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COMMITTEE HEARING

BEFORE THE

ENERGY RESOURCES CONSERVATION AND DEVELOPMENT

COMMISSION OF THE STATE OF CALIFORNIA

In the matter of,	)	
	)	Docket No. 15-IEPR-03
	)	
2015 Integrated Energy Policy	)	
Report (2015 IEPR)	)	

IEPR COMMISSIONER WORKSHOP ON

REVISED NATURAL GAS OUTLOOK

CALIFORNIA ENERGY COMMISSION

FIRST FLOOR, ART ROSENFELD HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

TUESDAY, NOVEMBER 3, 2015

10:04 A.M.

Reported By:
Peter Petty

APPEARANCES

Commissioners

Andrew McAllister, Lead Commissioner 2015 IEPR

Robert B. Weisenmiller, Chair, Lead Commissioner for Electricity and Natural Gas

CEC Staff Present

Heather Raitt, IEPR Program Manager

Ivin Rhyne, Manager, Supply Analysis Office, Energy Commission

Also Present/Public Comment

Tim Carmichael, California Natural Gas Coalition

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P R O C E E D I N G S

NOVEMBER 3, 2015 10:04 A.M.

MS. RAITT: Welcome to today's IEPR workshop on the Revised Natural Gas Outlook Staff Report. I'm Heather Raitt, Program Manager for the IEPR.

The housekeeping items, if there's an emergency we need to evacuate the building. Please follow staff to Roosevelt Park, diagonal to the Energy Commission.

The workshop is being recorded on WebEx. So, we'll have a recording posted in a few days and a transcript in about a month.

After Ivin Rhyne's presentation this morning, we'll have an opportunity for public comment. We'll be limiting it to three minutes. First, folks in the room and then folks on WebEx can comment. And please use the chat function if you're on WebEx to tell our coordinator that you'd like to make a comment.

And written comments are welcome and due November 17th. And the information for providing comments is on the public notice. And that's it.

COMMISSIONER MC ALLISTER: Great. Thanks, Heather. So, let's see, I guess this is one more step in the forecasting process for natural gas. I think in the first workshop we had we really framed the context a lot and sort of, I think, put across the message of how

important this is. And, you know, I think very few people in the room and probably not that many people on the WebEx. But it is somewhat of a specialized topic, but it is really fundamental with where we're going with energy policy in the State.

Natural gas, obviously, kind of what you think about it depends on where you sit in the marketplace and in society. But I think there's really no doubt that a lot of our energy comes from natural gas, both, you know, from the generation side, much of it at the margin, as Chair Weisenmiller points out with truth.

So, and then also at the end use where we're really, you know, concerned about the existing buildings and getting their carbon footprint down. And sort of both ends of the spectrum are very important and will be changing over the coming years and decades.

And so, understanding that and the dynamic underneath -- underlying the natural gas markets and patterns of use is really important.

So, I'm looking forward to the update and hearing what's changed since the last workshop, and what tweaks and modifications staff has done on the forecast.

CHAIR WEISENMILLER: Yeah, I wanted to thank staff for really drilling down on the gas price forecast since our last workshop. I think, as we were looking at

it the last time, there were at least questions or concerns. The price forecast is important. It's certainly a key element in our retail rate forecast. It's a key element in a lot of our cost effectiveness for our Building and Appliance Standards.

So, we wanted to really drill down some and understand it a little bit better. And appreciate staff really going back and taking a second look at some of the pieces of it. And now, we have the benefit today of that additional look at stuff.

So, again, thanks for digging in and let's dig into it.

MS. RAITT: Okay, so now we have Ivin Rhyne from the Energy Commission.

MR. RHYNE: All right, thanks Heather. I'll adjust this upwards a little bit here. There we go.

So, good morning. My name is Ivin Rhyne and I am the Manager of the Supply Analysis Office, part of the Energy Assessments Division here at the Energy Commission.

The Natural Gas Forecast -- sorry, the Natural Gas Outlook, I should say, is produced by a combined effort of Natural Gas Unit staff, which is part of my office, as well as End-Use Demand Forecasting staff, which is part of the Demand Analysis Office.

It also takes inputs from the Transportation Demand Forecasting group, as well as integrating the information collected through a stakeholder process. Which, Commissioner McAllister, you mentioned we had a previous workshop on September the 21st, and we've integrated feedback both from internal and external stakeholders as we move forward with this Revised Natural Gas Outlook.

And what we're going to be -- what I'm going to be providing today is a summary and overview of the results which are contained in this Outlook Report.

It's important, I think, to keep in mind a couple of pieces of context. First of all, natural gas is not disconnected from the remainder of the United States energy supply in a way that allows us to produce a forecast that ignores all of the other sectors.

Natural gas is an important element. It acts as a very large and flexible piece of both the power generation and the end-use demand sectors. It allows people to -- in the industrial sector to produce a number of different products, both through direct use of the chemical structure of natural gas, as well as its heating properties. And so, it's an important element of how things are done today in the United States with regard to the energy sector.

It's important to note that a lot of those end uses, trends and things that are going on in the natural gas sector are addressed separately in the AB 1257 report, which was just recently finalized, published and delivered to the Legislature per our mandate.

And it's important there to keep in mind that that compendium of information really takes the place of some of the previous trend reports that we have produced in the past.

And so we focused this report really on looking forward at natural gas into the future. And so, with that in mind, we'll go ahead and launch into it.

The important thing, I think every forecaster who's ever done a presentation has probably quoted Yogi Berra to the effect to say it's tough to make predictions, especially about the future.

I would suggest that there's another Yogi Berra quote that is perhaps more relevant to what we're about to talk about. And he says, "When you come to a fork in the road, take it".

What I think is relevant about that quote is the fact that we're sitting here today, looking out into the future, trying to understand where these trends and end uses, prices, all of those things may go. But the world is a chaotic and non-linear place. And people will

continuously take forks in the road that we don't expect.

And so, as we go through this report today, as we talk through these results, I want everyone to keep in mind a couple of things. First of all, we will present a range of values for both prices and demand across the United States, and across California, that represent what we think is a plausible range of possible values for those end uses. But they are not the only possible values that we may see in the future.

The other thing to keep in mind is that they represent annual average values. Rather than any one day's spike, or peak, or valley in prices or demand, these represent the values that we think we may see out into the future, spread out and sort of averaged over the course of an entire year.

And so, what may be a headline today may get washed out by a longer-term trend that happens over the course of a year, two years or, in the case of a forecast, ten years.

So with that in mind, we've gone through, and as Chair Weisenmiller mentioned, really drilled into our results since the last workshop. And some of the changes that have happened since the last workshop we're going to talk about.

Then, we're going to talk specifically about the California prices and demand. We'll talk also about national prices and demand.

And, finally, we'll wrap up with a discussion of where the U.S. level, imports, experts and LNG may be heading, since the international ties -- natural gas's ties to international markets can have an effect on national markets.

And, finally, we will wrap up with a discussion of conclusions.

So, in a single slide here, just trying to summarize some of the changes that have happened since our September 21st workshop.

First of all, we made a choice to pair the high-cost environment with the low-demand case. Again, I mentioned that this is done as an IEPR process, where we've connected the natural gas forecast to other forecasts that are being produced as a part of the 2015 IEPR.

It's important for us to make sure that we keep things consistent. And in doing so, we realized that it was better for us to pair the high-cost environment of production and allow that high price to help drive demand down in our low-demand IEPR case. And so we've done so and vice-versa, where we've connected the low-

cost environment with the higher demand.

It's important to realize that sometimes price is in the driver's seat and sometimes demand is in the driver's seat, in the real world. In this case, we're allowing price to help drive demand.

We also, as the Chair pointed out, drilled down into a number of other assumptions. One of those being that coal retirements associated with the new Part 111-D rule issued by the EPA, we were able to dig through their Regulatory Impact Analysis document and get a finer-grained estimate of what those future retirements of coal may look like. But I think, more importantly, we were able to assess how much of that retirement may be switched over to gas. And that was sort of the important element there.

We reduced our estimate of what could be switched over in all three of our cases and adjusted them downward to be consistent with what is in that Regulatory Impact analysis.

Another change that we made, previously we had estimated that states outside of the Western Electric Coordinating Council would be late in meeting their Renewable Portfolio Standards goals.

A review of research being done at Lawrence Berkeley National Lab, in tracking the progress of

states that are -- that have a Renewable Portfolio Standards goal is showing that, I think in a wonderful success story, the majority of them are on track to -- the vast majority of them are on track to meet their goals. And so, we thought it was a more appropriate assumption to show that the states outside of the Western Electric Coordinating Council, or WECC for short, meet those goals on time.

In a small adjustment from what we did in our previous workshop, we still use a forward curve as part of how we adjust the near-term prices. But rather than just picking a random day, based on the fact that the bid week, which is an end-of-the-month sort of massive, sort of market turnover process, the bid week forward curve is one of the best estimators of the future price for the coming month. And so, we used the end of September bid week, which at the time was the most recent bid week price curve, as a part of that adjustment.

Finally, we made several small adjustments to deal with minor modeling issues, including alignment with U.S. Energy Information Administrative values. And so, we were able to bring our forecast numbers and our calibration numbers into alignment with USEIA values.

So, let's move into the California prices and

demand. And I'll note that these were produced by our Demand Analysis Office, and so our thanks to the staff in that office for being a part of this process, as well.

So, California total natural gas demand. We have what we think is a pretty good story here looking forward. California natural gas demand in the reference case is represented by the blue bars. And then our high and low demand cases are represented by the red and green lines, respectively.

And what we see is that California's total natural gas demand we expect to decline slightly over the next six to eight, almost ten years, before starting a slow climb, again. In part, we think that is driven by the fact that once we meet our 33 percent Renewable Portfolio Standards goals, and we see later demand growth associated with the electric power sector, that some of that recovery of gas demand will be associated with needing some additional gas resources. Certainly, not on the scale as we used to. Some additional gas resources in order to meet that growth in demand.

We do see, in the high-demand case, the potential for roughly flat natural gas demand overall until the out years. And then in the low-demand case, we see the possibility that perhaps we can go beyond 33

percent and perhaps really help push natural gas demand in California down even further.

End-use natural gas demand, which is a subset of total. It's really the commercial, residential, industrial. It's everything except power generation.

What we have on this slide is a graph. The black line, which is our historic actuals -- sorry, our historical actuals, I should be careful. And then we have our projections produced out through 2026, of the high-, mid- and low-demand cases.

Now, the purple line that's sort of hanging out there at the bottom was the 2013 mid-demand case. And you'll see that the 2013 case showed that the expected end-use natural gas demand was essentially flat. And that was really driven at the time by a presumption that we would see an increase in natural gas price that would help keep suppressing natural gas demand.

We didn't see that spike in natural gas prices and we have since adjusted to deal with that reality. And we have a higher starting point. And so, that's an important sort of element.

We do know that there's always going to be adjustments of this kind as we go forward, and so we'll keep an eye on this.

Commissioner McAllister, you had a question?

COMMISSIONER MC ALLISTER: Yes, a couple questions. So, I'm looking at the low and the mid case and it looks like in the out years -- in the early years they were roughly the same and in the out years, actually, the mid becomes lower than the low. I'm wondering kind of what's the underlying kind of dynamic behind that.

And then, on the previous slide, I'm looking at the last, you know, five years or so when it starts to creep back up. You know, we're going to have 50-percent RPS approaching at that time. And then we're going to have probably lots of storage technologies or whatever else at the margin. You know, presumably we'll have succeeded. I think, I'm fairly confident at least, in narrowing how much natural gas we actually have at the margin on the generation side. Hopefully, we're also going to see some technologies coming into our existing buildings on the electrification front or, you know, natural gas biofuels, or biogas replacing some of that fossil natural gas.

I guess I'm wondering if the out years, you know, the last five years there leading up to 2030, is that transportation or what is that, exactly, that's causing it to uptick again?

MR. RHYNE: So, we do see in the -- these

California gas demand values are based on the preliminary natural gas demand values presented by the Demand Analysis Office. They are, actually, currently running a revised set of California-specific numbers.

COMMISSIONER MC ALLISTER: Okay.

MR. RHYNE: But in their preliminary values that was the out years. We're driven, to some extent, by growth in natural gas for transportation end use. And we think that that is -- we do expect some growth. The exact value in those outer years I think is a little bit difficult to wrap our arms around.

But a movement away from sort of the traditional, you know, petroleum-fuels-only model is part of what we see going out into those later years.

And so, one of the things that we're doing, as the Transportation Forecasting Group, is revising and sort of streamlining their own estimations of those out years. And what will become, later on in the final version of this report, we'll be able to integrate all of that.

But really, to some extent, that's driven -- the end-use demand that you see in this slide, to some extent is driven by a transportation, growth in transportation demand for natural gas, and differences in the efficiency assumptions across the three cases.

COMMISSIONER MC ALLISTER: Okay. And then the other, the first question on the low and mid, and how they pretty much track and even switch roles out in the out years?

MR. RHYNE: Yeah, so my understanding, and I'll have to confirm this with the Demand Analysis Office, is that that had to do with differences in transportation demand assumptions.

COMMISSIONER MC ALLISTER: Oh, okay.

MR. RHYNE: But I will verify that by the end of the day.

COMMISSIONER MC ALLISTER: Thanks.

MR. RHYNE: So, an important element for the Energy Commission is we've really looked traditionally a lot at the gas demand for power generation in California. We know that it plays a very important role here, in the State.

And I think one of the success stories that we think is materializing here is that overall demand for natural gas, for power generation, is looking to decline despite the fact that the total electric demand is remaining, you know, sort of flat. And we know that that's taken a pretty tremendous effort to keep that demand flat.

What we see in this slide is the growth of

renewables picking up a larger and larger share of the overall electric generation sector. Again, the blue bars are the reference case, the red and green are the high and low demand cases.

And we think it's appropriate to see, you know, perhaps in the high case things remain roughly flat with where they are today. And in the low case certainly drops from where we are today, which is call it two and three-quarters billion cubic feet per day, and down in the low case of just below one and a half.

So, we see, as a potential for a sizeable reduction in natural gas demand for power generation out into the future.

I will caution everyone, though, is that, again, these are annual average numbers. This is not a statement about how much a peak day of natural gas demand might pull, how much stress that might put on the system or not put on the system, or what kind of operational constraints that may place on things. But we do see an overall reduction in the total amount of energy needed from natural gas resources. And, therefore, a resultant decline in the total natural gas demand from power generation sources.

CHAIR WEISENMILLER: It's interesting, you're looking at the high/low as price driven. And actually,

since gas is the marginal resource, the real high/lows will be a function of hydro, temperature and sort of outages.

So, you could have incredibly low values if you have cool, wet years with, say, Diablo at full tilt. And, conversely, if you have a Diablo outage scheduled, say, and you know, you suddenly have dry, hot, you know, you're going to have a pretty great -- you know, a larger swing than what we're seeing here, or at least it's going to accentuate the highs and the lows.

COMMISSIONER MC ALLISTER: Yeah.

CHAIR WEISENMILLER: Yeah, yeah.

MR. RHYNE: Yeah, and we do, we agree completely, Chair Weisenmiller, that when it comes to gas demand for power generation the price effect is relatively small overall. Really, as you mentioned, it has more to do with its role in the overall portfolio of what is available in any given year and what gets built in the out years.

And we see a trend towards reducing the overall construction of new generation facilities as our demand forecast continues to fall, and our resource base is solid, and we keep adding renewable resources.

But, certainly, price has a small effect but it's really not the primary driver of the values that

you see here on the screen.

So, we'll talk for a moment about where California gets its gas. Currently, we get about 90 percent of our gas from areas outside of California. About 10 percent, perhaps just a little bit less than that, from production sources actually here, in the State. I think it might come as a surprise to folks who, perhaps, don't follow this well, that California has traditionally been a relatively resource-rich state, in part producing some of its own petroleum resources and producing some of its own natural gas resources.

But from outside the State we really have three major sources. The Canadian natural gas basins, again sort of as the name would imply, located north of Washington State, up in Canada. We have gas produced in the Rocky Mountains. And then, we have gas produced in the desert southwest, specifically the San Juan Basin.

And that's an important sort of mix to keep in mind. We can buy gas from any of these basins and each of them have their own costs associated with production. They have their own unique sort of behaviors, patterns. They also serve different marketplaces.

And so, our demand over the course of any given day, or any given year, can vary as end-users, as the gas utilities can buy from different resources.

But what we see out in 2025 is overall an increase in the total percentage of gas that comes from out of state. Really, growing from about 90 or 91 percent to about 98 percent of our gas coming from out of state.

And then we think that, based on sort of the overall supply and demand balances, that we are looking about half of that's going to come through the north, at an entry point called Malin. It's actually a hub just north of the border, in Oregon. And Malin can receive gas either from the Rockies, or from Canada, or it can come along to other major pathways. One is the Kern River Pipeline, which brings in Rocky Mountain's gas. And then, the Southern California border which brings in gas from the desert southwest.

And so, it's about half in the north and about half of the gas will come in from the south in 2025.

Now, the price differentials between the north and south end of the State really are, historically, small with the exception of a few excursions where we had unique market events that were typically very short lived.

And so, this graph doesn't show you a whole lot because the prices are really on top of each other. But we've combined a graph that shows what we expect the

price to be at Malin, the price we expect at Topock, which is the Southern California border, along with Henry Hub. Now, Henry Hub is a key national pricing point for natural gas.

And what you can see, Henry Hub there, in the light blue, is that both Malin and Topock are very, very close in price to that Henry Hub. In fact, so close that it's not really useful, I think, to use this graph. So, rather, we have plotted these differentials in a bar graph here, on this slide 10.

And what we see is that Topock tends to be slightly, the Southern California border tends to be slightly more expensive than the national benchmark of Henry Hub. And we see that Malin tends to be slightly less expensive.

Now, I want to sort of remind everyone, California does not get its gas directly from Henry Hub. But Henry Hub acts as a national price standard against which everyone else sort of measures their gas prices. And so, these differentials are important, often called basis differentials, when we talk about the relationship to Henry Hub.

And what we see is that the San Juan Basin, the price, the cost associated with getting that gas out, getting it to the border, it's slightly more expensive

than Henry Hub.

And then, the price point at Malin is very close to the prices at Henry Hub. And Malin is an interesting price hub because it does have those two different sources of gas. It can get gas from Canada, it can get gas from the Rockies. And that overall competition helps keep it very close to the national benchmark, along with the fact that -- along with the fact that the Rockies' gas is relatively inexpensive.

So, it's an important element. What we see, though, going forward is that we expect California gas to roughly mirror the overall price of gas at the national hub. That would be the key takeaway here.

And, finally, this -- when we talk about California, it's important to talk about storage. And I'll preface this slide, which this is not a forecast. This is not a projection. But it is a statement, a graph that shows where natural gas storage values fall this year. 2015 is the blue line and it stops there in August, which is where we had our last set of values as we were getting this prepared.

But the top and bottom lines represent the five-year range of storage. So, this is average of Bcf a day, each month. And what we see here is that in 2015 we were essentially at the five-year average mark for

natural gas storage.

Now, this is slightly different than the natural average, where the national storage averages were -- the actuals are pretty high right now. And so, we've got a lot of gas in storage, nationwide, going into this winter.

And in the short term, right now the market seems to think that that seems that we will have relatively cheap gas going into at least this year. We think that's driven by forecasts that show potentially a warm winter and, obviously, plentiful gas overall.

And so, while that doesn't necessarily tell us where the 20-year or the 10-year values of gas price or demand will be, it is important going into at least this coming winter and the next 12 months or so.

So, we're going to move from a California-centric view of the world to national. And it's important because California is connected to the national market and, therefore, really that's an important sort of outlook going forward.

And I mentioned Henry Hub as being sort of the key price point. This slide is our estimated price, our three cases for price at Henry Hub. And you can see the historical values there in the dashed, purple line. And our reference case is the red. And then our high and

low demand are in the green and blue.

And I will remind you high demand, in this case, is associated with the low price. Low demand is associated with the high price. So, if you're trying to keep those straight in your head, it's the high is on the bottom end and the low is on the top end. It's a little reversed, but it's important to keep that in mind.

And what we see is a relatively steady growth in price between where we are today and 2030. The reference case, we see the price climbing to about $5 a thousand cubic feet of natural gas. With a low -- the high demand/low price case actually following a track really, very much in line with the bid week forward strip, as it stands today.

I will sort of mention here that we think that this near term low price will probably adjust upward at some point in the future, and that we reflect that in the reference case. We think that this sort of -- I won't say it's a real excess, but there is a little bit probably more gas supply than there is demand in the market right now. That's helping to keep prices suppressed. But we think that's going to balance out. When exactly that occurs, in the next six months to a year, that's going to be harder to predict. But we do

see that adjusting upward closer to the reference case.

COMMISSIONER MC ALLISTER: Yeah, Ivin, do you know sort of how the EIA's been treating the Clean Power Plan and sort of what the timeline -- you know, presumably, coal retirements, there's some national, there's a trend, you know, to do more natural gas.

Any idea sort of -- you know, how have you guys incorporated that into your view of the world?

MR. RHYNE: So, the Clean Power Plan Regulatory Impact Analysis came out after EIA's initial, preliminary annual energy outlook. So, in the Regulatory Impact Analysis they have only two years that they look at. I believe it's 2025 and 2015. And so, there's no sense of timing in that impact analysis as to how that all will play out. And so, we're going to be paying attention to where EIA makes their assumptions when they revise the Annual Energy Outlook.

But we think we're pretty consistent with them. In our treatment, those retirements actually begin in -- some retirements begin in 2014, in sort of anticipation of the plan based on economics. And those retirements continue on sort of at a steady clip through the life of this.

It's kind of hard to say at this point, unless you go to a plant-by-plant basis. And for the purposes

of price we may not see the effects of any individual retirement show up in the overall national Henry Hub price.

COMMISSIONER MC ALLISTER: Thanks.

MR. RHYNE: Okay. So, again, just Henry Hub price is growing at a steady, annual rate of about 2.6 percent. We think that that's a reasonable estimation as we move forward. And that price growth does have some amount of uncertainty.

One of the things that this team has done, that I think is unique, perhaps, in the forecasting world, with the exception of EIA, and we'll talk about them in just a moment, is we've gone back and looked at how well or poorly our past forecasts have actually approximated the real-world price tracks.

In doing so, we were able to put a range of uncertainty over and above our high and low price tracks. And what we see is that any single-year price we think could range anywhere from $8.21 to $1.80 per MCF by 2030.

And what we think is interesting here is that the overall spread of that uncertainty tracks, we think, rather nicely with the construction of our three price cases. And for us, is a pretty good indicator that we've done a reasonable job of capturing some of that

uncertainty.

So, total natural gas demand, we think for the United States overall, is going to remain flat in the near term, relatively flat in the near term. Growing only slightly from about 72, 73 Bcf per day, at where it stands now, to just under 89 Bcf per day out in 2030. That would be in the reference case.

The high and the low demand case you can see, shown there in the lines. To some extent that is driven by assumptions about where power generation demand, economic growth and, specifically, growth in residential and industrial sectors. And how things like a strong and robust economy may drive demand in the industrial sector, specifically.

When we look at U.S. power generation demand for natural gas, coal switching to gas is offset to some extent by a switch to renewables. There is a national movement towards the use of renewables. We know that the current administration's Clean Power Plan really is emphasizing both efficiency and renewables.

And that the combination of those two things, in the reference case you can see in the near term continues a slight downward trend in natural gas demand, with some growth in the later years as overall national demand picks back up.

In our low demand/high price case, we see the potential for even additional renewables. Renewables perhaps beyond where current RPS standards are for other states. And we think there's some amount of spillover that may occur, where states that are adopting and seeing a great deal of investment in renewables will see investment beyond even what a government mandate would suggest or drive them toward.

In the high demand/low price case, that is driven by seeing more switching from coal to gas, than perhaps the EIA originally expected. That would be our high end number. It's about 61 gigawatts of switching to gas. With not as much offset by the renewables.

And so, we see a range here of somewhere around 20 to about 33 Bcf per day possible by 2030 for natural gas demand, for power gen in the United States.

CHAIR WEISENMILLER: You know, and I was going to say I think the two data points I would give is one, if you look at SDG&E, which was pretty close to zero when the first RPS bill passed, and is now at 33 percent and expects to get to 40 next year.

MR. RHYNE: Right.

CHAIR WEISENMILLER: And, obviously, 40 was not a requirement when they signed the contracts.

And then Nevada, as I understand talking to the

governor's office and PSE there, the utilities are now buying renewables not because of a mandate, but because of cost.

MR. RHYNE: Right.

CHAIR WEISENMILLER: So, they're going past their RPS targets.

MR. RHYNE: We think that changes in the drivers of new resources, especially in the power generation side, may alter the landscape exactly as you're describing, where we switch from the driver being a regulatory one to being economic.

One of the big stories over the last decade, in the natural gas sector, has been the growth of natural gas from shale resources. So, these are resources that historically we've known about in the United States, but had a difficult time extracting at a cost that is competitive.

And with the growth of horizontal drilling techniques, combined with new mapping techniques, we've been able to unlock a lot of these shale resources. Some of them in the northeast, in the upper Midwest. And that's sort of moving where a lot of the production in the United States has come from. It's traditionally been in the southwest. Now, some of that production is now moving up into the upper Midwest.

The important and interesting piece of that is that shale gas -- gas from shale, I should say, is becoming a larger percent of the overall gas portfolio, from what was nearly nil 15 years ago to a really significant percentage.

And so, on the right-hand scale you can see the line marking the percent of shale production, as estimated by Lippman Consulting. And then applied to their estimate of U.S. production, which are the red bars. And so, what you end up with are the blue bars at the bottom, which is an estimate of how much shale gas will be produced out through 2020.

For information purposes we've added our own mid-case estimate of U.S. production, which is slightly higher than LCI. And, regardless, we end up with a situation where we see a couple of interesting things. First of all, obviously growing percentage of production from shale.

But it's the tapering off and the flattening out of that growth that I think is interesting overall as a becoming a more -- the percentage of growth, perhaps, is not as fast as previously. So, we may be reaching some sort of a plateau in terms of how much new shale is brought online.

That's not say that it won't grow. Obviously,

as overall production grows that fixed percentage means that shale production will grow with it. But it's not the sort of exponential growth that we've seen over the last several years.

And finally, the natural gas resources and infrastructure. What we see is, just taking a slightly different look at that shale gas, in Bcf per day, our estimate of where that production will be. You can see in this stacked graph that, really, the lion's share of U.S. production of gas will come from shale. We have type gas production, which is a slightly different type of play.

We have conventional gas. It's the sort of traditional, you know, big, empty cavern filled with natural gas that we, you know, put -- sort of in the industry they say they put a straw in it, and they just sort of suck it out.

And then we have associated gas production. That's gas production from -- they're going after something else, typically oil, and they're able to also, because those reservoirs also contain gas, they're able to pull it out.

and, finally, coalbed methane, which is a small portion of the overall portfolio. So, this is what we see in the national production portfolio going out

through 2020.

Moving on to imports, exports and LNG. I mentioned that California is a part of the national market. Well, natural gas is an international market, overall. And so, the United States is a part of that larger international market. Specifically, we are connected and tied to Canada, Mexico and then, in a growing sense, to the rest of the world through liquefied natural gas or LNG.

So, first of all, Canadian gas has been a pretty important source of gas for the United States throughout history. They have plentiful reserves in their basins. But with the growth of gas development from shale resources, we've seen a decline in the overall imports, net imports I should say, from Canada. We always export a little bit at different times of the year. But, overall, we are a net importer.

And so, in the low demand and the mid -- sorry, the reference, the mid demand case, we continue to be net importers of gas from Canada, but in declining amounts.

The interesting thing here is that in looking at scenarios and estimating what may occur, in our high demand, which is a low price case, I want to keep that in mind, where gas production in the United States is

relatively cheap, there is a possibility and this aligns with estimates produced by EIA, where we could in fact turn to be net gas exporters to Canada. Now, that's only in a case where we have a real abundance and a low price for gas, but it's not an impossibility as we look out into the future.

And I just shaded that area there at the bottom to show when we switch over into being a net gas exporter, just for the sake of clarity on the graph.

So, we see that as a small possibility, but a possibility nonetheless.

Our other physical connection to other markets is via pipeline to Mexico. Mexico is a growing economic sort of entity. There's a great deal of movement in Mexico to connect with the United States in more than just the traditional sense. There's a great deal of effort of the part of this administration here, in California, to support and connect with the industry, industrial growth and just general improvements that are going on in Mexico.

We know that Mexico has a couple of things going for it. Number one, they have a growing demand for industrial uses of natural gas and they have a growing demand for natural gas for power generation. And, in fact, there are a number of applications to build

pipeline, natural gas pipeline down into Mexico.

And so we see our exports to Mexico growing in all three cases, in the short term. However, in all three cases we also see the reality that at some point Mexico will eventually develop its own resources. And we know that there's changes in their constitution that will allow investment from outside of Mexico to help make that a reality.

And so, when that development occurs really is just depending on when it becomes really economically feasible and viable for PEMEX, which is the Mexican gas corporation, to undertake that activity.

And so, in our low demand/high price case, which is shown here in the green line, where our production of gas is relatively expensive, it becomes economic sooner for Mexico to develop their case. And so, you see that plateau and downward trend sooner and at a lower level.

In our reference and high demand case, where the cost of gas in the United States is relatively higher, and obviously in the high demand -- I'm sorry, it's relatively lower, sorry. In our high demand/low price case gas is cheap and so, Mexico waits longer to begin developing its own resource. But in all three cases we see that occurring out in the future.

And so that's, we think, one of those

interesting trends that we'll be sort of watching for as time goes by.

Finally, our connection, the United States' connection to the international market is mainly through liquefied natural gas. Now, this is really a reversal from the thinking of where we were a decade ago, where we thought we had reached a point where we were going to have to become importers of natural gas via LNG. And there was a flurry of activity around the possibility of permitting some of these LNG import facilities.

Well, that died out once the price of gas came back down and then we began developing these resources here, in the United States. And what we found is that, quite the opposite of becoming LNG importers, there are a number of companies out there looking to become LNG exporters.

And there are 14 LNG liquefaction terminals approved by the U.S. Department of Energy. Jordan Cove, which is located in Oregon, is expecting its final FERC approval by the end of this year. Sabine Pass is expected to begin exporting, actually, early next year. And Cameron LNG has filed to expand its LNG export capacity.

And overall what this means is that our net LNG exports are expected to grow in all three cases. In our

highest demand/low price case, we end up with a slightly lower, and our low demand/high price case is higher. But that has to do with the fact that by exposing ourselves to international markets, it actually increases the overall price. And so, that's one of the sort of twisty pieces of logic as you try and figure out how we ended up where we ended up.

But really, overall in the reference case we see about 15 Bcf per day of net LNG exports going on by 2030.

CHAIR WEISENMILLER: Yeah, and I was going to say, I've obviously been to both Germany and Mexico. And in Germany, talking to the embassy folks there, there was a lot of interest in trying to get U.S. LNG into Europe, in part to respond to Russia and the Ukraine issues.

And it was just remarkable, when they were looking through things of saying, yeah, it's going to take years. And just going through the regulatory process, even with a pretty big geopolitical imperative that, you know, it wasn't something that was going to occur in less than three or four years.

And in Mexico, obviously, there's a huge push to flip the power system from oil to gas. And Texas is really driving that pretty hard. So, I think, again,

you're going to see a lot of shift there.

They're obviously looking at renewables, also, although at this point, at least when I was there last time, the legislation defining clean energy hadn't really passed their legislation. And there's a question of whether gas would be part of that or not part of it.

But, you know, there's a fair amount of wind down in the peninsula, only about 60 megawatts total of solar. There's a huge potential there for solar. So, the exact mix is unclear, but there will be a huge shift over to gas.

MR. RHYNE: Thank you. So, the key takeaway, before we walk into the rest of our conclusions, in terms of the import/export, is the international connections of the U.S. market, we don't necessarily foresee having an immediate or direct impact on the California market, per se.

But the indirect effects on the California market in terms of price, in terms of changes to the overall infrastructure, we will definitely see some of that, especially as these developments continue, the exports to Mexico, the LNG export facilities, those types of things.

And so, that's one of those areas where we, as an Energy Commission, and we, I mean as analysts, will

have to keep an eye on that and make sure we stay apprised of how those developments sort of play out.

So, finally, hopefully, you're not entirely too tired of my voice just yet, but we will summarize the conclusions here.

Just numerically speaking, I just want to sort of summarize a couple of things. Total U.S. natural gas demand grows at an annual rate of, really, about 1.4 percent between 2015 and 2030, reaching just short of 8 Bcf per day in the mid case. That is really a slow, steady growth overall in natural gas demand, with some potential for a little bit of a dip, a little bit of a decline in the middle years.

Total California natural gas declines -- gas demand, I should say, declines to about 5.8 Bcf per day by 2030, remaining below its overall 2015 level, again in the mid case.

Implementation of renewables in energy efficiency suppress California's total natural gas demand, declining at an annual rate of .63 percent between 2015 and 2026.

Henry Hub prices range between $4.00 and $6.87, expressed in 2014 dollars, per Mcf by 2030, representing an annual growth rate of about 2.6 percent between 2020 and 2030.

Coal retirements outside California contribute to higher natural gas demand and prices. But as we mentioned, the retirement of coal is offset to some extent by the growth in renewables and efficiency.

And finally, U.S. exports are expected to grow, including liquefied natural gas, exports to Mexico, and even the possibility of increased exports to Canada.

So with that, we've reached the point where I get to stop talking. I will encourage everyone online, and here in the room, to submit your comments. Those are due by November 17th. The Energy Commission does use the new electronic comment system, so you should go to the website that's listed here, follow the instructions on this slide and submit your comments that way.

I will also stop for just a moment and I want to express thanks to all the stakeholders who participated and commented on the process to date. I think the sort of quiet nature of the room in here, today, actually is testimony to the fact that we've done, I hope, a good job of integrating the information, comments and feedback from a number of stakeholders. And we will continue to do so until we issue the final Natural Gas Outlook.

And with that, I will stop talking and open the

floor to any questions or comments.

CHAIR WEISENMILLER: Yeah. Well, again, I think we both want to thank you and the staff for going back through things fairly carefully, and sort of smoothing out the analysis.

Obviously, where we really want people to focus on is comments on the price forecast going forward, since that will feed so much.

I was going to note on the -- you mentioned the wide range of uncertainty. I was going to say, I was at one conference with a bunch of bankers a number of years ago, and gas prices had hit like $22 in one month. And so, they're all just, you know, just you can imagine wreaking havoc on any number of projects sitting there. And then some poor soul goes up to do his price forecast out in the future which is, of course, you know, about one percent relative to inflation, with plus or minus one percent. And they're all saying wait a minute, you know, how could you possibly have that forecast for volatility, you know, given what we've just lived through?

But anyway, so this, I think, represents better some of the range. And like I said, particularly if you think about our highs and lows and, you know, worrying a little bit about temperature and hydro variability in

terms of climate change, we could see a lot lower or higher gas demand going forward in months/years/days, which will certainly translate back into that volatility, again. Just as polar vortex back east has really hammered the gas price forecast.

So, I think we're going to go, moving into a world of much more volatile gas prices, although the demand generally is heading downward.

So, anyway, certainly appreciate the effort on this.

COMMISSIONER MC ALLISTER: Yeah, definitely. I mean, I guess, you know, the downside -- so, you know, it's hard to have a job where you're going to be wrong. You know, you pretty much know that. And the challenge is to characterize the uncertainty in a way that is meaningful. And I think you've done that and it's really good. So, I want to thank staff and reiterate what the Chair said.

Also, I would just point out that, you know, the bounds, the upper and lower bound are off by, you know, a factor of five or so. So, they're different by a factor of five or so, so that's just sort of an uncomfortable reality we have to live with.

So, I think, really, the way that you deal with is by engaging with the stakeholders, making sure that

you're looking at and aware of all these issues, and kind of as -- you know, and roll with the punches, basically, as the market evolves, and things happen, we hit forks in the road, and sort of making sure that people out there in the world know that we're looking at each of those events, and trying to understand them, and utilize that going forward.

So, this is sort of a little bit of -- people have to understand, I think, that there is a bit of -- you know, there is some crystal ball here, but it is actually rooted in analytics.

And so, I really appreciate your balancing those competing needs, I think, and uncertainties. So, thanks.

I do look forward to sort of getting more insight on the impact of the Clean Power Plan. I mean that's -- I think, California, we're not sort of fearful in terms of what it's going to ask us to do, because our goals are sort of more aggressive than the Clean Power Plan overall. But to the extent that we are subject to national markets and all that, I think it's important to understand the trends and how they might impact us on the price front.

So with that, are there any public comments? I do not have -- oh, there's a -- you have your own blue

card. Please.

MR. CARMICHAEL: I'll turn it in. I'll introduce myself. Tim Carmichael, with the California Natural Gas Vehicle Coalition. Thank you very much for the presentation.

I just had one question. Really, it's a two-part question. The variation in the lower and upper bound for natural gas prices surprised me. And I know we're talking about 15 years out, but it still surprised me because the forecasts I've seen for petroleum don't show that much variation by percentage. And so, that's question one.

And then, question two is in your concluding slide you showed that the Henry Hub expected variation is actually quite a little bit, a lot narrower than the California potential price variation, if I'm understanding correctly. In California, you've got 1.80 to 8 something, and Henry Hub you've got 4 something to 6 something.

So, it's two parts, one that compares into petroleum and one that compares into the national projection number. Thank you very much.

MR. RHYNE: So, to answer your question, and it's a great question, there's two ways to try and capture the future variability, the variation in price.

One is to build into our assumptions, and into our modeling and analysis a variety of assumptions about what that future might hold. And we've tried to do that in our variations between the reference -- sorry, the mid case and the high demand/low price, low demand/high price case.

And those variations translate well across all of the estimates. So, all of the factors that we presented had all three of those. And so that we've tried to capture that variation sort of intrinsically within the model.

The slide that I think triggers the most sort of open question here is this one, where we have superimposed on top of those intrinsic variations a more specific analysis that looks only at our estimates of future Henry Hub price. And we looked at how close we actually came to meeting -- to matching reality. And we looked at where we were off and by how much.

And then we began -- and then we sort of built those bands out around that. And so, while we were able to capture some of the variation in the future Henry Hub price just by making assumptions about what the future might hold, this is built entirely on an historical analysis of how well or poorly we did in matching with the real world.

And so, it's not tied, for example, to the estimates of petroleum prices or other forecasts' attempts to capture their own possible futures. This is simply a statement that says in the real world things happen that are beyond even our current ability to sort of estimate. They're discontinuous, they're nonlinear.

And in doing so, we end up with things like major price spikes associated with a hurricane that happens to roll through the Gulf Coast that we just couldn't see coming. And so, we end up with a year that has a large variation out there.

And one of the other things that's really important in general forecasting is that every year that you're off compounds the next year because every event -- every time you're off a little bit one year, well, you're off by that starting out the next year, and then you're off a little more the following year.

And so what we see is that the growth in that uncertainty sort of balloons out, out into the future. And so it's actually, and I mentioned this, it's very rare in any sort of a forecasting activity for people to sort of throw up their sort of report card, so to speak, and say this is how well or how poorly we did in the past. And we take it very seriously here to try and figure out how wide people, who make planning decisions

or policy decisions, should be thinking about what the possible future prices might be.

But we didn't attempt to do this through all of the metrics that you saw. So, the California price variations only reflect the variations that we attempted to create scenarios for, not this overall historical statistical analysis.

So, that's maybe a long-winded way of answering your question but, hopefully, that answers it.

MS. RAITT: Thanks, Ivin.

Any other questions in the room? And I don't think we have anyone on WebEx.

COMMISSIONER MC ALLISTER: Okay. Well, great, thanks everybody. And thanks again to staff. Really, lots of yeoman's work here. And looking forward to the next update or the final -- well, I guess the next discussion we'll have in the IEPR record is the final.

So, with that we're adjourned. Thanks, everyone.

(Thereupon, the Workshop was adjourned at 11:06 a.m.)

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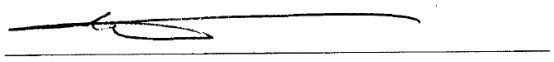

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