's essentially changed, like it's really easy just to do a change. But the problem is there's so much noise in that. Like that doesn't mean anything.

And so if you look at that middle image this is where we're running a whole different series of algorithms to look through the changes and find things that are actually worth an operator's attention. In this case, looking for landslides and new housing and you can see two of those call-outs. And I think this is a case where it's really easy to generate a ton of data, but really you want these algorithms to go through and find these things for people to look at.

I think another interesting takeaway is we talk about big data and how we can find all these problems, but there's also an opportunity for the big data to reveal where things are okay. Like for example, in that 100 square miles there is four things worth looking at, all right? So I think there are a lot of potential negatives that you want to be able to find, but let's not lose track of the fact that it can also validate where things are going well. And it I think provides a very strong component for traceable and verifiable, complete record-keeping and other socio-compliance obligations.

Last lesson, data visualization. So as I mentioned before big data supports not supplants people. And the implication of this is that people actually need to look at your big data.

And within an operator you typically will have a GIS group. And then you also have users that are not ArcGIS experts. And they also potentially need to see a lot of this data, but inside a different kind of framework. And this is challenging, because data scientists will typically want to abstract this into some sort of mathematical fairyland that is completely meaningless in a physical sense. And so there's a challenge here to bridge that gap.

And so the lesson here is to ensure that big data results are easily accessible to everybody. I think the big data methods must accept your GIS as an input. There is so much GIS data that an operator generates that becomes extremely useful as an input. And then the big data algorithms must output natively into ArcGIS, because you don't want to disrupt operations. But then there is also a need to visualize data in, I would say 4D, because methane leak detection is a 4D problem. A plume (phonetic) is three-dimensional, but it's also very time dependent and this becomes very challenging.

And this is an example of a 3D visualization of an excavation happening just outside a right-of-way in Santa Cruz. On the left is the aerial image of that excavation. On the right it's kind of hard to see in the static 2D, but this is a 3D model being reconstructed. And you can actually rotate this around. The bottom right corner is the hole that has been excavated. Now imagine this being a living thing that is evolving over time.

With methane leaks this is something that you really do want to track is that time history in the evolution of that entire system. So how you tell the story visually becomes a very important part of closing this big data.

Oh, out of time.

MR. KURTOVICH: So if anyone has any questions please come up to the mic.

MR. O'CONNOR: Can I ask a question?

MR. KURTOVICH: Sure.

MR. O'CONNOR: Hi, this is Tim. The gentleman from Enview, it seems that big data is going to be such a complex undertaking for the analytical piece. It really sort of will very quickly go beyond the capabilities of an individual sort of company or like an operator or a utility or something like that. So do you think you'd need this sort of third-party framework to come in and do the analysis? Or do you think utilities themselves can manage these kinds of data sets from what you've seen?

MR. GUNAWARDANA: From what I've seen I think the short answer is I haven't seen within the electric transmission side. Within some of the gas operations side I think they're challenged to find the right type of talent to do that.

That said I think it's always possible for these companies to develop that capability in-house. And I think the important part when you collect this remote sensing data is to make sure that the in-house teams can have access to the data to develop their own lessons and analyses. And this is why you don't want that proprietary, walled-off data format that some vendors might collect, because that completely precludes that possibility. And I think it's of benefit to everybody if there's an open competition for whoever can do the analysis the fastest, cheapest, and most effectively.

MR. KURTOVICH: Okay. I'm going to ask a question. In our SB 71 proceedings there was a working group on best practices. And about two months ago there was a paper we issued that summarized some of the findings from this working group. And it included four principles for methane leak abatement best practices. And one of them, I thought was very emphatic and that was that industry standards for safety and supplemental measures are needed to meet the challenge of eliminating methane emissions to the extent necessary to meet state goals.

And I was wondering if anyone on the panel knew or was aware of any measures or initiatives for there to be industry standards related to data and data utilization and analysis? I mean, you have state agencies, federal agencies that are working on this and developing it. But has Alberta or any other industries come forward with trying to standardize it, so what you have in California is the same as you have in Texas or Colorado, back on that?

MR. DRIVER: So it's Keith. I can speak not from the California experience, but otherwise is that I think we would all be -- well, maybe not all of us, but a number of us would be very surprised at how little data is kept in the upstream sector, particularly year round. So they'll know where the well sites are. And they'll have the sense generally of what equipment is there.

But to do inventories of the number of pneumatics or the number of flanges or the number of leaks, maybe at gathering stations in some of the larger infrastructure. But specifically at all the other distribution sites it's just not there. And it hasn't been there, because there's been no need for it. And its assets move so dynamically among parties that having a data set of an asset you're not going to own forever isn't useful. And so part of these requests or data requests or otherwise are hitting or are swapping blind.

An example would be in B.C. there was a push to swap out all high-bleed devices. You could either swap them out or can you can measure them continuously, measuring continuously costs a lot more than swapping them out, so people were quite concerned. Initially we had to push back and say, "We can't do that. There's just too many of them and frankly, we don't know where they are."

So to meet that objective, that rulemaking strategy which makes sense of you must swap them out, you're going to drive up the price and the cost without getting any environmental good out of it. So we swapped to a different approach. I think those fundamental gaps, how do we create the data sets that we can then analyze, is important.

MR. O'CONNOR: If I can answer that -- and I'd like to actually ask Bob from PHMSA a question on this. There's a big effort underway to try to understand the emissions of loss in unaccounted for gas. And PHMSA has a requirement to do so, to report that. But of course we know that "lost and unaccounted for" is not just gas lost to the atmosphere, it's gas that is changed in the pipes in terms of volumes. There's a number of things: meter errors, thefts, pressure differential changes. And there's been a lot of talk about trying to develop some standardized metrics for coming up with gas lost to atmosphere.

Do you know of any movement underway there that's by PHYMSA or by the industry to try to come up with some lost and unaccounted for gas metrics that actually are uniform and they can capture gas loss to the atmosphere?

MR. SMITH: Thanks for the question. We are going to have rulemaking on the subject, so part of that I would imagine there will be a discussion about what metrics are going to be important for an operator from the standpoint of changes to reporting requirements and stuff like that.

Per the other question before I was kind of hesitant, because I know the API, the American Petroleum Institute, were looking at whether or not the standards could be applied for leak detections systems. But that's more about technology redundancies and overlap, so we don't have a situation where a leak just progresses for years and years; it's detected.

So those are the focuses there that not in the context of really what we're talking about here. But I do believe the rulemaking process that will begin with the leak detection will get to some of the discussions with the states as well as the metrics that are going to be important, so stay tuned.

MS. SCHEEHLE: Hi, I had a question. So Elizabeth Scheehle from ARB, really interesting presentations and I'm still sort of chewing on the last couple.

But I did have some questions for NETL and PHMSA on the state participation efforts that are coming up. I know Cynthia you had mentioned a lot of collaboration with industry and all that. Are you going to invite some of the states that have been working on these issues into that, into some of the (indiscernible)?

And it's a same question on the pipeline, PHMSA side, and just for the upcoming PHMSA LIDAR, when will that rulemaking start?

MS. POWELL: First, yeah so within the current flow of this out there, state participation is not a requirement. That said we certainly recognize the importance of engagement. And we will be reaching out with workshops and things like that to try to be as broadly engaging as we can with interested states.

MR. SMITH: Our engagement with the states is significant, both individually with the states as well as through the National Association of Pipeline Safety Representatives, the trade organization representing them. And it can be from anything from working to better improve state programs, whether it be in excavation damage programs or integrity management programs.

We participate in each other's events throughout the year. From the research side they're always invited to help us review submissions. They're a part of our R&D forums to say, "Here is our national challenges for the states for research needs." And so we have a significant role for the states to play in a number of programs at PHMSA.

MR. HOU: Hi, Yu Hou from the Energy Commission. I have a question for San for the big data.

The electricity system I can see both the power lines, especially the transmission lines, they are above ground where you can see it. You can fly over them. But for the natural gas there are much more structures or infrastructures that are underground. And I just kind of am wondering what are your thoughts on that in terms of collecting data?

MR. GUNAWARDANA: Yeah. No, thank you. That's a great question. I think it's very apt. The infrastructure for a pipeline is definitely harder to observe and I think that puts a bigger burden on the types of sensors and the need to collect data, so it's a harder challenge.

We see a lot of operators doing some pretty amazing stuff out there. You think about the leak detection you are sampling essentially the above-ground products of that underground leak. Where it gets really tricky is being able to back-calculate that to the point of origin. And so I think this once again it actually becomes a bigger data problem for methane leak detection on the pipeline side. And the fact that you can see the infrastructure directly complicates it, but isn't a showstopper.

MR. SMITH: If I can add to that comment, I think that's a key point. We see these maps of pipeline or leak areas within like an urban area. Those are leak paths, those aren't necessarily the exact location of the leaks. There's a number of factors that govern where the natural gas, geo-methane, is escaping from.

So it could be several very small leaks aggregating together coming out through a manhole. It could be the strata of the earth, the times of year, the operating pressures. We have gas migration issues where sometimes through drought seasons we have an annulus that occurs between the pipe and the soil layer. And gas is able to migrate for upwards of miles before it's finally released to the environment, so there's a number of more factors. That's why it's key to work with the pipeline operators on action plans about what they actually need to have is inputs to develop remediation programs for these leaks.

MR. KURTOVICH: Any more questions? Seeing none I guess we'll adjourn and then re-convene at 1:15.

MS. KOZAWA: We have ended a little early, but I would like everyone to be sure to take advantage of talking vendors outside if you haven't already. And we do have vehicles in the courtyard being displayed currently.

So we'll actually reconvene for the panel session at 12:30. It's not even 11:00 right now, so come back here at 12:30 for the first panel session.

Thanks so much.

(Off the record at 10:40 a.m.)

(On the record at 12:35 p.m.)

MS. KOZAWA: Good afternoon and welcome back. Oh, I dropped the microphone.

Welcome back to Session 5, our regulatory panel is about to begin, to moderate this panel today with the Division Chief for the Industrial Strategies Division, Floyd Vergara. Floyd?

MR. VERGARA: Thank you, Kathleen.

Welcome back everybody. I hope you enjoyed your lunch and the really nice weather we're having especially relative to the triple digits we've had over the last couple of days.

I was listening in on this morning's session, I thought it was really informative and I'm looking forward to an informative session on the regulatory side as well. I've been at the Board for 28 years doing nothing, but regulations. So I'm looking forward to hearing all the different perspectives on directions with regard to regulations and how to reduce methane emissions both in California and outside of California.

So with me today we have a distinguished group of panelists. Introducing from my life Elizabeth Scheehle, she works for me at the Air Board. She's the Chief of the Oil and Gas and GHG Mitigation Branch.

To her left is Art O'Donnell from our sister agency at the California Public Utilities Commission.

To his left is Trina Martynowicz from USEPA Region 9. To her left is Brady Van Engelen, he's from the -- oh I'm sorry -- from DOGGR. I think most of you know DOGGR, but for those who don't it's the Division of Oil, Gas and Geothermal Resources at the Department of Conservation.

And then finally, our last speaker is Laurie ten Hope, Deputy Director for Research and Development at the California Energy Commission.

So I'm going to open it up by asking the panelists one by one to take a little bit of time to tell us about their programs, what's going on, and give us the lay of the land.

And I'll start with Elizabeth.

MS. SCHEEHLE: Thanks, Floyd.

And thanks everybody here, I think this has been a really interesting and useful symposium and is very timely for us as we're working on our oil and gas regulation and working with the PUC on what they're doing as well. I'm just going to spend a few minutes, talk about the oil and gas regulation that we just put out last week and some of the other work that we're doing.

So we put out a regulation last week and it covers kind of the upstream portion as well as underground storage and processing and transmission compressor stations. And so what that looks at is reducing emissions from tanks, compressors, pneumatic devices and components.

And one important thing that kind of you heard this throughout some of the discussions. We did incorporate high leaker factors for some of those, for the components where possible, because we did see this trend, this fat tail trend happening and wanted to make sure that we accounted for that. So that was something we found important.

And I also wanted to emphasize that this is built upon decades of work that's been happening at the local air districts on ozone issues. So there are VOC emissions from the oil and gas industry as well. And so we worked with the districts very closely, what they've put in place toward the VOC emissions, and then expanded that to look at kind of the non-VOC sources, the primarily methane sources. So that has been very useful.

And I think we actually start from a different baseline than a lot of other places might. We actually have lower emissions than maybe some other oil and gas producing regions.

I also wanted to mention -- I'll let Art really dive into this -- but we are working closely with the Public Utilities Commission on their work on reducing emissions from the transmission and distribution side.

So the combination of this, both of those regulations, the upstream and the downstream we really are looking at covering the entire infrastructure within the state. And we are anticipating that to look at basically a 40 or 45 percent reduction. You've seen that number before in different presentations. And what's left after that is really accounting for what we import as well in the emissions associated with that since 90 percent of the natural gas we consume is imported.

I also wanted to mention that we are covering all of the infrastructure, but we are also looking at, "Is there anything we are missing?" And I think some of what you saw, are things that we're thinking about in terms of abandoned wells and are there things beyond the meter that we need to be thinking about next?

So finally, I'll also just say we're also interested in looking at the co-benefits from these regulations, reductions and talks in making sure there are no increases in other pollutants as well. So that just kind of gives an overview of what we're working on at ARB on the oil and gas side. And I'll turn it over to Art or Floyd if you want to give a --

MR. VERGARA: No, thanks Elizabeth.

And I think what we'll do here is we'll let all the panelists go through their talking points. And then we'll either open it up to the audience for questions or I have some questions myself I could pose as well.

So Art, why don't you go ahead and go through your presentation?

MR. O'DONNELL: Okay. Good afternoon, everyone. Okay, one more time, good afternoon everyone.

AUDIENCE: Good afternoon.

MR. O'DONNELL: Thank you. Let's get the energy level back up here. (Laughter.)

I am Arthur O'Donnell. I am a Supervisor in the Risk Assessment and Safety Advisory Section of the Safety and Enforcement Division at the California Public Utilities Commission. I am the purveyor of just in time regulation, as you can tell as I walked in the door after we started, so my apologies to fellow panelists. We hit some heavy traffic outside of Davis for no apparent reason.

I say "just in time regulation," because sometimes it's really difficult to keep up with events. And one of our current proceedings that we're working with Elizabeth and the staff at ARB on is a prime example of that. In that it was responding to legislation, SB 1371, from Senator Leno which directed the Public Utilities Commission -- working cooperatively with the ARB -- to do several things.

But mostly it was to get a handle on what the real situation is with leaks and emissions of natural gas. But in particular methane component of natural gas -- which as you know is the major component of the natural gas that gets delivered through our system -- to develop best practices for the detection, the quantification, and the reduction of such leaks and to do this on a regular basis, and to build those new understandings into our rules, policies, and regulations covering the gas industry.

Now the Public Utilities Commission has a pretty defined regulatory authority over this, in that acting on behalf of the federal government the PHMSA Group -- which is the Pipeline Hazardous Materials Administration, safety administration -- we are the agents of federal policy for auditing, inspecting, making sure that the pipeline system, everything above ground is up to snuff, meets standards, and does not blow up every now and again.

All right, we also have jurisdiction over when things that do blow up, like through excavations or dig-ins.

And during the pendency of this particular proceeding, we had Aliso Canyon, which started last October. And the leaks there lasted through February, which really not only upended our sense of our jurisdiction, because our friends at DOGGR had primary jurisdiction over that component of the storage system, and yet everyone got called into this emergency, all right? So that's one thing.

The second is that because of that, now agencies up and down the line from the federal government on down to the state are ratcheting up their regulations. And so while we thought we were being cutting edge with some of the things we were doing in the 1371 proceeding, we're actually catching up in some regards. And the newest regulations from ARB that impacts the storage component and some of the other components of the system are a good reference point, because we were moving in a direction and now we have to go really fast.

I'll close right here with one of the big important factors of SB 1371, which was really for the first time -- and I'm not sure that all our friends in the gas industry have quite gotten it yet -- we are treating methane releases as a safety hazard, as a hazard to the environment, a health problem.

Our jurisdiction, under PHMSA is largely about safety, because everything gets determined or gets categorized by, "Is this hazardous to people or property?" All right, that's category one. Category two is, "Could it be if we let it go, right?" And so you schedule that for repair. And three, is leaks on the system that are not considered hazardous under that régime. And those would be category three leaks, because they're far away from properties or they're of a minor volume. And so the gas companies generally have, "Watch those, schedule them for repairs if they seem to be getting worse." Or sometimes letting them go on and on and on.

Part of this proceeding was to actually get all the gas companies to report on their leaks. And I'll say that we were surprised at one major finding from our first round of surveys -- which happened last May -- was that while we thought that the problem with leaks and emissions was in these category three leaks on the gas pipeline system and other components, really what we found were there were uncategorized leaks largely from vented emissions during maintenance procedures at gas facilities. And to our surprise "other," the vast other category which was largely comprised of the threaded fittings between the riser that comes up from the distribution part of the gas system to the meter at the household.

Now a caveat, these are estimated emissions, all right? We don't really have a really good handle on what the actual emissions profile is, but using the emission factors that ARB developed and that the utilities routinely use, we determined that this could be almost half of the total emissions profile that we want to do something about.

So when we came out with best practices in March, we put a heavy emphasis on those two components as well as things like increasing the schedule for repairing the leaks, category twos or threes. And a lot of other best practices that I can talk about in response to questions. But that's generally the framework around which we're working.

One more just in time issue is that the Legislature is in session. And if you've been following them at all, you know that there are literally a dozen different bills that somehow impact the gas system, because of Aliso Canyon. And we're trying to not only follow them as they change on an almost every day basis, but also figure out what that's going to mean for our regulation, for ARB's regulation, for DOGGR's regulation, for your business.

So I'll leave you with that and turn it on over to Trina.

MS. MARTYNOWICZ: Hi, Trina Martynowicz, U. S. Environmental Protection Agency.

So back in March of 2014, Obama announced his goal to be reducing methane emissions 40 to 45 percent, primarily utilizing the Clean Air Act. There are other federal statutes as well. There were various white papers that were released that year.

And last August, we proposed a few different rules to cut methane as well as VOCs, both from the oil and natural gas industry and clarifying various air permit requirements. About three weeks ago, mid-May, we finalized those rules as you may be aware as well as proposed an information collection request.

The three rules that were finalized were for new modified sources. During that public comment period, received over 900,000 public comments. And I'm sure a lot of you in the room probably helped provide those comments, so thank you for taking that time to do so. We incorporated a good number of them, which I'm happy to highlight.

From these three rules, we anticipate reducing over 510,000 short tons of methane by 2025 or 11 million metric tons of carbon dioxide. The climate benefits are anticipated to reach $690 million by 2025. Besides reducing methane, of course we'll be reducing VOCs, an anticipated 210 tons. And then various air toxics, 3,900 tons. I'm happy to highlight these three rules. And as I mentioned, these are for new modified or reconstructed oil and gas facilities.

We first belt upon our 2012 VOC emission rules. For these sources, we are setting methane limits. We're also looking at having a fixed schedule for monitoring leaks. And there is a year for initial leak survey detection. We also are allowing facilities to take a variety of approaches for detecting leaks, including using method 21, repairing a threshold of 500 appm. And then also facilities can use emerging or innovative ways to detect these leaks per EPA approval.

For the new source determination rule, we're clarifying our air permitting rules, looking at clarifying the Prevention of Significant Determination, PSD, on the non-attainment new source review, and the Title 5 operating permits. These rules are defining what adjacent equipment and activities are -- essentially if there's different types of equipment that are on the same site that share common equipment and that are within a quarter mile from one another.

We also finalized the Federal Implementation Plan, or FIP, for Indian country for minor new source review. This is just really streamlining the permit process for those facilities that are on Indian country or in tribal lands beginning in October of this year. The FIP also, I should mention especially being here in California, does not apply to those tribes that are nonattainment areas. So if a tribe is in a nonattainment area, they're still going to need a site-specific permit or if a reservation already has a FIP, they're able to use that.

We will be issuing control technique guide lines to be reducing VOCs from existing sources in nonattainment areas. And then as I mentioned, we are issued a draft, kind of draft survey, for information collection requests. So this essentially is for existing facilities. That comment period is open, so I suggest you please -- we're requesting everyone to provide comments, which this ICR request we're anticipating will help create our eventual regulations for existing sources.

I'm happy to talk maybe a little later about EPA working with a variety of states, of course the State of California, on harmonizing our final rules with our proposed rules. BLM is also having proposed rules coming down the pike. And then we're also doing a bit kind of more broadly on methane that I'm also happy to talk about a lot of partnerships, tools, resources, funding opportunities, etcetera. Thanks.

MR. VERGARA: Great. Thanks, Trina.

Brady, if you could talk to us about what's going on with DOGGR?

MR. VAN ENGELEN: Sure. Thank you. My name's Brady Van Engelen from the Division of Oil and Gas and Geothermal Resources. We're the agency that oversees the oil and gas production for the state.

Beginning last fall, we had started to revise our underground injection control regulations. Obviously in late October that process was derailed by Aliso Canyon. And since then we've focused our energies on gas storage with UIC still being a component that'll be worked on at a later date. But for now, given that the gas storage emergency regulations went into place on February 5th our energies are focused primarily on creating a regulatory --

modernized regulatory framework for gas storage.

The broader approach that we're looking at here is trying to create a proactive environment rather than a detective environment, if you will. The regs as they currently -- or I guess you could say as they were written prior to the emergency regulations, require a lot of reactive testing and response by the operators. We'd like to move towards more of an environmental where the testing informs the engineers on the ground, who then follow up with the operators and inform them of what steps need to be taken for each.

Well, mainly what we're trying to do is reflect modern technological advances, advancements -- well construction standards up to date as well too. Leak detection as (indiscernible) we're working on very closely in consultation with the Air Resources Board. And a very large component of our gas storage regulations will be the risk management plans. And we're working on those very closely with the National Labs who played a key role at Aliso Canyon and continue to work with us today and they're a valuable asset for us.

The risk management plans are primarily devised to respect the fact that all these wells are -- all these fields are in different -- the geology's different for each field and essentially each well too, so the operators need to take that into account. If that's taken into account and reviewed by the engineers at that point then a response to go forward could be provided.

We're not there yet. It's really something publicly, but we're working diligently to get something out. I'm happy to answer broader questions, but again those are still in the draft process.

MR. VERGARA: Great. Thanks, Brady.

And Laurie if you could take up the activities of the Energy Commission, please?

MS. TEN HOPE: Sure.

So the Energy Commission is really working in concert with our sister agencies on several aspects, so from sort of a policy prospective and a nuts and bolts perspective. And I'll sort of start backwards with some of the nuts and bolts who the last couple of days have been spent on methane detection, monitoring, assessment abatement. And we're very much engaged in those activities from a research perspective.

You heard presentations from some of the researchers that are funded by the Energy Commission and Yu Hou who presented for the Energy Commission and will continue supporting research that gives us a better assessment of where the super-emitters are, how to detect them more cost effectively, what strategies there are to monitor and mitigate. We work closely with the Air Board on research. We want to collect research with a common methodology that the Air Board can utilize as its looking for what regulations make sense.

For example, we have a project where we'll be looking for super emitters around the state. And our research is focused on the natural gas infrastructure. And the Air Board will be focused on other sources, but will use the same contractor or the same sub and develop a common methodology. So what's collected from one source is comparable to another source.

I think we've heard discussions that we have indications that leakage might be higher in buildings than we thought, so let's go take a look at that. We're conducting research in residential and commercial buildings to increase the sample size of what kind of leakage there is behind the meter.

We're also looking in a complementary area of pipeline safety, so some of these leaks -- they don't lead to catastrophic health issues in the short run. I'm talking about explosion kind of health issues. So we also focused on work to support the CPUC and the utilities on how to more cost effectively assess corrosion and other types of issues with the natural gas pipelines, so that they can -- leaks and issues can be found more quickly and do a better risk assessment. Right now, it's expensive and it's challenging.

We're also planning to do research on abandoned wells and the impact of ground subsidence on wells, find them. Also DOGGR is helping with providing different generations and whether wells have been capped or not and where they are, so that we can assess different generations and what the leakage patterns are, given different types of capping strategies.

I mean, there's a lot that we're planning to do in the research area to help support leakage detection. But I think the question put to the panel was also broader in terms the role of natural gas going forward. And I think there are a lot of questions. We certainly know that the more we can transition away from natural gas, that's an obvious mission reduction strategy, but how to do that in what sectors and when, there are a lot analytical questions to be addressed.

Right now with the electricity mix that we have, it doesn't necessarily make sense to switch to natural gas, but as you are more and more electrified by renewable sources than your emission and cost profile changes. So at what point should we be pushing electrification of appliances versus more efficient appliances. But that's an analytical question that the Energy Commission plans to tackle along with the ISO and the CPUC and the assessments that are planned for the 2016 and 2017 IEPR, probably more the 2017 and beyond, to really look at the questions of the role of natural gas going forward.

In the short term the questions that the Energy Commission will be looking at from a policy prospective are really around reliability, so given Aliso Canyon and the dependence that the state had on natural gas storage facility what kinds of strategies can be put in place to mitigate reliability issues this summer, this winter, and next summer.

So that's the short term focus. And then the longer term focus would be look at much deeper into the challenges of electrification and transitioning from natural gas.

MR. VERGARA: Great. Thank you, Laurie. It sounds like we're all very busy with activities related to methane. So it sounds like there's a lot of things to keep track of.

Before I open it up to the audience for questions I have a couple of questions myself and I'd like to open it up to the panel members to address it. I'm going to address this to the panel at large, so any of you can take it or all of you can take it.

So Aliso Canyon was mentioned earlier, and obviously it was a big wakeup call for everybody involved. I'd like to know if there were any specific lessons learned, takeaways from Aliso Canyon, that inform what we are doing or what we should be doing in the future. So is there -- and related to that is, you know, what can we learn from Aliso Canyon to prevent another similar incident as well?

So I'll open it up to the panelists to take that up. Whatever order you guys want to do. We'll start to my left, since she works for me, so. (Laughter.)

MS. SCHEEHLE: Thanks?

I can start out by talking about what we have done. I didn't really mention it in my opening remarks, but we have, based off of what happened at Aliso Canyon, we'd always in the oil and gas reg had storage in there and had the storage facilities being subject to the leak detection repair requirements, which are sort of a quarterly requirement that folks have to go out to their facility and detect leaks and fix them within a certain timeframe.

What we've done in response and actually working with DOGGR on this, they have as part of their emergency regulations a daily leak detection kind of protocol that facilities follow. They submit it and then it gets approved by them and ARB is working with DOGGR on that.

And we actually are incorporating that into our regulations, kind of taking on the air portion of that, looking at the daily monitoring as well as continuous ambient monitoring, so that if there are leaks that we find them quickly. And that may enable fixing them quickly or before they become worse, so that's part of what we've done.

We've also done some clarifications within the reg to make sure that things that are leaks downhole are considered leaks above ground as well, so from the ARB perspective that's some of what we've done.

We are looking to what happened with the root analysis. What comes out of that and see if there's anything additional, obviously working with our sister agencies on that on who's the appropriate person to take that on. But if there is something additional that we need to do, is consider it at that time.

MR. O'DONNELL: I have four lessons and two of them will get me in trouble with my bosses, so Maria you just keep your mouth shut. (Laughter.)

The first is that it told us once again. Every incident tells us this. How fragile the system really is. We have an aging infrastructure. Electricity, natural gas, just about anything that we rely on; they all are eligible for AARP membership, pretty much.

Also, this teaches how interconnected our systems are. And so we have to think broader than the risks to the gas system or the risks to storage and the impacts that that has on electricity. Currently, we're dealing with the possibility -- I'm just saying possibility -- that under peak circumstances this summer there may not be enough gas, because this major storage facility is unavailable, to power generators in Southern California. And so that causes a whole host of subsidiary policies to be put into effect on a somewhat expedited basis, sometimes without the benefit of due process, right? That's what happens anyway.

So one of the good lessons is that you get your coordination in advance. That you work with the other agencies to develop the mechanisms for sharing information so that you have that on the shelf. And we kind of like had to try and keep up with that.

But I'll say, for instance, that when we started the 1371 proceeding, the first thing that I ended up doing was shepherding a Memorandum of Understanding between our agency and the ARB in order to share what otherwise would be considered confidential information from the gas companies. And we're now affecting similar MOUs with DOGGR, with OES, with the Energy Commission. I just got an MOU signed by our executive directors with the Energy Commission for a whole other purpose. But when we have those in effect, response is a lot faster.

The second is that risk management, and its proper role in regulation, is really something that we have to pay attention to.

And you've heard it mentioned a few times here. In our case, one of the lessons that we had to learn is our major function as an economic regulator is to approve utility requests for money right, through general rate cases. And there was in fact, in the Southern California Gas general rate case that is now coming to a conclusion but filed initially in 2014, a section about storage infrastructure, the aging storage infrastructure, and the proposal that SoCalGas had for a six year program to essentially inspect every component part of their system, their storage system, repair what needed to be done, upgrade the rest and figure out what to do from there.

A general rate case is not really the place to do that, if three months later the system is going to fall apart, all right? So we learned that we have to one, read between the lines a little bit more. And be more proactive and suggest to our utility friends that if they see something that they think is really going to be a problem, take it out of the GRC and give it to us in a format that we can deal with much more rapidly.

Now I'm not going to fault them for this. They came to us with a proactive plan that on paper looked pretty good, but in retrospect, what do you hear? You hear from the Legislature. You hear from the Governor. You hear from the media that, "Oh, they told you in 2014 that their system was falling apart and you didn't do anything about it."

Well, we in fact were doing something about it, but in a slow procedural manner which was not appropriate for the particular circumstance, but 20-20 hindsight, you've heard of that.

All right, the final lesson is that you have to, as an agency as regulators, accept responsibility even if it's not your responsibility, right? And because the Legislature is in the habit of beating up on the Public Utilities Commission and has been since the San Bruno explosion -- and before that really -- they came down hard on us. And it did not do us any good to say, "But DOGGR, DOGGR, those guys over there," because that just doesn't work, all right?

And so we had to kind of like own up to it. Make it part of our responsibility, in coordination with DOGGR, in coordination with the Office of Emergency Services, in coordination with ARB and everybody else that got involved. And there were many, many telephone calls in order to figure out how to do it. So those were lessons that we learned at the PUC.

MS. MARTYNOWICZ: So EPA is working on actually our recommendations, so I guess Floyd's question is stay tuned for the fall.

We, I think, the NETL presentation mentioned earlier today that there's a federal task force examining the incident. The White House is involved, the Pipeline Hazardous Safety Administration, Health and Human Services, Interior, Commerce, FERC, NOAA and EPA, DOE.

The task force was charged to submit a final report in the fall, six months, where specific recommendations will be provided that could potentially apply to around 400 natural gas storage facilities throughout the nation and potential regulations to follow that. This report's going to include analysis and a conclusion of looking at the cause of the leak, measures taken to stop the leak, the impacts of the health, safety, environment and economy of the residents and property around the area, and then just an overall analysis of the response.

We're working with a variety of state agencies here, so thank you folks for working with us on this. And there's a variety of work groups that are breaking down these activities in infrastructure and storage and safety, looking at how the leak occurred and prevention.

And then the EPA is overseeing -- my office out of San Francisco, is overseeing the Public Health and Environmental Work Group and coordinating the communication on that. We're looking at post-leak, so looking at the health and safety of the residents, the ambient air monitoring and communications.

So for example did we use the right monitors? Did we test for the right pollutants? How is that data utilized? How is that communicated? What was the process of testing indoor health, for example? And then how was that communicated publicly and what decisions were made and were those the right decisions and the right process, so for example moving the residents out of their homes.

And then looking at more of the emission sides, the greenhouse gas emissions, the quantification, was that accurate, and then the future activities and proposals for mitigation.

That report, as I mentioned, is going to be coming out in the fall. And yeah, of course, it's all hindsight, right? It's all could-of, should-of, would-of, and that's really not the focus of this report. That's not the purpose. It's not finger pointing, but really looking at what were those good decisions? What lessons were learned? And then what recommendations are going to be transferrable?

And then I should also mention that our Information Collection Request looking at the existing facilities is going to examine underground storage tanks and facilities, which of course EPA is not currently regulating.

MR. VAN ENGELEN: So I guess the easy out here is today that we have -- we're working with the PUC on a joint investigation, which will provide some lessons learned. And also our Monitoring and Compliance Unit within the Division is also conducting their own investigation, which will be more specific on the well itself, which provides some lessons learned.

But from a broader prospective the Division historically has looked at gas storage as a subset of UIC. And we quickly realized that we couldn't meet our mandates required of us if we continued to do that. It's grown into its own program, so I guess that's probably the bigger lesson learned from the Division. But the timing on that, getting back to the investigations, the timing will be largely determined on the testing, which is underway right now. And I don't have a great timeline on that.

MS. TEN HOPE: I'd say too the lessons learned kind of parallel a couple of things that Arthur mentioned and a third that's a little bit different.

But you were mentioning how fragile the system is. And I think a lot of the strategies that we are putting in place can build in flexibility to the system and helps with that fragility. We still need to replace infrastructure, but the strategies with renewables demand response, storage and building up more of renewables and strategies, more on the distribution and end use level, does build up some flexibilities so you're not quite so dependent on large utility-scale infrastructure. And it allows deploying new strategies when something like this happens.

One of the other ones that Arthur mentioned was collaboration among agencies. And it probably sounds kind of boring, but it really works. All the state agencies, in particular, at this table along with the ISO met regularly, weekly if not daily, with the Aliso Canyon crisis. And then on an ongoing basis for, "What do we do mid and long term to address these issues?" And when you're all working in concert to the same goal, you actually get somewhere, so that -- it's I think been really important.

And the third lesson learned was, we had a research project that was looking at whether an instrumented aircraft could measure and detect leakages from the gas system and be useful in finding some of the large emitters. And it sure was. We were able to deploy it to Aliso Canyon and take measurements and that was some of the early numbers that were coming in about really what the scale of the release was. And so I think that validated the research and also the value of a research aircraft in that situation.

MR. VERGARA: Great, thank you.

Those are all great insights and lessons learned. I think we can all appreciate the importance of Aliso Canyon in terms of informing our future activities.

I'm going to open it up to the audience at this point. Anyone have any questions? We do have microphones that can be brought to you, just raise your hand if you have a question.

(No audible response.)

No questions? Okay. Well, I will entertain you with more questions. All right, I'm going to ask one and answer it to the extent you're comfortable. I'm not going to try to put anybody on the spot, here.

But natural gas in California, I think about 10 percent of it is produced in-state and 90 percent of it is imported from out of state. And as much as people refer to California as kind of an island in itself, we all in California, at least at the regulatory stage, recognize that we can't solve the word's problems by ourselves.

Methane certainly is a global climate issue and given that 90 percent of the natural gas is imported from other states, the question I would pose to the folks here, and again I will open it up to the entire panel, is given that most of the natural gas comes in to California from outside of the state, what are the things that California can do as a state to reduce methane emissions from the national natural gas production and transmission system?

I know there are some thoughts going around, but perhaps if you could share some of your thinking from the regulatory agency standpoint. And even though this is a regulatory panel I would open up the question to include both regulations and non-regulatory policy instruments as well.

MS. SCHEEHLE: I can start out again. I think this is a really important component. As you said, 90 percent of our natural gas is imported and we have developed a good system within California to get at the emissions from both production, transmission, distribution.

I think one thing we've considered when developing the regulations is how can those be exportable? So I think that's part of it is, are these things that other states can do?

On the production side we've taken what's been done in the districts, we've looked at other states, and what's being done federally. And looked at how we can make this something that other places can do as well. And that's a consideration when we're looking at the transmission and distribution side as well. I think that's even more sort of cutting edge in terms of looking at methane from that sector.

And we're looking into more what are the emissions associated with that? So we have a good sense from EPA on kind of the national emissions, but what actually comes in to California from the different basins. And that's sort of the life cycle model that we talked about and getting a sense of that. But and then watching actually what EPA is doing, the new source performance standards are important, but those do just impact the new and modified sources. So seeing what happens for the existing sources, does that get to the significant reductions we need when considering the emissions that are associated with what we use here. Or is there something additional that we need to do?

I mean when you looked at -- in going over Roman Alvarez's figures earlier about what this leakage translates to into coal plants. I mean, that's a significant number and looking at that, I think that is something we need to address. How specifically we do it, I think we're still thinking about, but one thing is the exportability and looking at what's going on, on the federal level.

MS. MARTYNOWICZ: Yeah, I mentioned EPA's rules.

I also definitely want to mention other methane sources and renewable natural gas. The EPA has always been a huge proponent of renewable natural gas. And we have a variety of partnership programs that you probably have heard of some of them looking at landfills, dairies, waste water treatment facilities, etcetera.

So we provide different tools and resources essentially to help bio-methane production from these different sources. So if it's here in California, I think there's still a huge opportunity. And I know with Aliso Canyon and some mitigation activities there'll be some additional resources as well as under the short-lived climate pollutant strategies. So I think applauding the state on that strategy and really just trying to focus more on let's get more renewable natural gas. So I think there's a lot of opportunity there.

And then yeah, we'll see with the EPA's Information Collection Request, like you said, for existing facilities, which I think we all know probably is not --the proposed rules if definitely not final rules are going to occur before November. So we'll see.

MR. VAN ENGELEN: So on the gas storage side I guess more of on a well-by-well basis, a much more aggressive testing regime, and it has proven to be beneficial to this point. You know, there have been other fields where come to bear that their wells (indiscernible) and so that testing regime has been effective in the limited scope that it's been used to date. Obviously, there would be some other components to, that getting back to risk management and detection, but those are the primary components that we look at.

MR. O'DONNELL: All right, if I might, I'm going to take off my regulatory hat and hearken back to my 30 years as a journalist who covered the energy business, largely in California, but also for national entities that cared a lot about California.

And the biggest and best thing that California can do is be a role model for the rest of the country. And we have done this again and again, in many areas of energy policy. In particular on the environmental side, with the introduction of selective catalytic reduction equipment on power plants in Southern California, in order to essentially save the air. Because if anyone was here in the 1970s you could not see the San Gabriel Mountains from downtown Los Angeles and you couldn't see Downtown Los Angeles from the Hollywood hills. And it's not perfect, but it's a lot better. And the air control devices that our South Coast Air Quality Management District pioneered have become accepted throughout the world, really.

When it came to climate change, California did not throw up its hands and say, "Hey, it's a global problem and there's nothing that we can do about it because it's really China's problem or India's problem or somebody else's problem. We decided to do it and become a role model.

Now the rest of the country has not necessarily accepted all of our policies, but some of the good ones that we've taken on, which we're proceeding and which are taking roots, are electrification of transportation, right? There are more electric vehicles in California than in the rest of the United States combined and that's just going to continue and pull along the industry with it.

It is amazing to me. I drive a Honda Civic Hybrid, so does my wife. And the ten years since we bought our vehicles, now there are 20 different models from different manufacturers that do better than our car and so our next car, hopefully, will be an all electric vehicle, all right -- to push it.

Also, one area that we might consider on the electric side, we have a performance standard. Essentially for any power that's purchased from outside of California's border it has an emissions limit. And so that, under long-term contracts that essentially does away with coal in the mix of our generation. I'm not saying we're going to do that for natural gas, don't freak out, all right? But there are things that we can consider that will have an impact beyond our borders if we do them right.

MR. VERGARA: Great. Thank you.

We have an audience question. John, do you have a question?

MR. SHEARS: Yeah, John Shears, with the Center for Energy Efficiency and Renewable Technologies. I'm also going to be speaking on the later panel this afternoon, so I don't want to take away too much of what I was going to say. But our shop's been engaged in advocacy on the short-lived climate pollutant strategy probably earlier than most, including posting one of the first symposia here in Sacramento and in California, on the issue involving many of the agencies represented here today.

One of the ways that we look at methane is we don't just look it at as a climate issue. Our organization originally started as an air quality organization. And we look at methane as an important air pollutant as well, especially when it comes to ozone, which is another short-lived climate pollutant.

And in fact, the World Meteorological Organization in the United Nations Environmental Program, through its integrated assessment on black carbon and tropospheric ozone, a couple of years or three or four years ago basically put forward the message that two-thirds of background ozone is the result of methane. And so we've been advocating that CARB, and all environmental organizations that work on air quality, should be looking at methane not just as a climate issue. For us climate is just another form of air -- the climate issue is just not an issue in terms of air quality and air pollution -- but it should also be looked as an important and critical precursor to background ozone.

Given that, and what Arthur was just articulating in terms of the improvement in air quality in the L.A. Basin etcetera, how could the EPA further extend what it's doing to assist California -- recognizing that California still may be a bit reluctant to move forward on the air quality angle on methane -- to help us get the foot print down further than is currently envisioned.

Forty to forty-five percent is good, but what we're looking at is we have to get basically a near zero tolerance policy on leakage from the natural gas system for it to be a climate benefit. We need to get it down to a system-wide average leakage rate no greater than 2 to 3 percent depending on whether you're using technology warming potential, global warming potential, what have you.

So given that EPA also has authority over air quality, is there more that EPA could be doing given that a lot of the regulations are state-level issue, could the EPA be doing more using that angle to help California and the ARB be again the first mover in this space.

MS. MARTYNOWICZ: Thanks. Yeah, that's a great question.

Sure, I think there's always an opportunity for more, especially for those existing sources. One thing I know nobody ever really wants to hear but is enforcement. And so ensuring enforcement of existing rules, VOCs for example, which of course would be in turn reducing methane if you're fixing leaks at the end of the day.

I unfortunately was not able to be here yesterday, but I believe there were some JPL and NASA presentations. So we've been working with the researchers there on helping them determine what sources or facilities to be looking at for monitoring for these pretty large significant sources. So I think that's a start.

As we've all heard, our information is only so good as the data that we're collecting. And so we've been working with them to be providing a list of facilities that we know that where there are some potential opportunities for reductions. And then with our upcoming roles, also, at the end of the day, there will be enforcement as well.

I know EPA throughout the nation has taken a variety of enforcement actions from various natural gas facilities.

MR. SHEARS: So maybe this might be too probing a question. So based on all of the work -- and this past two days has been fantastic I think for anyone else in the world that hasn't been working in this space this is a great deep dive and introduction into all of the issues and what's being done to deal with those issues.

Is there thinking going on within the EPA to further extend, tighten the regulations? Again, highlighting the fact that you can also use the ozone precursor angle given that there are these regulations that are basically in flux, in motion right now. So is the EPA willing to consider being more aggressive given that we were having all this very fresh, very revealing research demonstrate to us what's really happening in the system?

MS. MARTYNOWICZ: Yeah. I would say definitely so. And I would definitely encourage you, and like I said the others, to provide comments on our Information Collection Request.

We're going to be creating two different forms of a survey. So a draft survey that's out collecting those comments, incorporating those comments, and then sending out a second draft survey to the public to providing final comments. And so definitely encouraging folks exactly to do that.

And then we're also going to be having a voluntary information collection request for academia, for researchers, for industry of course, as well as regulators on providing information to us -- state information that will in turn help with these draft rules.

MR. O'DONNELL: May I ask Trina a follow up question?

MS. MARTYNOWICZ: Wait a minute, Art. Who was allowed in (indiscernible) other panel? (Laughter.)

MR. O'DONNELL: I'm still a journalist. I'm still acting as a journalist.

But we all have to deal with constraints, all right? And as I alluded kind of at the local level we get beat up for not doing enough. At the federal level EPA gets beat up by Congress for doing too much. So in this particular area you've got lawsuits against the Climate Action Plan and many of your other policies.

In this particular area what do you see as the political constraints that you might have to try and overcome? Not just Region 9, but EPA as a whole?

MS. MARTYNOWICZ: Yeah, that's a loaded question. And come November I should mention, especially it being a Primary Election today who knows right, where we'll be as a nation? So yeah, we do take into consideration that we are here in California, in our bubble for good, for bad.

But yeah, there are a lot of constraints throughout the nation. And that's why I think the rules that we finalized a few weeks ago were very challenging, knowing that there's of course progressive states like California who are in the process of drafting rules, compared to those other states that are suing us left and right on pretty much all activities under anything on air quality. So, a lot of opportunity, right?

MR. VERGARA: All right, I'm going to switch gears here and read out a question that was posed online. It's pretty much in the weeds, but we'll ask it anyway.

This is with regard -- this is a question involving aging pipes and pipelines and what to do about them. So the question is, "It's my understanding that the pipes involved in the Aliso Canyon leak and many of the distribution lines around the state are decades old; some as much as 60 years old. What effect does pipeline age have on likelihood of leaks and do any of the proposed regulatory actions focus on requiring pipe replacement at regular intervals?

MR. O'DONNELL: I'll hazard an answer to that recognizing that I'm actually fairly new to the Safety Enforcement Division, only a year into this. But this is something that we deal with all the time. And maybe we can take up this in the next panel as well because we have operational experts.

It's not just age, right? You have type of pipe and California is actually blessed in that we don't have a lot of clay pipe or lead pipe still in the system, whereas cities and communities back East still feature that. And those are far more prone to leaks on the distribution level.

There is also still some remnant of the vintage of plastic pipe -- we call it Alydyl-A -- that was inserted in the '70s, I believe. But our utilities have been working really hard to try and replace that. There's still some there. But that represents probably the biggest vulnerability in the system, because we didn't know as much. We thought plastic was forever, but its brittle and it cracks and it causes leaks and it needs to get replaced. Again, there are other places in the country where it's far more of a problem for us.

Our situation that we've discovered is that no matter how much money we put into the system, the replacement of pipes cannot keep up with the aging. That's just a fact of life. You know? Under the best of circumstances as approved in general rate cases we're still looking at maybe 100 years before we can turn out the entire system and replace it with now, what would be state of the art, but who knows what that would look like in 50 years? Would it have its own problems?

So you could say that it's hopeless or you could say that we'd better be better at identifying where we need to replace and repair. Detection is one of the ways you do that, understanding the chemistry of the system is another, because one pipe in a dry area is not affected the same as a pipe in a moist, wet area, like the Delta. So you have to focus your efforts in the places where your risks are the greatest.

And I'll stop there to keep from getting in trouble.

MR. VERGARA: Okay. Thank you.

Any other questions from the audience; if not, I have some other questions.

All right, I have a couple here. I think he raised his hand first and then McKinley.

MR. ZENG: My name is Yousheng Zeng with Providence. I'd like to ask a question about a leak definition. In the regulatory framework, especially for the LDRAR Program, a leak or not a leak is defined by sniffing, and to measure the concentration measured as ppm. That was because of a lack of other ways 20 or 30 years ago. Now, we have methods to quantify. And in the past couple of days there has been a lot of discussion about the quantification in terms of a mass leaking rate.

I think we all agree that a mass leak rate is one to the agency or the management who will need -- ppm physically really does not directly correlate to what is the leak rate. And the EPA did that because of, again, historical reasons.

So now, we're going to -- or I hope that a regulation is going to eventually migrate toward the actual mass eco-rate (phonetic) based type of management system.

In the recent rule of three weeks ago that the oil and gas (indiscernible) there's a number there that shows a 60 grams per hour leak rate. Basically, that's the kind of a --

So my question is can we consider that as the EPA's current view as basically if it's smaller than 60 grams per hour it's not -- well basically is that kind of a new trend to have some sort of cut off of about 60 grams per hour, is that one?

Another related question is that we heard a lot about super emitter? I don't recall if there's some -- I know there's not going to be a clear cut -- and to what level -- but kind of an order of magnitude if anybody on the panel can say? Well, we consider first of all at lower level what a mass leak rate will be significant enough for the agency to consider?

Next is what is the kind of general range for the definition of a super emitter?

I also understand that especially for the lower part of that you can say well, if you have a definition that is let's say 60 grams per hour does that mean everybody that -- all the component that is not detected will have to use that upper limit? To kind of like in the general chemistry use the detection limit for everything that is not detected, which will cause a huge number too.

So what is the agency's kind of view on that and just to run that? Thank you.

MS. MARTYNOWICZ: Yeah. In regards to this specific EPA rules and the kind of cut-off rate of the -- I honestly can't answer that, but I'm happy to put you in touch with those folks that actually wrote the rule and are going to be able to answer the question. I don't want to give you misinformation, so please come see me afterwards and I'll definitely connect you with those right individuals.

MR. VERGARA: Okay. And I think there was a question from McKinley up there.

MR. ADDY: Yes, is it on? I'm fine, okay thank you. McKinley Addy with AdTra.

This question might inform a possible comment at the end for the CEC's IEPR Workshop. But with the Aliso Canyon leak and concerns about fugitive methane emissions, what is the current thinking, perhaps from a regulatory and policy perspective about the opportunities for transportation of natural gas? I thought that this might be something that Laurie might want to --

MS. TEN HOPE: Well, I think the policy -- well I'm sure the Air Board would want to address it as well -- but from a policy perspective I think it fits into the question, in the bigger picture, of what's the role of natural gas.

The Energy Commission in their research program has looked at natural gas as at least a transition fuel for heavy duty applications that are not likely to electrify in the short run. So we see some applications for natural gas heavy duty and we've provided research for the last few years and anticipate doing that for a while. How long or what the alternatives might be mid and long-term to completely transition away, I think is a question that requires more analysis.

I'm not sure if the Air Board wants to speak to the future of natural gas in transportation as well?

MR. VERGARA: Yeah. I mean, just very briefly, because the vehicular side of things is not generally in our shop. But I do see my counterpart in the Mobile Source Control Division here who fortunately just walked in, so we can ask him to chime in.

You know the general policy thrust for natural gas in our vehicular direction is that in the heavy-duty side we would be looking at zero emission technologies everywhere that's possible. And then where it's not feasible then we would be looking at near zero technologies, which would encompass things like ultra low NOx diesel engines being powered by renewable natural gas or renewable diesel, for example, so things like that would be kind of our general policy direction.

Maybe Jack, if you want to chime in and kind of elaborate or correct me if I'm wrong?

MR. KITOWSKI: No. That's great, Floyd.

Jack Kitowski, Chief of the Mobile Source Control Division. Yeah I think Floyd is exactly right. There are several strategies we're going to need (indiscernible) excited about. Cummins has a very low .02 gram NOx engine, usage of that, engines like that along with renewable natural gas, are going to be a key part moving forward. There are some (indiscernible)

(Audio cuts out briefly.)

MR. KITOWSKI: There are some areas like transit buses, last-mile delivery where we're excited about the probability of going zero emission, but that's challenging across the heavy-duty sector. So we see a combination of technologies being necessary there. But natural gas certainly plays a role, but it plays a role as low NOx engines with renewable natural gas (indiscernible)

MS. TEN HOPE: If I could just add on the renewable natural gas picture, I think we've done analysis of different strategies to get to the 2050 goals. The role of biomass can play such an important role in either generation as a renewable source for load following, for renewable natural gas in transportation applications, and also for de-carbonizing the natural gas system.

And so but it's a limited resource, so figuring out the highest and best value for the renewable natural gas is really important. So we kind of have our fingers in all of those to enable all of them, but we don't have the fuel source to really support them all at a large scale.

MR. SANDER: Well thank you for that, Steve Sander, CalRecycle.

On that specific issue of biomass and renewable natural gas production and in the context of EPA as well, how does that jibe with the goal of reducing food waste input into landfill?

MR. VERGARA: Well, I'm not a panelist, but I can answer that question.

We took to our Board, the Air Resources Board, a short-lived climate pollutant strategy for their consideration last month. And we'll be taking into account any public comments we receive and then revising our draft strategy accordingly before we take that back to our Board. A big part of that strategy is what to do with waste. I mean that's definitely a major policy direction for us at the Board, working in conjunction with you folks at CalRecycle and other sister agencies.

A key part of that strategy is organics diversion. Trying to get -- virtually eliminate the organics that are going to the landfill. And then those organic wastes that are not going to a landfill, but can be put to the highest and best uses, we would be looking at enhancing the penetration of digesters for producing biomethane that could be made into useful energy and fuels, looking at enhancing our composting system, looking at alternatives to a chemical conversion, so a thermal conversion to biomass to produce useful fuels as well.

So the short-lived climate pollutant and other efforts that we're undertaking basically embody a holistic look at our entire cradle-to-grave, including the waste side of things, to make those into useful products, so that we are displacing petroleum fuel as much as possible.

MS. MARTYNOWICZ: Yeah. And I should also mention we have a few tools, that I think we could do better probably at marketing and communicating.

We have our CoEAT tool, it's a pretty basic economic feasibility of food waste and the co-digestion of food waste at waste water treatment plants for the purpose of biogas production, using publicly available data and calculating the different economic, environmental, and operational outputs of what type of -- how much biogas would be produced at the co-digestion facilities, for example.

We also have a biogas mapping tool, so it's looking at major food waste companies, organizations, entities. So everything from like grocery stores, I think dairies are included as well.

And we also fund a few different types of kind of more broadly biogas projects or activities. We're providing funds to San Joaquin Valley Air District under their technology advancement program to get biogas projects up and running.

We're also looking at ultra low NOx engines.

There's also a pipeline injection project that's still kind moving forward in a variety of permitting phases, looking at high solid green waste.

And then we have funded through our Diesel Emission Reduction Act grant retiring old diesel trash trucks here in Sacramento at Atlas Disposal, which is a food recovery facility, for refuse trucks that run on renewable natural gas, so just a few activities.

We're also doing some research, kind of more broadly on biogas, looking at the different biogas processing technologies. And the costs associated with those technologies and then the air quality benefits, of course, methane being one of those, so yeah.

MR. VERGARA: Great.

Anymore questions from the audience? We did receive some questions online. I can read those.

All right, while you're going over there let me read this question online. It's a little bit in the weeds and may require some follow-up with this person. I think this is best addressed to ARB and possibly to Brady from DOGGR.

"How is looking daily for leaks on Aliso Canyon surface equipment going to find a downhole containment failure in a nascent stage; isn't such a daily LDAR on surface equipment a waste of resources?"

MS. SCHEEHLE: So I think Brady may have something to add here, because there is multiple components going on.

What I was speaking of was the leak detection repair sort of above ground, saw dustings, and DOGGR is looking at the downhole side and regulations on that side.

We do feel like when you're dealing with storage facilities where you have a high-pressure situation a lot of natural gas and the potential for a lot of emissions, that looking at daily or continuous monitoring is important.

And we'll continue to -- obviously this is an open regulation. We've just put it out there, so if there are comments on that we welcome them. And we will be going to the Board in July, but we think this is an important component to make sure that we find leaks early. And as you heard earlier today those leaks can happen at any time. There's not really -- people haven't been able to pinpoint when that's going to happen. So having regular checks is important.

MR. VAN ENGELEN: Right, so I think the key word that Elizabeth said there is component.

And the daily leak detection is just one component. There's also a lot of downhole testing that's required. So when you look at it globally, the bigger picture, it should capture everything which dramatically -- and a lot of people on this panel have mentioned looking at the bigger picture beyond just your agency -- and not looking at it through a straw hole through your agency. But also looking at the other components as well too, which complement the bigger picture.

So while leak detection is only a part of it, and it may seem inconsequential to some, it can add and provide information to the bigger picture. So I'd say there's value there for sure.

MR. O'DONNELL: If I might add, there's an assumption that's built into that question, which is that the technology that's used for continuous monitoring is ungodly expensive. And that is not necessarily the case. It may be expensive now, but we're certainly coming down and coming down rather rapidly, because of advances and because of use.

So think about it in this way -- aside from being an energy reporter I was also a medical reporter at one time. And you're not going to do an MRI every day if you have a heart condition. But you are going to take your pulse. You are going to take some medicine for the high-blood pressure. You are going to do other things on a regular basis. And those things come down in cost the more they're used, the more people use them, when drugs go to generic, right, as opposed to proprietary.

When Picarro becomes generic then it'll be a lot cheaper than it is today. (Laughter.)

You've got to start somewhere. And if your goal is to have a continuous sense of the pulse of the system, of the heartbeat of the health of the system, you make that investment, because what's the price tag otherwise? $650 million now for SoCalGas? Deanna got that.

Okay. How many devices could that have bought?

MR. VERGARA: Yeah. No, that's an excellent point.

Did we have a question back there as well? Okay, go ahead.

MS. PISTEY-LYHNE: So there was a good point made at the end of the day yesterday in public comment, which I haven't really heard brought up by any of the panelists.

Given that this whole conversation is about natural gas and how to mitigate leakage and how to bring down the climate impact of natural gas. And however no one has really talked about the fact that what we're actually trying to get out here is getting away from a fossil fuel economy and moving toward clean energy is to really mitigate climate impacts.

Using the latest ITCC's (phonetic) technology warming potentials, natural gas at a 2.8 leakage rate negates any climate benefit over coal. And what we've seen over the last day and a half has been that leakage rates are far exceeding that across entire life cycle.

I'm interested in given California's situation with the Aliso Canyon situation and this summer, the concerns that we will run short of natural gas and that we have this emergency kind of regulation, promulgation of the situation, is there any way in which this can trigger some sort of quicker implementation of demand response or renewables plus storage being implemented in order to be able to avoid the concerns this summer? Are those being looked at from a regulatory perspective within the CEC or the CPUC?

And kind of how can this situation be used to drive forward getting away from a natural gas economy, which we understand is a problem in many ways from health and climate concerns, and actually moving forward clean energy?

MR. O'DONNELL: Well, I'll step up to that one and again challenge some of your assumptions is that methane and GHG gasses is not the only basis of comparison between natural gas and coal. There are a lot of other bad things associated with coal that are not associated with natural gas. And that has gone into the figuring.

Everywhere else in the United States natural gas is a clean alternative to oil and coal. California is the only place that I know of where's it's the devil. And I like natural gas. I like cooking with natural gas, all right? I am steadfastly a proponent of reducing the leakage to the extent that we can possibly, so that it is a continued valuable component of our system.

Having come more from the electric side than the natural gas side -- let me preface this -- I published a book once called "The Guilty Environmentalist." I am a guilty environmentalist, which means that I cannot always live up to my highest ideals, okay?

My highest ideals are totally with Adam Hochschild and Mark Ferron when they say we should electrify 100 percent of the system. My knowledge of the system tells me it's going to be a long time before we can really do that, because the way the electric system runs, it needs spinning turbines. And one of the ways that you spin turbines is to boil water and create steam and it spins the turbines.

Now we have some other technologies that are on the edge now of being accepted, which can help provide some of that system support, energy storage. I was hired in fact to help the California Public Utilities Commission get an energy storage procurement target in place. I'm all for that.

But you can't have storage everywhere. You can't have 100 percent PV, because of the impacts on the local distribution system or doing away with the local distribution system. You can do it in a step approach. And I firmly believe that it's going to be easy for us to move to a 50 percent renewable system in California. I kind of believe that we can get to a 75 percent renewable system. I'm not sure we can get to a 100 percent renewable system.

If you can prove me wrong, great come back in 10 years, because 10 years ago utility engineers told you that 15 percent was the gap. "As soon as we get 15 percent on any circuit the whole thing is going to go to hell." Well, we have circuits that have 65 percent of photovoltaics on them. And they have some problems. And they have to get bolstered with storage and with new capacitors and with new electronic devices that help smooth out the system.

When you blow that up to a system which is 50,000 megawatts of peak load during the summer, with transmission lines throughout the state that need voltage support in order to keep from collapsing, I have a hard time getting past 75 percent.

MS. TEN HOPE: Well, I think the Governor's Executive Order in response to Aliso Canyon did direct the agencies to do whatever they could to deploy energy efficiency demand response and other strategies in the short run.

And maybe Arthur can speak to the energy efficiency. I don't really know what the utilities have been directed to do specifically in their deployment of energy efficiency.

On a sort of a more -- I don't want to say symbolic -- but because in our research program where we can we have a lot of active demonstration projects. And where we can we're deploying those specifically in Aliso Canyon. We've just funded several demand response projects. And if they have a -- some of them are really tied to particular sites and locations in the state. But we've asked our managers to work with the researchers to deploy as many of the demonstration projects as possible in the area. And we're also targeting our food waste bio solicitation to that area.

So those are really just short term. But I think Arthur and others have spoken to the policies that California has in place to move us from natural gas with the 50 percent renewables, 50 percent improvement in energy efficiency. And then all the underpinnings of efficiency and research programs to get us there with ZNE standards, ZNE pilot projects, and then overcoming what some of those barriers are. So they're, I'm sure, not news to anybody, but technical barriers to get to those goals.

And then also testing different strategies where -- you know, that make them more acceptable and increase the market penetration of technologies. So we're working in large deployments with ZNE with builders and doing behavioral sort of research on what strategies are more palatable and are going to really increase the uptake.

And gas cooking is one of the things that is a real challenge, because if you could completely electrify, you save all your distribution infrastructure on new construction. But people don't want to switch. And that's such a challenge, because it seems like such a simple thing. But it really sort puts a big challenge in the cost effectiveness of what could otherwise be a full electrified subdivision or power park.

MR. O'DONNELL: Yeah. I'm going to try to move fast, because we have another panel and I don't want to take away from it.

But I have a long memory and back in 1981-'82 there was a rate-payer revolt in California that didn't have anything to do with restructuring. It was because so many customers were on all-electric service. And there was a price spike in electricity. And it was not mediated by natural gas, because we didn't really have natural gas in the system. There were whole swaths of California that were not served by natural gas. So you always run that risk, right?

Right now we're in one of those blessed periods where natural gas at the well head is a buck, all right? And that actually kind of inhibits a lot of alternatives, because people in their mind say, "Why should I spend on research when it's so cheap?" But you have to get past that.

Laurie alluded to quite a number of things that are in the works. No one can ever accuse California of not having enough energy policy or not trying enough things. And the Energy Commission is ripe with menus of things that we're doing. They have to get accelerated under this circumstance.

If you look at the last two months of Commission meetings at the Public Utilities Commission, a whole series of decisions have been put in, in order to address the specific question that you asked, which is, "What can we do in the short term?" "How do we prevent this possible problem?" And energy efficiency, demand response, have all been ratcheted up.

Just the last meeting, we put out a resolution for Southern California Edison to expedite its acquisition of storage in the local area that would be affected by this. There are some constraints. We want those storage units to be in, and in operation by December 31st of this year actually to solve the winter problem, because natural gas is really a winter peaking resource, generally. So we're trying to deal with the short term in terms of consumption and reducing demand in the longer term, in terms of diversifying the resources and moving that faster.

And yet we have interconnection problems in which it can take two years for some new resource at the small scale, local level using Rule 21 to actually get interconnected and up and running despite all of our efforts behind it.

So you can try and push things faster, but you can only push the river so much.

MR. VERGARA: Great.

And we are out of time. I really enjoyed the vigorous and full discussion from all the members of the panels or the panelists. I think you all agree that there's a lot going on. The landscape, both regulatory and otherwise, currently and then moving forward there's a lot going on at both the state and federal level.

So I do appreciate the panelists' time. Thank you very much for all your insights. And if you can all join me in thanking them, please?

(Applause.)

All right, then we'll switch over to our next panel.

MS. KOZAWA: There's a break.

MR. VERGARA: Oh, okay. When is --

MS. KOZAWA: Ten minutes.

MR. VERGAR: All right, ten minutes, please. Reconvene.

(Off the record at 2:03 p.m.)

(On the record at 2:16 p.m.)

MR. O'DONNELL: Not only can you please take seats, can you take seats up front, all right? Can you move down? We have a lot of open space here. It's always a hazard of two-day conferences, even one-day conferences, that the very last panel of the day is marked by attrition. I used to say at conferences, "Here we are, the few, the proud, the ones who couldn't get early flights out." (Laughter.) That's not necessarily the case in Sacramento, but there is an Irish saying, "We may be small, but we are mighty."

All right, and I'm actually pleased to see so many of you sticking around for the rest of the afternoon.

MS. KOZAWA: Sorry to steal your thunder, Arthur, but I just wanted to make one announcement. If you do have public comment for the CEC IEPR Workshop, please go ahead and fill out a blue card, which is in the back on the back two tables and hand it to one of the CEC liaisons that I'm kind of waving my hand around to, back there.

Thank you, very much.

MR. O'DONNELL: We talked about the evolution of technologies, the evolution of regulation, the sense of things changing. And one of the things that's going to change, mark my words, in the next three years is the heavy use of the word "stakeholder." Many people find it to be not adequate to explain the variety of positions and kind of perspectives that come into play in any forum.

We used to use "special interests," right? And then it turned out that everyone was a special interest and so stakeholders was used to kind of signify that people did have a stake in what was going on and broaden the sense of who has an actual stake.

And so over the course of the last 50 years really decisions that previously and been made between regulators and utilities now involve a whole host of stakeholders that get active in proceedings. I was floored by EPA's comment that they got 900,000 comments on a rulemaking. Every single one of those is a stakeholder, but we'll have to come up with a better word.

This is the stakeholder's panel then, I'm Arthur O'Donnell. I'm a Supervisor in the Safety Enforcement Division at the California Public Utilities Commission.

Joining me today will be Christine Cowsert who is Senior Director of Asset Knowledge and Integrity Management, a big title for a very small business card, at Pacific Gas and Electric. Deanna Haines, who is Director of Gas Engineering -- Gas Engineering and System Integrity -- a much more traditional type of title, Deanna. Briana Mordick, who is Senior Scientist at NRDC and John Shears who has no title, because the Center for Energy Efficiency and Renewable Technologies is a very horizontal organization, in which everyone has an important role including John.

So as we have in the previous panels I'm going to just kind of roll down the line and give everybody a couple of minutes to state their positions and then we'll open it up to questions. I have a couple and will really look forward to some from the audience.

MS. COWSERT: Okay. So I'm Christine Cowsert from PG&E. PG&E is really focused on delivering safe, reliable, affordable and clean energy to our customers. And the clean part is what we're here to talk about today, a key piece of that being greenhouse gas emissions and methane emissions, reducing those for California's environment.

Since 1998 we've reduced our overall emissions as a company by 70 percent and since 2010 we've been really focused on reducing the number of leaks in our system, our Grade 2 and 2 Plus leaks being reduced by over 99 percent in that time period.

PG&E was also the first investor owned utility to be in support of AB 32 and we're currently working with the State Legislature, ARB, CEC and the CPUC as well as other stakeholders to make sure that the implementation of AB 32 is a success.

So first I want to talk a little bit about some of the things that we're doing from a research and development and system upgrade standpoint that are helping us reduce methane emissions from our natural gas system.

So from an R&D perspective we're focused on detecting leaks and repairing leaks in a much more effective way, both by land and by air. With the air portion of our R&D work we've using LIDAR technology to detect leaks as well as working with NASA's JPL, who I think are out in the lobby here, to implement their technology, which is a very sensitive methane detection technology via drones. So we've been doing that research with UC Merced over the course of the last several years.

From a land standpoint we've had a longstanding partnership with Picarro who I know, as I was walking in today, is parked outside. And we've been doing a significant amount of work with them to use their technology to survey our system. So this year we're planning on surveying about 23,000 miles of our natural gas system using that technology, which is 1,000 times more sensitive than the traditional leak survey technology on the market today.

We've also been partnering with Picarro to work on our end-to-end leak management systems, so not just the detection of leaks, but also what we do with the data associated with that, how we start to use that to build analytics to understand what's driving our leaks on our system, understand what the potential methane emissions are associated with those leaks.

So a significant amount of effort has gone into using that technology not just to help us manage leaks from a safety standpoint, but also manage them from a methane emissions standpoint.

In addition, we're partnering with Stanford to look at how we can leverage Picarro to look specifically for super-emitting leaks. So we've been using it for our traditional compliance survey on our distribution system and transmission systems. But this would actually take it to a different level beyond that compliance view, looking specifically for larger leaks to identify them and mitigate them more quickly.

So in addition to the leak survey work we've been doing we've made a significant amount of investment in our system over the course of the last several years in replacing pipe. And while this work is heavily driven by safety considerations, there's actually a fairly significant methane emissions benefit from that as well. So last year on our distribution system we replaced over 100 miles of pipe, of our more leak-prone pipe, vintage plastic and steel as well as cast iron. We've eliminated all cast iron pipe from our distribution system at this point.

In addition, we've got a program that's focused on replacement of service lines that have a history of leakage. And while historically those leaks would have been repaired we've elected to replace them when we have a leak under the assumption that once it leaks once it's likely to leak again. If we repair it or if we replace it at the time that we detect a leak we're unlikely to see that future leak come to fruition, so again an opportunity for us to reduce methane emissions from our system.

And while that work is really triggered by safety considerations we recognize it's kind of a two-for. Some of the other work we're looking at for methane emissions is going to be specific to reducing emissions. That's going to be the focus of the effort and in looking at that we'll want to work with all of the stakeholders involved to help us figure out how to do that in a cost-effective and economic fashion so that we aren't trading off emissions for safety work, as safety is our highest priority as a utility.

So beyond the actual physical work we're doing on our system and the research and development work we've been performing, we also have quite a presence around policy. And have been committed to making sure that our methane emissions, our gas emissions are made transparent to the public. So we participated the California Climate Action Registry as well as we voluntarily report our emissions to the Climate Registry, which is a nonprofit organization, but sets reporting standards in North America.

And lastly, we have several strategic alliances that we participate in. One that stands out most is our participation in the EPA's Methane Challenge. We just began that earlier this year and that's a voluntary program to help reduce emissions from our natural gas system. And it's a flexible approach, so it lets us target the sources of emissions that we believe will have the biggest bang for the buck in improving our performance.

So that's the summary of what we're up to and we feel like we've made significant progress over the course of the last several years in the emissions from our gas system. But through investments in new technologies as well as investing in our assets themselves, we foresee the ability to continue to improve that and to partner with the stakeholders here and outside of this room to help improve further.

MS. HAINES: Hi, thanks California Energy Commission, CARB and CPUC. I think this has been a really interesting two days and I guess you save the best for last, hug? (Laughter.)

Yeah, SoCalGas and San Diego Gas & Electric are essentially the bottom half of the state. We serve over 20 million customers. We've been around for 150 years and it's just unbelievable. I was talking to Briana, I was like, "I can't believe we've been around 150 years." We're part of the community or we have strong unions and we employ over 8,000 folks. And it's -- you know, really proud to work for both these companies.

Yeah, one of the things that I want to talk about is the politics and the politicizing of science in a sense. We're at a very interesting time right now. It's very political right now. How many have voted today in the Primary? Raise your hand. It's the political atmosphere right now is just unbelievable. The inflammatory rhetoric around things have reached a new high. And it's really more important than ever now that we allow science to drive policy and data and facts.

And I think these last two days, and yesterday especially I heard was just -- I wasn't able to go to the meetings, but I heard it really had a good research science-based flavor to it. So that needs to really drive good policy. We have to stay focused on the facts, focused on policy, that is not based on emojis.

And we support all efforts to understand the nature of this issues. And SoCalGas and San Diego Gas, we have a research fund that the CPUC has allowed us to have, that we spend millions of dollars on research to help with energy conservation programs and getting equipment, lower emitting and things like that. The conservation and energy conservation is our number one defense in this whole issue. And it's a really important defense. And it's really helped our companies not only grow the system without increasing emissions, I mean we've been able to grow the system dramatically without increasing emissions. People make the assumption sometimes that if you add more pipe you add emissions and that's just not true. That's not factual at all.

And we've been able to actually reduce emissions and grow the system and serve customers. And a lot of that has to do with being very good at implementing energy efficiency programs and developing research around lower emitting equipment. So that's, I think, really good news. And the more that we can do that, the better off I think we are to invest in our systems.

To support climate adaptation and manage this risk we must look at a portfolio of options. I'm a hedge person. I have a sail boat, because I can't imagine going out on the ocean with an engine and it dies on me and I'm stuck in a shipping lane. I always like a hedge and any energy system, we now know how interconnected our energy systems are. It's really critical that we have a portfolio of options to tackle these issues.

We need resilient energy, a restructure, we need affordable energy, a third of our customers are on CARE programs. It's really unfortunate, but it's a huge issue and I think Art talked about if you've been around long enough energy rates and the cost of a monthly bill for a household is so critical to people. And if a third of our customers can't afford the energy, I mean it creates so much stress and to me this is a health issue.

You know, financial stress is a health issue. My parents fought over financial stuff all the time. I mean, this is a huge stress issue for people and families, so affordable energy is really critical. With these limited constraints we need to pick the right solutions that are effective and affordable and don't increase rates dramatically.

You know, we have some recent science that has come up -- and I haven't heard it mentioned, but first of all yesterday I understand the Dr. Lam study was mentioned, where we worked with the Environmental Defense Fund and about a dozen other utilities across the nation to kind of update the emissions factors in the distribution sector, in our sector only. And what they found is that the emissions have gone down dramatically anywhere from 36 to 70 percent in our sector. And now this fact is reflected in the new

EPA inventory.

For the distribution sector emissions have gone down and they will continue to go down. And it's really an artifact of we've been modernizing. Christine talked about we've replaced pipe, none of us in California have cast iron pipe. All of us eliminated that. The gas company, SoCalGas Company eliminated it 20 years ago; we eliminated cast iron from our system.

Our San Diego system has only protected steel pipe, has only plastic pipe, it is a super tight system. I call it the super system, and it's really a model for the rest of the systems.

So we've done a lot and we also joined the EPA's Natural Gas STAR Program. We were a founding member of that program back in the early '90s where that was about voluntarily reducing methane emissions. That was before any mandatory greenhouse gas reporting on both the federal level and the state level. We recognized over 20 years ago that this is an issue, that we need to do stuff. And we need to be diligent about this. And so we've been going after best practices for our system for over 20 years following the Natural Gas STAR Program.

I actually ended up in Russia, helping Russians with this issue, because they lose about 10 percent -- at that time they lost about 10 percent of their gas. And it was unbelievable how much they lost. And we're sharing best practices with them.

So we've been at this for a long time and cumulatively in the last 20 years we've saved over 2.5 billion cubic feet as a result of our efforts. And we're not stopping. We joined the Methane Challenge Program recently, it's another refresh on the Natural Gas STAR Program. We are going for it again and we think this is -- we need to continue going for it. So this is a really important issue. We've been doing it over 20 and we will continue to do as much as we can that we think is cost effective and feasible.

How many of you heard about this New Zealand scientist that recently did a study in the Arctic? That he took ice core samples and they found that the carbon, the methane in those ice core samples are biogenic in origin. Anybody heard about that? This is just a couple of months ago.

(No audible response.)

There's nobody that heard of it? I was surprised that it hasn't been talked about. You know, this is like a huge finding that they took ice core samples in the Arctic. And they found that most of that methane is biogenic in origin. And they think it's coming from increased rice cultivation and livestock, food to feed people. So the increased amount of people on the planet, we're trying to feed them and it's increased our biogenic methane emissions dramatically which ties into, I think, nicely with some of the solutions that we're thinking about around this issue.

Now I'm glad to hear that EPA has really backed renewable natural gas. You know, going after those biogenic emissions is I think going to be a critical piece to solving this puzzle for us. So we're very, very pro biogas and very pro renewable natural gas. We see the benefits to disadvantaged communities, to health impacts, things like that.

I mean, using renewable natural gas to replace diesel is a huge issue. People that are living by the freeways -- I don't know if anybody has been in L.A. and going down the 710 freeway -- I live in Long Beach and it is horrible. And the people that have to live by these freeways and suck in this black carbon, these diesel emissions, it's just ridiculous.

We have technology. You know, Cummins Westport was talked about earlier today, we have technology to take care of this today. People don't have to be suffering anymore, so renewable natural gas is a huge win-win for us and using our systems that are everywhere.

One thing that is really unique that I don't think other people have talked about either is that utilities, we have to serve everybody. You know, oil companies, when you go to your Arco or whatever, they don't have to serve everybody. We have to serve everybody. We have to serve people who can't afford energy. We have to serve everybody. That's why we're a utility. We have to serve everybody.

And when you think about it if you got your transportation fuel from a utility, whether it was electricity or natural gas you have a lot of people that are looking at our costs. You know, we go through these general aid cases, you have people intervening and looking at our costs, and they're questioning. I don't have that capability and transparency when I go to fill up my tank with gasoline. I have no say in how much that gasoline costs, but if you fuel with electricity or you fuel with natural gas you will have a say in how much that product costs you. Just like you have a say in your monthly bills.

So anyway I'm going to leave it at that, but this is a huge opportunity for us. Recent science is saying that a lot of this new methane is biogenic in origin. It doesn't mean that we have to stop doing what we should be doing on the oil and gas side, we still have to go for those emissions, but it means that there's a real opportunity here to make a difference and to go after a huge problem and create a win-win for the climate and for us.

MR. O'DONNELL: Thank you, Deanna.

Briana?

MS. MORDICK: Thanks for the invitation to be here today, Briana Mordick. The Natural Resources Defense Council is a national nonprofit environmental advocacy organization. For those who aren't familiar we were founded in 1970 sand we've had a presence in California for nearly all that time.

Stopping global warming is one NRDC's top priorities. We come at that from a lot of different angles, but reducing methane emissions is a big part of that work and in particular reducing methane emissions from the oil and gas industry.

About four years ago we put out a report called "Leaking Profits," which highlighted this issue and identified ten key technologies to reducing methane emissions from the oil and gas sector.

We followed up on that a couple of years after with a report that we, with our partners Clean Air Taskforce and the Sierra Club, called "Waste Not, Want Not," which also again highlighted the scale of the problem, the fact that more recent studies were showing that emissions are potentially significantly higher than what EPA's official estimates show. And again, highlighting these readily available cost effective technologies that could be used to reduce emissions today regardless of what the actual amount of was.

In California we've also been heavily involved in global warming issues, AB 32, and now with the ARB's recent rulemaking on reducing methane emissions from the oil and gas industry.

We've put out a report about a year and a half ago looking at who's actually at risk from air pollution, from the oil and gas industry in California. We found that more than 5 million Californians live within a mile of one or more oil and gas wells. Of those, about 2 million are living in communities or places that have already been identified by California EPA as areas that are the most heavily burdened by environmental pollution. And of those, nearly 2 million, more than 90 percent are people of color.

So reducing pollution from the oil and gas industry is not only a major climate change issue, it's also a significant public health issue and a major environmental justice issue. So there are a lot of compelling reasons to act on this problem swiftly and rigorously.

MR. O'DONNELL: Thank you.

John?

MR. SHEARS: Good afternoon, John Shears with the

Center-- the non-hierarchal Center for Energy Efficiency and Renewable Technologies.

MR. O'DONNELL: You have to add a couple more of more "e"s. So er-er-er-t. (phonetic)

MR. SHEARS: As you can tell we have a long-standing relationship with the PUC.

So we're an organization that's actually a coalition of some of the world's leading clean tech companies and leading NGOs. NRDC as one example, is a member of our organization. We were founded back in 1990 and 1991 as the Coalition for Energy Efficiency and Renewable Technologies and were founded around the notion that renewable energy could help clean up air quality.

So as I mentioned earlier we look at climate pollution as just another form of air pollution. It's just an extension as upheld by the Supreme Court of California as authority to regulate climate pollution as air pollution.

I've already mentioned that we view methane as being important, not just as a short-lived climate pollutant, but also as an important contributor to background ozone levels on a global level. There's tons of research in the academic and technical literature that are working on the relationship between methane and other precursors and their role in ozone.

So we're here today to talk about the natural gas system. In giving these types of talks I would note that it's been long known that actually since basically the industrial revolution that a growing proportion of methane emissions on the planet are indeed biogenic. So this research that was referred to is just sort of the latest reaffirming what's generally known in the research community around the relative makeup of -- proportional makeup of where methane's coming from in terms of biogenic versus thermogenic. But we're focused on thermogenic for this symposium.

In what I would like to stress is the fact again that ten percent of the system's natural gas is indigenous. Ninety percent is national, which essentially makes the California system the national system. So we, in order to ensure that we're gaining true climate benefits from the use of natural gas, we have to make sure that we have a good handle with the help of the USEPA and other federal agencies -- that we have a really good handle on what's going on with the national pipeline system. And the infrastructure that feeds into that system. Otherwise we're not gaining any real climate benefits.

So as a lot of the research headed up through the efforts of the Environmental Defense Fund have shown and was mentioned in the previous -- one of the questioners on the previous panel and by myself -- if we're out of whack by 2 to 3 percent in terms of the overall average leakage rate for this system, that negates the climate benefit of natural gas.

So we have to really get a handle on this and we basically have to look at every joint, elbow, valve, every connector and every piece of pipe in the system and continuously monitor it in order to be able to track and capture these super-emitters.

So Adam Brandt, yesterday, in some of his remarks from the side after his panel, some of the subsequent panels, what I think was trying to get at this issue -- which I've also talked about for a couple of years now -- which is the magnitude of the problem is huge. And this morning's panel session also was touching upon the fact that we basically were talking about having to collect, monitor, process huge amounts of data if we're properly and vigorously monitoring the system.

So the challenge is not an easy challenge although based on what we've seen these past couple of days it looks promising.

Now, I want to touch quickly on the concept that natural gas in California policy has been viewed as a bridge fuel, as a clean bridge fuel, to get us from coal intense and fossil intense systems to a clean, more renewably-based system.

The original power plant performance standard was established based on a combined-cycle natural gas tailpipe output without looking at upstream emissions. It assumed at the time, the notion at the time -- and this was back 2006-2007 -- the notion was that natural gas was again a clean fossil fuel. We now have to wonder about that. So when Arthur is mentioning how clean the natural gas plants are, that's the tailpipe emissions from the turban. That's not dealing with the upstream emissions, which are at issue.

And California, yeah we might be the ones most upset about it, but anyone who's trying to move forward on climate policy needs to address, work on and address, the issue around leakage. In terms of getting to the climate goals, 2030, 2050, right now we're focused on 2030 our shop helped convene a consortium of clean tech companies, utilities, DOE, EIA, NREL to produce what's called the Low Carbon 2030 Grid Study.

So if you do a Google for lowcarbongrid2030.org you can find an extensive amount of information about the fact that we, by 2030, can reduce the fossil intensity of the California Grid by 50 percent at no additional cost. No silver bullets, using conventional technology, using conventional systems, requires using a lot more flexibility in the system, also requires adjustments in terms of integrating with the wider WEC all the way up through BC, Alberta down to Tijuana, etcetera. Those initial movements in that direction are happening now with PacifiCorp and CAISO.

But we can do that without having to build more fossil plants. Ultimately as we get to 2050, which is only 34 years away if we're to meet climate goals, we need to get to 80, possibly 90 percent de-carbonization, because everything else that we're doing -- electric vehicles that Arthur also mentioned earlier -- are going to be plugging into that grid. They need to be 80 to 90 percent de-carbonized.

Fuel cell vehicles, possibly generated by excess solar as we're seeing with what's called the duck or flock of geese of problem with excess solar in the mild spring and fall days. That's a place where we could also put in an additional beneficial load through the -- it would make economic sense to produce hydrogen for energy storage and as a fuel for a fuel cell vehicle fleet.

Our shop's perspective on what the roll of natural gas in 2050 is not that natural gas power plants will be nonexistent, but our view is that by 2050 the Grid will be one dominated by renewables with natural gas on the margins. A flip of the way the Grid has looked in the past.

So I just want to put forward that we really need to first get a better handle and ensure that we're gaining real climate benefits, at the same time of the co-benefits that we can get, for air quality in terms of the background ozone problems by really vigilantly going after this problem. And then we can move forward in terms of using that fuel in the context that California policy is a true cleaner fossil fuel that is a bridge fuel to our renewables future. So thanks.

MR. O'DONNELL: Thank you very much, John. Thank you all.

Let's start with this notion of science, that science should drive policy. But there are few environmental organizations active in the United States that rely more on science than NRDC and CEERT, CEERT is a little bit more on the political science part of it, but definitely science. EDF is another one that is actually based on rational policies based on quantifiable, discernible issues that can be tested and measured in a scientific way.

So let's ask the panels today, what you've heard at this conference on the science, what's new to you, what can you then go back and incorporate in your work as a utility for operations or policy and for your advocacy, for your positions? Let's start with John and then come back this way.

MR. SHEARS: Well, since I actually follow this research closely -- and I should again mention that the lowcarbongrid2030.org advertisement -- was a peer-reviewed study involving again DOE and EIA. And EIA wanted to be involved, because they essentially wanted to take the modeling work that was a part of that project, because they didn't have the tools to do the national work. So they want to take that work and start using it now for nationally.

So we may be political -- NRDC has an advocacy and a lobbying arm -- but we also base our understanding in sound technical understanding of what the issues are. So I've been following this issue, so there's no real surprise for me except maybe the one take-home message is once we get a sense, a true sense of how fat the fat tail is, what portion of that tail that we cut off will be sufficient to get us below that 2 to 3 percent threshold?

So there's some promise there in that if we have good confidence that we truly understand what the system looks like, what that fat tail looks like and we can chop off the significant part of it, so again we want to be practical. There's the ideal and then there's what's realistic. That I think is the thing that is most hopeful coming out of this along with the fact that with ARPA-E efforts etcetera that the technology seems to be advancing in the direction of miniaturization and lower expenses, which is all very promising.

MR. O'DONNELL: Great, Briana?

MS. MORDICK: Yeah. I mean, I think the presentations that we've seen have been fantastic. I saw some really exciting new research. You know, again this is an area that we follow closely as well, but seeing some of the convergence around exactly what are the right questions to be asking, what are the important questions, and where does that kind of lead you in terms of research? Especially some of the new technology that's coming up around actually measuring methane emissions, I think is incredibly important.

And I think we're seeing the science pointing to some pretty clear policy solutions again with the fat tail problem. Recognizing that because of the sort of random nature of these problems as everyone kept saying (indiscernible) the importance of more regular monitoring. But then also as many others pointed out as well, for the pieces of the leakage that aren't part of that fat tail we do know that there are again commercially available off the shelf cost-effective technologies that can be employed to address those as well.

So I think we're really seeing the science help drive policy that's very clear that these -- again notwithstanding that there's still quite a bit to understand, but that there are clear solutions to this issue.

MR. O'DONNELL: Thank you.

Deanna?

MS. HAINES: You know, I thought today the discussion on big data and data analytics I think is a really good discussion and it's important for us. We're rolling out our advanced meters on the gas system. We have roughly about 6 million meters that we have to roll out and we just surpassed the 5 million meter mark.

As part of the data analytics on the advanced meters, we're starting to find leaks behind the meter much sooner than we would have if we had traditional mechanisms. This is really coming out of the high bill investigations that happen traditionally. Usually people would get a bill that's super high and they're like, "Oh my gosh, what happened?" And it would be 30 days after the leak had started or some barbecue was left on, things like that.

Well we're now able to see these things happen almost within a few days of when they happened if not sooner. And we're also finding water leaks. People are like, "What do you mean water leaks?" Hot water systems where it could be the exit piping off the hot water or the water heater itself is leaking and it's constantly refreshing with new water and it's having to cycle over and over again. And it's creating all this excessive consumption. We're finding hot water leaks.

And it's really fascinating, but I think this is really going to be a breakthrough in terms of our ability to diagnose our system from a holistic perspective to get after the hot spots on our system, the leakiest parts of our system to go after and target replacement for those areas using our new GIS tools, things like that.

We're really, big data I think is going to be a game changer for us.

MR. O'DONNELL: Okay. And who specifically at this conference raised that, so that we can...

MS. HAINES: It was the first panel. It was the company, I forget what it was called, that did the -- Viance (phonetic) or something like that?

MR. O'DONNELL: Enview?

MS. HAINES: Enview.

MR. O'DONNELL: Okay, so from this morning's 9:00 a.m. to 11:00 a.m.?

MS. HAINES: Yeah.

MR. O'DONNELL: Right, we're call your attention to that if like me, you weren't able to attend.

MS. COWSERT: Yeah, unfortunately I have not been able to attend most of the conference, but from the last panel one of the things that I took away from the comments from the CEC was related to behind the meter and the methane emissions associated with that. And we are deploying a significant amount of technology where we might be able to pick up on more of those things than we've looked at in the past either via our leak detection technology or via our smart meters.

And so that was something that I noted as something I'd like to take back and look at more, understanding what we can glean from the data we have about that and whether there's anything that that can help us trigger in terms of work on methane emissions.

MR. O'DONNELL: Thank you.

Science notwithstanding it's always been my contention that the utility system is ten percent physics and 90 percent accounting, mostly because that's how the money gets allocated.

Deanna used the terms cost effective and feasible in her talk and we find these are terms that increasingly get added into legislation directing us what to do. And we are often at a loss as to how one defines that. So I'm going to go down the panel and see if we can reach some consensus on what do we mean by cost effective and feasible in this realm of technologies for the detection, the quantification and the mitigation of methane leaks?

John.

MR. SHEARS: Are we using 100-year GWP or a 20-year GWP?

MR. O'DONNELL: Okay. You can raise questions, let's hash it out here?

MR. SHEARS: Just that's another part of what is the appropriate metric in terms of any kind of incentivizing of the system. And the Environmental Defense is proposing -- and this goes back to their original paper in 2011 and 2012 in the proceedings of the National Academy where they recommended this technology warming potential to take into account how emissions work in the real world and how we should really be tracking those emissions.

So first I would advocate for a 20 year on a GWP, which then is more closely related to their technology warming potential.

Beyond that, you know, again not being an accountant and not really knowing what the relative revenue streams are I don't really have a good answer for you at this point. I know it's more challenging right now with natural gas prices being so low, which makes the solution that more difficult because that means the technology has got to get to that much, much lower price point.

But clearly our organization supports that, but we do make the distinction of -- we do recognize near, mid, and long term, so we may not necessarily think that something has to be cost-effective in the near term if it gets us to something that we wouldn't otherwise get to that's cost effective in the mid to long term, so I'll leave it at that for now.

MR. O'DONNELL: Briana?

MS. MORDICK: Yeah, I mean I'm also not an expert on cost benefit analysis. I think when we're using the term cost effective we're looking at it in terms of -- again in the simplest terms this is industry capturing back its own product -- and so the more that they can keep in the system the better it is, obviously, for them.

Now, obviously there's been some argument that because of that reason that industry is motivated to do this voluntarily, I think we've seen that that hasn't necessarily always been the case and maybe in different sectors of the industry.

You know, EPA just created its new Methane Challenge Program, which is building on the EPA Natural Gas STAR Program. There are 41 companies I think, who were part of the initial sign up for that. Not a single one of those was an E&P company, so no one from the production sector has voluntarily agreed to participate and reduce their emissions. So I think -- you know, well we obviously think that that's why the regulatory roll is so important.

But yeah, I think when we're thinking in terms of cost effective these are things that can be implemented at very low cost, because what's being captured back is the product.

MR. O'DONNELL: Deanna, and can you bring in the feasible too since you have to live with that? (Laughter.)

MS. HAINES: Yeah, we have to actually do it.

Yeah, there is a methodology that ICF, a consulting firm, recently put together to come up with a marginal abatement cost curve. And they did see that for our sector, you know we talked about it -- I think it was today we talked about -- there is an 80 times difference in cost effectiveness between different best practices.

And for the distribution sector unfortunately it's very expensive to do reductions in the distribution sector.

With that said I think the utilities are in a very unique position, because we have to ask for funding to recover our costs. And there's a lot of folks, stakeholders, that have a say in what is reasonable for us to recover. And what we do is essentially say, "Okay, if you want us to do this, this is how much it's going to cost. And here's how much we're going to need to recover that cost." And then they figure out how does that affect rates, how does that affect your energy bill, ultimately.

And then sometimes we're able to settle with those intervenors. They say, "Well, we think you need 80 percent or we think you need 90 percent, you don't really need all that 100 percent."

So to me cost effectiveness in this context is really going to be up to the intervenors and the CPUC in terms of what they think is a reasonable cost for the amount of reductions that we're going to get. I don't think we should be putting a threshold on it. I think that is short-sighted.

Right now, as John had said the cost of natural gas is so low, so just saving the two dollars in Mcf is not going to get you much reductions in our sector. It's just not. And so we have to think beyond that, but we have to think about is it going to be affordable for people? Are people going to be able to -- how much is this going to increase people's bills? And is it going to be affordable?

And that is a kind of a process that occurs on a regular basis every three years for us, in our general rate cases. And I think the intervenors are going to decide if it is affordable or not, for us.

MS. COWSERT: Yeah, I tend to agree. I think that generally we're subject to the rate prayers, right?

So we need to make sure that the techniques or the concepts that we're putting in place are considered reasonable in our rate case proceedings.

I think there are opportunities for us to get bang for our buck in places where we're getting benefits in other parts of our businesses and methane emissions, right? So some of the things we're doing around replacing leak-prone pipe or doing that kind of work, we do see benefits on the methane emission side. And so those are places where it's obviously very feasible for us to do that work. It's already embedded in our rates, it's therefore very cost effective.

I think the piece, if we're starting to focus our attention on work that's specifically for methane emissions we need to come up with a way for there to be a rate-making mechanism for recovery of those costs. That ultimately has to go through the same kind of scrutiny from all stakeholders to make sure that it's achieving the desired objectives as well as doing so within the lines of a reasonable cost.

I think from a feasibility standpoint we're exploring options that are maybe not feasible today, but maybe in the future through a significant amount of research and development, partnerships with CEC and others to explore ways for us to at least detect leaks for effectively therefore allowing us to repair more leaks and reduce methane emissions. And so feasibility to me doesn't necessarily mean that it has to be something we can do today, but exploring technologies that we see as being promising over the course of the next several years. Those concepts would also apply.

MR. O'DONNELL: Okay. One more term of art that shows up in legislation, and in fact in SB 1371 I alluded to it, is best practices. You'd be surprised that we cannot agree on a definition of best practices. So I'm going to ask folks, I'm going to kind of jump in the middle and ask Deanna to tell us what do you think of when we say best practices? And how does that play out in terms of what you're willing to do?

MS. HAINES: You know, I'm an engineer and I think that there's a lot of ways to figure things out and a lot of solutions to a problem.

So best practices to me is something that has been tried and true and that there's obviously a commonality amongst the industry of employing that practice, because it seems to be working and it's feasible. And it's implementable and it's a reasonable cost to do.

So I'd look to places like EPA's Natural Gas STAR Program that kind of have done this for over 20 years to look for those practices that folks have voluntarily done.

And have been proven to be something that does reduce and is workable.

And I also look to beyond that, you know, I try to think outside the box with this. Sometimes best practices may not be on our system. We may find that the best way to reduce methane is to interconnect with a renewable natural gas source. That that is really the best bang for the buck for the resources that we have and the limited monies that we have and the constraints, if that is really a better investment for not only the ratepayer, but for the system and the sustainability of the system.

So I'd like to think that I would not just follow what's industry best practices, I would look for more creative ways to see where we can reduce methane that can be a win-win for our customers and for the environment.

MR. O'DONNELL: Okay. From our environmental stakeholders, anything from you?

MS. MORDICK: Yeah, I mean it's definitely not an easily defined term and I think it's partly depending on your frame of reference and your risk tolerance. As an environmental advocate my risk tolerance for a methane leak may be lower than Sempra has a risk tolerance for a leak.

And best practices is also something that's just continually evolving. You know, we've talked a lot about the Aliso Canyon incident, that was caused by a well failure. DOGGR hasn't updated their well construction regulations in 30 years, so are they using best practices currently? Probably not, but can we expect regulation to continually keep pace with best practices? We would hope so, but I think the current model we're using of write it once, leave it on the shelf for 20 years and come back to it 20 years later isn't really working, so best practices has to be a process of continuous improvement.

MR. SHEARS: Yeah, Briana sort of took the words right out of my mouth. I was going to say that best practices to me is a constantly moving and evolving target based on the best available knowledge and economics of the time. So again, as a public advocate as Briana noted, my tolerance for what should be an allowable leak is going to be different than -- or at least initially different than maybe what industry's tolerance considers to be a tolerable leak.

But again, I think it's a matter of putting it in a context of keeping I guess an eye on the prize, and that is we need to. Otherwise humanity is going to have a very miserable existence, we need to figure out collectively across the entire system how we can get to an effective overall 90 percent of reduction in global warming emissions. And it doesn't mean that -- necessarily that means we'll get to 90 percent in every sector. We might get 100 percent in some sectors, but others might fall short.

So as that policy around the carbon question evolves and the incentive system built and designed around that changes, that will also affect what can be feasible as a best practice.

And then I think we're now entering a phase where we're constantly going to be -- as you mentioned earlier Arthur -- there's never a shortage of energy policy in California. Likewise for the past few decades there's rarely been a shortage of energy research related to developing policy and I think we're going to see California and other jurisdictions picking that model up more and more especially now that my home country of Canada has joined reality again and come back to the fold. Hopefully we'll be able to strengthen the alliances with the provinces and also with the federal government in Ottawa to do a lot more.

MR. O'DONNELL: Christine?

MS. COWSERT: Yeah, so best practices from my perspective may be even more broadly than the methane emissions base is. You know, I think I look at three places. So I look to my peers right, so industry benchmarking, see what others within the United States, within the world, are doing around a topic. And whether there's anything we can bring back home to apply to our system.

We look to industry organizations to help us find some of those where they maybe have information that we don't necessarily have access to, to help guide and provide some insights there.

And then I think we also try to look to other industries where there are things that we can steal shamelessly from others to apply to our own industry. So thinking just within the natural gas industry, thinking just within the State of California, we can apply best practices, because we do lead in a lot of places. But there are opportunities to look internationally, there are opportunities to look outside of our industry to find additional concepts as well.

MR. O'DONNELL: Okay. I will comment to the audience and anyone listening to look at the CPUC and ARB Staff Proposal. It is a proposal on best practices to apply to methane reductions in the gas system here in California. We recognize that not all of those recommendations will be adopted and we have a spirited set of comments. And so if you can figure out how to use the PUC's website, you can actually find those documents through a docket card or the website portal for the risk assessment section, which I hope is a little bit easier to use.

MR. SHEARS: Arthur, you should also mention that the PUC does have staff that can help people who've never navigated --

MR. O'DONNELL: Do they? They've never been able to help me. (Laughter.)

MR. SHEARS: -- the process before to --

MR. O'DONNELL: I mean ARB was trying to get access to our documents, it took them a week right and then they were joined in the proceeding.

MR. SHEARS: So anyone who's naïve to being involved with the PUC processes, they do have staff that will help you figure it out.

MR. O'DONNELL: Okay. I'll take your word for it, John.

Let's see if there's questions from the audience or anything coming in over the transom, please. And do if you have a question how about identifying yourself too, since this is a stakeholders panel we want to know which stake you hold.

Thank you, can you hear me?

MR. CLAVIN: Thanks, I'm Chris Clavin.

MR. O'DONNELL: We're going to start over here on the right and then we'll come over here.

MR. CLAVIN: Oh, sorry.

MR. FLEISHMAN: Yeah, thank you. My name is Steve Fleishman, I'm a consultant in the energy industry, not a native Californian so the stake I hold is much more remote. But I did have a question about best practices in so far as what's practical and what's economically available. And I wanted to key you on something that I heard on the science side of things yesterday, which not all of you were able to attend, but probably are well aware of.

The focus on the fat tail and the benefits of slicing off that tail, to borrow the phrase from earlier, and the practical remedies available to do that at the utility level and perhaps further upstream, my question is basically what do you see out there in the latest EPA rules for the new sources? It seems OGI has been embraced as one way to go about it.

MR. O'DONNELL: OGI being?

MR. FLEISHMAN: Optical Gas Imagery, didn't hear a lot about in the last day or so, but I'm wondering what your views are on taking this kind of technology which we know is deployed already in the field and applying it to solving, for example, the potentially high value fat tail problem that we've identified as well.

I would address that to the entire panel including the regulatory side. Thank you.

MR. O'DONNELL: Anybody want to weigh in on that?

MR. SHEARS: Well, certainly. I mean any of the optical techniques are powerful at least in making the initial detection and then it's a matter of whether you can use any of those techniques to make the measurement, so that you can actually calculate the fluxes. So we're having a similar kind of to and fro with CAR (phonetic) right now with their oil and gas regulations in how they should inspect and how frequently they should inspect. But I would think any of the optical detection technologies, especially as the market expands for them, so hopefully get the benefits of scale.

And in terms of sales and price drops those would be very attractive. As to those solutions in terms of actually figuring out what it is that you've -- how many emissions you've avoided, that's more of I guess a research question than it is an actual field operational question.

MR. O'DONNELL: I will weigh in on this. Don't make the mistake of thinking that best practices are always technology. We have taken the stance that the most effective and most cost effective are often process innovations. And you would not think that something like bundling maintenance work, so that you do several different tasks at the same time, would be all that pioneering or groundbreaking. And yet when we match the surveys that we found, that vented omissions from maintenance practices are one of the big ommitters and a heretofore kind of unrecognized problem. I'll say that we've always known it's been there, but there's several things to go into that.

If you can get planning such that various maintenance activities are bundled together and you only have one venting situation versus six venting situations, gee you've just saved 80 percent of the emission in that particular case. And then you can work on reducing the venting emission itself by cross compression or other various techniques. So it's not just about technology although we are seeing advances in technology.

I'll also say that my own personal perspective on best practices is not tried and true and average and everybody does it. That's conventional wisdom. We have to increase the bar. We have to go beyond that. We have to up the average. We have to find what really are new and evolving techniques, practices and policies that are being used. And then get other people to adopt them, sometimes voluntarily, sometimes not so voluntarily. And that's where policy really comes into play.

MR. SHEARS: We should also keep in mind Adam's quick little saying from yesterday, the cheapest detective is not always the cheapest detection. So it depends on what kind of emission sources you're looking at and at what tier or scale you need to be at in order to be able to practically detect those issues.

But I agree with you, Arthur.

MR. O'DONNELL: Okay. We had a question over here? Yes, right over here.

MR. CLAVIN: Yeah. Hi, my name is Chris Clavin, I'm with the Science and Technology Policy Institute.

Arthur, I'm actually going to build off on your last comments there about its more than technology. And one of the things I deal with is trying to reconcile between what the R&D community is producing and then also trying to get the user to articulate what their needs are as well too. And at some point get them to match up at some point in the future.

A lot of what we heard yesterday was what the research community was producing. These are outstanding scientific questions that they're trying to answer with some very innovative approaches as well, too. And then somewhere in the middle ARPA E states somewhere they would like to achieve. EDF, the methane detector challenge is to put actually labels -- put some numbers down on what capabilities they'd like to achieve with detection.

So three broad areas we've been hearing: detection, quantification, and source attribution is what

I've been hearing as well, too.

So I guess my question to everyone on the panel is what type of capabilities regardless of how they're delivered: technology, outreach, any way possible, what type of capabilities would you like to see from the research community at some point in the future whether its next year, five years from now, ten years from now? What are those types capabilities you would like to see for your purposes?

MR. SHEARS: Well, I can start off in terms of the research side, which is -- and, you know, it was discussed, I think it was Chip from JPL and a few of the folks -- is essentially it's the multi -- developing a robust, sustainable multi-tier system, which is what we're going to need I think to really get the handle on what the inventory is to begin with. And then so that's one problem set.

And then the next problem set is once you understand that and can work from that point, what can you provide industry, so that you can actually track that overall what industry's doing is effective, once you have that overall robust monitoring system in place. Because industry clearly doesn't need to be bothered necessarily with measuring fluxes and that; they just want to stop the leaks and fix the problems.

So I'll just offer that to start.

MS. HAINES: Yeah. I think that for us the quantification, the quick quantification of the leak is not as important as just fixing, investing in the system with good material. We really want to spend our efforts and our time fixing leaks and investing in replacing pipes that are leak prone. That gets us the long-term bang for the buck for the system. It makes it tighter.

We've seen that dramatic difference between our San Diego system, which I call it the super system, which doesn't have a leak backlog. We don't have any problems with trying to keep up with the leaks we're finding, because its already a tight system. So spending money on investing in the system to make it tighter is really important.

If we are going to be monitoring the thing for us is to quickly get that data into an Enterprise system, a GIS system, to see were the trends are, where are the hot spots?

For methane, methane's background is between 2 to 5 ppm in Southern California at least, so you don't need super sensitive things. You need to be able to see above the background to see the methane -- but for us because we have such natural occurring methane not just from biogenic sources, but from thermogenic sources -- that sometimes just detecting the methane is not enough. We have to go beyond that. We have to see something.

What would be great to be able to differentiate natural gas pipeline methane from other methane is to be able to detect the odorant that we all have to put in the natural gas systems. If you could detect the odorant, then we for sure know that's our methane.

Otherwise, we're spending a lot of time trying to find a leak that may just be an intermittent source. Somebody turned on their burner, because the equipment is so sensitive. And that is a big waste of time. We'd rather just spend the time planning and repairing that leak or investing in replacing that pipe, because it should be -- it's not the latest (indiscernible) pipe.

MR. O'DONNELL: I'm sorry, do I understand that you say that we don't have a very good way of detecting the odorant aside from smell?

MS. HAINES: Yeah, besides the smell, which is really the best way -- I mean most leaks -- yeah we have to odorize the gas so that somebody can smell at one-fifth of the lower explosive limit, which is about 10,000 parts per million. But most people can smell it much, much lower than that. They can smell. It's amazing how our olfactory nerves can smell pretty low in the parts per trillion, parts per billion, range. But there's really no technology that can detect at that level.

And so it would be great if we could detect the odorant.

MR. O'DONNELL: Or we could add something to the odorant that is detectable?

MS. HAINES: Like some kind of tracer, you're saying?

MR. SHEARS: Yeah, me and the guys that are working on artificial noses to maybe come up with something.

MR. O'DONNELL: Somebody mentioned emojis recently. I mean, we -- (Laughter.)

MS. COWSERT: Well, you can detect ethane for pipeline gas versus like sewer gas and other things. But I don't know if that gets you close enough to what you're --

MS. HAINES: The ethane-methane ratio doesn't really work for us, because we have naturally occurring methane, ethane and propane in Southern California.

It's like Saudi Arabia of Southern California, you know, we have the La Brea Tar Pits. Anybody ever been to the La Brea Tar Pits? You know, it's a surface expression of oil and methane and we have ocean seeps that have methane, ethane, and propane.

I mean we have producers that produce gas and put it in our system and all of that looks and breathes and feels like a natural gas pipeline. Unfortunately, it's just one of those things in our service territory -- I don't think other people have it in their service territories -- but just detecting methane is not enough for us. We have to go beyond that.

MR. O'DONNELL: Harkening back to the medical journalism that I used to do I reported a lot about research. And there are three tiers of research. There's basic research, right, that you would think that after all these centuries we understood how we operate and ourselves as organisms. We don't. And continually new discoveries are made that help us understand that, so there is a component of the research that is needed in the system that is essentially basic research. I think somebody alluded to the ice core samples. That's kind of basic research. What's really the problem and how do we identify the problem?

Then there's the research into better detection of health, MRIs, and x-rays and everything and the whole continuum of that. And that's one of the things we're talking about with imaging technologies and sensing.

And then there's the applied, what we used to call clinical medicine. And that's what kind of research is necessary for the utilities to do a better job, and would be more efficient in that?

I would suggest that all of those things need to be done and concentrated. And that's why we have a grand California Energy Commission with lots of research funding that's available. And they work in partnership with Gas Technology Institute and other things.

But it is up to the stakeholders, whether regulators or utilities or environmental groups or others, to help direct the attention towards what should be focused on. It's not enough to expect the research community to come up with these ideas all the time of themselves, because then you'll never get that practical application. They'll always be focused on the basic stuff.

So there's got to be a combination there.

MR. SHEARS: And don't the EPIC funding.

MR. O'DONNELL: Yeah. I'm sorry, the ethnic funding?

MR. SHEARS: EPIC.

MR. O'DONNELL: Oh EPIC. Yes, EPIC is one of them.

There are a couple questions in the back and then over here. So let's start over here and then to Win and then to the front here. Okay.

MR. ADDY: Yeah, is this on? Yes, so McKinley Addy with AdTra.

And I guess this question goes towards a comment that you just made about what should be focused on, so the need to address the methane leakage is compelling. Some of the information we've heard in this symposium last two days suggests that the trend for methane leakages is sort of (indiscernible) if we use the information that we have presented and I believe the gentleman from LDL. (phonetic)

And then when you take into account the new regulations and some of the new technologies for detection and mitigation, one can expect some future additional reductions. So the question is, is there a lower bound methane leakage rate that the stakeholders would like to see?

MR. O'DONNELL: Like a threshold rate, somebody was talking about 65 grams or something like that?

MR. ADDY: Yeah, I mean --

MR. O'DONNELL: I mean, that is a politically fraught situation, because you cannot really equate particular rates of emission with volume of emission unless you know how long it's been leaking. And that requires a whole different set of tools and technologies to measure that.

The way that we've done it traditionally has been about safety, right? If it poses a safety hazard, then you fix it right away and then you do that. I'm going to say that it would be a very difficult thing for a regulatory agency like the PUC to do.

If EPA is still here, maybe they could talk about it or ARB, but I'm going to kind of say that's going to be a tough one.

MR. ADDY: But, you know, forgive me, but generally some sentiments expressed have talked about system-wide leakage rates of maybe low 1 percent or below 2 percent?

MR. O'DONNELL: Okay. That's an aggregate, all right? And that's a lot easier to figure out than what's the threshold that comes from a distribution pipe or even a larger pipe, because you've got constantly flowing.

All right, two different things, I'm going to say apples and oranges there. Anybody else want to --

MR. SHEARS: No, I'd agree.

I mean, it's a matter -- it's one thing to detect an instantaneous emission as opposed to having an actual picture of what the total emission is, what the flux is and everything.

Those are two different challenges with two different potential outcomes depending on what work you're doing around that.

MR. O'DONNELL: Kathleen, while the microphone's over there, did you have a question? And then we'll move it to the front here and then back to Win? I thought I saw you raise your hand.

MS. KOZAWA: No.

MR. O'DONNELL: Okay. All right, then in the front here, center.

MR. BRADBURY: Thank you, James Bradbury with the U.S. Department of Energy.

I had a question just building on this great discussion, particularly on the issue of best practices. I was interested in thoughts on examples of best practices. At the federal level obviously we're interested in learning from the experience here in California. And any sort of innovative approaches that could provide lessons learned for other parts of the country as well.

So I don't know, maybe PG&E, Sempra, if you have some thoughts on what you consider would be a practice or a method that has been particularly effective? Or from the other side of the table anything you've seen from industry that is worth highlighting going on here in California that others could learn from?

MR. O'DONNELL: Okay, so when you meet with your colleagues right, and you do, what are the things you're excited to tell them about that's working? And so if I can recast your question that way?

MS. HAINES: Well, I think Art kind of touched upon this earlier about bundling, seeing hot spots.

You know, most of the utilities now are using a geographic information system to look at their system in a whole new way to visualize their system where they weren't able to visualize before. And I think a best practice is to use that system to get the data, the leak data, on the system and be able to visualize where the hot spots are in a system. And correlate to and decide whether or not you should invest in replacing that pipe or you should go out and repair that one leak. Where if it's state-of-the-art pipe already then you go out and just make the repair. But if it's not state-of-the-art pipe then you bundle that work and you go replace it.

I think that is the best effort right now to really start moving toward permanent tightness of a system is to make good decisions on whether to invest in replacement of non-state-of-the-art pipe, or make the repair. And that is utilizing this new technology and getting that data into that technology quickly where somebody can assess it and make those decisions.

And it's something that is fairly new, within the last I'd say year, that we're finally able to start utilizing the GIS system on how we need to utilize it.

MS. COWSERT: I'd agree with that. And I would add on the application of leak detection technologies that are able to detect more leaks, smaller leaks. And so you combine the detection with the overlay of information, the kind of looking for clusters or bundles of leaks, and addressing those aggressively if you're looking at vintage or non-state-of-the-art type pipe. And going out and doing capital replacement of that work rather than repairs.

And that actually -- the concept of upgrading systems is something that is being performed by many distribution companies within the country. The application of new leak detection technologies is kind of an emerging best practice.

MS. HAINES: I also think bringing in other data, the dig-in situation. Where we're having dig-ins is a huge issue for any natural gas system, third parties hitting our system.

And right now there's not a lot of folks that are taking the USA tickets that people are calling in for and porting that over to their GIS system. And then taking in the transponders from their vehicles and porting that into the GIS system to see where the people are, to go do random audits on high-risk areas. And using the GIS systems build algorithms to look at areas where there's high risk. If somebody hit that line it could eliminate 23,000 customers right away or if it's a high-pressure line that we didn't know was there.

I think that utilizing this big data again and bringing that into a workable format where we could do better analysis on threats to the system, I think is a huge area that we really haven't fully explored. And half the time, people don't call the USA ticket. So the people that hit our system, half the time they don't follow the law, essentially.

And there's a theory that we should be having better enforcement to go after these folks, but a lot of these folks are homeowners. They're just clueless about what's going on. Or they're just bad actors. And if they're bad actor contractors we should be calling our state agencies that oversee contractors and say, "Hey, these people are not doing what they should be doing."

But we should be utilizing our GIS to as much power to go after, and identify threats to the system more than we have in the past, and get the data quickly into the system through automatic data collection means. I think we still are too dependent on paper and inspections in the field and things like that.

Also, you know, there's opportunities to get the public involved and engaged. You know, there's only so many of the utility folks that can run around and check them. But we need to do a better job of getting the public involved in helping us find these illegal excavators that could be hitting our system. I don't know if putting out an app that gives them a Starbucks gift card or something if they find somebody. Something to get more people that have eyes on the system to help us find illegal excavators that could be hitting our system and creating significant integrity problems and safety issues for the public.

MR. O'DONNELL: Maybe they could just get the gift card for calling in the number? It could save money in the long run.

MS. COWSERT: Right, incentives.

One other thing I wanted to add on the concept of dig-ins and the methane emission component of that, is a best practice that we've instituted that's starting to spread to the industry is tracking our shut on the gas time. So when we do experience a dig-in there is opportunity for gas to blow for a period of time before we're able to actually shut it in. So we started tracking the time it takes for us to actually do that for both main and service dig-ins.

So the complexity of the work is different if someone hits our distribution main or transmission main, versus hitting a service line. But we do track that now from the time we receive a call about damage to our facilities to the time that we respond in the field and are able to shut off the gas.

And so that tracking that and trying to improve on that time helps us reduce methane emissions as well.

MR. O'DONNELL: Okay. We have five minutes left. Is there another question waiting? Win, did you have something?

MR. SETIAWAN: Win from ARB. My question is to the industry regarding the cost effectiveness of best practice.

Do you think, just looking at the amount of gas saving is it enough in this case or do you have to take into account damage caused by the gas released into the atmosphere? Given the fact that you can pass along your investment to the rate payers, you would try to convince the rate payers this is good for the environment, good for their own health.

And second, after you convince the rate payers, they usually would like to track the amount of money that they already spent, whether industry would be transparent in this case, how their rate payers money have been spent to reduce emissions?

MR. O'DONNELL: Okay, so that's a question that goes to social costs and the cost-benefit analysis, which we have a hard time dealing with and also accountability. So who wants to take that on?

MS. COWSERT: Maybe I'll start, so I guess from my perspective cost effective in the realm of a utility doesn't necessarily just mean that the cost associated with saving gas is all that we're going take into consideration when we decide whether or not we're going do something to reduce methane emissions. I think it comes in to play where it has to be agreement among the stake holders involved in a rate proceeding to determine what the additional benefit from a societal perspective is and what rate payers are willing to pay for that.

So I would argue its not simply the cost of gas, but something probably a little bit more than that, that we would take into consideration. But that would have to be agreed upon through that proceeding. So we would make a proposal of what we think is reasonable and what we think is affordable from a rate-base perspective. But then that would clearly be adjudicated and visited by all the variety of stakeholders who might have a say in that.

So that's my perspective.

MS. HAINES: Yeah, I have to agree with Christine.

I think we can't just limit ourselves to the cost of gas, especially now with gas so cheap now. But I have to tell you that it's very expensive to get reductions on the distribution system. And that our customers, our interveners, are going to basically tell us what they can tolerate in terms of energy rates going up and things like that. So I think we'll get that loud and clear when we do propose our reduction ideas. And we'll get an idea of what interveners will tolerate in terms of how much they're willing to pay for that.

Right now just eliminate our backlog I think it was like $33 for an MCF. An MCF which is a 1,000 cubic feet of gas roughly, is going for probably $2 to $3 right now. And so already the cost to implement that reduction in our backlog is an order of magnitude greater than the cost of the gas itself.

So are we going to get funded for that? Are the interveners going to be okay with us going after that gas? I would hope so, but that's not really up to us. We put out what it's going to cost and what we think is the best way to do it. And we'll find out whether or not our interveners are going to say, "Yeah, we're okay with that."

MR. O'DONNELL: NRDC was a pioneer of using social cost factors in energy efficiency cost benefit analysis. Do you have a position in this case?

MS. MORDICK: I mean I don't know that I have much to add other than yeah, obviously we think incorporating social costs of carbon into rulemakings is incredibly important. We're not good as a society at quantifying benefits, so yeah.

MR. O'DONNELL: One of the surprises to me in becoming a regulator is that I always thought that if the regulator tells a utility to do something, then we have an obligation to give them the money to do so. That's not the case. Especially with regard to safe and reliable operations of the system, we expect them to operate safely and reliably, no matter how much money we give them. So that's a quandary that we have.

We have one more question in the back. Yeah, okay.

MR. SETIAWAN: Well, yeah I think my second question got answered.

MR. O'DONNELL: I just answered that one. That's accountability.

MR. SETIAWAN: Oh, yeah

MR. O'DONNELL: They have to do it anyway, all right? And prove it to us.

One more?

MR. HOU: Hi, Yu Hou from the Energy Commission.

Going back to the comment about threshold, and I think I just will make a comment and see what are your thoughts on that, it's also besides the percentage -- you know, we're talking about 2 to 3 percent throughout our whole system due to the emission rate -- there is also the actual amount. Because if you are able to reduce to 2 percent or 1 percent, but your total cost of consumption as a nation went up twice as much and the impact is the same.

MR. O'DONNELL: Okay. I'm sorry, I don't understand the question there?

MR. HOU: I'm just going back to previous comments on what's the threshold, because should we look at a total emission amount annually, you know, maybe from inventory. Or because of the percentage like what I said, that if your total consumption rate went up, even if you reduce the percentage, you will still have a similar climate impact.

MR. O'DONNELL: The Commission is currently grappling with the issue of how one sets targets and how one enforces those targets in what we're looking at.

So if we have a grand goal articulated through AB 32 of 40 percent emissions reduction from one point to another point, does that mean by company, does that mean by industry, does that mean by component? How do you segment that out? And we're still trying to deal with that.

As a percentage it's a little bit more difficult, because again it's you're looking at aggregated figures and that doesn't really help you identify where you can do those savings. It's a little bit like trying to reduce line losses on the electric transmission system from 6 percent to 4 percent. Well, you can do that, but you have to know exactly where to apply your technologies and your practices to do that. And that's what we're really more concerned with is exactly where. What's the surgical way, because that's how you reduce your costs, rather than trying to have a grand emissions reduction?

So yeah we can live within a 40 percent reduction as has been articulated, but we have to figure out how to get there. And that's really the more important and more difficult work I would think.

All right, I'm going to close it here, because we are a couple of minutes over. I want to thank our panel very much for the participation and the insights that they brought to us.

And I want to thank you for your questions and for your attention. (Applause.)

I want to thank the conference organizers, our three sister agencies as well as the individuals who worked very hard to make this happen and all of the vendors, all of the presenters, everybody involved, the guys that are out there waiting for your business when you need to go to the taxi stand and to the airport. Thank you all very much.

Elizabeth is coming back.

MS. SCHLEEHLE: Hi, I'll be quick, because I know this is at the last, but I just wanted to sum up what I've heard over the last few days and just kind of go give a few takeaways and what we're going to do next. And this is just what I'm taking away from this, obviously not what -- I haven't talked to the CEC or the PUC about that.

I just want to throw back up the objectives here and I wanted to thank everybody, because I think all the presenters and all the conversations we really have reached all of these objectives. I think we've had a really robust conversation on the science of life cycle emissions. We have looked at where some of the gaps are. And I think that will help inform us on where we're going from here and that sort of feeds into the last one of informing future policy discussions on the next steps.

I'm not going to go through all of my slides, but I did want to hit on a few things. I think one thing we heard a lot was a tiered approach to emission research is important. And that's something that we'll take away from that. We have that effort and we'll continue that effort looking at some of the work with the CEC on flights, on the hot spots analysis, our tower work as well as our bottom up work.

Integrating high emitters is important and we are starting that process in some of our leak detection work and component work.

On sort of the emission sources we've heard that fat tail distribution is very important and that tank emissions are important, not that everything else isn't, obviously those are also important but that is one thing that I heard coming out of this as well as imported natural gas and the leakage rate associated with that.

I think that's come up during the panel discussions. It's come out during various parts of the conversation. And that's something we've been thinking about and I think we'll continue to think about and watch what's going on, on the federal side of things.

Finally a couple of other things, detection technologies, as we've seen outside and downstairs today there's a lot of technologies that are quickly evolving. And we will be following those and figuring out how can we incorporate those into our future efforts.

And I think the big data analysis was really interesting this morning. And that can be useful for determining our emission reduction opportunities as well as linking science and data, how we'll integrate that into the process I think will be interesting. I still haven't quite grappled with how we can integrate that in kind of a regulatory process. Maybe it is just something that utilities may find useful as all of this new data is coming in from (indiscernible) and from various different places.

So those are some of my takeaways. And just quickly on the next steps we're obviously, all three agencies are continuing our efforts, there's a lot of research going on in this. And we'll continue those efforts. A lot of our efforts have been mentioned. We'll also continue following the detection technologies and we'll be doing upcoming research as well that has been mentioned.

After meter in homes, I think any work and especially hearing some of what has been discussed on this panel and any interactions we can have with the data you might have to inform that, I think would be really useful.

And then one thing that we're excited about is the life cycle model that we're starting very soon. And we will continue stakeholder discussions on that and outreach on that, so look for that.

And finally, as I mentioned earlier monitoring the federal actions that are going on and seeing if that is getting to some of the imported natural gas emissions.

So those are some of my takeaways in the next steps that we're going to do here at ARB. And I think you'll -- I would like to invite you to continue to stay involved in our process, the PUC process for the transmission distribution side, there's a lot of good information coming out of there. And also CEC work and all the work that's going on.

So that's it for me. I just want to thank everybody. This has been really useful and a great discussion, so thank you very much.

And I think we actually do have to open it for public comment. So for the IEPR CEC process, if there's anybody that has comments I think you were supposed to fill out a blue thing, so I'll turn it over to Kathleen.

MS. KOZAWA: Thanks, Elizabeth.

I don't know if McKinley Addy, are you still here -- okay, you are, you did sign up to speak. So go ahead and come up to the microphone, thank you.

MR. ADDY: Thank you. I don't know if CEC staff is still here, but for the purposes of the IEPR proceeding, my name is McKinley Addy and I'm the Vice President of AdTra.

(Brief pause to fix audio.)

All right, so I'm a Vice President of AdTra and our company is a virtual integrator of low carbon, high efficiency technologies at scale, to foster the deployment of low carbon solutions, develop and deploy technologies and projects. We helped recently to develop two new heavy-duty natural gas engines for trucks that are rated at 450 horsepower and 525 horsepower.

I appreciate the opportunity to comment on the IEPR proceeding. The topics discussed in the last two days cover a lot of the topics that the IEPR proceeding will cover. And I'd just like to link the information from the last two days to the low carbon transportation natural gas fuel use in the importance of California's transportation future.

You know, four years ago methane leaks were raised by the Environmental Defense Fund when there was a question about the potential benefit from low carbon natural gas trucks. We have shared this concern that EDF raised at the American Trucking Association's Summit in Washington D.C. And this was going to be an issue sort of on the horizon in the CEC and (indiscernible) pay attention to it. So it's sort of good that four years later these agencies are paying attention to this.

We are pleased to know that efforts are ongoing to collect and improve data sets, to better quantify methane leaks through multiple methodologies. And with new regulations and leak reduction targets at the state and federal levels, information that the workshop developed suggests that leak rates might be in the range of .8 to 2.4 percent and these are trending in the viable direction. I think Adam Brandt's research paper about two years ago suggests a threshold of 3 percent is desirable, others have looked 1 percent.

We note that with more efficient natural gas engines such as what our company and our colleagues are developing, combined with reduced methane leaks afforded by several technology solutions discussed, the low carbon benefits of natural gas trucks remain also or by methane blends.

This is important, because the transportation natural gas use in the truck sector is a path to achieving California low carbon fuel standard targets and the state's alternative fuels (indiscernible) goals as well as Governor Brown's petroleum reduction vision.

There are two feedbacks to the Energy Commission for the IEPR proceeding is that it is important for CEC, in the IEPR update, to maintain consistency with earlier transportation natural gas scenario outcomes from the LCSF updates and the state oil fuels plan.

I recommend that CEC staff's active involving with the Air Resources Board's effort in the development of the natural gas version or component of the Op-G (phonetic) model.

MS. KOZAWA: Thank you, for your comment.

Any additional comment for CEC workshop?

MR. LEYVA: Jennifer, are there any questions on the line, on the phone?

OPERATOR: No, I'm showing no questions.

MR. LEYVA: Okay. Thank you.

MS. KOZAWA: Okay. With that, I'd like to conclude the public workshop portion of today. And we thank you for sticking around the whole time for the symposium. (Applause.)

(Whereupon, at 3:55 p.m., the Joint Agency Symposium & Workshop was adjourned)

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