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BEFORE THE
CALIFORNIA ENERGY COMMISSION

In the Matter of:

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2020 Integrated Energy)	Docket No. 20-IEPR-02
Policy Report Update)	REMOTE ACCESS WORKSHOP
(2020 IEPR Update))	
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IEPR COMMISSIONER WORKSHOP

HYDROGEN AND FUEL CELL ELECTRIC VEHICLE MARKET STATUS

REMOTE VIA ZOOM

SESSION 2: FCEV MARKET STATUS

THURSDAY, JULY 2, 2020

1:30 P.M.

Reported by: Peter Petty

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Karen Douglas, Commissioner

STAFF PRESENT:

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Scott Samuelson, UC Irvine
Joan Ogden, UC Davis

PANELISTS:

Antonio Ruiz, Nikola
Lauren Skiver, Sunline Transit Agency
Jaimie Levin, Center for Transport and the Environment
Brian Lindgren, Kenworth
James Kast, Toyota Motor, North America, Inc.
Jackie Birdsall, Toyota
Jerome Gregeois, Hyundai
Jonathan Palacios-Avila, StratosFuel
Monterey Gardiner, BMW of North America

PUBLIC COMMENTS:

Christian Peeples, Contra Costa County
Nico Bouwkamp, CA Fuel Cell Partnership
Travis Andren, Seedling, LLC
Kevin Maggay
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INDEX

	Page
1. Call to Order	4
2. Heavy-Duty Fuel Cell EVs (Antonio Ruiz, Lauren Skiver, Jaimie Levin, Brian Lindgren, James Kast)	8
3. Light-Duty Fuel Cell EVs (Jackie Birdsall, Jerome Gregeois, Jonathan Palacios-Avila, Monterey Gardiner)	58
4. Public Comments	111
Reporter's Certificate	
Transcriber's Certificate	

P R O C E E D I N G S

1
2 JULY 2, 2020

9:30 A.M.

3 MS. RAITT: I'm Heather Raitt, I'm the program
4 manager for the Integrated Energy Policy Report, or IEPR for
5 short.

6 Welcome to the second session of today's workshop on
7 Hydrogen and Fuel Cell Electric Vehicle Market Status.
8 Today's workshop is being held remotely, consistent with
9 Executive Orders N-25-20 and N-29-20 and the recommendations
10 of the California Department of Public Health to encourage
11 physical distancing to slow the spread of COVID-19.

12 Please note that this meeting is being recorded. We
13 will post a recording and written transcript on our website
14 and you can find today's presentations posted on our website.

15 This session is going to have two panels, one on
16 heavy-duty fuel cell EVs and a second on light-duty fuel cell
17 EVs. If you were in the morning session, we used the Zoom
18 Q&A function and we'll do that again this afternoon.
19 Attendees may type questions for panelists by clicking on
20 that Q&A icon at the bottom of your screen. And before
21 typing a question, please check to see if someone else has
22 already posed a similar question. If so, you can click the
23 thumbs up to vote on it and that will move it up in the
24 queue. The questions with the most thumbs up are uploaded to
25 the top of the list, and so we will do our best to respond to

1 questions, but unlikely to elevate all due to time
2 restrictions.

3 I'll go over how to provide comments on today's
4 materials. There will be an opportunity for public comments
5 at the end of the workshop. We typically provide three
6 minutes for public comment, but we know there's a lot of
7 interest in this topic, and so we may limit the comment
8 period to one minute per person to allow for greater
9 participation. In Zoom, you can click the raise hand icon at
10 the bottom of your screen to let us know you'd like to make a
11 comment and you can also click it again if you change your
12 mind and want to lower your hand.

13 For those on the phone not using Zoom, just press
14 star 9 and that will raise your hand to let us know you'd
15 like to comment. So again, if you're on the phone, it's star
16 9. Alternately, written comments are welcome after the
17 workshop and they're due on July 23rd, and the notice gives
18 you all the instructions for how to provide written comments.

19 And with that, I'll turn it over to Commissioner
20 Monahan. Thank you.

21 COMMISSIONER MONAHAN: Great. Thanks, Heather.

22 And welcome, everybody, to the afternoon session of
23 our full day on hydrogen and fuel cells. We had a really
24 interesting discussion in the morning about hydrogen and
25 hydrogen delivery, and this afternoon we're going to be

1 focusing in on the vehicle side of the equation.

2 I think it's no surprise to everybody transportation
3 pollution is our number one challenge in California in terms
4 of meeting our carbon reduction goals, and emissions have
5 been trending up instead of down.

6 But California's commitment towards cleaning up our
7 transportation system and setting a course for as much as we
8 can zero carbon mobility remains unwavering. Just recently
9 the Air Resources Board passed the world's first regulation
10 requiring that trucks go zero-emission, and by 2045 any new
11 truck sold in California has to be zero-emission. And zero-
12 emission, there's two choices. There's batteries and fuel
13 cells. So, batteries have made a lot of progress. The fuel
14 cells are also making progress and I think, you know, there
15 are some sectors, particularly in the heavy-duty and off-road
16 space where it's not clear that batteries will actually be
17 able to deliver.

18 So really looking forward to this afternoon set of
19 conversations around heavy- and light-duty fuel cell
20 vehicles.

21 And I pass the baton over to Commissioner Douglas to
22 see if she would like to make any opening remarks as well.

23 COMMISSIONER DOUGLAS: Hi, good afternoon, everybody.
24 I'll pass on opening remarks, but I'm delighted to be here.
25 Thank you.

1 MS. RAITT: All right, thanks. This is Heather
2 Raitt. We can go ahead and move on to our first panel, and
3 it is being moderated by Professor Scott Samuelson from UC
4 Irvine.

5 So, go ahead.

6 MR. SAMUELSEN: Thank you, Heather. Heather, thank
7 you and good afternoon, everyone. I am Scott Samuelson from
8 the Advanced Power and Energy Program at the University of
9 California Irvine, and it is my pleasure to moderate the
10 first panel this afternoon on fuel cell electric vehicle
11 market status with a focus on heavy-duty fuel cell vehicle
12 which encompasses, for our discussion today, fuel cell
13 electric buses and fuel cell electric trucks.

14 We're indeed very fortunate to have an outstanding
15 panel consisting of Antonio Ruiz from Nikola, Lauren Skiver
16 from the SunLine Transit Agency, Jaimie Levin from the Center
17 for Transportation and the Environment, Brian Lindgren from
18 Kenworth, and James Kast from Toyota.

19 Our format will follow the form that we had this
20 morning. Namely, each panelist will provide a short
21 overview. The Commissioners will then direct questions to
22 members of the panel. I will moderate a question and answer
23 session with the panelists, and we will conclude with
24 questions that you raise using the Q&A icon, as Heather
25 described, at the bottom of your screen.

1 So let's begin with a short overview from each of the
2 panelists, beginning with Antonio Ruiz. Antonio's head of
3 fuel cell vehicle codes and standards at Nikola Motor
4 Company, a position he has held since 2018. He was
5 previously a technology development manager for 14 years at
6 the U.S. Department of Energy DOE Fuel Cell Technology
7 Program office, managing the safety codes and standards
8 program for that office.

9 Please join me in welcoming Antonio.

10 MR. RUIZ: Thank you, Mr. Samuelson. I hope you can
11 all hear me fine.

12 Thank you, Madam Commissioner and all the
13 distinguished audience. I'd like to share a little bit about
14 Nikola and hopefully put in perspective what we're
15 envisioning in the near -- the near future.

16 We can go to the first slide that says hydrogen at
17 scale.

18 I want to talk to you a little bit about what Nikola
19 does, which is a bit different to what you may be used to.
20 We are looking at deploying fuel cell trucks, along with the
21 fueling infrastructure to support it. Now these fuel cell
22 vehicles are Class 8 long haul vehicles with high torque and
23 about 1,000 horsepower. Obviously being fuel cell electric
24 vehicles, they're zero-emission at the tailpipe.

25 With a station, we look at fast fueling if the

1 vehicles have large onboard storage capacity. We envision
2 that this will be available throughout California and
3 throughout the country. To that extent, we see a network of
4 stations that will be able to supply the fuel for this
5 deployment. We look at our stations in predominantly
6 production on side of hydrogen from renewable and clean
7 electricity where available.

8 Next slide, please.

9 What we see in the Nikola fueling stations
10 deployment, we see the need to fuel vehicles that have up to
11 80 kilograms onboard storage. We're looking at using 700 bar
12 or 70 megapascal pressure on board. And to be entirely with
13 diesel vehicles, we look at a fueling time between 10 to 15
14 minutes. Now that introduces a new fueling protocol that we
15 are also working with industry to develop. Now this is
16 something that we envision could be done within the near
17 future in advance of the deployment plan for 2023.

18 So in our stations we also look at offering hydrogen,
19 not just for the Class 8 vehicles, but also for light-duty
20 passengers. So we would have a dispenser that will be able
21 to delivery with 2601 fueling protocol for light-duty
22 vehicles 700 bar. Also we look at having charging stations
23 along the way, at the stations. The stations have to be
24 capacity-wise multiple tons of hydrogen on site for these
25 vehicles. So we look at stations at about 8 tons half a day

1 station, which can fuel about 150 trucks coming in. But this
2 has to be scalable to larger capacity, especially when you
3 look at a truck depot and you may have to scale it all the
4 way up to, like, 32 tons per day production.

5 Next slide, please.

6 As I alluded to earlier at the start, zero-emission
7 we're looking at producing and completely impacting how the
8 emissions from the vehicles all the way from (indiscernible),
9 so we're looking at renewable solutions where you can use
10 renewable power. We use electrolytic hydrogen production
11 basically saving water and storing it at high storage banks
12 onsite, and we will be deploying or delivering that fuel at
13 700 bar, or 300 bar, on the vehicle. Now we look at, as I
14 said earlier, we have to be within 10 to 15 minutes fueling
15 time. So we're looking at fast fueling these vehicles, and
16 obviously you have to maintain the cost by a delivery system.

17 Next slide, please.

18 To that, I want to point out that we have an MOU with
19 other well-known companies working with this realm of heavy-
20 duty deployment. Our colleagues at Nel and Air Liquide and
21 Shell are our suppliers, and they go along with Hyundai and
22 Toyota, our OEMs, looking at deployment vehicles within the
23 near future, particularly in California. That group is also
24 looking at developing the fueling and the hardware necessary
25 to meet those requirements.

1 On the next slide, I want to just give you an
2 overview of some of the challenges that we are working on,
3 which includes the fueling hardware necessary for higher
4 flow. So if you look at the way vehicles are fueled today,
5 those are significantly smaller storage vessels on board,
6 where you can fill those vehicles within three to five
7 minutes.

8 But when we look at higher capacity vehicles, we have
9 to speed up the process, and along the way we have to
10 understand some of the boundary and implications of the
11 system itself. So we're working with our colleagues within
12 the consortium that I just pointed out, but also
13 internationally to develop and look at how to promote in the
14 right fashion of such fueling procedure. Along the way, we
15 also need to ensure the safety of the vehicle. So we learn
16 from the work that's being done on light-duty vehicles within
17 the regulatory framework that was put in place by the
18 Department of Transportation through the global clinical
19 regulations.

20 And the last one I want to point out was that we need
21 to better be able to measure, develop measuring methods for
22 fuel economy of these vehicles. Now keep in mind that these
23 are hybridized systems, where you have battery as well as
24 fuel cells, so it's not -- those methods are not available
25 today, so we're working with an SME, the fuel cells, and as

1 committed, to develop those requirements as well.

2 I think that's all that I had to share for today, but
3 I'll be happy to answer any questions. Thank you.

4 MR. SAMUELSEN: Thank you, Antonio.

5 Let's move from Class 8 fuel cell heavy-duty electric
6 vehicles to fuel cell electric buses with the leadership over
7 the years of SunLine. I'll ask Lauren Skiver. Lauren is the
8 chief executive officer and general manager of SunLine
9 Transit Agency in Thousand Palms, California, which is
10 serving the Coachella Valley. Lauren joined SunLine in 2013
11 as a CEO after 20 years of service in the transit industry
12 working at least three other agencies from Tampa, Florida to
13 Baltimore, Maryland to Wilmington, Delaware.

14 Please join me in welcoming Lauren.

15 MS. SKIVER: Thank you so much, Mr. Samuelson.

16 Thank you so much to the Commissioners and staff for
17 allowing me to speak.

18 Next slide.

19 SunLine is an early adopter of fuel cell technology
20 and we also run all battery electric buses as well. We are
21 centering our fleet deployment on fuel cell and have
22 annotated that in our ICT rollout plan, which has already
23 been adopted by our board, and will be filed with California
24 Air Resources Board shortly.

25 Why did we choose fuel cell? Well, it's not just the

1 internal knowledge and the experience that we have with fuel
2 cell that made us make that decision for our ultimate
3 conversion to zero-emission technology. It's also the range
4 that we find and the productivity of our fuel cell fleet. In
5 studying the productivity of our all-battery electric, we
6 have assumed that we would need two buses for every one bus
7 that we are currently running as CNG or a hydrogen fuel cell
8 electric vehicle.

9 We also have determined that the way that these buses
10 are refueled is so similar to the way that we've been
11 refueling for over 20 years that there's not a learning curve
12 for our organization about how to fill our buses at night
13 using fuel cell technology. We have route flexibility with
14 these buses. The Coachella Valley, our service area is 1120
15 square miles, which is a large service area for only 88 of
16 fixed route buses. And so many of our routes are long in
17 nature and over 300 miles in a service day.

18 We also, as you may know if you've ever been out here
19 to the dessert, have very challenging terrain and extreme
20 climate that we operate in, and so fuel cell has really been
21 the vehicle that we are centering our fleet deployments
22 around.

23 Next slide, please.

24 So this is, just shows you a little bit about the
25 combination of our fleet. One of the points I want to move

1 forward to all fleet operators, whether you're a public
2 transit agency or a private fleet operator, we believe that
3 the future is going to require mixed propulsion fleet and
4 maybe even mixed manufacturer fleet. As you can see on the
5 right, we have multiple bus providers and fuel cell and drive
6 systems. That does not create an issue for our maintenance
7 personnel and our technology technicians. We pull those
8 buses out every day, and so the days of a fleet of the exact
9 same truck or bus out on the yard may be a thing of the past
10 as we move into the zero-emission world.

11 I did want to mention that COVID-19 has affected all
12 of us, and deeply, but I want to bring a word of optimism.
13 And during COVID-19, SunLine was awarded VW mitigation funds,
14 1.2 million in order to convert five CNG buses, replace --
15 being replaced fuel cell, and we were just notified that we
16 won an EPA TAG award for five fuel cell buses. And so our
17 zero-emission project is moving stronger than ever. We are
18 technology agnostic. We do run four all-battery electric BYD
19 buses, but again, those buses are very specific to a job.
20 They do an express route where they can be opportunity
21 charged during the day and midday between trips, and we find
22 that that is really the job that they're best suited for.

23 Next slide.

24 So I want to talk a little bit about our hydrogen
25 production. One of the things I want to bring forward about

1 hydrogen fuel cell or any kind of fleet operator, fueling is
2 the most important aspect. And so you can have all the
3 vehicles in the world available to buy, but if fueling and
4 fueling infrastructure is difficult, it's going to be an
5 impediment to the deployment of zero-emission technology,
6 whether it's all battery electric or fuel cell electric.

7 SunLine was the benefit of a CARB award for a new
8 hydrogen station. We've been running and producing hydrogen
9 for more than 20 years, but on a much smaller scale. These
10 are photos of our 900-kilogram per day electrolyzer. This
11 was a Nel/Proton project. We had a great working
12 relationship with them with Kiewit as the construction arm.
13 We are already producing 900 kilograms per day and are
14 working on our public station which I'll talk about in just a
15 moment.

16 Next slide.

17 So this is our next round of projects. So we don't
18 sit back with anything. We are looking to buy property
19 across the street from us. We will be putting a solar farm
20 and we have already raised the funds for that first phase.

21 The second will be a solar-to-hydrogen electricity
22 storage so that we can gain all this California sun, store
23 it, and produce our hydrogen at night and during the day when
24 we need it.

25 Phase 3 will be to upgrading our public fueling

1 station which is already in place. It just needs some
2 compression upgrades.

3 And Phase 4 is to put a hydrogen and renewable
4 electricity truck plaza on this property so that trucks
5 coming in to the L.A. basin from points west or east can fuel
6 at our facility before they get into the congestion of the
7 L.A. area.

8 Next slide.

9 That's the last slide. Thank you very much.

10 MR. SAMUELSEN: Thank you, Lauren.

11 We'll transition now to a mix of fuel cell electric
12 buses and fuel cell heavy-duty trucks with Jaimie Levin.
13 Jaimie is director of the West Coast operations for the
14 Center for Transportation and the Environment, a position
15 that he has held since 2013 after 15 years of service with
16 the Alameda Contra Costa Transit District as director of
17 environmental technology.

18 Please join me in welcoming Jaimie.

19 MR. LEVIN: Hey, thanks Scott.

20 Good afternoon, everybody, from sunny Berkeley.

21 Next slide, please.

22 So CTE is a 501(c)(3). We're engaged in a number of
23 really significant hydrogen fuel cell projects, including
24 Class 6 UPS trucks, Class 8 Drayage trucks with Kenworth,
25 marine cargo top loader fuel cell lifts with Hyster-Yale,

1 both 40- and 60-foot transit buses being deployed
2 commercially, and then heavy-duty and light-duty hydrogen
3 fueling stations.

4 Next slide, please.

5 So what this is all about is operational efficiency.
6 And we have to be able to appeal to the end user, the end
7 user here being the fleet operators, whether it's a transit
8 or trucks. And so we subscribe to the KISS principle -- Keep
9 It Simple Stupid, and there are five key performance aspects
10 of this. Three key performance objectives -- range,
11 passenger capacity payload, and multiple duty cycles, being
12 able to operate your vehicles on a one-to-one basis.

13 But there's two key fiscal objectives. One is the
14 affordability of the vehicles and that really means bringing
15 the cost, the CapEx, of the vehicles down, and that is
16 happening with volume. And the second one is OpEx. Fleet
17 operators are looking at fuel efficiency and lower costs of
18 fuel purchases to be able to operate their vehicles.

19 Next slide, please.

20 So Lauren touched on this. Essentially, we see four
21 really key advantages to fuel cell. One is proven range.
22 Secondly is significant reduction in vehicle weight, and that
23 is continuing to drop in order to increase freight payload
24 and to increase passengers. Fuel cells continue to be more
25 power dense and capable. Then the speed of fueling that's

1 throughput being able to get your vehicles through the
2 fueling period and out on the street. Just keep in mind that
3 for transit as an example, you have to marry passenger
4 schedules, vehicle schedules, and driver schedules. And so
5 you don't want to add a fourth dimension of complexity on the
6 refueling, and that's where hydrogen has great advantages,
7 ultimately leading to one-to-one replacement.

8 Lauren touched on the impact of climate. And one of
9 the advantages with fuel cell, especially in cold weather
10 climates, not so much here in California, but is the ability
11 to utilize exhaust heat from the fuel cell to operate at
12 correct temperatures without turning on electric heaters
13 which draw down energy.

14 Next slide, please.

15 So here's the challenge with fuel cells at startup
16 because of cost and the effort and really unfamiliar aspect
17 of hydrogen. There's always a steep high bar to climb over
18 but with scale, you actually can achieve significant cost
19 savings and efficiencies.

20 You see this image of AC Transit's fueling station.
21 This was built some years ago. It supplied and supported
22 10 to 12 buses. We recently upgraded this station. It's a
23 footprint of 45 feet by 56 feet. It competes with bus
24 parking. As you can see, this is during the day when the
25 buses are not all there, but at night it fills up completely.

1 Under a recent test three weeks ago, AC Transit processed 30
2 buses through each with an average fill of 24 kilograms and
3 in the process did that in 6 hours and 40 minutes. We know
4 we can do this same time period with 60 buses at this station
5 and with added two dispensers, 120.

6 Next slide, please.

7 So, there are five key issues that have to be dealt
8 with with infrastructure, that's one of the biggest
9 challenges. Price is number one, hydrogen's too expensive.
10 The footprint, the real estate on the property is critical.
11 R is for renewables, resiliency to be able to address natural
12 disasters, and redundancy to ensure 100 percent uptime.
13 Scalability and speed of fueling, we touched on that already.
14 And entry level startup, that high bar to cross at the
15 beginning.

16 Next slide, please.

17 Last year, Patty Monahan spoke at the International
18 Zero-Emission Bus Conference, ran this survey with 500
19 people, mostly from transit. And you can see here there was
20 almost on parity with battery and fuel cell what they see in
21 ten years. Last year, a year ago it would have been 5
22 percent assumed fuel cell.

23 And last slide, please.

24 Recently, we submitted 18 letters from transit
25 agencies authorities in California to the Energy Commission,

1 emphasizing the importance of hydrogen to meet our zero-
2 emission goals.

3 And thank you very much for the time.

4 MR. SAMUELSEN: Very good. Thank you, Jaimie.

5 And the last two presentations we'll focus on the
6 application of fuel cell technology to Class 8 heavy-duty
7 trucks, beginning with Kenworth and Brian Lindgren. Brian is
8 a director of research development at Kenworth Truck Company.
9 While he has served as director for nearly three years, he
10 has been with Kenworth over 40 years in managing the research
11 and development program for Kenworth for nearly over nine
12 years.

13 Please join me in welcoming Brian. Brian.

14 MR. LINDGREN: Thank you, Scott. And thank you to
15 the Commission for the opportunity to share our perspective
16 today.

17 I'll try to keep my comments very brief so we can
18 allow more time for Q&A. So I'll just give a quick
19 introduction to who Kenworth is and then an idea of the
20 projects we're currently working on.

21 Next slide, please.

22 So just in terms of who are we, Kenworth Truck
23 Company's been in the business since 1923 when founders Harry
24 Kent and Edgar Worthington bought the assets of the Gersix
25 Motor Truck Company. And since then we've built over 1.2

1 million trucks, and last year alone we built over 60,000
2 trucks. And we support these trucks with over 400 dealership
3 locations across U.S. and Canada. We also have a factory in
4 Mexico where we build for Central and South America. We have
5 a factory in Australia where we build for the Australia and
6 New Zealand markets. Kenworth is part of parent company
7 PACCAR, which also owns Peterbilt, as well as DAF Trucks in
8 Europe and Leyland Trucks in the U.K.

9 Last slide, please. Here we go.

10 So we've been working on a number of projects here.
11 As you can see the green truck in the upper left is a fuel
12 cell electric truck. It's a -- it happens to use a Ballard
13 fuel cell. The one next to it in blue with the markings on
14 it is a CNG range extended electric truck, uses the same
15 power train as the Ballard fuel cell truck, but it gets its
16 energy from a different source. And both of these trucks are
17 in commercial operation in Southern California. The green
18 one has about 5,000 miles on it so far. The blue one about
19 9,000.

20 And then below that are the next generation
21 iterations of each of those. The lower left corner shows
22 our -- what we are calling Ocean. It's a ZANZEFF grant
23 project that we are working with the Toyota folks on. Ten
24 trucks there, we've got I think six of them operating now.
25 Those use Toyota fuel cells and a very similar electric power

1 train to the ones up above.

2 And then the one in the middle on the bottom is
3 another CNG range extended electric truck. It uses a near
4 zero-emission natural gas engine, so it uses the same
5 electric power train. And then the one on the right is
6 happens to be a battery electric one that we're just starting
7 into the design phase on now.

8 So you can see by looking through this that Kenworth
9 is a little bit agnostic as to where the power comes from,
10 and I think that there will be a number of solutions as we
11 move toward zero-emission trucking, and not any one is going
12 to capture all of the market. I think there's a place for
13 battery electric, I think there's a place for natural gas,
14 and I think there's a place for hydrogen certainly.

15 Hydrogen looks like it is going to be the winner for
16 longer haul, as Lauren and Jaimie have already covered, and
17 as I've covered in previous workshops. That it -- hydrogen
18 has a big benefit compared to battery electric in terms of
19 range and refuel recharge time. And I think so, and as well
20 as for payload. So until we see an order of magnitude change
21 in battery technology to improve energy density as well as
22 costs on batteries, I don't see battery electric as being the
23 solution for longer haul. So therefore, we're working
24 strongly on the hydrogen programs.

25 So that's just a brief overview for Kenworth, and I

1 will hand it back to Scott from here. Thank you.

2 MR. SAMUELSEN: Very good. Thank you, Brian.

3 Our fifth of five presentations is from James Kast of
4 Toyota. James is the fuel cell business analyst in the
5 Electrified Vehicle and Technologies office at Toyota Motor
6 North America. He joined Toyota in 2017 after serving two
7 years as a science and technology policy fellow at the U.S.
8 Department of Energy.

9 Please join me in welcoming James. Hello, James.

10 MR. KAST: Hello, Professor Samuelson, and thank you
11 for the introduction. And thank you, Commissioners and staff
12 for the opportunity today.

13 So you see here, this is actually my only slide. So
14 I'll really try to use this to tell the story of hydrogen and
15 fuel cells within Toyota and how we got ourselves into the
16 heavy-duty space in the first place.

17 So I think it really starts actually in the top
18 middle, where you see the Toyota Mirai. You see six of those
19 vehicles on the back of the truck and, of course, this is
20 really where it all began 25 plus years ago with our initial
21 development of both hybrid and fuel cell technology.

22 So this vehicle represents really Toyota's dedication
23 to the technology and to all technologies to help bring
24 cleaner vehicles to the road. But we are looking for ways to
25 bring this beyond that space. And I think there was a huge

1 need for how you would decarbonize and clean up, you know,
2 other sectors of transportation as well, certainly heavy-duty
3 being a big piece of that, especially at the ports.

4 So we took this upon ourselves to see how we could
5 leverage an existing development within two Toyota Mirai by
6 disassembling them, taking as many pieces as we possibly can,
7 and in some kind of almost Frankenstein experiment created
8 the first truck there on the bottom, the blue truck, we call
9 it the Alpha Truck, which we unveiled in 2017 to essentially
10 prove out that we could scale light-duty technology to a
11 heavy-duty platform in a full Class 8 fuel cell truck. So we
12 did exactly that. We created a 200-mile range zero-emission
13 truck that was able to actually tow and meet the needs of
14 diesel operators today.

15 So then we took the learnings of the first truck and
16 moved to the next generation, the top right there in the Beta
17 Truck, the red truck there you see. So even after just one
18 year of extra development, we were able to reduce not only
19 the weight reduction as well, we were able to add a sleeper
20 cab, we added to 300 miles of range while still meeting many
21 of the performance needs that diesel operators expect.

22 So these were kind of our first initial proof of
23 concept vehicles that led us to the program that Brian
24 actually alluded to. You see on the left there is actually
25 one of those Ocean Trucks he spoke of. So now we're

1 currently in strong development with the Kenworth Truck
2 Company, a respected truck company within certainly the U.S.
3 market and others globally, for how we can bring ten of these
4 trucks to market and actually start supporting vehicle
5 operations within four key operators, mainly UPS, of course,
6 the most noted of them.

7 But taking all this experience from light-duty, going
8 to heavy-duty, and helping clean up the ports does definitely
9 require a fuel side as well. So we've been working with Air
10 Liquide on two of the current stations that we have today in
11 the ground, supporting initial demonstrations, and
12 collaboration with Shell to have the next three heavy-duty
13 design stations all with over one ton per day of capacity.
14 And all those are actually quite far along in development
15 which will be online by early point of next year.

16 Now Toyota's not just stopping at only heavy duty and
17 one application, but we're looking for ways to explore many
18 other applications for our fuel cell technology to
19 decarbonize other sectors throughout the global markets. So
20 you've seen announcements from forklifts to buses, medium-
21 duty trucks, even stationary power and also marine
22 applications, all with fuel cell power train, based on the
23 exact same modularity that is developed for the Toyota Mirai.

24 So the last piece I'll leave you with is really just
25 how much heavy-duty and light-duty need each other in a

1 synergistic manner. So the scale of light-duty is actually
2 quite large compared to other sectors. And by leveraging the
3 scale of light-duty, you can help bring down the cost of the
4 actual technology and what goes into all these different
5 kinds of vehicles. But to help bring down the cost of the
6 fuel, you need this high demand to make the investments in
7 the fuel side, and that's where heavy duty and other
8 applications come in since they demand so much more fuel
9 compared to a typical retail light-duty customer.

10 So with investments in both light light, heavy duty,
11 and other areas, you can really start to bring them all
12 together in a synergistic way to enable what we consider the
13 hydrogen society where you have a cost effective zero-
14 emission solution for all.

15 Thank you very much.

16 MR. SAMUELSEN: Thank you, James.

17 This concludes the presentations, and I invite
18 Commissioners Monahan and Douglas to ask questions, and hand
19 the virtual microphone over to Commissioner Monahan to take
20 that step.

21 COMMISSIONER MONAHAN: Thanks, Scott. Yeah, and I
22 think all the panelists can put their videos back on for this
23 part.

24 So I have a question for James, I think, is most
25 appropriate. You know, this morning we heard from hydrogen,

1 you know, fuel, folks that are producing the fuel or
2 dispensing the fuel and, you know, we heard a lot of exciting
3 announcements about how fuel cell, you know, the hydrogen
4 actually is being produced not just for the sake of vehicles,
5 but potentially there's a wider array of ways that we could
6 use that low carbon hydrogen to help us with meeting our
7 carbon reduction goals in multiple sectors.

8 And I'm curious about what you were saying about how
9 we need scale and light duty in order to bring heavy duty
10 along. And this idea that, well, hydrogen is going to be
11 produced for a wide variety of -- like, let's say the
12 hydrogen issue gets solved, it's lying and waiting there.
13 Let's say that there's enough demand from multiple sectors
14 who are trying to decarbonize for the hydrogen.

15 How much would you still need that light-duty scale,
16 and, you know, can we do both heavy and light duty
17 simultaneously? And I say that because, you know, heavy duty
18 is our challenge in terms of, you know, we don't have a lot
19 of alternatives right now in the heavy-duty space and we
20 really need fuel cells to deliver and on heavy duties, I
21 think, in order to meet our carbon reduction goals for
22 transportation.

23 MR. KAST: Uh-huh. You know, it's a very good
24 question. And I think, really to your point where the fuel
25 can be used for so many different applications, that's really

1 what helps unlock the investments in the hydrogen supply
2 chair, which you alluded to itself and I think was a big
3 topic of the discussion earlier today. And what we're saying
4 is the same is also true on the vehicle side. So you kind of
5 even heard from Brian, you know, the scale of the trucks they
6 make is, you know, 60,000 or so per year. It tends to be
7 somewhere around there. It could be a lot more or less.
8 But, you know, that scale is only so much, and you could do
9 that on other applications.

10 But at the end of the day, how many light-duty
11 vehicles are produced and sold every day? This is a huge
12 number. It's an order of magnitude different. And once you
13 get to the cost of manufacturing, you get to these economies
14 of scale, you can just reach them so much more quickly on the
15 light duty side where we're already going to be producing,
16 you know, 30,000 vehicles per year, starting as early as next
17 year for our next generation Mirai. And that's not something
18 that we could achieve, you know, in those volumes with any
19 other application today around the world.

20 So leveraging that scale is what helps give you all
21 the components itself, not just the fuel cells pack, but
22 everything else that goes into the vehicle can help bring
23 down that cost, and much more quickly than just focusing on
24 one or a few of the other applications.

25 COMMISSIONER MONAHAN: What we're seeing, I mean,

1 right now in China we're seeing a lot of interest in buses
2 and trucks for fuel cells. And I'm, I mean, I'm curious
3 because the number of buses in China is so large, whether
4 that could potentially bring down costs for buses here in the
5 United States. And I don't know if anybody on this panel --
6 oh, Jaimie, Jaimie can answer every question about --

7 MR. LEVIN: Yeah. Well, for sure.

8 COMMISSIONER MONAHAN: What do you think, Jaimie?

9 MR. LEVIN: Well, we're already seeing the benefit of
10 what's happening in China by reducing the cost of fuel cells.
11 So we're seeing fuel cell costs dramatically drop. Our early
12 buses, I mean, we built beginning fuel cell buses for 3.2
13 million apiece, down to 2½ million recently, now under 1.2.
14 And we feel there's no question we can reach price parity
15 with battery electric and reaching our zero-emission goals.

16 But the Chinese have played a huge role in ramping up
17 volumes. And this is all about volumes in terms of CapEx.
18 And I would just comment based on what James was saying, the
19 one advantage on the fuel side that you have with buses or
20 fleets is you have a very nice mix of supply and demand. You
21 can pull those together. You're not waiting for individual
22 consumers. But ultimately, to get the fuel price down, we
23 need the volumes that light-duty will bring to the table. So
24 these are complementary technology applications that we need.
25 We need to see both play out.

1 COMMISSIONER MONAHAN: Great. Thank you.

2 Commissioner Douglas, do you have any questions?

3 COMMISSIONER DOUGLAS: Just one. I was curious, you
4 know, what have your experiences been getting hydrogen fuel?
5 Do you tend to source the fuel locally? How is it, what
6 percentage of, you know, renewable fuel are you able to
7 source? Is that a significant challenge? How does the
8 fueling side look in the heavy-duty space?

9 MR. LEVIN: Okay. I can

10 MR. SAMUELSEN: Go ahead.

11 MR. LEVIN: I can start out, at least.

12 The projects we've worked on is sourcing primarily
13 liquid fuel from different directions because there's limited
14 supply. We have a project down in Southern California that
15 draws liquid supply from Northern California. And a project
16 in Northern California that's drawing supply from Southern
17 California. There have been some projects with electrolysis.
18 Lauren can speak and will speak on her great project at
19 SunLine, but we don't have the supply that we would like to
20 see.

21 We've not had shortages in the fleet application, as
22 I believe it's been experienced in the light duty, but we're
23 looking forward to the projects like Air Liquide's project
24 and other suppliers stepping up as the technology expands.

25 MS. SKIVER: I would just add that the cost for a

1 kilogram of hydrogen is in the transmission. That's where
2 the big influx in cost comes from. And that's why production
3 and infrastructure, the hydrogen community creating smaller
4 scale, smaller cost production sites is really important in
5 stations, because, you know, we can produce a kilogram of
6 hydrogen right now using grid power for \$8 a kilogram. If we
7 buy it from Colton and have it transmitted, it's over \$30 a
8 kilogram. So that gives you the where the cost is from. The
9 cost isn't the molecule, it's moving it.

10 COMMISSIONER DOUGLAS: But just as a follow-up
11 question on that, you know. With today's economics and so
12 on, you know, what's the optimal size of one of the small, of
13 the smaller more distributed project? Is that the project
14 you guys are moving forward with basically?

15 MS. SKIVER: Our project won't be small.

16 COMMISSIONER DOUGLAS: Oh, okay.

17 MS. SKIVER: Do you mean, what is -- I think that if
18 we could get a hydrogen production starter set that would
19 create in a renewable way, possibly down the road, you know,
20 300 kilograms per day, 300 to 500, then we're talking that
21 fleet operators could start to do deployments that aren't too
22 small, like SunLine had at the beginning with five buses
23 because we could only make 200 kilograms per day, but could
24 do something that generates more of a deployment strategy,
25 and these need to be scalable like our station is. And I

1 think that most of the hydrogen infrastructure producers now
2 are making scalable solutions. But you need to have a
3 starter set that could easily be added on to as your fleet
4 deployments grow for this to really take off. Because on the
5 vehicle side, for buses anyway, the commercialization, the
6 productivity and reliability is there. It's the
7 infrastructure that needs to catch up.

8 COMMISSIONER DOUGLAS: Yeah --

9 MR. LEVIN: Commissioner Douglas, we, we just --

10 COMMISSIONER DOUGLAS: -- let me ask just one follow
11 up, and then I'd love to hear it.

12 MR. LEVIN: Oh. Go --

13 COMMISSIONER DOUGLAS: The only other follow up is,
14 you know, when you look at the transportation costs, like how
15 close to your, you know, fleet should the production be? Is
16 it a big deal if it has to be moved five miles? Is it, you
17 know, how close is best for you?

18 MS. SKIVER: Well, I'm only going to speak for
19 transit. In your backyard is best. It's called a deadhead
20 mile, and fleet operators would say the same thing. For
21 every mile you have to travel, there's a cost associated.

22 COMMISSIONER DOUGLAS: Sorry, please. Who else was
23 answering? Jaimie.

24 MR. LEVIN: Yeah. I was going to say we built, we
25 recently built the Orange County station for \$5 million to

1 support 50 buses --

2 MS. SKIVER: Though, if we can get transmission, you
3 know. Just because I run so many vehicles.

4 Go ahead, Jaimie.

5 MR. LEVIN: Hello? Oh, okay. Yeah, so we built that
6 at around \$100,000 per CapEx per bus to support that size
7 system. That compares actually very favorably to the costs
8 that are required for charging infrastructure at facilities.
9 But the cost of the fuel is still ranging for liquid delivery
10 between 7, 7½ dollars, and \$8 per kilogram. And clearly, if
11 we had supplies that were closer at hand, that cost would
12 drop significantly.

13 As Lauren said, transportation is a big part of that
14 cost. Because of SB-1505, a third of that hydrogen has to be
15 renewable, and ultimately we see renewable supplies as the
16 goal that we have to all achieve. So there is a cheaper cost
17 on the CapEx and we're seeing more benefits as more stations
18 get built.

19 COMMISSIONER DOUGLAS: Super. Thank you.

20 COMMISSIONER MONAHAN: So before I sign off and let
21 the, have the panel discussion, I just want to acknowledge
22 SunLine's leadership in this. I mean, I actually could
23 acknowledge Jaimie Levin's leadership as well. There's a lot
24 of leaders in this, on this grid. But, you know, this vision
25 of, you know, being, leaning in to a new technology and then

1 this longer term vision of capitalizing on renewable energy
2 to power the vehicles, provide a public station -- I just
3 want to say, like, that's the kind of vision that is really
4 inspirational to learn more about. So just thank you for
5 sharing that story.

6 All right. Now we can go -- Scott, we'll turn it
7 over to you for the panel discussion.

8 MR. SAMUELSEN: All right. Thank you. And thank you
9 Commissioner Monahan and Commissioner Douglas.

10 We'll take about 20 minutes now where I'll moderate a
11 discussion from the panel. And then, remember, we'll
12 conclude with a Q&A where you'll have a chance to raise your
13 questions and use that icon at the bottom Q&A in order to
14 provide us with a question that you have.

15 I'm going to begin with a topic of interest to the
16 commissioners, I believe, which has to do with the impact, if
17 any, of COVID on the development and deployment of fuel cell
18 heavy-duty vehicle technology. And I'd like to look to two
19 of you to respond.

20 First, from a fuel cell electric bus perspective,
21 Lauren would you provide a response to that question?

22 MS. SKIVER: I would say that I'm going to bring a
23 message of optimism. There is a lot of negativity in the
24 world right now for all of us, but, you know, SunLine is
25 looking at this as a way to redesign our network. We were

1 planning on doing it anyway. And actually our projects or
2 our station project, we have a few construction projects
3 going on right now -- we're seeing those actually move along
4 faster than pre-COVID times.

5 So I think that our program, our fuel cell program,
6 our zero-emission ICT plan will not stop. We are actually
7 more actively working on putting in for grants. The world
8 has slowed down a bit where we can actually take time to look
9 at other opportunities. We are going to need that solar grid
10 funded, and so we're driving that project by putting in for
11 grants.

12 So I would say that there are impacts to revenue
13 generation through fares and through ridership, but I don't
14 think this is going to be something that we experience
15 forever and I think transit agencies are becoming more
16 optimistic about using this time to redevelop and bring new
17 services that the public really wants. We have to stop
18 selling what people aren't buying and start bringing services
19 that people want ride.

20 MR. SAMUELSEN: You suggest we might even be from the
21 sites.

22 MS. SKIVER: That's right.

23 MR. SAMUELSEN: James, would you respond with regard
24 to fuel cell heavy-duty Class 8 vehicles?

25 MR. KAST: Of course. And certainly, you know, the

1 times today have certainly caused everybody to reprioritize,
2 and I'm very pleased to share that within Toyota, fuel cells
3 and everything about hydrogen has actually remained more of a
4 priority than before because it is such a future technology
5 and growth. So anything from the Mirai to all these other
6 applications have actually been accelerated, even given the
7 current situation, because we just see how much it's going to
8 be needed in the near term and in the long term.

9 MR. SAMUELSEN: Let me move to a major question
10 addressing the market and address the, this question to
11 Brian, Antonio, and James.

12 Other than fuel cell electric buses where the market
13 is beginning to embrace the technology, as Jaimie just
14 alluded to with the Orange County Transit Authority, we know
15 the longstanding record of SunLine. But for trucks, in what
16 locations are you envisioning heavy-duty fuel cell electric
17 vehicles competing in the initial years?

18 Brian, would you be so kind as the first to respond?

19 MR. LINDGREN: Sure. I'll be happy to start that one
20 out.

21 Yeah, as we look at it, at the broad variety of
22 heavy-duty trucking applications, we really see tractors that
23 run 200 to 500 miles a day as being the target opportunity,
24 initially anyway, for fuel cell trucks. Shorter runs like
25 under a hundred miles a day, that can probably be done with a

1 battery electric. If you're going to run from Los Angeles to
2 New York City, that's probably going to stay diesel for a
3 while because it'll be a while to build out the
4 infrastructure.

5 But the payload advantages and refueling time
6 advantages of hydrogen compared to battery, I think, is where
7 we see the big advantage. Right now, it still is a bit more
8 expensive than diesel. So it's going to require some
9 incentives to the end user to move from diesel to hydrogen.
10 Over time, I think we can overcome that, but again, like some
11 of the others have said, it really comes down to volume, and
12 until we get the volume up into the thousands or tens of
13 thousands, then we're probably not going to see parity with
14 diesel for a while.

15 But again, the application tractors in 200- to 500-
16 mile-a-day applications is where we see the sweet spot.

17 MR. SAMUELSEN: Thank you, Brian.

18 Antonio, hoping you're still with us. Would you be
19 so kind as to respond to that question on the locations that
20 you're seeing to enable the initial market?

21 MR. RUIZ: Yes. I hope you can hear me okay. I'm
22 actually sitting in a plane. I apologize for the noise in
23 the background.

24 We envision the long haul application will be
25 deployed to (indiscernible) North America and even Canada.

1 And to that extent, we see the need for (indiscernible)
2 stations that could be in the course of 700 range of stations
3 needed. So our initial deployment obviously will be launched
4 within the priority space like California and have a great
5 momentum globally. And then we see that moving slowly where
6 other parts of the country. But California is the initial
7 target.

8 MR. SAMUELSEN: Thank you, Antonio. We heard you
9 very well.

10 James, would you conclude by responding to this
11 question?

12 MR. KAST: Of course. And rather than repeat kind of
13 the benefits on the vehicle side, I'd actually like to share
14 the infrastructure perspective because I think it's something
15 sometimes is overlooked.

16 And when you really think about how to support a
17 fleet, even if those vehicles only need 100 hundred miles of
18 range, you still need to be able to charge them all in the
19 amount of time, their uptime. So in any kind of application
20 where they need to have a high uptime, where you have a very
21 large fleet, the actual throughput of your fueling may become
22 the depending factor, not necessarily just the vehicle
23 itself. So that's where hydrogen really provides a lot of
24 good advantages for that fast fueling. You get more vehicles
25 fueling in a shorter amount of time, and it also just scales

1 much better and easier. And I think that gets exactly to
2 Jaimie's point, where charging one truck versus fueling one
3 truck, you know, hydrogen is not so good. But anything more
4 than, you know, 20 to 50 vehicles, all of a sudden hydrogen
5 starts to look like a very good investment.

6 MR. SAMUELSEN: Thank you, James.

7 Let me move to a question I'd like to address to
8 Jaimie and Lauren and Brian, which, if you would speak to the
9 hurdles that you are facing in the rollout of fuel cell
10 electric heavy-duty vehicle technology with these different,
11 you know, perspectives of the bus technology and then of the
12 Class 8 technology.

13 Jaimie, would you be so kind as to begin?

14 MR. LEVIN: Yes, Scott.

15 So I think the biggest challenge that we face right
16 now is infrastructure. In my presentation, I laid out five
17 key issues that fleet operators have to address if they're
18 going to, both technically and from an affordability
19 standpoint, move forward with the technology.

20 We're seeing capital costs come down. The vehicle
21 performance is doing exceedingly well, but there's still a
22 marginal cost difference there that makes it difficult for
23 public transit operators to make that jump. That is why
24 California has been extremely important in leadership and
25 being able to not only pass the regulations, but to fund the

1 programs that we have today.

2 But infrastructure is really key. If you go to
3 someone like AC Transit, which now has 21 fuel cell buses,
4 their board's moved forward to buy another 20, they have
5 capacity of up over close to 100 buses that they could fill
6 within their current fueling structure. The cost of fuel is
7 the big challenge for them. And that's why we need
8 investments still from California and from the Energy
9 Commission specifically to support infrastructure development
10 and fuel supply.

11 MS. SKIVER: I would just add that, you know, on our
12 CNG fleet, if something goes down with our internal station,
13 we can find it. If something goes down with our hydrogen
14 production plant, we're not finding that. And so, I think it
15 goes to Jaimie's point where reliability on the fueling
16 infrastructure side and more choices for it, instead of
17 buying a tube truck at \$30 a kilogram and waiting for it to
18 get delivered, you can't do that when the buses need to roll
19 out. Or whether, it wouldn't matter what your business is,
20 you've got to roll out the next day. It's what our business
21 is all about. It's time and rubber on the road.

22 So I think infrastructure as well is what I would
23 highlight. I would also highlight internal champions and
24 internal knowledge, having folks within the organization
25 that's embraced the technology and want to learn about it is

1 extremely important. It's part of SunLine's pivotal success,
2 is we have internal folks who understand our fueling and our
3 bus side, how those vehicles work, and close relationship
4 with our manufacturers.

5 MR. SAMUELSEN: Lauren, (indiscernible, unstable
6 Internet connection) which are now (indiscernible) kilograms
7 a day, do you have a Plan B to back that up of trucking it
8 in, or have you found you've reached the reliability and
9 resiliency for that strategy that you are now comfortable in
10 supporting your operations?

11 MS. SKIVER: Supporting our operation daily, but
12 we're already driving a resiliency project and looking what's
13 being developed by manufacturers right now for a portable
14 refueler. You know, our new project across the street --
15 we're already actually planning on the next module of our
16 electrolyzer because we just won 10 more buses, which will
17 take us to 27, plus 2 on the way, that's 29, and our station
18 will be tapped out after another award.

19 So I think that that's one thing we're working on
20 now. We have a steam methane reformer that was going to be
21 our backup, but she had to be decommissioned. She was just
22 beyond her useful life. So we're busy looking for our
23 resiliency factor right now, since buying fuel and having it
24 trucked out to the desert is not where we want to be in the
25 future.

1 MR. SAMUELSEN: Thank you.

2 MR. LEVIN: Scott, if there's a chance, I'd like to
3 make a comment or two on resiliency. But I'll let the next
4 speaker you ask the question of first.

5 MR. SAMUELSEN: Thank you, Jaimie. Let's do that.

6 Brian, would you be so kind as to respond to --

7 MR. LINDGREN: Sure. You'd talked about hurdles, and
8 there's been a lot of good development on city buses running
9 on hydrogen, and Lauren has talked about that, Jaimie's
10 talked about that, too.

11 Moving to heavy trucks, heavy trucks are not buses.
12 Where buses weigh about 45,000 pounds and typically go 25 to
13 45 miles an hour, heavy trucks are typically 80,000 pounds or
14 more and need to be able to climb long grades of three to
15 five miles in the L.A. basin at 60 miles an hour, and be able
16 to compete with trucks that have 450 to 500 horsepower in
17 their diesel engine. So we need to -- one of the challenges
18 is making sure that we have enough power on board that we can
19 put it to the ground in a sustained manner, so that you don't
20 end up depleting what little battery you have on the truck
21 before you get to the bottom of the grade just by going
22 freeway speeds, and then have to crawl up the hill at only
23 what you can put out by reduced power, if you have kind of a
24 range extender arrangement, like we do on our first truck.

25 So that's one of the hurdles. One of the others, of

1 course, is building to scale. This is an emerging market for
2 electric vehicles in the heavy-duty category. So there
3 currently aren't component suppliers who have the bits and
4 pieces that we need to put it all together. Things like
5 break air compressors, and refrigerant compressors for the
6 air conditioning system and to chill the batteries or
7 whatever. Power steering, those kinds of things, we don't
8 have those in high volume today, so we're having to kind of
9 create new products to meet those needs. And then that kind
10 of permeates through the entire truck.

11 MR. SAMUELSEN: Very good. Appreciate that, Brian.

12 Jaimie, let's go to resiliency. What'd you want to
13 share?

14 MR. LEVIN: Yeah, I have to mention this. So as we
15 move toward zero-emission transportation, especially here in
16 California, resiliency issues are very big. And here are
17 three advantages, or two primary advantages to fuel cell
18 electric transportation, and specifically as it relates to
19 transit.

20 We, in the transit industry -- often, first
21 responders look at transit vehicles as a means of moving
22 people after an earthquake, for instance, from one region to
23 another. And so you need vehicles with range, zero-emission
24 vehicles that can cover that range to go, let's say, from the
25 Bay Area up to Sacramento with people from hospitals or

1 senior centers.

2 But the other key advantage is exportable power. On a
3 40-foot fuel cell electric bus that SunLine's operating
4 Orange County AC Transit, there is 600 kilowatt hours of
5 usable energy on that vehicle. On the articulated fuel cell
6 bus we're building for agency in Illinois, there's over a
7 megawatt hour of energy. So you can image in the future that
8 hospitals, senior centers, emergency operation centers have
9 switch gears, and these buses pull up to those switch gears,
10 plug in, and export their power. And oh, by the way, it only
11 takes 6 to 10, maybe 15 minutes max to refuel those vehicles,
12 either with a portable fueler or a swap with another bus.
13 That is an important value of fuel cell vehicles in this
14 state, for sure, in many states dealing with natural
15 disasters.

16 MR. SAMUELSEN: So appreciate you making that
17 observation, that point. Jaimie, thank you.

18 Let me go to policy. And let me divide policy into
19 two aspects. One would be policy that is actually
20 facilitating the deployment and development. The other is
21 policy that's perhaps hindering the development and
22 deployment of fuel cell heavy-duty vehicle technology.

23 I'm going to ask this, actually, of all of you.
24 Antonio, are you in a position where you can go first?

25 We cannot hear you at this moment. Let's hold on

1 that.

2 Lauren, would you take the --

3 MR. RUIZ: Okay. Sorry.

4 MR. SAMUELSEN: Oh, here we go.

5 MR. RUIZ: Can you hear me now?

6 MR. SAMUELSEN: Yes. Uh-huh. Please join.

7 MR. RUIZ: Yeah. Yes. Some of the -- some of the
8 challenges, actually we were -- we were very fortunate to
9 start on with the light-duty vehicles into the landscape for
10 their regulatory requirement. So when we go into our
11 heavy-duty realm, what we looking at is the standards on it.
12 So there has been a lot of fundamental learnings on the
13 vehicles, infrastructure, and actually the characteristics of
14 the algorithm itself to the point that now we are pretty much
15 learned from that sense. But there's not enough open
16 regulatory requirement, as I pointed out earlier, for any of
17 these vehicles like fueling, fuel economy, and the hard work
18 necessary for the entirely flow fueling of the vehicle.

19 MR. SAMUELSEN: Thank you. James, can I go to you
20 for response?

21 MR. KAST: Of course. And so I think, you know a key
22 point that Antonio was also alluding to is really just the
23 predictability of policy. So as much as policy can be
24 predictable and you can plan for it, that really helps volume
25 that is, you know these are -- these are not things that take

1 one year to develop, these are very long lead times to
2 actually develop trucks and move them out to where they need
3 to be. So having things like this mandate that's, you know,
4 right now, 15-, 20-year, you know, really horizon for what
5 this looks like, helps us really enable how do we actually
6 develop direct technology to meet these kind of requirements.

7 But of course to actually do this, there needs to be
8 the incentive structure to allow the end customer to be able
9 to afford these new vehicles. And I'll note that the total
10 cost of ownership for heavy-duty trucks is very different
11 than a typical light-duty Mirai customer. They're using this
12 vehicle as a tool for a business and not just something to
13 get to work to and from every day. So they'll certainly be
14 very receptive to cost and we need to be able to build out
15 the infrastructure to bring down the fuel cost to do that.
16 And of course, the vehicles themselves, we can actually get
17 truckers into the vehicles to meet the requirements that
18 we're trying to achieve from an air quality perspective.

19 MR. SAMUELSEN: Thank you. Brian, what is your take?

20 MR. LINDGREN: Sure. Yeah. Many of the good
21 comments have already been taken so I'll tag on a little bit
22 with those. One of the concerns I guess I have that is
23 the -- the zero-emission certification for a vehicle that is
24 clearly zero-emissions inherently. Seems a bit burdensome
25 and I think there is an opportunity there that might be able

1 to be addressed for vehicles that are clearly zero-emission
2 by design. Another one that has me a bit concerned are the
3 excise tax and sales tax on these vehicles. Especially the
4 early ones. If we've got a 12 percent federal excise tax and
5 a 10 percent sales, local -- state and local sales tax,
6 that's on an expensive vehicle, as these early ones are.
7 That can be a big burden on the end user. I think that's
8 something that the state and the federal governments could
9 address if they choose to.

10 MR. SAMUELSEN: Jaimie, do you have a few items to
11 add?

12 MR. LEVIN: I would say the unfunded mandates, which
13 others have spoken of, I think sales tax on emerging
14 technologies makes no sense, especially if we're using state
15 funding to develop these programs. On the positive side,
16 because of California's leadership, the House just this week
17 passed Invest America Stimulus Program. Now, whether that's
18 going to get through the Senate in this year, but it could
19 very well likely happen next year. There's \$1.7 billion that
20 have been proposed for zero-emission buses. And that has
21 survived the process through the House, and that is really
22 taking the next step beyond what the state of California is,
23 to help transit make this conversion.

24 MR. SAMUELSEN: Lauren, I'm going to save the last
25 policy and last question for you. It has to do with the

1 California Air Resources Board decision last Thursday to
2 adopt the rule that by 2045 all trucks sold in California
3 must be zero-emission. Because you're in the L.A. area, you
4 may have seen a few days later, in the Los Angeles Times on
5 Sunday, an editorial supporting the initiative and stating,
6 "This rule is the first of a kind and among the most
7 ambitious efforts in the world to replace diesel trucks with
8 battery powered and other zero-emission vehicles."

9 My question to you is really twofold, but to
10 associate with that last part of their phrase, battery
11 powered and other zero-emission -- other zero-emission
12 vehicles. Number one, do you know of other zero-emission
13 vehicles and battery electric vehicles? You might be able to
14 name one. And secondly --

15 MS. SKIVER: Well, I think -- sorry.

16 MR. SAMUELSEN: -- why is it we find it so difficult
17 for politicians and decision makers, and policymakers, and in
18 this case the editorial board, to use the words fuel cell?

19 MS. SKIVER: You know what, that was going to be my
20 comments. That when we talk about electrification, we have
21 no problem talking about all battery electric, but it cannot
22 come out of most people's mouths other than those that are
23 actually operating it or working to develop it, the benefits
24 of fuel cell. And so my ask was going to be that there is
25 more discussion, there is more award. And there's this,

1 maybe it's an educational, and a form like this, there's lots
2 of education about what the industry is doing for fuel cell.

3 And I will lead the audience with this, SunLine's
4 been operating fuel cells, as I said, for over 20 years.
5 I've been there seven. The first five years I was there we'd
6 have a visitor from around the world, maybe six times a year.
7 We've had more transit agencies come to our facility in the
8 last six months to see what we're doing in hydrogen. And
9 these are organizations within Southern California that have
10 really centered around all battery electric and see that they
11 won't be able to take it to the finish line with their fleet,
12 with an all battery electric solution.

13 And so I agree with those comments. It was what I
14 was sitting on my hands to say. I think that fuel cell is
15 working. People are using it. Major corporations are
16 developing and commercializing vehicles in it, yet we have a
17 problem talking about it. And I don't think it should be
18 some kind of gaseous or solid secret that we can't bring out
19 into the -- out into the atmosphere. I also think that
20 awards by our funders in California and across the country
21 need to include fuel cell awards. It typically is an orphan
22 that gets a small award, or at one agency gets an award for
23 fuel cell and the rest of the money goes to all battery
24 electric, and I think there needs to be parity on those
25 awards and those deployments.

1 MR. SAMUELSEN: Thank you, all participants
2 involved --

3 MS. SKIVER: Wish I could answer that, Scott.

4 MR. SAMUELSEN: -- for this very stimulating
5 moderated discussion.

6 That will bring this portion of the session to close,
7 and let me move the microphone over to Jonathan for attendee
8 questions and answers.

9 MR. BOBADILLA: Thank you, Scott.

10 I'm going to start with the ones with thumbs up.
11 Start from the top.

12 With concerns -- this one's from, I'm sorry, Travis
13 Andren. With concerns around mass transit compared to --
14 around mass transit compared to social distance, is the mass
15 transit sector of the mindset that things will return to
16 normal operation? Or are we facing a significant usability
17 shift that may affect ridership permanently going forward?

18 And that question's not directed at anyone in
19 particular, so it's open to the floor.

20 MR. SAMUELSEN: Jaimie?

21 MS. SKIVER: Well I mean, I'm an operator, so I'll
22 say that normal is not a word we use anymore, but it's
23 adaptability. And so I think that we are looking at how
24 many, you know, the productivity of our buses. We're
25 developing our own rideshare. We're looking at other micro

1 transit sorts of applications to use. Will it all be a 40-
2 foot or 60-foot bus in the future? Maybe not. But will it
3 be a combination of those services? Yes.

4 And actually in my opinion, and this is one person's
5 opinion, COVID-19 actually pushed transit forward to look at
6 a service that needed to be looked at for 25 years, and to
7 start being more entrepreneurial and innovative in the way
8 that we are delivering service. So I actually think there's
9 going to be a huge benefit to the riding public and to
10 transit agencies, based on what COVID-19 has brought forward.

11 MR. LEVIN: Yeah, and I would add to what Lauren said
12 that it isn't going to stop us from moving in a direction of
13 zero-emission. Regardless of the specific technology or the
14 vehicle modes, zero-emission is our future. That's not going
15 to go away and so it shouldn't affect what we're all trying
16 to accomplish with fuel cell electric technology.

17 MR. BOBADILLA: Thank you.

18 And then next one came in from Raoul, sorry if I
19 misspoke that. The State of California has invested in a
20 trial of fuel cell vehicles and fueling stations over the
21 last few years. That trial has shown that this is a viable
22 technology for zero-emission vehicles. In 2019, California's
23 8,000 FCEVs traveled about 90 million miles and used about
24 1.5 million kilograms of fuel. FCEVs are a drop-in
25 replacement for ICE vehicles, but the fueling network needs

1 to be built. This trial provides convincing evidence that
2 the public will adopt FCEVs once there is a robust fueling
3 network in place. Why not make the policy commitment now and
4 move as quickly as possible to get that fueling network built
5 so widespread adoption will be possible?

6 And that -- it's not directed at anyone in
7 particular, but it's open to the floor.

8 MR. LEVIN: Well the optimism is that the Energy
9 Commission has already identified a forthcoming grant funding
10 opportunity for transit infrastructure. Heavy-duty transit
11 infrastructure. So we're seeing signs of movement in the
12 right direction.

13 MR. KAST: And I think the only thing I'll add is
14 just, you know, instead of assuming that two can happen by
15 themselves, infrastructure kind of in its own bubble and the
16 fuel side in one bubble, the two just need to come together
17 and collaborate even more than we already are today so that
18 we could match up the investments to scale both vehicles and
19 the infrastructure so it actually meets the needs of
20 customers at the end of the day.

21 MS. SKIVER: And that was what I was going to add. I
22 mean, right now, currently, a fleet operator could do one set
23 of grants for the vehicles, but then has to go apply at
24 another area for the infrastructure. I mean, the beauty of
25 the CARB grant for us was it was both. It was infrastructure

1 and vehicles and we need to see more of those package deals
2 go out as grant opportunities so that you're not having to
3 piecemeal your program. It makes it very difficult to plan
4 when you may have all the opportunity in the world to get
5 vehicles, but then you can't fuel them.

6 And so I think communication and collaboration,
7 there's a lot that happening now in California. I think
8 that's going to be the blueprint for the future on how
9 deployments happen more successfully and how they happen more
10 rapidly.

11 MR. LEVIN: And, you know, to that point, Lauren, CEC
12 is actually with CARB for the first time are soon going to
13 release a GFO for dredge truck and fueling infrastructure
14 together. So it's wonderful that these two agencies are
15 working in concert to do that very thing.

16 MR. BOBADILLA: Excellent. And I believe we have
17 time for one more question. This is from anonymous. Toyota
18 has said that scaling light-duty fuel cell electric cars will
19 assist in cost reduction for heavy-duty fuel cell electric
20 trucks. Are there examples now where light-duty car
21 components are used directly in heavy-duty truck diesel
22 engine drive train systems that support this assumption?

23 MR. KAST: So the short answer is every single one of
24 them, Toyota's built. We haven't manufactured any different
25 fuel cell technology so even the Prius itself, all the hybrid

1 components were then utilized for Mirai, and now all the fuel
2 cell stacks you see in every single fuel cell component that
3 we build around the world uses the exact same fuel cell
4 technology.

5 MR. LINDGREN: If the question we're looking to say
6 are we using any passenger car pieces in today's diesel truck
7 power train, I'm struggling to come up with any. In the
8 power train, no. There might be some bits and pieces in the
9 cab that get borrowed from passenger car technology, but
10 frame rail, chassis, power train, those are pretty
11 much -- those are pretty much truck oriented. But the
12 technologies are not very different. The specific parts tend
13 to be different.

14 MR. BOBADILLA: Thank you. And Brian, since I
15 already have you, actually there is one directed towards you.
16 Also from anonymous. Is Kenworth currently working on long
17 haul usage of their trucks? And if so, how are they
18 addressing the issue of fueling stations?

19 MR. LINDGREN: So the way we see hydrogen fuel cells
20 working out is primarily ones that are going to run either
21 point to point or start at some hub and then come back to
22 that hub to refuel. Over time, I see the infrastructure
23 building out and we do have discussions with a few fuel
24 suppliers in terms of how that will work.

25 And, but I see it growing organically. I think there

1 will be a lot of -- a lot of trucks that will be centered
2 around the ports of Los Angeles and Long Beach. So it makes
3 sense to have fueling infrastructure there. Those trucks
4 will start moving around the L.A. basin. Many of them will
5 go to the Inland Empire. It makes sense to have a fueling
6 station up in the Fontana, Ontario area.

7 The same kind of thing will happen, I think, in the
8 Bay Area. We'll start to see trucks running out of the East
9 Bay, and then ultimately running over to Stockton and
10 Sacramento. So there will probably be some fueling stations,
11 both East Bay, as well as Stockton, Sacramento areas. And
12 then eventually maybe something around Kettleman City would
13 make sense. In between so that trucks can run the entire
14 length of the State, but -- or at least between Los Angeles
15 Basin and the Bay Area of Sacramento and not have worries
16 about being able to refuel along the way.

17 And then over time that will move up the I-5
18 corridor, up to Seattle and Vancouver British Columbia. And
19 over time that will move eastward out I-80 and I-10, but that
20 will be -- that will be over time.

21 MR. LEVIN: Just a note to Commissioner Douglas, we
22 hope that the Kenworth Toyota trucks, or any of the truck
23 fuel cell operators will be delivering hydrogen to the fleet
24 operators, to the transit operators.

25 MR. BOBADILLA: Thank you so much.

1 And with that, I believe we've reached our break.

2 MS. RAITT: Actually, thanks Jonathan. This is
3 Heather Raitt. I, and thank you to the panelists and to
4 Professor Samuelson.

5 I -- if I could just jump in before we take a break.
6 It's always dangerous to jump in before a break, but we would
7 like to do a quick panel -- I mean excuse me, a quick poll to
8 help us gauge how many people would like to make verbal
9 comments during the public comment period. So we'll just run
10 a quick poll. Just take a few moments here. And if you are
11 interested in making comments, please just go ahead and let
12 us know and that'll just help us do a little bit of planning.
13 We'll just give it a few more seconds here.

14 All right. Well I think we can close it. All right.
15 So it looks like we have about seven people interested in
16 commenting. Thanks so much everybody and so we'll go ahead
17 and take a break and we'll be back promptly at 3:00.

18 (Off the record at 2:46 p.m.)

19 (One the record at 3:00 p.m.)

20 MS. RAITT: This is Heather Raitt. We can go ahead
21 and restart.

22 So we're back on the record and so we're going to
23 move on to our second panel which is on Hydrogen Supply and
24 Fueling Infrastructure, moderated by Joan Ogden. So, go
25 ahead, from -- Professor Ogden is from UC Davis. So go

1 ahead, Professor.

2 MS. OGDEN: Well good afternoon.

3 MS. RAITT: I am so sorry.

4 MS. OGDEN: It's really a pleasure to be here.

5 I think we're on the fuel cell --

6 MS. RAITT: Yes.

7 MS. OGDEN: -- vehicle market status.

8 MS. RAITT: I am so sorry. I don't know what I was
9 thinking. We are absolutely on the light-duty fuel cells.
10 Thank you.

11 MS. OGDEN: Okay. Good. Okay.

12 So I'm really, it's really a pleasure to be here.
13 And we're going to have some opening remarks from each of our
14 panelists. And so we're going to hold the questions until
15 all the panelists have made their presentations.

16 And -- and then we'll -- I'll start off with
17 introducing our first panelist. Maybe I'll ask the panelists
18 to turn on their videos, too, or our first one.

19 Jackie Birdsall, are you -- are you here? Let's -- I
20 guess let's move on to Jerome, then. Jerome Gregeois. Hmm.
21 Okay and what about John --

22 MR. GRECEOIS: Yes. This is Jerome. I don't know if
23 you can hear me. I can --

24 MS. OGDEN: Yes.

25 MR. GRECEOIS: -- I can speak, but I'm locked out of

1 the video right now. It says that the host has stopped me
2 from forecasting.

3 MS. BIRDSALL: Yeah. This is Jackie. I'm having the
4 same. It says my camera is disabled.

5 MS. OGDEN: Okay. I don't see any of the other video
6 for the other, for Jonathan or Monterey either. Maybe
7 Jackie, we'll go ahead and start with you, then. And I'll
8 just briefly introduce.

9 Jackie Birdsall is a senior engineer in the Fuel Cell
10 Hybrid Vehicle Group of Toyota Motor, North America Research
11 and Development, and specializes in hydrogen infrastructure,
12 high pressure hydrogen systems, and associated codes,
13 standards, and regulations. She also serves as a technical
14 spokesperson for Toyota Mirai. And has been in numerous
15 publications, including Car and Driver Fortune, Wall Street
16 Journal. She's had long experience in the automotive
17 industry prior to joining Toyota in 2012 and has 12 years of
18 experience with fuel cell vehicles.

19 So Jackie, I'll turn it over to you.

20 MS. BIRDSALL: Thank you so much for that kind
21 introduction, Joan. Can I confirm that everyone can hear me?
22 But you can't see me. Okay. Got that.

23 Well, we really appreciate the opportunity to share
24 Toyota's perspective related to light-duty hydrogen fuel cell
25 electric vehicles in California today. So here at Toyota,

1 our goal is to provide mass market solutions, to reduce the
2 impact of greenhouse gasses and local pollutants by
3 increasing our electrification portfolio.

4 We see programs and policies from California agencies
5 such as the CEC and ARB as critical to achieving these goals.
6 I mean, really realistically, we could not launch our zero-
7 emission vehicles without the regulatory signal that our
8 technology is welcome, and that sufficient infrastructure
9 will be made available.

10 For hydrogen policy specifically, this means equal
11 footing with other zero-emission technologies. That means
12 investments like the upcoming GFO for hydrogen infrastructure
13 and a signal that these policies will be sustained, allowing
14 for the expansion of green jobs, and for new programs to be
15 launched. So if you could go to the next slide, that would
16 be great.

17 So thanks in large part to the State's effort to
18 date, we now have more than 6,000 Toyota Mirai on the road
19 fueling at 4,100 hydrogen stations in California. And we
20 also have several Class 8 fuel cell electric trucks hard at
21 work in and around the ports of Los Angeles and Long Beach
22 moving freight, reducing local air pollution, and improving
23 the lives of local communities, as you may have heard earlier
24 from my colleague, James. And we've seen the capabilities
25 of fuel cell electric technology when adequate hydrogen

1 infrastructure is available. And this means that vehicles
2 can fill within minutes, one after another and then drive off
3 with 300-plus miles of all electric range.

4 This makes zero-emission driving accessible to our
5 customers without dedicated parking spaces, much less a
6 garage, or for those whose -- who have families who share a
7 vehicle, or who otherwise just prefer fueling to charging.

8 And you may have heard this in earlier panels, but in
9 California, our hydrogen infrastructure has been tried with a
10 greater demand versus supply than anywhere else in the world.
11 And we believe this is a testament to the ideals of
12 Californians and our aspirations for electrification.

13 Could you go to the next slide, please?

14 So last year we announced our latest contribution to
15 our collective goal, the 2021 Toyota Mirai. And we scaled up
16 production capabilities by an order of magnitude. But really
17 regardless of how fantastic I think this vehicle is, for it
18 to be a success, the availability and reliability of fueling
19 infrastructure is key. So to that end, we support the CEC to
20 apply the full \$200 million allocated to light-duty hydrogen
21 infrastructure, to align with the 200-station goal per
22 Governor Brown's 2018 Executive Order on ZEV infrastructure.

23 And to take that a step further, we also align with
24 other stakeholders on the premise that enhanced ZEV targets
25 also call for bolder infrastructure goals. For example, to

1 align with Governor Brown's target of 5 million zero-emission
2 vehicles by 2030, we believe that California must also commit
3 to a goal of establishing 1,000 hydrogen fueling stations to
4 enable one million fuel cell electric vehicles.

5 So with that said, I'll go ahead and stop talking and
6 again express my gratitude for this opportunity. And really
7 look forward to a fantastic panel.

8 Thank you, Joan.

9 MS. OGDEN: Okay. Thank you very much, Jackie.

10 Our next speaker is Jerome Gregeois. And Jerome is a
11 power train senior manager at the Hyundai Research Lab in
12 Chino, California. The Hyundai California Lab develops power
13 trains for zero-emission vehicles, researches eco
14 technologies marketability, and supports refueling
15 infrastructure development. He holds a master of science in
16 Mechanical Engineering. And prior to joining Hyundai in
17 2008, he held positions in design, testing, and quality for
18 power train systems at Nissan in the United States, and
19 Renault in Europe. Jerome.

20 MR. GREGEOIS: Good afternoon, everyone, and thank
21 you for having me. I hope you can hear me well or well stop
22 me if you can't.

23 So I'll be discussing the efforts that Hyundai has
24 been doing developing fuel cell vehicles and specifically in
25 California.

1 If you want to move to the next slide.

2 Just a quick introduction about Hyundai Research and
3 Development worldwide. We are located in South Korea, and we
4 have two R&D centers there, the Namyang R&D Center that is in
5 charge of developing the large majority of vehicles,
6 including vehicles that will have fuel cell power train. And
7 we have a dedicated fuel cell center in the City of Mabuk
8 that works on the fuel cell systems and hydrogen storage.

9 And if we move into the U.S., we have the R&D that is
10 headquartered in Michigan. But we have a large presence in
11 the state of California with three entities that are under
12 R&D, our California proving ground where our vehicles have
13 been tested, our fuel cells and durability. The California
14 design studio in Irvine that works on packaging and also
15 developing vehicle systems. And the California fuel cell lab
16 where I am located in Chino, California that has been since
17 the early 2000s working on fuel cell vehicles first reviewing
18 programs. And recently on the NEXO, our latest vehicle. And
19 finally we also have our Hyundai Motor America headquartered
20 in California, which is the sales organization that is in
21 charge of selling the vehicles and servicing the vehicles.

22 Next slide.

23 So I have a few dates on this slides to kind of
24 indicate when it started and then what's the vision from 1998
25 to 2030. 1998 is really the year where Hyundai started

1 working on fuel cell technology. And it took until 2013 in
2 order to have a vehicle that would be available as a lease to
3 customers. 2013 worldwide, 2014 for the State of California.
4 This is the first time where any OEM introduced a hydrogen
5 electric SUV. That vehicle was sold in -- 18 vehicles in
6 America and Europe and was used in global taxi and car
7 sharing services and got an award, The Ten Best Engine in
8 2015.

9 Our second generation came on the market in 2018, and
10 it's to date, the world longest zero-emission range SUV with
11 380 miles. So that's a vehicle that not only is zero-
12 emission but is also Hyundai's technology flagship.
13 Contributes to purification of air. Some of us not familiar
14 with the fact that fuel cells actually get air through their
15 system and contribute to purification of air. And you can
16 get 380 miles of range in 5 minutes of refueling and keep
17 doing all day long. That vehicle also received an award in
18 2019, with awards, and it is currently available for lease in
19 California at \$399 a month. And also with a credit of
20 \$13,000 of complementary fuel, which is an incredible bargain
21 for a vehicle of that level.

22 And if we project ourselves into the future, really
23 the vision for Hyundai is the quote that I will do from our
24 Executive Vice Chairman that mentioned that as a first mover
25 in the forthcoming hydrogen economy, Hyundai will lead us a

1 society that uses hydrogen as its main source of energy. So
2 this includes transportation and beyond.

3 Next slide.

4 So if we want to focus a little bit more on
5 California I'll give, I guess, the history of how Hyundai got
6 exposed with retailing vehicles in the U.S. market and it
7 started in 2014. But it has a milestone, first milestone at
8 2013 where there were zero public retail stations in
9 California. It was not possible to go anywhere and buy, with
10 a credit card, hydrogen. When you were able to access a
11 station, there would be a protocol that would get you a cost
12 of in between the 15 to \$30 per kilogram, depending on where
13 you would be refueling. And it was a complex process, more
14 industrial like with thin pad.

15 If we fast forward to this year in 2020, we have 41
16 public retail stations where anyone can use their credit card
17 and buy fuel as easily as gasoline. And we have a price
18 that's diminished significantly, but still is at 10 to \$17
19 per kilogram, which is not competitive with gasoline. And if
20 we look at the retail market, we now have three options for
21 consumers. So there's the beginning of the competitive
22 retail market which will benefit consumers.

23 The enabler, really. from that progress in those
24 seven years is AB-8, as AB-8 contributed to establishing the
25 stability for all the different stakeholders, that they would

1 be station builders, OEM, industrial gas providers, and also
2 consumers feeling competent that the technology was backed
3 up.

4 And as we fast-forward into the future, I didn't put
5 a date there but looking forward to a time where we could see
6 around 1,000 public stations. That would be giving the
7 coverage equivalent, or very close to gasoline, and possibly
8 a price at \$5 per kilogram of hydrogen. Which seems very
9 challenging today, but in some areas in the world, we're not
10 that far from that. And that would be a real enabler for
11 getting to a wide range of vehicles that could be put on the
12 market and that would offer competitive options for
13 consumers.

14 And this is my last slide so if we want to move to
15 the next one, that will be my conclusion.

16 I'm looking forward to the panel so we can discuss
17 how we can bring vehicles like this one, powered by the
18 renewable energy that's in the background. Thank you.

19 MS. OGDEN: Thank you, Jerome.

20 Next I'd like to invite our next panelist, Jonathan
21 Palacios-Avila. He's the chief executive officer of
22 StratosFuel. StratosFuel, Inc. is a renewable hydrogen
23 production company that owns and operates refueling stations,
24 production plants, and the fuel cell car carrying company,
25 StratosShare. Prior to cofounding StratosFuel, Jonathan

1 studied chemistry and public administration at California
2 State University, Los Angeles. And received a bachelor
3 degree in 2012.

4 While at CSULA, he learned hands on about the
5 functionality of hydrogen stations and fuel cells. And in
6 2013, Jonathan and two other team members founded StratosFuel
7 with a purpose to create a renewable hydrogen infrastructure.
8 As CEO at StratosFuel, Jonathan leads the overall corporate
9 strategy in the citizen development process for the company's
10 production facility. He also oversees the car share company
11 StratosShare, as it's a huge part of the company's strategy
12 of offering an all-inclusive hydrogen infrastructure.

13 Jonathan.

14 MR.PALACIOS-AVILA: Thank you so much for that. So
15 like you said, my name is Jonathan Palacios-Avila cofounder
16 and CEO of StratosFuel.

17 If you could please go to my first slide.

18 So this slide I'm going to talk a little bit about
19 StratosFuel and our background. We were founded in 2014 with
20 the sole purpose to make hydrogen an everyday fuel. We are a
21 proud recipient of multiple CEC grants relating to hydrogen
22 stations, renewable hydrogen production, and zero-emission
23 shared mobility services.

24 Currently StratosFuel is building out the first phase
25 of their 100 percent renewable hydrogen production plant that

1 uses in-state renewable electrical feedstocks. It has an
2 intake capacity of 5,000 kilograms and this plant is
3 specifically designed for the hydrogen fuel cell mobility
4 market. Secondly, StratosFuel in collaboration with the
5 California Energy Commission and Toyota deployed 15 fuel cell
6 electric Toyota Mirai vehicles to -- within the inland
7 empire, which are available to be rented by the hour or day
8 through the StratosShare app.

9 Next slide, please.

10 So for the sake of this discussion today, I'm going
11 to be talking a little bit about our -- how we're making
12 hydrogen mobility more accessible, and kind of the effects of
13 that and the benefits we have to the greater overall
14 infrastructure.

15 Next slide, please.

16 So what StratosFuel's doing with StratosShare is
17 we're providing on-demand vehicles that are rented by the
18 hour or day. And what this is essentially doing is providing
19 access to zero-emission vehicles for communities that
20 otherwise don't have the infrastructure or don't have the
21 vehicles or affordability to have them. Our initial rollout
22 of the 15 cars were deployed in disadvantaged communities.
23 We targeted San Bernardino and Riverside. One because of
24 the -- based on CalEnviroScreen score, they ranked the most
25 highest as disadvantaged communities, and they have some of

1 the highest pollution rates within the state of California.

2 And what we found is that deploying the area,
3 deploying fuel cell vehicles for shared mobility in these
4 areas allows us to increase a hydrogen demand for the local
5 stations.

6 Next slide, please.

7 And additionally, the shared mobility services reduce
8 congestion. We see that one shared vehicle can replace up to
9 15 cars on the road. And for every zero-emission mile that
10 our fleet has traveled, we've reduced 24 pounds of greenhouse
11 gas emissions that otherwise are emitted. And we also
12 reduced the cost of ownership for vehicles which make
13 sometimes owning a vehicle, yet alone a zero-emission
14 vehicle, prohibitive for some people.

15 Next slide, please.

16 So kind of what we're looking at as a policy push is
17 one to really increase funding for zero-emission
18 transportation. We have some extensive data on the
19 utilization of these vehicles and how much fuel they are
20 using on a daily and weekly basis. And we're seeing that if
21 we can incorporate this with subsidized transportation, such
22 as LIFE, which stands for Low Income Fair is Easy, that's
23 available in Los Angeles County which provides --
24 essentially, it's a card that allows people to ride the bus
25 and take other modes of public transportation for free or for

1 subsidized cost.

2 We're seeing if we can utilize that and subsidize
3 zero-emission transportation through shared mobility, then we
4 can really come to a cost parity where it is more cost
5 effective to take a shared vehicle, or another form of
6 mobility service which we think that right now we're -- we
7 can rapidly deploy more vehicles in areas that need to go
8 zero-emission. And if we can make it more affordable, this
9 would also help target areas that maybe don't otherwise have
10 zero-emission infrastructure but can help spawn that in other
11 communities.

12 So that's kind of the policy recommendation and the
13 strategy with StratosFuel and Share. And thank you and back
14 to Joan.

15 MS. OGDEN: Thank you, Jonathan.

16 All right. Our last panelist now is Monterey
17 Gardiner. Monterey spent two decades supporting working to
18 accelerate the commercialization of hydrogen technologies and
19 promote renewable energy policies. He started his career at
20 the UC Davis Institute of Transportation Study, completing
21 his PhD under the guidance of Andy Burke and Joanna Groza
22 while building a cryogenic storage hydrogen prototype tank
23 based on activated carbon at the Hydrogen Research Institute
24 at the University of Trois-Rivieres in Quebec, Canada.

25 He now works at the BMW technology Office in Mountain

1 View, California exploring and working to remove barriers to
2 eMobility and representing BMW North America within the
3 hydrogen community. He spent five years technology scouting
4 for BMW Group and in North America, part of that he spent
5 seven years with the U.S. Department of Energy's Fuel Cell
6 Technology Offices, directing R&D efforts to bring down cost
7 of hydrogen delivery technologies and component costs,
8 operating strategies for refueling stations.

9 While at DOE, he advocated for one of the lowest cost
10 and the highest density advanced storage options called cryo-
11 compressed hydrogen. For about three years he was a safety
12 engineer at the California Fuel Cell Partnership and then
13 managed Hyundai's first fleet of fuel cell vehicles in
14 Northern California.

15 Monterey, it's a pleasure to see you, as a former
16 Aggie, still an Aggie, among all the other things that you've
17 done. So, we'll turn it over to Monterey.

18 MR. GARDINER: Thank you so much, Joan, for that kind
19 introduction. I assume everybody can hear me okay.

20 MS. ODGEN: Yes.

21 MR. GARDINER: So as Joan mentioned, my name's
22 Monterey Gardiner and I work here at the technology office in
23 Mountain View, California. And I would also like to thank
24 the CEC Commissioners Douglas and Monahan for this
25 opportunity and dialog to share some perspective from BMW

1 group.

2 I have a long history with hydrogen, and I spent more
3 than ten years outside of California. So living in D.C.,
4 exploring the national cost reduction opportunities for
5 hydrogen, living and working in Germany and Japan for BMW
6 before returning here ten years later with my two boys and
7 family. They were born in Davis.

8 I grew up in Sonoma County without grid connected
9 electricity, just using a small generator through eighth
10 grade just relying on LPG for cooking and lighting. And
11 personally, I feel we're at a cusp of a tipping point. Given
12 the promising presentation this morning on the cost reduction
13 of hydrogen and progress made by multiple countries. Just
14 last week Germany announced a 9 billion Euro investment plan
15 to promote hydrogen technologies and deployment of upwards of
16 5 gigawatts of electrolyzers. So there's an enormous amount
17 of effort going on now.

18 The BMW Group's committed to the height of the Paris
19 Agreement and already offers a wide range of electrified
20 vehicles. We'll have upwards of 25 models globally in the
21 next couple years. But we really believe in the power of
22 choice for customers and hydrogen vehicles could be part of
23 that story.

24 Next slide, please.

25 So as you can see here, we have a bit of a rollout

1 strategy. Our former board member of Development, Krauss
2 (indiscernible) said that from the start of our fuel cell
3 development, we pilot, we master, and we scale technology.
4 The next step in the rollout for BMW's high hydrogen NEXT is
5 really pressed to master that technology with a small fleet.
6 So we're currently developing that based on our X5 model, and
7 it'll be possible, some of these vehicles could be brought to
8 the U.S. for testing and even California in 2022 or 2023.
9 But they won't be sold to customers. Not yet.

10 For passenger vehicles, we're convinced that we
11 really need this choice in respect to the power trains and
12 that best suit their needs. So we need to have a customer
13 that wants something more than existing electrified models on
14 the road. Long distance travel is more flexibility and where
15 they use those vehicles, and regular access to charging and
16 infrastructure, and that's what's most critical.

17 We appreciate California's efforts to build out the
18 network of hydrogen fueling stations and that the hydrogen
19 commodity is -- glides hydrogen at a competitive price. It's
20 renewable based and it's something that our vehicles
21 customers will find useful and convenient. But it really
22 needs to be matured globally, not just in California.

23 So we're continuing our R&D program in preparation
24 for this market introduction, possibly in the second half of
25 this decade. Exact timing and models are still being decided

1 and it really just depends on each market conditions.

2 Next slide. Thank you.

3 So on the right side, I think you've already heard a
4 bit, some of this may be fairly basic, but the fuel cell
5 system that we're looking at provides upwards of 125
6 kilowatts of electric power and we have the -- the motor will
7 be 270 kilowatts power. But right now really the focus is
8 learning how that technology. So there's two 700 bar tanks
9 in the system, which can give upwards of 600 -- 500
10 kilometers of range and refuel in just a few minutes.

11 So that's the, probably the most important aspect is,
12 right, finding that convenience that gives something over and
13 above like the existing electric drive car chains on the
14 road. So with regard to hydrogen, BMW right, has shown,
15 right, this, you have this very valuable green energy. You
16 want that highest efficiency going where there's least
17 conversion losses. But we also recognize, right, that this
18 long-range convenience will require hydrogen. But it will be
19 for larger vehicles, it will be for trucking, as we heard
20 from other sessions. And so it's just a matter of time for
21 that to be built out.

22 But hydrogen needs to be cost efficient versus that
23 direct use of electricity and really focusing on that CO₂, and
24 right, reducing that where it has the biggest impact.

25 So I think I'm going to keep it short here and I

1 really look forward to everyone's questions and I appreciate
2 the time to share a little bit about BMW's strategy.

3 MS. OGDEN: Thank you very much, Monterey.

4 I think now we're going to ask all the panelists to
5 turn their video back on and we're going to now go to the
6 Commissioners. So we're going to ask Commissioner Monahan,
7 Commissioner Douglas to invite them to ask some questions of
8 this panel. And maybe we'll start off, let's see, whichever
9 Commissioner would like to go first.

10 COMMISSIONER MONAHAN: Well, I can start. And Joan,
11 thank you. Thank you for your leadership for so many years
12 on hydrogen fuel cells, clean transportation broadly.

13 And I do feel a little like there's a conspiracy
14 going on with the UCITS Davis folks just basically
15 infiltrating every aspect of clean transportation. It's been
16 a theme going on with many of our panels.

17 MS. OGDEN: We have UCI and CS UCLA here too, among
18 others.

19 COMMISSIONER MONAHAN: That's true and I don't mean
20 to -- not everything begins and ends at UC Davis, even though
21 Dan Sperling may say otherwise.

22 So I had a question and I asked this question in the
23 morning -- in the morning. I'm curious about what you all
24 think too. You know, I think of how we move the market on
25 fuel cell vehicles and it really does take global investment.

1 And you all have referred to some global investment
2 happening, but I wonder if you could deepen the discussion of
3 that. And, you know, one of -- one of the kind of, I've been
4 just pondering what does it take to build a global market for
5 fuel cell electric vehicles. And to me, China is really
6 important. World's biggest market. They're leaning in more
7 on heavy-duty fuel cells, not so much on light duty. We have
8 Japan, Korea making some investments. Germany's starting to.

9 But I wonder if you all can talk more about how
10 you're seeing global momentum towards fuel cell electric
11 vehicles in the light-duty space.

12 And one question I had for Monterey Gardiner on
13 the -- on the BMW side is just why so long? Second half of
14 this. Why not next year? So just give us a sense of what
15 your -- what the hurdles are to getting commercialized and
16 just building this whole global momentum on light-duty fuel
17 cell electric vehicles.

18 MR. GARDINER: Did you want me to start or?

19 So I think for BMW, right, profitability is very
20 critical. If you look at some of the other auto
21 manufacturers, even amongst the European ones, we have this
22 8t to 10 percent profit range that is just part of our
23 culture and just being very focused, right, on the workers
24 and that we don't have these big jumps from, right, a few
25 percent of profitability to 20 percent. But what that does,

1 and it means that our technology development has to be very
2 methodical, and it has to be very measured where the markets
3 and that we don't make missteps. So BMW is somewhat risk
4 averse in that, so we build technology that's, right, very
5 desirable, but we want to make sure that we can make money
6 with it.

7 And so the reasoning is, right, we're looking at \$20
8 a kilogram, then we need that maturity. And I think that's
9 where California can step in to give that certainty to
10 industry for end to end investments where you have really
11 large scale renewable based hydrogen, as we saw from Dr. Wang
12 this morning, right. Those costs can come down. Large scale
13 storage and like jump starting that market to the
14 transportation fuel to match what industry needs. So we know
15 it works, it's just a matter of getting to scale.

16 I don't know if I answered your question or if
17 there's anything else I can expand on.

18 COMMISSIONER MONAHAN: I think you answered my
19 question on the why so long, but not on the what other, you
20 know, what's sort of the global theory of change for how we
21 bring down prices and really build the market, that's fuel
22 cell light-duty vehicles.

23 MR. GARDINER: So we need that scale, right? We need
24 the -- for the auto manufacturers, that certainty that the
25 fuel's going to be there. Cost and convenient for our

1 customers. But we need to see it in China, in Korea, in
2 Japan, where it's coming in Europe, and California. But like
3 having building cars just for California is not something we
4 can do. But it's really that scale and I think we're seeing
5 that both in China and Europe in some of the announcements
6 and that it's coming.

7 But I think another panelist can answer more to that
8 question about global scale manufacturing.

9 MR. GRECEOIS: Yeah, I can make a comment if nobody
10 else wants to jump in.

11 I guess I'll give some comments on investments that
12 are made in Korea so that gives you a perspective, I guess,
13 on the efforts that Hyundai has been doing. But Korea's
14 really the first market where Nexo has been deployed. So we
15 have about a little over 7,000 Nexo's on the Korean market.
16 It started in 2018 and 2019 was about 4,000 vehicles and then
17 this year we're on the same track as before, about 5,000
18 vehicles. And it's a market that has currently 30 stations.

19 COMMISSIONER MONAHAN: Is that -- Jerome, is that new
20 vehicles? 5,000 new vehicles or 5,000 vehicles cumulatively?

21 MR. GRECEOIS: That's 7,000, over 7,000 cumulated
22 vehicles. And then this year is expected to be 5,000 so --

23 COMMISSIONER MONAHAN: Additional.

24 MR. GRECEOIS: From January -- from January 1st,
25 2020, 5,000 vehicles additional to the market.

1 COMMISSIONER MONAHAN: So then Korea will take the
2 mantle from California for having the most fuel cell electric
3 vehicles on the road in the light-duty space.

4 MR. GEGEOIS: It will be close. Depending on how
5 things go. Yes, the market could be about the same. But the
6 difference is there's really, Nexo is the player on the
7 Korean market so maybe that's helping us. There's not a lot
8 of competition to go and shop around.

9 But that's enabled by, I guess a couple item, is one
10 is the Korean market is very favorable to fuel cell vehicles
11 because the country, in general, believe in that hydrogen
12 society and you can actually acquire a Nexo for the price of
13 some of the gasoline vehicle. Really the price you would get
14 is around \$30,000 after incentives starting from a little
15 over \$60,000. So that's one element.

16 And then the second element is that fuel in Korea is
17 also very cost effective. Depending on where you refuel,
18 you're in between 5.8 to \$7.3 per kilogram. And that's 5.8
19 in a market that has gasoline more expensive than in the
20 United States, you're already at a benefit when you -- when
21 you choose to have a vehicle.

22 So that's explaining I guess where the -- the efforts
23 are going. And obviously the California market is critical.
24 We don't have as many vehicles here, but I think that every
25 market in the world is looking at the California market as

1 really the leader in pushing the technology and showing that
2 you can have the best retail experience and with a, I guess
3 more established market, or mature. And so that effort in
4 Korea is definitely also because of the efforts that were
5 done in California.

6 MS. BIRDSALL: I would also like to interject, if I
7 may.

8 I really agree with that sentiment that this needs to
9 be a global development, right. And so that's why the Toyota
10 Mirai is a global vehicle. And that allows us the capability
11 to sell it anywhere, in Japan, in Europe, as well as in
12 California.

13 I think as far as a global effort, really what's
14 going to drive the development of the vehicle is the
15 infrastructure. So we've seen large investments poured into
16 Europe and you just heard about South Korea. In Japan it's
17 about 1.5 billion over six years that they've put into
18 establishing some kind of infrastructure around fuel cell
19 vehicles in Japan.

20 But there is a little bit of kind of nuance work
21 that's being done on the back end that doesn't get quite as
22 much time in the spotlight, because it's not as sexy, really.
23 And that's the development of code standards and regulation.
24 And really if you want to judge the staying power of any
25 technology, you look towards that effort. And there's been a

1 huge effort, including from the federal level at the U.S. to
2 establish what's called the Global Technical Regulation. In
3 addition to standards like SCG-2600 for the interface of the
4 station to the vehicles. That's also an international
5 standard now, through ISO, and allows our vehicle again, to
6 be launched anywhere, and a station in Europe can fill a
7 vehicle from California and vice versa.

8 And there's really, a really great cooperation
9 amongst the industry to make sure that internationally all
10 the standards are there to really capitalize on investment
11 that not only the governments are making right now to support
12 this technology but that the OEMs and the station providers
13 are making to ensure that a component that we make, you know,
14 in Japan, can be used anywhere else in the world.

15 COMMISSIONER MONAHAN: Well, I have found it
16 interesting, really, how Korea has stepped up its incentives
17 and support for fuel cell electric vehicles. And it's
18 curious to me that California has more fuel cell electric
19 light-duty vehicles than Japan does, even though Toyota and
20 Honda, who have been the leaders on fuel cells for as long as
21 we can remember, right. Hyundai is a new -- a new enter into
22 the space.

23 And I, you know, what I want to see is this global
24 movement where Japan follows suit and actually has, you know,
25 a robust fuel cell electric vehicle market. Together with

1 Korea, together with potentially Germany, together with
2 China, then we build a market, and then we could scale up.
3 So it just, you know California, we've been doing this for a
4 long time. We're continued -- we're going to continue to do
5 this because we're committed to zero-emission transportation.
6 But we need to think about this in a global context is where
7 I'm, the point I'm trying to make.

8 And I have one question for Jonathan because I love
9 your project so much, as do many folks. I'm curious what
10 you're learning as you try to roll out, I mean, what are
11 the -- do you have any stories for us about the customer
12 experience and? I mean, this is pretty new for a lot of
13 folks, getting into a shared vehicle, let alone a fuel cell
14 vehicle. What are -- what are you learning as you do this?

15 MR. PALACIOS-AVILA: Yeah, so I think that that's a
16 really great question. And one of the things that we -- that
17 we learn is the excitement that people get when they drive
18 these cars. I think first when we -- we initially
19 launched, I think a lot of people were renting the cars and
20 didn't really understand that they were hydrogen fuel cell
21 vehicles. I think they thought they were kind of like a new
22 type of Prius design. And when they actually got the feel of
23 one, a lot of people wrote us. They comment -- they can
24 leave comments on the app and they said I want to buy one,
25 where can I get one?

1 So I think that -- this is a great way, not only is
2 it a great way to really increase, I guess, demand for
3 hydrogen stations, but it's also a great marketing tool to
4 get people assimilated to hydrogen fuel cell vehicles. That
5 they look and feel just like a regular gasoline car, but with
6 more power and range. And I think another comment that
7 people really got was that they were surprised that it was
8 electric and the range that it had.

9 And we have a couple of fleet customers. I think the
10 County of San Bernardino is one of them that utilize our
11 vehicles within their fleet motor pool program. And these
12 vehicles have a 300 mile-plus range, which allowed them to go
13 to other parts of San Bernardino County which is the largest
14 county in the U.S., that they otherwise wouldn't be able to
15 have done in a battery car, such as a Volt or something like
16 that, that has the, you know, 180-mile range. So I think
17 that was the positive side.

18 And another thing is we encourage the customers to
19 fill. We give them a credit. I think they get like 30
20 minutes free of rental time if they go and refuel the
21 vehicle. And we've had people refuel the cars. We have a
22 sheet how to refuel and we haven't had any problems. I think
23 people initially are kind of confused on how to use the card
24 and the pin, but once they get assimilated to that, it's
25 pretty simple and you have people refueling the cars quite

1 often now.

2 COMMISSIONER MONAHAN: All right, thank you.

3 MR. PALACIOS-AVILA: No problem.

4 COMMISSIONER MONAHAN: Commissioner Douglas, do you
5 have questions?

6 COMMISSIONER DOUGLAS: You know, I don't think so.
7 It's been a great discussion. I don't -- I don't. I think
8 you asked some of my questions.

9 COMMISSIONER MONAHAN: Oh, sorry.

10 Well Joan, why don't we turn it over to you and we'll
11 get off video and you can continue the discussion.

12 MS. OGDEN: Okay. Thank you. I'm excited. I
13 enjoyed the discussion, that part of the discussion.

14 So -- so now we're going to go to another part of
15 the -- of the panel. And I'm going to ask you some questions
16 and just maybe direct these to different panel members to
17 talk about. I just have a, kind of a free discussion off of
18 these.

19 So the first one I wanted to ask you is how has the
20 COVID-19 crisis impacted your overall assessment of the
21 hydrogen and fuel cell market?

22 And maybe Jackie, I'll ask you to lead that one off.

23 MS. BIRDSALL: Sure, Joan. That's a -- that's a very
24 valid question. I think we've heard from earlier panelist
25 that this is kind of a rare opportunity to slow down and

1 reevaluate your values. And for us that has not deterred us
2 at all away from what we call our environmental challenge
3 2050, which has been a Toyota internal goal to reduce our CO₂
4 impact related to our fleet.

5 And again, the way of getting there for us is
6 electrification, which includes fuel cell EV technology. So
7 for us, there's been even more of a shift towards supporting
8 the rollout of fuel cell electric vehicles and finding new
9 ways, as James mentioned before, new potential solutions
10 where we can introduce fuel cell technology to solve
11 problems, or to solve -- to step in as a solution for things
12 that used to be powered by diesel or gasoline.

13 So, yeah, I think it -- I think it's one of those
14 rare opportunities that you really get to slow down and
15 evaluate your values and for us, that has not changed ours.

16 MS. OGDEN: Great. Now anybody else on the panel
17 like to comment? Jonathan.

18 MR.PALACIOS-AVIA: Yes. Yeah, I think, you know, the
19 effects of COVID-19 really changed the way how we serve the
20 public in terms of transportation. I think one of the things
21 we saw was that, you know, transportation is an essential
22 business, but we were now supporting a limited number of
23 customers, but we still wanted to maintain our excellent
24 level of service that we would normally do. So that included
25 ramping up I guess, cleaning procedures for some of our

1 rides, taking vehicles off -- offline after they'd been
2 returned, allowing us to have time to clean them. Going
3 through checklists, through our app and with the customers.
4 If they're experiencing any fever, or COVID-related symptoms.

5 So those are some things that we're implementing and
6 just doing constant cleaning. But it's really changed the
7 way, kind of, how we operate. But we still want to ensure
8 that people have, you know, that 100 percent reliability that
9 they can turn on their phone and reserve a car and still go.
10 And we've been really thankful for the hydrogen stations that
11 have maintained online, and during this time and had fuel
12 which was really, really good, and really helpful for a lot
13 of the drivers that were still commuting.

14 MS. OGDEN: Thank you. Monterey, you want to say
15 something on this too?

16 MR. GARDINER: Yeah, just a short sentence coming
17 from the European perspective. It's really stirred a lot of
18 interest in investing these recovery funds towards hydrogen.
19 And it's accelerating these discussions on urban mobility,
20 right. As you see, sidewalks are expanding into parking
21 spaces. And air quality, we're seeing what a (indiscernible)
22 zero-emission landscape looks like now. And by -- there's --
23 it's really initiated a lot of dialog between BMW and
24 stakeholders in like, how do we get there faster.

25 So thanks to that question from Monahan, this morning

1 right. Previously, right? What's it taking to accelerate
2 it? I think that COVID-19 has pushed that a fair amount.

3 MS. OGDEN: Yeah. Interesting.

4 Jerome, did you want to add anything on this -- on
5 this one?

6 MR. GREGEOIS: Sure. One -- one sentence, I guess.
7 Short term, if we just look at the sales of the vehicles,
8 overall we've observed, you know, like for any brand, things
9 are a little down since the beginning of the year and it
10 seems like maybe electrified vehicles may be a little more
11 affected, but we'll have to see how that trend evolves.

12 But I'd say that's for the short term. For the long
13 term, we're looking at 2030, and then the strategy that I
14 mentioned before. I don't think that this has changed the
15 direction.

16 MS. OGDEN: Okay, thank you.

17 Let's move on to another question. I wanted to get
18 your thoughts on what is California's role in scaling up the
19 industry? In particular, what benefits regarding state
20 action in the light-duty fuel cell market. What's
21 California's role in helping catalyze that market?

22 Anybody want to go first?

23 MS. BIRDSALL: I feel like I already spoke to it
24 several times from the light-duty infrastructure perspective.
25 So I'd like to maybe give Monterey a chance.

1 MS. OGDEN: Okay, Monterey.

2 MR. GARDINER: Yeah. I may be a broken record here
3 and don't know if this is entirely BMWs perspective. But I
4 think it's incredibly important, the investment from the
5 state in these early stations, and like maturing the
6 technology, making sure the codes and standards are there.
7 But moving to the next stage, right. What do we do in the
8 next coming years? We really need that investment. I think
9 there's various bills working it through the legislature and,
10 right, this discussion of like how do we connect
11 electrolyzers to the grid? How do we make that officially
12 part of the conversation between CEC, the CPUC, and ARB? And
13 like recognizing that electrolyzers have a role in
14 accelerating, yeah, renewable energy by forcing it to be a
15 direct connection to where that renewable energy is located.
16 Really puts a roadblock to the scale that's needed.

17 And we take that one step further, we need large
18 scale local faction and, right. Take a hard look at
19 California. Why did that have to happen in Nevada, right? A
20 few miles from the border. And what does it take to do large
21 scale storage that's needed connecting, right, the
22 electrolyzers and that mixed capacity factor to a liquefier.
23 And I think, Joan, you know about it as much as that of any
24 of the panelists here.

25 MS. OGDEN: Thank you, Monterey.

1 Jonathan or Jerome, did you want to talk about
2 California's role in the scale up?

3 MR. GRECEOIS: Sure. I think -- yeah, I think from
4 my perspective, California's still looked at the leader in
5 deploying new technology. And, you know, we're talking about
6 California today but, you know, seen from Korea, California
7 and, you know, is on the West Coast of the U.S. and so
8 there's, I'm sure, perception that what's happening in
9 California has the potential to spread in a larger market.
10 And that that market is still the largest economy on the
11 planet.

12 And so there's a -- there's a strong signal coming
13 from California to every other market, even though there's a
14 lot of Nexo's in Korea, you know if there were a sense that
15 California was changing its mind, it may be considered maybe
16 the U.S. is changing its -- its position. And so there's a
17 strong -- a strong element, you know, when you're the leader,
18 people look at you, even though they may can sometimes
19 surpass your -- your market, they still look at you as the
20 place where it all started and as a place that has the good
21 model for corporation between the different members.

22 So for me it's, you know, it's keystone is what's
23 happening in California.

24 MS. OGDEN: This links to maybe the next question.
25 Maybe I'll jump to this one, too, which is a little bit more

1 about global trends with the deployment of SEDs and how is
2 what's going on in California compare to other regions, let's
3 say Germany, Japan, Korea, China. I'd be curious to get your
4 take on how people are doing things differently, how
5 California's doing it. Compare it, maybe contrast with other
6 parts of the global market.

7 So let's see, Monterey, do you want to take the
8 European perspective here on that?

9 MR. GARDINER: Sure. One of the really smart things
10 that happened early on with the National Organization of
11 (indiscernible) but the (indiscernible) organization that's
12 like helping manage those government funds and investments is
13 really making an agreement with auto manufacturers, we're
14 going to put in a certain number of stations and it's up to
15 you to fill up those stations which we'll define that next
16 step.

17 And I think that's similar to where California is
18 now. But I find that very frank discussion between industry
19 and government to make sure the rollout happens hand in hand.

20 And so there's a lot of discussion should light-duty
21 vehicles be part of this hydrogen strategy that was released
22 last week. And like to recognize those are part of it but
23 it's not just vehicles, it's also heavy duty, it's also
24 greening of aviation fuels and like can legally get to this
25 cost competitiveness of electrolyzers replacing natural gas.

1 All of those topics are on the table (indiscernible)
2 and I think we'll see a lot of advancement here in the next
3 few years.

4 MS. OGDEN: Yeah. Anyone else like to weigh in on
5 this? Because we have lot of parts --

6 MS. BIRDSALL: Yeah, sure.

7 MS. OGDEN: Yeah.

8 MS. BIRDSALL: So, you know, in Japan obviously
9 there's, you know, a lot of support for hydrogen. We've
10 invested \$300 million into the -- although the big switch
11 will unfortunately be postponed. But to demonstrate the
12 vision of hydrogen, right, how we can have a hydrogen
13 society.

14 I think California and actually I'm glad that I can
15 kind of loop back to the previous question. Because I think
16 California has done some practical things that are really
17 brilliant and are leading the rest of the world. And those
18 are, you know, the HRI credits for the LCFS. Even the
19 language that goes into contracts for the hydrogen stations
20 for the GFO. Right? Making them available 24/7 to our
21 customers. These things aren't available in Japan, the
22 stations aren't available 24/7.

23 So there's some real practical learnings from
24 California that we think could be applied to the rest of the
25 world. Even metrology. I think California was the first to

1 make hydrogen a retail motor fuel. So there's all, again,
2 these little nuance details that are something that should be
3 shared learnings worldwide and they are currently kind of a
4 differentiation point between what's happening in California
5 and what's happening in Japan.

6 MS. OGDEN: Yeah, interesting.

7 Jonathan or Jerome, do you want to comment on sort of
8 California compared to other parts of the world?

9 MR. PALACIOS-AVILA: Yeah, I think I can comment a
10 little bit to the point. Not too familiar with other global
11 industries going on but I know that California really is the
12 market beater in things that are being demonstrated here with
13 kind of a statewide rollout of hydrogen fueling stations,
14 renewable hydrogen production, and I think California is the
15 first state in the U.S. to really have a hydrogen fuel cell
16 shareability program that is focused on serving, you know,
17 Southern California community.

18 So I really can't speak to the global side on what's
19 going on but I know I've seen similar projects in Europe. I
20 don't know how well those performed. But I know that without
21 California's commitment to develop in the infrastructure,
22 some of these projects in commuting would not be possible in
23 the fuel cell.

24 MS. OGDEN: Hmm-hmm, yeah.

25 Jerome?

1 MR. GREGEOIS: Yeah, I'll just make a comment I guess
2 along the line of what Jonathan mentioned. I think the
3 California market, although it's, you know, relatively small
4 market, it's still more mature than other markets. And, you
5 know, although maybe there's as many or close to as many
6 Nexo's as fuel cells you would have in California versus
7 Korea, I think the mechanism to get to \$5.3 per kilogram may
8 be challenge, maybe over time as the models are scaling up.

9 And I think, you know, in California and in the U.S.,
10 people will have a more -- people will have an eye on it
11 needs to become a market that will sustain itself at some
12 point. And so what we put in motion right now is always with
13 the perspective of, you know, competition and the best
14 benefit for everyone in the end.

15 And I think in that dimension, maybe California is
16 the only market where you can find all three vehicles
17 currently available and then diversity providers of stations.
18 And you're not going to find that in Korea as much, I'm not
19 sure about Japan. But, you know, that competition and market
20 spirit is definitely more alive here.

21 MS. OGDEN: Thanks. I'd like to kind of change gears
22 here in the next question and talk a little about
23 considerations of equity, of social justice equity in the
24 deployment of fuel cell vehicles.

25 And maybe, Jonathan, I'll ask you to kick this one

1 off. Can you discuss a little about that?

2 MR. PALACIOS-AVILA: Yeah, definitely. I think -- I
3 think initially when you look at -- you just take a look at a
4 CalEnviro score, EnviroScreen process and you kind of see
5 where disadvantaged communities are and that is based on
6 income demographics and environmental and pollutants.

7 The Inland Empire ranks highly among that group of
8 individuals and air quality but has the least amount of
9 hydrogen stations. So what we wanted to do was really impact
10 that by deploying a fleet of vehicles within the surrounding
11 area to help reduce those air quality.

12 And secondly, you know, our plant is based within
13 this Inland Empire region that is going to provide fuel to
14 zero-emission -- or hydrogen stations and provide fuel cell
15 zero-emission vehicles. So we're looking at really if we can
16 deploy more stations and vehicles in these areas, then that
17 can spawn more growth and I think really cross the border of
18 focusing more on the higher demographic communities such as
19 coastal areas and things like that.

20 MS. OGEN: Very interesting.

21 Let's see, Jackie would you like to say anything,
22 too, do you have anything for us?

23 MS. BIRDSALL: Sure. This is fun to do via Zoom. I
24 don't want to step on anyone's toes so I'm just waiting to
25 see if I get picked.

1 So, yeah, I mean, environmental equity, right? It's
2 about making zero-emission vehicles accessible to everyone.
3 And for that, that, you know, that's why Toyota has pursuit
4 of portfolio approach so that our customers can choose the
5 zero-emission vehicle that suits their lifestyle.

6 So I mean, for me, I've lived in L.A. for eight years
7 now. For half of that I didn't even have a designated
8 parking spot. Right? So plugging in for me was not an
9 option, for many people it is. That's fine. But when we
10 talk about serving everyone and everyone having access to
11 this technology, that means that we need to make all these
12 technologies available.

13 And if you go a station, like I have one just down
14 the road from my apartment now and you see a vehicle fill one
15 after another after another, it makes so much sense, again,
16 for those people that are in highly urbanized areas that
17 don't have the luxury of going into a garage and charging
18 overnight.

19 So, yeah, I think that the environmental equity is
20 incredibly important. I think as we see economies of scale
21 go up and the price of both battery electric and fuel cell
22 electrics go down, it's going to become more affordable and
23 we need to make sure all those options are on the table.

24 MS. OGDEN: Okay. Monterey, do you want to give us
25 some thoughts on the equity in the fuel cell?

1 MR. GARDINER: Sure, of course, I'll take a stab at
2 that.

3 Like for BMW, the equity is fundamental for any of
4 these zero-emission vehicle strategies. For BMW, there's no
5 difference between whether it's a battery electric vehicle or
6 fuel cell electric vehicle. It has to be part of the
7 conversation.

8 Right now in the fuel cell technology, it's still
9 expensive and so we are planning on implementing that in our
10 premium vehicles. But at the same time, we just launched a
11 premium electric vehicle that can be below \$19,000 new from
12 the dealer. It's a mini electric, if you take the stock
13 incentives, it can reach that. So like making sure the codes
14 or incentives are available and like there's no difference
15 you're going to see in disparity likely, federal level. It's
16 not something that California to deal with but that we did
17 lose the federal tax credit for a bit and that again impact
18 how decisions are made.

19 So equity is important but making sure the incentives
20 are across the board for any of the zero-emission vehicles.

21 MS. OGDEN: Yeah.

22 And Jerome?

23 MR. GREGEOIS: Sure. Yeah, I think, you know, the
24 technology of the fuel cell is still young and is obviously,
25 you know, not fully at scale so it's still kind of expensive

1 and not as accessible as it could be. I think that's why
2 OEMs in general not only Hyundai participate in subsidizing the
3 fuel. And, you know, for us it's \$13,000. It's probably
4 what you will spend over three years if you drive like an
5 average Californian. And I think that at least five
6 (indiscernible) so very, very competitive. You know, our
7 vehicles, it's 3.99, you can find cheaper than that.

8 It's not quite as cost effective as some of our
9 hybrid technologies that have been there for a longer period
10 of time and are made of, you know, larger volume. But that's
11 one way that we can contribute to expose as many people as we
12 can.

13 And also we've had, you know, vehicles engage in the
14 various car sharing activities which is maybe the ultimate
15 low-cost transportation if you don't have a need to have a
16 private vehicle for your lifestyle. And, you know, in that
17 regard, you know, fuel cell or other technologies would be --
18 would be equal there. But that's how we can try to strength
19 technology as much as we can in our community.

20 MS. OGDEN: Thanks. I think we've still got a few
21 minutes left here so I'm going to throw out a question now
22 which we touched on earlier in one of the earlier panels, the
23 previous one on heavy duty which are what are your thoughts
24 of light-duty vehicles interacting with heavy-duty vehicles
25 at the refueling infrastructure stage?

1 So let's see, maybe Jackie, can you kick that one
2 off?

3 MS. BIRDSALL: Yeah. Absolutely. So I think, you
4 know, in urbanized area again and, you know, a lot of the CEC
5 GFO awards that go to these retail hydrogen stations, there
6 are colocated hydrogen dispensers at gasoline stations in
7 urban areas.

8 For the most part that means heavy-duty trucks can't
9 even fit under the canopy, right? So as far as colocation of
10 heavy-duty with light-duty dispensers in urban areas, I'm
11 struggling to see that as a foreseeable option. But when we
12 talk about major thoroughfares and, you know, like rest stops
13 that you see along major corridors, it absolutely makes sense
14 where there's the footprint to allow for it to, again,
15 capitalize on that investment.

16 That said also a point that we alluded to earlier,
17 there is a synergistic development of the two technologies.
18 Light-duty vehicles drive up the scale, the production of the
19 fuel cell stacks themselves which drive down the cost. Heavy
20 duty provides the throughput, there's a lot of hydrogen that
21 these trucks are going to go through. And that'll, you know,
22 incentivize new players into the hydrogen space and drive
23 down the cost of the fuel.

24 So there's a large synergistic approach. But as far
25 as if you're referring to colocation of dispensers in urban

1 areas, that could be a little difficult.

2 MS. OGDEN: Okay. Anyone else? Some thoughts maybe
3 in some other geographies of where -- how heavy duty and
4 light duty might interact on the infrastructure side?

5 You can raise hand if you want to speak.

6 Okay. Jerome.

7 MR. GREGOIS: Yeah, I'd think I'd say the, you know,
8 if you compare fuel cell, you know, hydrogen is somewhat
9 similar to the gasoline experience, that's kind of the idea
10 to have something that's as fluid. And there's not a lot of
11 shared, you know, gasoline between heavy duty and light duty
12 today. And we could argue why but it's just not there.

13 But I think for stations that are connected to
14 stations, for instance if you're driving from L.A. to San
15 Francisco and here's a station that on the weekend may see a
16 higher demand than during the week or not, it may have a
17 lower demand at some point. If you have a local heavy duty
18 also market for that, that could be a combination because
19 you're now more traveling and it's not your experience.

20 And there's a great example, you know, in between
21 L.A. and San Francisco where you can even your
22 (indiscernible) if you wanted to, you know, you can
23 (indiscernible) you want at that location. And it's a large
24 footprint, it's very pleasant. But there is a, you know,
25 refueling station for trucks nearby my office and I don't see

1 myself maneuvering there. It's more intimidating when you're
2 there than when you think about it as when we're in a Zoom
3 experience or in a meeting room. It's a different
4 experience. But for connector stations, definitely I think
5 it would make more sense to have that kind of setup.

6 MS. OGDEN: Yeah. Okay.

7 Okay, Monterey.

8 MR. GARDINER: Yeah, I can't say much more than
9 what's already been said about connector stations and how
10 difficult it is in central business districts. It's hard
11 enough putting hydrogen refueling stations (indiscernible) in
12 trucks. Anybody who has been in San Francisco at lunch time
13 knows the challenges.

14 That being said, I think we are missing opportunities
15 when we look at the scale throughput in the scale production.
16 And I understand that each agency has their jurisdiction, but
17 where there's opportunities to allow incentives for large-
18 scale production with the liberty of hydrogen and backup
19 (indiscernible) we needed for the light-duty infrastructure
20 for back-up supply, that there really needs to be a hard look
21 by the CEC to find intelligent ways with policy to support
22 both and really drive down the cost in the production side.

23 MS. OGDEN: Okay. Thanks.

24 Well, I think we're getting to the end of our time
25 for my part of the panel now for this part of the Q&A. And

1 we're going to -- we're going to move now.

2 So maybe I'll ask Jonathan to set up with the Zoom
3 Q&A and sort of take over. And it's through some of the top
4 questions that the attendees have been submitting.

5 So I'm going to end my part of the panel now. And
6 Jonathan, ready to turn it over to you.

7 MR. BOBADILLA: Thank you.

8 So this question is for the other Jonathan. The
9 question from Raoul. He said, would -- sorry, it got
10 moved -- it got shuffled. Have you considered deploying the
11 Mirai lease returned vehicles that are on the market for
12 under \$20,000 including a fuel card?

13 MR. PALACIOS-AVILA: Yes. So I think that's -- what
14 we've looked at we've been in the StratosShare program. You
15 know, we've looked at the possibility of incorporating, you
16 know, off-lease vehicles and new vehicles into our service.
17 We do include fuel with every rental that is available, fuel
18 maintenance insurance amongst other things. So I think the
19 fuel card would be great but I know that we haven't really
20 discussed that in much detail with the OEMs for including
21 that. But we have looked at off-lease fuel cell vehicles as
22 being incorporated into the StratosShare program.

23 MR. BOBADILLA: Great. Thank you.

24 And then Glenn Rambach asked: Are there any
25 meaningful efforts within the OEMs to move away from CapEx

1 and OpEx costs related to 1,000 bar compression for station
2 as well as vehicle storage and the negative 40 CF chilling
3 for fast fueling?

4 And that's open to the panel.

5 MR. GREGOEOIS: Well, you know, it depends how you
6 want to quality what a meaningful life that is. But I think
7 if you look at the history of fuel cell vehicles maybe in the
8 2000s we had applications with 350 bar and then that moved to
9 700 bar for the following generation. And the direct benefit
10 of that is basically twice the range.

11 Obviously there is additional costs with the
12 compression on the storage side, but it's also what brings
13 the great benefit of fuel cell over maybe all the technology
14 of long range and the ability to refuel quickly a larger
15 amount of energy.

16 So I think all the light duty going to -- going
17 backward would first not necessarily be compatible with the
18 next -- the current generation of space deployed and the next
19 one coming. Not all of them are capable of 350 and then you
20 lose the benefit of that long range which is maybe allowing
21 you to reach in only once a week or twice a month.

22 MR. GARDINER: This is Monterey.

23 BWM doesn't make stations and we don't have
24 significant number of cars out there but it's pretty clear
25 that 700 bar is make the direction for the vehicle that's

1 going worldwide for passenger cars and decided took a stab at
2 some alternatives but it didn't pan out.

3 That being said, I think there are a few very small
4 players are looking at potentially much lower costs
5 technologies that could support maybe a lower pressure fuel,
6 no communication than cooling. That being said, it may not
7 be entirely compatible with some of the existing OEMs but I
8 would really like to see additional dialog with these new
9 states that are maybe not ZEV mandate states or in between to
10 find this alternative where, okay, it's not a full 700 bar
11 fueling but if it could be a fraction of the cost, maybe
12 there's a connector station or a small rural area that could
13 benefit this.

14 MS. BIRDSALL: Yeah, and to Jerome's point, really
15 the strength of the fuel cell vehicles come in the range and
16 the quick refueling time. So for us, 700 bar, 10,000 psi
17 will be the next generation Mirai, the 2021 Mirai will
18 incorporate and we expect that to be filled with minus 40 CF
19 fueling allowing for the three- to five-minute fueling target
20 time for our customers. So for us, that is the future.

21 MR. BOBADILLA: Thank you. And we have a question
22 from Geoffrey Budd.

23 He says hello and the question is for Jerome.

24 Thank you for your great summary of Hyundai's
25 progressive activities and deployment of SCEVs. If at all

1 possible, can you provide any information on the adoption of
2 fuel cell power trains for Hyundai's heavy-duty applications
3 in the U.S.? Many thanks. Geoff Budd.

4 MR. GREGEOIS: Geoff, thank you for question. I can
5 almost answer the entire question except the last three
6 words, in the U.S. So I'll just mention that there's efforts
7 from Hyundai in the heavy-duty field and currently the one
8 program ongoing was announced last year and is ongoing is in
9 Switzerland where there's a total of 1,600 trucks that will
10 be deployed I think until 2024. And so that's what we --
11 we're working on.

12 The initial power train on those trucks that are
13 Class 8 or equivalent Class 8 for Europe is largely inspired
14 by the technology of the Nexo but that will evolve also over
15 time.

16 And we, you know, had people in the U.S. recently
17 to -- from our commercial division to look at eventually
18 (indiscernible). This was before COVID so they are now back
19 to Korea. And that's as far as I can go on that topic.

20 MR. BOBADILLA: Thank you.

21 And question from Raoul. Would the automakers please
22 comment on the potential for plug-in hybrid fuel cell
23 vehicles; i.e., plug-in battery electric plus a fuel cell
24 system that would take over when the battery is depleted?

25 MS. BIRDSALL: From Toyota's perspective, I mean

1 technically that's feasible, right? It comes down to cost
2 and weight and really what the customer usage case is.

3 So if we can demonstrate a customer with 2021 Mirai,
4 for example, you can fill in less than five minutes and get
5 over 400 miles of range, it seems kind of unnecessary to also
6 be able to plug in. And then again you'll have to account
7 for a larger battery, additional weight for reduction in your
8 fuel economy attributed to the additional weight of the
9 battery.

10 So there is a crossover there where you need to do
11 some engineering calculations to figure out where that makes
12 sense from a cost and complexity standpoint.

13 MR. GARDINER: This is Monterey --

14 MS. BIRDSALL: Sorry if I stepped on your toes,
15 Monterey.

16 MR. GARDINER: Oh, no, that's fine. I'm happy you
17 jumped into it. I was only going to say that like
18 (indiscernible) has tried that in the past and like they're
19 both expensive technology is more than existing. So trying
20 to shoehorn two different storage technologies into a vehicle
21 is quite difficult. Right? It may make sense sometime in
22 the distant future but for now, really the focus is just on
23 hydrogen fuel cell vehicle.

24 There is a small battery (indiscernible) kilowatt
25 hours for bootstrapping in very cold weather and you might

1 see that change, right, if you look out to very, very low
2 cost batteries and low-cost fuel cell but in different
3 configuration that evolve. There may be more space and
4 flexibility in some of the buses and heavy duty. And if we
5 are seeing weather change, more droughts, there may be an
6 interest in having mobile tower more accessible.

7 So I don't think it's going to happen now but the
8 idea of maybe you could just plug it at home and go in the
9 future, that's probably very distant future.

10 MR. BOBADILLA: Great. Question from an anonymous
11 attendee. Well over 90 percent of Californians drive on
12 gasoline. What steps are the panelists and their companies
13 taking to inform these Californians that driving on zero-
14 emissions hydrogen fuel vehicles is even an option?

15 And that question is open to anybody that wants to
16 take it.

17 MR. GREGEOIS: I guess I'll get started.

18 I think there's a fair amount of effort to promote
19 the technology. You know, incredibly even though we're --
20 most the people in this call are familiar with hydrogen,
21 there are a lot of people who are completely not aware. And,
22 you know, one reason for that I think is the amount of
23 efforts that everybody's putting in, you know, putting other
24 types of technology on the market. Or that marketing money
25 is going towards vehicles that are solely market volume today

1 than the fuel cell just because of how many vehicles we can
2 put on the market or what's our production capacity.

3 But if you imagine the world where we withstand, for
4 instance, at Hyundai as much money promoting the Nexo as we
5 would maybe promoting the Palisade or Aconia or Santa Fe, we
6 would have a long line of unsatisfied customers looking for
7 Nexo's and the lucky ones, you know, may be struggling to
8 actually have a good experience after that as they're trying
9 to refuel because we're saturating the market as we're trying
10 to grow both infrastructure and market at the same time.

11 With that said, yes, I think there's a lot of people
12 who are not familiar with the technology, not familiar with
13 the OEMs that are promoting that technology. But there's
14 enough, I think, right now that are aware in order to be able
15 place as many vehicles as we can with the current structure
16 of the market.

17 MS. BIRDSALL: I think the first thing Toyota did was
18 launch the Prius and that was, you know, to get the customer
19 used to the idea of having a large battery and then an
20 electrified power train as part of their daily driving habit.
21 And now we have over 10 million of them, I believe.

22 And now as we're moving towards fully electric zero-
23 emission vehicles, we are similar to Jerome's point doing
24 targeted campaigning around where the vehicle is available
25 based on the dealerships that are trained to sell and service

1 the Mirai as well as where the hydrogen infrastructure is
2 available.

3 Again, the last thing we'd want to do is market the
4 Mirai to a customer that has no hydrogen dispenser available
5 to them and then have them asking for a vehicle that they
6 couldn't drive. So hopefully if you live in one of our
7 market areas, you've actually seen one of our ads. And if
8 not, we'll probably have to go back and talk to our marketing
9 group about what they're doing wrong there.

10 MR. PALACIOS-AVILA: Yeah, I'd like to add something
11 too.

12 So I think, you know, after being a CEC recipient of
13 a few grants, you know, public outreach is part of the grant
14 requirement. So what we do is when we go into communities,
15 we really do market heavily by partnering with the cities
16 themselves. You know, sometimes nonprofits in the area
17 that's supposed to have a good community presence.

18 And additionally what we do, too, is we educate, we
19 have some education on hydrogen fuel cells on our website and
20 we also kind of have what we call a welcome kit. When you
21 come into your rental, it's just a pamphlet that explains a
22 little bit about the California Energy Commission, the
23 funding that it was used for. It explains it's a hydrogen
24 car and it also has links, web links to our website as well
25 that show you how to refuel a car and the process behind it

1 and how much percentage of renewable hydrogen is within the
2 stations.

3 So education is really large and I think a lot of the
4 demographics that we attract as part of that. Otherwise,
5 would it really know what a hydrogen car is unless you're
6 looking, you're very environmental friendly, you're looking
7 to drive -- looking for a zero-emission vehicle to drive,
8 then you would know.

9 But if you're just looking to get from Point A to
10 Point B in a vehicle, I think that's the group that we're
11 really educating. And I think it's opening doors to new
12 possibilities and new markets for the OEMs to really look at.
13 And that's data that we're collecting now. And I'm excited
14 to see kind of where that data could go over the next, you
15 know, 12 months.

16 MR. GARDINER: This is Monterey.

17 I would just mention three quick points. I think
18 what StratosFuel is going is incredibly important. Of kind
19 of consumer studies I've seen like without having experience
20 in an electric vehicle. You don't know what's available,
21 right, for Davis has done some studies showing like they've
22 tripled, doubled the number of charging stations in
23 California and it hasn't changed their opinion. Right? If
24 you can't see the chargers because you don't know about them,
25 you don't know to ask.

1 And the second point I'd like to make, a couple of
2 years ago, the fuel pump partnership put out their 2018
3 vision document. And they showed a succinct plan, right,
4 between heavy duty, light duty to reach (indiscernible)
5 stations in California by 2030. They could reach something
6 like 97 percent of disadvantaged communities and over 90
7 percent of Californians.

8 But we need that widespread infrastructure to have
9 the confidence and be able to do widespread marketing that
10 these vehicles are available. As Jackie succinctly put it,
11 it's really hard. We don't want to make unhappy customers,
12 so we really need infrastructure to be accelerated.

13 MR. BOBADILLA: Excellent.

14 And we have the last question from Travis Andren.
15 Have any of the panelists or their companies successfully
16 receive VW mitigation funding, specifically funds managed by
17 Electrify America?

18 A follow up to that. Do the panelists' organizations
19 play an active role in state by state representation of fuel
20 cell electric vehicles within legislation, state coalition,
21 and other educational efforts?

22 And that's open to the panel.

23 MR. GARDINER: So BMW's not pursuing the funds. I
24 would say that like periodically and next week there's open
25 webinar for public input. And I think we're going to be

1 listening to see what's happening, but to make sure that
2 hydrogen is still on their radar. As was mentioned some of
3 their challenges with gee, this is an investment and that
4 likely they need to be conservative where those funds are.

5 The second thing I mentioned in terms of the
6 northeast, they're starting a new program within a like
7 decarbonization and transportation and valuing that. So
8 BMW's monitoring those efforts and looking at how fast that
9 can happen. There's other challenges to refueling stations
10 in the northeast but we're monitoring the progress in these
11 different states looking at the role out of the mandates as
12 it accelerates through the U.S. And it's just a matter of
13 finding out what is the right time to jump in.

14 MR. BOBADILLA: All right. Thank you very much,
15 panel.

16 Heather, give it back to you.

17 MR. RAITT: Great. Thank you so much, Jonathan. And
18 thank you panelists for that excellent discussion.

19 So now we're going to move on to public comment part
20 of this workshop. And RoseMary Avalos from the Public
21 Advisor Office is here to walk us through that.

22 And -- but I will just say just a reminder, if you'd
23 like to make public comments, go ahead and use the raise hand
24 function on Zoom. And if you're on the phone and you'd like
25 to make comments, press star 9 and that'll let us know.

1 And so go ahead, RoseMary. Thank you.

2 MS. AVALOS: Thank you, Heather.

3 This first -- I would like to first call on attendees
4 using the raised hand on the Zoom. And please state your
5 name and affiliation for the record. And you could please
6 remember to spell your first and last name after you're
7 unmuted and before you begin commenting.

8 And also, please do not speak on a speaker phone
9 feature when talking because we won't be able to hear you
10 clearly.

11 All right. Christian Peeples, go ahead. You are
12 unmuted.

13 MR. PEEPLES: Good afternoon. My name is Chris
14 Peeples, C-H-R-I-S, P-E-E-P-L-E-S, and I'm an elected at-
15 large director of the Alameda-Contra Costa Transit District,
16 and I'm a banana slug rather than an Aggie.

17 We have been running fuel cell buses for a little
18 under 20 years. In fact, we inherited our first fuel cell
19 bus from SunLine almost 20 years ago. And have accumulated
20 millions of miles and millions of passenger boardings and
21 have basically proved that this technology, at least in the
22 40,000-pound class, works very well and is quite durable.

23 We would really like to thank the CEC because when we
24 built out our fueling station in our Emeryville division,
25 they provided us funding so that Emeryville provided one of

1 the very early light-duty 10,000 psi hydrogen fueling
2 stations in the Bay Area.

3 We've approved a program and gotten pieces of it
4 funded through CARB to do a comparison between 30 fuel cell
5 electric buses, 30 battery electric buses, 30 diesel electric
6 buses, and 30 straight diesel buses. And we hope that that
7 will provide a lot of information for CARB and CEC and NREL
8 to verify some of their modeling with actual on the street
9 work.

10 What's really important for us now, we're convinced
11 that this is the way to go and that any fleet, any large
12 fleet is going to be a mixed fleet with both battery and fuel
13 cell electric.

14 But it's particularly important to get more fuel cell
15 vehicles out there so that the fuel cell market gets more
16 mature. I mean, as Jaimie pointed out, we get our hydrogen
17 from Southern California. Orange County gets their hydrogen
18 from Northern California. That's the way we've got to do it
19 now. But on the long-term, that doesn't make sense.

20 We make some of our own, we make some of it with
21 solar power and some of it using bloom boxes that use natural
22 gas. But in an urban area, we really believe that the -- we
23 don't refine our own diesel so we buy hydrogen in liquid
24 form.

25 So the more that can be done to roll out hydrogen

1 and get the hydrogen economy more mature, and thus lower the
2 price of hydrogen, I think that's extremely important as
3 things move along.

4 But anyway, Commissioners Monahan and Douglas, thank
5 you for your attention today and for your interest in this.
6 Former Commissioner Peterman actually was at the kickoff of
7 our Emeryville station.

8 Thank you.

9 MS. AVALOS: Thank you, Mr. Peeples.

10 We'll move on to Nico Bouwkamp. You're unmuted. And
11 please spell your first and last name.

12 MR. BOUWKAMP: Can you hear me?

13 MS. AVALOS: Yes.

14 MR. BOUWKAMP: Okay. So my name is Nico Bouwkamp,
15 I'm with the California Fuel Cell Partnership and the staff
16 fleet for heavy-duty fuel cell battery vehicle activities.
17 My first and last name is spelled as follows: N-I-C-O; last
18 name, B-O-U-W-K-A-M-P.

19 Good afternoon, Commissioner Monahan, Commissioner
20 Douglas, and moderators and panelists. Thank you for
21 recognizing these specific market status update workshops and
22 opportunity to provide public comments.

23 We know you CEC commissioners are very busy and
24 you're also working together with staff on the IEPR 2020
25 update. And you plan to provide a complete overview of the

1 ZEV market status and include both fuel cell vehicle and
2 battery electric vehicle technology.

3 For the base of -- for the purpose of this update, I
4 just want to emphasize and add the following points to the
5 excellent overview provided by the panelists of both panels
6 this afternoon. So in addition to continued support of
7 light-duty hydrogen infrastructure investments, there is a
8 need for balance investments and heavy-duty ZEV fueling
9 infrastructure, heavy-duty hydrogen fueling and fast
10 charging. Also, there's a need for an emphasis on both
11 heavy-duty and light-duty vehicles in the IEPR vision.

12 Next point, with regards to comments made about
13 redundancy early in the panel -- earlier this afternoon, this
14 applies both to the fueling infrastructure location, but
15 definitely also to production and distribution. So
16 include -- so inclusion of both renewable gas-based and
17 renewable electricity-based source is important.

18 Although, James Kast of Toyota mentioned use of fuel
19 cell vehicles, fuel cells, and many applications. And, Jack,
20 your reference a little bit as well heavy, heavy-duty off-
21 roads was not mentioned such as Anglo American is doing with
22 applying fuel cells in mining trucks. It's an area that's
23 maybe mentioned as well on the reports.

24 With regard to IEPR policy recommendation, currently
25 there's a need for an overarching hydrogen strategy for

1 California, something along the lines of what the Hydrogen
2 Council has published for the U.S. overall.

3 Also question with regard to the IEPR, could this
4 document also include recommendations with regards or
5 consideration for recommendations with regards to heavy-duty
6 hydrogen fast fueling technology development and testing such
7 as CEC is doing to its best fit individual funding programs
8 for vehicle charging. And also establishing heavy-duty HRI
9 and FRI LCFS credits to encourage large capacity and high
10 performance heavy-duty ZEV fueling infrastructure investments
11 by private industry which will also encourage increase
12 investment of renewable resource for the fuel.

13 And finally, I don't want to forget about our other
14 CFCP industry members. Aside from all those that have
15 already participated in the panels today, Cummins and
16 Hydrogenics, Iwatani. Then also the folks that provide fuel
17 and vehicles, Ballard, Linde, Praxair, New Flyer, important
18 for the bus market, as well as BAE and NEL for the hydrogen
19 production. And AC Transit is the other bus operator in the
20 state aside -- in addition to SunLine.

21 Thank you for your attention.

22 MS. AVALOS: Thank you, Mr. Bouwkamp.

23 Next public commenter, Travis Andren. You're
24 unmuted. Thank you.

25 MR. ANDREN: Thank you very much. My name is Travis

1 Andren; T-R-A-V-I-S, A-N-D-R-E-N, I represent D3 Designs,
2 Inc., as well as Seedling, LLC.

3 First of all I'd like to thank each and every one of
4 the panelists today from both the heavy-duty sector as well
5 as the consumer sector. Your efforts are -- and due
6 diligence are greatly appreciated across this country and
7 within the entire industry.

8 My comment today is in response to a topic that was
9 first brought up in the heavy-duty sector and echo through
10 Jackie Birdsall's comments in regards to fuel cell electric
11 vehicles being recognized as zero-emission vehicles as
12 compared to BEV or battery electric vehicles.

13 Across this country, we are seeing legislation in
14 multiple states. The prioritize is BEV infrastructure as
15 well as applications and funding for both over fuel cell
16 electric and hydrogen infrastructure and application funding
17 programs. If at all, recognizing fuel cell and hydrogen as a
18 zero-emissions vehicle technology. These legislations are
19 being supported by state electric vehicle coalitions, Public
20 Utility Commissions, and independent public providers all in
21 partnership with BEV automotive and infrastructure companies
22 such as Tesla and ChargePoint.

23 My comment today is a call of action to both the CEC
24 as well as CARB who is not on this call. As the legislative
25 opponents to the Volkswagen settlement, calling for the

1 funding management by Electrify America, you are the
2 representing body who maintains the order and the
3 responsibility that Electrify America distribute these funds
4 equally or at least market appropriately. Thus far, through
5 Cycle 1 and Cycle 2, Electrify America has been prioritizing
6 all BEV funding excluding fuel cell and hydrogen electric
7 infrastructure and applications.

8 As goes California, goes the rest of the country. We
9 are seeing misinformation happening across this country and
10 we need California to step up with industry partners to make
11 sure this funding is being handled appropriately and that
12 these BEV participants are no longer using public utilities
13 to drive their own agenda and manipulate markets and
14 disinform consumers.

15 Thank you very much.

16 MS. AVALOS: Thank you, Mr. Andren.

17 Next public commenter Kevin Maggay. You're unmuted.

18 MR. MAGGAY: Hi, can you guys hear me okay?

19 MS. AVALOS: Yes.

20 MR. MAGGAY: Hi, thank you. First off, thanks to the
21 CEC for holding these workshops today, this has been great.
22 This has been really informative and timely, especially after
23 the adoption of the gasoline trucks regulation by CARB.
24 First at the beginning of the meeting, hydrogen was kind of
25 branded as the other zero-emission technology. I would urge

1 everyone to rebrand it as the long-range fast fuel low
2 (indiscernible) impact zero-emission technology. There are
3 so many inherent advantages of hydrogen, many of which have
4 been stated already but I think they still get overlooked,
5 unfortunately.

6 I agree with the statement made earlier that there
7 should be parity in how zero-emission technology is treated.
8 A few weeks ago there was a zero-emission market trend
9 workshop, and then today we had the hydrogen market trend
10 workshop. They should be one in the same.

11 And market signals like that matter. A number of
12 state agencies put very high value on market signals, even
13 more so than things like actual emission reductions. One of
14 those market signals is the CEC is proposing to remove all
15 the funding for low-carbon fuel production supply in the
16 Clean Transportation Program for the upcoming 2020-2021
17 fiscal year. And this would be funding that could be used
18 for low-carbon hydrogen. Talked this morning about the
19 potential for ag and food waste for low-carbon hydrogen which
20 this probably could fund.

21 This being proposed to be zeroed out, I think this
22 sends a negative signal to the market. And I'm concerned
23 that some signals being sent out are not are completely
24 technology neutral. But even with that said, I think that
25 CEC has done a good job supporting hydrogen and trying to

1 create certainty in the market by putting future funding into
2 the fold with the current solicitations. And that kind of
3 certainty is gravely needed.

4 Looking forward, I think that it would be detrimental
5 to the market if the CEC were to every pull or consider
6 pulling some of those dedicated funds if we reach some of the
7 targets like 100 retail stations. So I think that's
8 certainty and strong where market signals CEC would be
9 beneficial.

10 Thank you.

11 MS. AVALOS: Thank you, Mr. Maggay.

12 I'd like to remind the folks on the phone that if
13 you -- you can use the star 9 dial -- dial star 9 and raise
14 your hand and star 6 to mute and unmute.

15 All right. Thank you. And we'll go on to the next
16 public commenter, William Zobel. Go ahead, your line is
17 unmute.

18 MR. ZOBEL: Yes, good afternoon, hope you can all
19 hear me. My name is Bill --

20 MS. AVALOS: Yes.

21 MR. ZOBEL: -- Zobel, B-I-L-L, Z-O-B-E-L.

22 I'm the executed director of the California Hydrogen
23 Business Council, glad to be here. Appreciated the panels
24 this afternoon, they were very informative and do appreciate
25 the CEC support in this area.

1 We would note from both panels this afternoon that
2 scale was mentioned more than once and it's the key to
3 unlocking some of the broader benefits and lowering the cost
4 of broader hydrogen deployment.

5 Several panelists mentioned the importance of the
6 light-duty sector. The scale that is available on that
7 market, the advancements that have been made in that market,
8 and including those in the international standards area. All
9 seem to agree that the two markets, light duty and heavy duty
10 complement one another. We could not agree more with that
11 and that scaling both markets simultaneously will expedite
12 the benefits of fuel for everyone.

13 All this gets back to one important theme discussed
14 on this morning's panel where speakers there were calling for
15 regulatory certainty to facilitate investment. Those
16 comments were again reiterated on this afternoon's panel that
17 we would make note of those as well.

18 In that regard AB-8 was also mentioned on this
19 afternoon's panel. We would note that CARB recognized the
20 importance of extending AB-8's funds beyond the 2023 sunset
21 date in its recent SB-498 report. This recommendation is in
22 line with holding the goals of the governor's zero-emission
23 vehicle Execute Order. And we urge the CEC to join this call
24 for extension of AB-8 funds in its recommendation in this
25 IEPR update.

1 The notion of, you know, what are the international
2 markets doing was discussed quite a bit on this afternoon's
3 panel, both in Asia and in Europe. We would point out that
4 recent announcements made by the EU and specifically Germany
5 committing to spend 9 billion Euros on research investment on
6 the hydrogen economy is noteworthy. This very recent and
7 compelling example were clear and consistent policy signals
8 support the business case which will spur investment and
9 allow markets to grow to scale and mature.

10 This all takes us back really to where Dr. Wang
11 started us off this morning from Bloomberg New Energy Finance
12 on her first panel providing a compelling information and
13 making it clear that we can unlock tremendous benefits with
14 scale, innovation, and investment which can only be initiated
15 by clear and consistent public policy.

16 In closing, the Council urges the Energy Commission
17 to include in the IEPR update programs with clear and
18 consistent policy that helps scale the hydrogen market so the
19 state can meet its decarbonization goals.

20 Thank you.

21 MS. AVALOS: Thank you, Mr. Zobel.

22 Our next public commenter is David Park. Go ahead,
23 your line is unmuted.

24 MR. PARK: Good afternoon, Commissioner Monahan,
25 Commissioner Douglas, online hosts. Thank you very much for

1 having me. My name is David Park, last name P-A-R-K. And I
2 am the California Fuel Cell Partnership industry liaison for
3 the light-duty manufacturers and infrastructure development
4 members.

5 And I'd just like to continue my comment from this
6 morning. To echo the -- this panel's comments, the world is
7 looking to California for guidance on carbon reduction. We
8 emphasize the road to achieving the ZEV tipping point that
9 Dr. Leighty this morning pointed to will require the state
10 and the world to enable all mechanisms to lower this hurdle
11 across all ZEV platforms.

12 I'd like to emphasize the theme of consistent policy
13 signals that was just discussed by Mr. Zobel and the panel
14 this morning. We cannot put more emphasis on the fact that
15 California needs to provide clear market signals to the
16 investment community. That will alleviate the perception of
17 risk in investing in the ZEV marketplace.

18 We point to as an example to a recent occurrence
19 which was Governor Brown's executive order to achieve 200
20 fueling stations by 2025 and 5 million ZEV by 2030. This
21 would achieve a tipping point but -- and that was a massive
22 positive signal to industry that their investment decisions
23 in fuel cell electric vehicles were well made.

24 However, when that order was not backed up by
25 funding, this created massive uncertainty within the fuel

1 cell electric vehicle manufacturing sector. We feel that the
2 Energy Commission is that organization that can provide those
3 clear policy signals and we look forward to our continued
4 partnership in creating a healthy economic marketplace to
5 support this emerging zero-emission vehicle ecosystem.

6 Thank you.

7 MS. AVALOS: Thank you, Mr. Park.

8 Are there any other comments? Please raise your
9 hand. You can -- if you are on the phone, you dial star 9 to
10 raise your hand and star 6 to mute and unmute.

11 Okay. We have a raised hand on the phone. 9-1-0, go
12 ahead and speak.

13 MR. RENAUD: Yes, thank you. Yeah, this is Raoul
14 Renaud; R-A-O-U-L, R-E-N-A-U-D.

15 I drive a fuel cell vehicle, I've been driving one
16 for three years. I think -- I've been listening today and
17 all day and I think this is a terrific day and very
18 informative.

19 If I've heard kind of a theme, it's risk. So let me
20 just address that briefly. The state of California has taken
21 a risk in seeing if fuel cell transportation can work. And
22 so we've built some stations and vehicles have come in and I
23 think you'd have to say that it worked. The -- if you want
24 to call it an experiment, I think the result would have to be
25 called a success. We've seen that the vehicles themselves

1 are fine. The fueling experience is comparable to that of
2 gasoline. And if you ask consumers who are driving gasoline
3 vehicles why don't you switch to hydrogen vehicle, the only
4 reason that you ever hear from anybody is well, there aren't
5 enough stations.

6 So I'd just like to encourage the state to continue
7 with this. You've taken that first big risk, I think that
8 risk has paid off, and I think it's entirely appropriate,
9 acceptable, and sensible to continue -- to continue forward
10 on this project, continue the investment, encourage
11 investment from private industry, work with -- work globally
12 to build out the fueling network to the point where
13 widespread adoption can take place. I think you can feel
14 quite certain that it will take place once the fueling
15 network is on its way.

16 So thanks again for putting out all this information.
17 Very much appreciate it.

18 MS. AVALOS: Thank you, Raoul.

19 And we'll go on to commenter Mikhael. You're
20 unmuted.

21 MR. SKVARLA: Thank you. My name's Mikhael Skvarla.
22 Mikhael is M-I-K-H-A-E-L; Skvarla is S-K-V-A-R-L-A, on behalf
23 of the California Hydrogen Coalition.

24 And I'll follow up with comments so that I can close
25 this out briefly. We appreciate discussion today and wanted

1 to reiterate some of the comments we heard from other folks
2 today.

3 As Kevin indicated, I think this separation of fuel
4 cells from the zero-emission vehicle I've heard -- hearing.
5 In the future, I think, you know, as we talk about light
6 duty, we should talk (indiscernible, unstable Internet
7 connection) and zero-emission vehicles both fuel cell and
8 battery in the same context. These are complementary
9 technologies in many ways but the fuel cells excel in certain
10 categories and as consumers make their use cases, we will see
11 how things develop.

12 And we also heard the underpinnings of infrastructure
13 is really what (indiscernible, unstable Internet connection)
14 deeper penetration (indiscernible, unstable Internet
15 connection) based community. Any effort to get, you know,
16 complete the GFO and get those funding out the door
17 (indiscernible, unstable Internet connection) HIR credits.

18 Also California has some of the most aggressive and
19 binding climate targets in the world. We don't have a chance
20 to wait for global markets to develop just as we didn't have
21 the chance to let global markets develop for the adoption of
22 renewables. And I think yesterday we saw Mary Nichols and
23 former CEC commissioners tweeting about how successful that
24 was with 90 percent of yesterday's electricity coming from
25 zero carbon sources.

1 And I think it's important that we underline, you
2 know, the develop of hydrogen in the same context that we
3 underline the development of wind and solar in California and
4 that we continue to send those strong market signals for
5 investment in state to help us achieve the 5 million zero-
6 emission vehicles that are needed in order to achieve our
7 goals as well as our carbon neutrality goals by 2045. The
8 infrastructure's agnostic with the function pathway and
9 indeed carbonize over time. So it's important to get that in
10 the ground so that we get the vehicles and further
11 decarbonize fuel source.

12 So we're very excited to hear all of this today and
13 the global announcements this week from our kind of climate
14 partners internationally and we hope that we can continue to
15 work on sending the substantial signals that are needed to
16 drive hydrogen infrastructures to decarbonize on this
17 economy.

18 Thank you.

19 MS. AVALOS: Thank you, Mikhael.

20 At this time, we have no further public comment.

21 I'll hand over the meeting to Heather.

22 MS. RAITT: Thank you, RoseMary.

23 So really just Commissioner Monahan, if you have --
24 or Commissioner Douglas if you have any closing remarks, I'm
25 all done.

1 Thank you so much.

2 COMMISSIONER MONAHAN: Just want to thank everybody
3 for participating, we've had a really interesting day.

4 And just a reminder to wear masks, stay safe. And --
5 yeah, it's been a really, you know, great day in terms of
6 talking about how we need to move to zero-emission
7 transportation and the role of hydrogen and fuel cells in
8 that future. And now we know as we go forth, we just need to
9 make sure that we are staying safe and doing all we can to
10 help bend the curve and get California on a good trajectory
11 again.

12 So thanks, everybody.

13 (Thereupon, the Hearing was adjourned at 4:43 p.m.)

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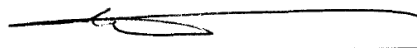
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IN WITNESS WHEREOF, I have hereunto set my hand this 29th day of September, 2020.



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