TOYOTA

TOYOTA MOTOR NORTH AMERICA, INC.
Product Regulatory Affairs
325 Seventh Street, NW #1000 Washington, DC 20004

February 28, 2020

To: Transportation and Climate Initiative (TCI) Leadership and Participating Jurisdictions

Re: Draft Memorandum of Understanding of the Transportation and Climate Initiative, December 17, 2019 (Draft TCI MOU)

Toyota Motor North America, Inc. (Toyota) appreciates the opportunity to provide our comments regarding the Draft TCI MOU. We support the leadership of the Northeast & Mid-Atlantic states, and the District of Columbia (the TCI Jurisdictions) that are contemplating the Draft TCI MOU, and the TCI Jurisdictions' officials that are working to develop this Draft TCI MOU to reduce greenhouse gas emissions from the transportation sector.

Transportation plays a significant role in facilitating the economy and improving the lives of everyone on this planet. As one of the world's largest full-line automakers, we recognize that we have a leading role to play in developing and offering sustainable mobility solutions. We have several comments to the Draft TCI MOU but in order to put those comments into context it is important to understand Toyota's overall approach to future powertrains and the need to consider the consumer in the overall strategy. We hope this background and context will help make our comments more clear.

TOYOTA ENVIRONMENTAL CHALLENGE 2050

In October 2015, Toyota developed the Toyota Environmental Challenge 2050, which comprises six challenges: By 2050, (1) Reduce CO_2 emissions from new vehicles by 90 percent from 2010 levels, (2) Eliminate CO_2 emissions in our supply chain and at our dealers, (3) Eliminate CO_2 emissions from our operations, (4) Protect water resources, (5) Support a recycling-based society, and (6) Operate in harmony with nature.[1]

As a progressive stepping stone, in 2019, Toyota announced that by 2025, (1) every model in the Toyota and Lexus lineup will be either zero-emission (battery electric vehicle (BEV) or fuel cell electric vehicle (FCEV)) or have an electrified option; and, (2) 50% of global sales – roughly 5.5 million vehicles per year – will be electrified, including one million zero-emission vehicles (ZEV).[2]

Toyota is committed to vehicle electrification and has been researching and developing electrified powertrains since the early 1990s. This commitment produced the 1997

[1] https://global.toyota/en/sustainability/esg/challenge2050/
[2] https://global.toyota/en/newsroom/corporate/28419929.html

launch of the pioneering Prius, Toyota's first mass-market hybrid electric vehicle (hybrid), and the 2014 launch of the trailblazing Mirai, Toyota's first mass-market FCEV. To date, Toyota has sold over 14.3 million electrified vehicles globally, and helped reduce over 100 million tons of vehicle CO_2 emissions. Here in the U.S., since 2008 we've sold over 3.6 million hybrids, which has saved more than 7.6 billion gallons of fuel and prevented 68 million tons of CO_2 from entering the atmosphere. Currently, 11% of our sales consist of electrified vehicles—that's three times the industry average. We sell more electrified vehicles than the rest of the industry combined. We are also leaders in zero-emission technologies, such as hydrogen fuel cells, and have made huge strides in the development of next-generation batteries, such as solid-state batteries, which will power tomorrow's cars. And to further promote the widespread adoption of electrified vehicles, Toyota has announced that it will grant royalty-free licenses on nearly 24,000 patents it holds (including some pending applications) for vehicle electrification-related technologies.[3]

MEETING CONSUMERS' NEEDS – A PORTFOLIO APPROACH TO ELECTRIFICATION

The introduction of new technologies presents daunting challenges for retail and commercial consumers and consumer adoption. The purchase of a new vehicle represents a significant investment of both money and time for consumers. The selection of a vehicle is intensely personal as consumers factor in branding, where it's made, safety, image, utility, durability, range, fueling, cold-weather performance, economics, all-wheel drive, car vs. SUV, re-sale value, and, of course, environmental attributes. In addition, commercial, fleet, and heavy-duty customers place emphasis on having the right tool for the job (recognizing there are many jobs or duty cycles), minimizing downtime, and optimizing total cost of ownership. Consumers see the benefits of an electrified future but require more confidence to improve their comfort level with the technology before they make that investment.

Toyota is engaged in developing technologies for existing conventional-engine vehicles, as well as developing technologies for and promoting the widespread use of electrified vehicles. No matter how environmentally friendly a car is, it cannot contribute to reducing the environmental burden unless it is widely used. We recognize that the infrastructure, energy policies, consumer preferences, and natural environments that vehicles operate in vary from region to region and from state to state. As a result, we promote the widespread use of environmentally-friendly vehicles by taking a portfolio approach and offering consumers a wide range of choices. These include hybrids, plug-in hybrid electric vehicles (PHEVs), BEVs, and FCEVs.

Hybrids – Recognizing that not every consumer has convenient access to zero-emission vehicle charging or fueling infrastructure, Toyota has expanded its hybrid powertrain offering beyond the Prius to other Toyota and Lexus vehicles, including the Toyota Corolla, Camry, Avalon, RAV4, and Highlander; and the Lexus ES, UX, NX, RX, LS,

[3] https://pressroom.toyota.com/toyota-promotes-global-vehicle-electrification-by-providing-nearly-24-thousand-licenses-royalty-free/

and LC. Toyota expects hybrids to play a role in helping TCI Jurisdictions achieve their goals of reducing carbon emissions from the transportation sector.

A fully-fueled 2020 Camry hybrid (51 mpg city / 53 mpg highway), with a range of 686 miles[4], can travel from Portland, ME, to Richmond, VA, through all the TCI states, without needing to stop for gas. Toyota's top-selling 2020 RAV4 hybrid (41 mpg city / 38 mpg highway), which costs consumers $850 more than the non-hybrid version[5], has a range of 580 miles[6], which will allow it to travel from Portland, ME, to Washington, DC, without needing to stop for gas.

Toyota recently announced that the all-new 2020 Highlander, a 3-row SUV, will offer a hybrid option that will have a best-in-class mpg with a manufacturer-estimated 36 combined mpg, and a 3,500 lb. towing capacity, for an additional $1,400.[7]

And there's more to come. We believe hybrids serve consumers in all areas of the TCI Jurisdictions, including its cities and more rural areas.

PHEVs – Toyota introduced plug-in hybrid technology with the Prius Prime in 2012, and today, it makes up 30% of total Prius sales. We think plug-in hybrid technology will make a great option for consumers transitioning from hybrids to full battery or fuel cell electric. Consumers can rely on the battery until it is depleted, and they don't have to stop and charge because the internal combustion engine kicks in. In October 2019, Toyota announced the RAV4 Prime, a plug-in hybrid version of our RAV4 SUV. The RAV4 Prime will be a model year 2021, comes with standard all-wheel drive, and be available in the summer of 2020. It is estimated to have an all-electric range of 39 miles, 302 horsepower, and a 0-60 time of 5.8 seconds, making it the second quickest in Toyota's lineup behind the Supra.

BEVs – Toyota recently announced plans to offer more than 10 BEV models globally by the first half of the 2020s. Starting with a rollout in China in 2020, these vehicles will be available to other countries to meet market demands. Right now, BEVs make up just over 1% of the entire North American market. Toyota believes there is potential for more growth over the next 10 years as anticipated improvements in vehicle range and charging times, availability of charging stations, and reductions in costs materialize. Toyota is developing partnerships with battery manufacturers, global research universities, suppliers, and other automakers to facilitate innovation and make these vehicles affordable.

FCEVs – We believe that FCEVs have the potential to be the powertrain for the next 100 years and are committed to the global deployment of these innovative, safe, reliable, scalable, and efficient ZEVs. In October 2019, Toyota revealed the next generation

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[4] https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=42016
[5] https://s3.amazonaws.com/toyota-cms-media/wp-content/uploads/2019/10/2019-2020-Toyota-Pricing-MASTER-10.18.19.pdf
[6] https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=42187
[7] https://pressroom.toyota.com/toyotas-fourth-generation-2020-highlander-redesigned-from-the-ground-up/

Mirai[8], which will be a sleek, mid-sized, four-door, five-passenger sedan. The next generation Mirai is expected to have a range of 400 miles and a refueling time of less than five minutes.

FCEVs like the Mirai perform well in a variety of climates. Compared to other zero-emission powertrains, fuel cell electric powertrains aren't susceptible to problems associated with cold weather such as start-up, charging/fueling, power, and range. The current generation Mirai fuel cell stack is designed to perform at temperatures down to -22°F and achieves full power in less than a minute.

FCEVs get their fuel from a distributed network of fueling stations, like gasoline vehicles do today. Drivers can fill up in less than five minutes and travel approximately 400 miles on a full tank. This makes ZEVs accessible to more consumers like those that do not have the access or the ability to install a home-based electric vehicle charging system – these include customers living in apartments, rentals, and high-density urban environments. Despite the higher cost of construction, hydrogen fueling stations can provide significantly more vehicle fueling per hour than a Level 3 electric vehicle charging station, which, if used frequently, can degrade the battery of a BEV[9]. Hydrogen fueling stations can easily be built to refuel multiple vehicles at one time. What's more: hydrogen fueling infrastructure does not require significant investment in power or natural gas infrastructure, is not as real estate-intensive since a single hydrogen dispenser can support over 300 cars and provides current convenience-store owners and gas station operators with an opportunity to participate in the clean-energy transformation.

Since the Mirai's introduction in 2015, California's retail hydrogen fueling infrastructure has grown from single digits to nearly 40, allowing for the sale of more than 6,000 Mirai. Together with FCEVs from Honda, Hyundai, and Mercedes, there are nearly 8,000 FCEVs on the road in California. California is well on its way to establishing a robust hydrogen infrastructure. In addition, the governments of China, Germany, and South Korea have taken significant steps to promote the purchase of FCEVs (from forklifts to passenger cars to buses and trains) and the development of hydrogen fueling stations. We believe the TCI Jurisdictions are positioned to lead the expansion of this new clean technology to the east coast of the U.S.

The largest constraining factor facing widespread FCEV adoption is the lack of hydrogen fueling infrastructure. In the Northeast, to mitigate this initial hurdle, Toyota is working with Air Liquide to develop a network of 12 hydrogen fueling stations[10]. However, 12 stations in a region as diverse and populous as the TCI Jurisdictions will not be enough.

One very significant attribute of fuel cell electric powertrains is its scalability. Fuel cell electric powertrains provide the flexibility and capability to cover more demanding use cases such as buses, ferries[11], medium-duty vehicles, heavy-duty class 8 tractors[12],

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[8] https://global.toyota/en/newsroom/toyota/29933463.html
[9] https://www.geotab.com/blog/ev-battery-health/
[10] https://www.toyota.com/usa/environmentreport/carbon.html
[11] https://ggzeromarine.com/projects/
[12] https://global.toyota/en/newsroom/corporate/24582088.html

ground support equipment, cargo handling equipment, utility tractor rigs[13], fork trucks, and even rail[14] and ships. Fuel cell electric powertrains scale advantageously to longer ranges, quicker fueling, better packaging, heavier cargo capacities, higher infrastructure throughput, and more profitable uptime allowing for a more favorable overall total cost of ownership. The greater the mobility need, the more benefits FCEVs bring.

Hydrogen fueling infrastructure can also be more economic to scale to medium- and heavy-duty consumption levels due to leveraging of industrial hydrogen availability and freedom from grid constraints.

While some see the tremendous potential for fuel cell electric in medium- and heavy-duty commercial applications, and ask why fuel cell is needed for light duty, we want to point to a synergistic relationship that exists between fuel cell for light duty and fuel cell for heavy duty. Heavy duty vehicles drive high levels of continuous consumption of hydrogen allowing for the scaling of fueling infrastructure and bringing down the cost of fuel, while light-duty vehicles drive high volumes of manufacturing of fuel cell electric powertrains, bringing down the cost of the powertrain. Having both will provide for greater reductions in cost and greenhouse gases.

COMMENTS TO THE DRAFT TCI MOU

Representatives from Toyota have attended nearly all the public workshops and webinars hosted by the TCI Jurisdictions. Below are our comments specific to the Draft TCI MOU.

Electrified vehicle purchase rebates – TCI Jurisdictions should consider investing proceeds into BEV and FCEV rebates that support the purchase of these vehicles. The cost of these advanced technologies remains high and is a barrier for purchase. Recognizing that consumers may be hesitant to purchase a BEV or FCEV due to consumer preference or lack of comfort with the available charging or fueling infrastructure, the TCI Jurisdictions should also consider supporting all forms of electrified vehicles, including hybrids and PHEVs as a facilitating step towards consumers' consideration and widespread adoption of all electrified vehicles. Hybrids are widely available today in a variety of sizes and drivetrain configurations (2WD and AWD), meet the needs of many different types of consumers, and don't require the TCI Jurisdictions to invest in charging or fueling infrastructure.

ZEV purchase rebate policy uniformity and administration: a potential point of "shared priority" – We appreciate the flexibility that the Draft TCI MOU affords in allowing each TCI Jurisdiction to determine investment proceeds. However, we suggest that ZEV purchase rebates and administration be a point of shared priority. A standard, predictable, and regional policy may allow financial institutions to participate and remove friction in the administration of the rebate program (for example, a financial institution may front a rebate to consumers (for a fee)), which would be of benefit for those who

[13] https://pressroom.toyota.com/toyota-and-fenix-demonstrate-first-hydrogen-fuel-cell-electric-utr/
[14] https://www.alstom.com/our-solutions/rolling-stock/coradia-ilint-worlds-1st-hydrogen-powered-train

could apply the rebate to the purchase of the vehicle vs. having to wait weeks / months to receive the rebate check from each TCI Jurisdiction.

ZEV Charging Infrastructure – TCI Jurisdictions should consider investing proceeds into BEV charging and FCEV fueling infrastructure. Toyota acknowledges that states have historically not played a role in supporting the development of gasoline and diesel fueling stations and that the TCI Jurisdictions may wonder why they need to play a role now. However, the charging and fueling infrastructure required to support these advanced technologies are still in early stage and not yet prevalent. Station grants would facilitate the proliferation of fueling points, which would provide comfort to consumers to adopt a new technology, drive scale, and bring down the cost of fuel. Toyota recognizes that there is already some momentum around charging infrastructure for PHEVs and BEVs. However, it is critical to also support the deployment of fuel cell powertrains considering their unique advantages for certain retail and commercial consumers. In addition: hydrogen has the potential to provide energy storage and electricity grid augmentation, does not require significant investment in power or natural gas infrastructure, is not as real estate-intensive since a single hydrogen dispenser can support over 300 cars, and provides current convenience-store owners and gas station operators with an opportunity to participate in the clean energy transformation.

Funding support for commercial ZEVs and pilot projects – TCI Jurisdictions should consider funding into commercial ZEV pilot projects. Electrification of medium- or heavy-duty transport, i.e., Class 8 drayage, and related charging / fueling remain challenging and tend to have higher initial costs. Furthermore, commercial vehicles tend to produce significant quantities of greenhouse gas, NOx, and fine particulate emissions, and operate in environmental justice communities. Grant-funded pilot projects would allow participants and stake-holders put skin in the game to develop the appropriate technologies and business models.

CLOSING

Toyota supports the work of the TCI Jurisdictions to create a holistic, market-based, program to reduce greenhouse gases from the transportation sector and raise revenue for investing in GHG reductions. We appreciate the opportunity to comment on the Draft TCI MOU and look forward to our continued conversations with the TCI Jurisdictions to refine and move this program towards implementation.

Sincerely,

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