

**Transcript of Investor Briefing on Batteries and Carbon Neutrality**  
**(Q&A Session with Overseas Investors and Analysts)**

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Participants	Masahiko Maeda, CTO, Masamichi Okada, CPO, Kenta Kon, CFO, Keiji Kaita, President of CN Advanced Engineering Development Center

**Q. I appreciate the presentation about long service life of lithium battery. Do you have any sort of program to recycle the battery because regulation cannot be avoided for a while. I understand Nissan, for instance, launched joint venture called 4R Energy that focus on recycling LEAF's battery. And I was wondering if you have that kind of program in the future?**

A. Masahiko Maeda, CTO:

First of all, Toyota has more than 20 years of history in selling hybrid electrified vehicles. When Toyota thinks about the recycling, reuse, or rebuilding of batteries, we need to think on how to recollect those batteries.

And so as I said, Toyota has more than 20 years of history selling hybrids. However, currently, Toyota has not been able to collect so much of the batteries that have been sold.

When we talk about extending, having a longer service life of batteries, this will also mean that the life of the vehicles will become longer as well. Therefore, when we think about in longing the life of the battery, at the same time, we'll have to think of how to establish a system to collect those batteries.

Currently, we do not have a detailed plan in order to do this. However, for example, we can think about a lease program where the electrified vehicles can be more proactively used for leasing and then consider the batteries or the vehicles that is leased to be returned and collected in Toyota.

Also in Japan, there is a recycling law for home appliances. And, therefore, this kind of an approach of having an enforced law, for now, it's about the electrical appliances, but creating such a similar system for the batteries may be one option to consider.

In addition to considering about how to create a system to collect and recover the batteries that we have sold, at the same time I think it is important to consider a design approach as well, about designing the vehicle structure so that the recycling or collection of the batteries will become easier in the future.

**Q. Do you have any charging station initiatives? That would be another very important strategy.**

A. Masahiko Maeda, CTO:

Currently, in Toyota, we do not have our own unique plan to create a large-scale charging station

ourselves. On the other hand, for Toyota, we do have many dealers that work with us and cooperate with us trying to contribute in achieving the carbon-neutrality targets.

Working together with dealers, at least in Japan, we have started initiatives to work on establishing the charging station infrastructure in Japan. Therefore, in the future, when we see that the electrified vehicles are much more popularized in society, I think the next key point for us is to work with dealers and think about how we can expand this network of charging stations.

And I think that there is another important point when we think about the charging stations. Probably, when you think about your own experience, if you visited the gasoline station, you probably never have experienced of not being able to fill up your car with gas.

That similar experience needs to be replicated with the charging stations as well. In other words, we should avoid a situation where our customers visit a charging station, but are not able to charge their vehicles. How to set up an environment that will allow the users to always be able to charge the cars, charge the vehicles will be a challenge or an important thing that we must think about.

To give you an example, there has been cases in Japan where at the charging station, the customer was not able to use their credit card for the payment. Since it didn't match this payment system, they were not able to charge their vehicle. There has been actual experiences with the customer where the charging station and the vehicle's charging function did not match well and therefore, the customer was not able to have their car charged.

When we work with dealers about setting up the charging stations, we will need to take care of these issues and be able to provide the services that will be not having these kinds of issues.

**Q. You mentioned a decrease battery cost by 50% by 2025. Can you please give some color of where you see your current battery cost?**

A. Keiji Kaita, President of CN Advanced Engineering Development Center:

We will launch an electrical vehicle, bZ4X, next year and the battery cost will be reduced 40% from the battery that applied to C-HR/IZOA/UX EV, the electrical vehicle we launched last year. And then, from that electrical vehicles, bZ4X, maybe in the latter part of 2020, we will reduce the battery cost to at most 50%. And maybe the 50% is accomplished maybe both of the improvement of reducing the drag or maybe rolling force of the vehicle, but also the battery cost itself. Mainly, the battery cost is coming from the material improvement and maybe a structural improvement, including the battery cell and battery pack.

**Q. Out of the JPY1.5 trillion, you plan to spend on batteries by 2030, how much will be allocated to all-solid-state batteries?**

A. Masahiko Maeda, CTO:

Well, I think your question was about how much of this total investment will be allocated to all-solid-state battery. My answer is that we have not decided a clear level or clear number for such allocation at the moment.

Out of JPY1.5 trillion, JPY500 billion is an investment for development, but this is not only for all-solid-state battery, but it also includes the investments for the development for the next-generation liquid type lithium-ion batteries, too.

When we go through the development, of course, for some material development, there are separate development uniquely for all-solid-state batteries or lithium-ion batteries and also liquid batteries, respectively. However, there are some common development elements too.

This year, in July, in Japan, we launched a model change version of Aqua, which is a hybrid car. This car carries a new type of bipolar battery. And this was developed jointly together with Toyota Industry Corporation.

Please understand this JPY500 billion would include some of such joint development with companies within Toyota Group. There will be some joint development within the Group or there will be some unique development by each company. And through such ways, we would like to pursue efficient development process.

**Q. Regarding the JPY1.5 trillion investment in batteries, could you give us a breakdown by region? Given United States, NAFTA, and local content rules, what is your outlook for US investment? I think most of your batteries are made like in China with CATL and also Pan Pacific with Panasonic in Japan. But are there plans to build batteries in the United States? And then also in China, what is your expectations for battery production?**

A. Masamichi Okada, CPO:

Toyota's plan is to make a JPY1.5 trillion investment until up to 2030 globally for the production lines. And for the production lines dedicated for BEVs, we are thinking of adding 70 lines.

And to elaborate, to talk about the production plans for each region, first of all, Toyota will have our in-house group companies that we work with to create plans for the production. And as it was included in the presentation of Maeda-san, we have also many partner companies that we will be working with to create a supply plan in each region. These plans are being discussed with these companies.

Basically, our policy is to do local production and local consumption. Following this policy, regardless of the region, whether it is US, China, or Europe, we will take the same approach of local same way of thinking, local production, local consumption.

In any case, towards 2030, Toyota will be proactively developing our supply of electrified vehicles. And for the batteries that will be supplied for these vehicles, we will be working with this approach or concept that I have said, local production, local consumption, and this will cover the material procurement and also the setting of additional production lines too. We will be proactively engaged in these development activities with our partners.

**Q. Regarding chip shortages today, it seems as though I know Toyota has been talking about recovering in production with the chip shortages. But is your EV strategy being delayed at all because of inability to source materials such as wire harnesses and the semiconductors?**

A. Masamichi Okada, CPO:

Here, we have been able to build a trust-based relationship throughout long years with our suppliers. Therefore, even though we are under a very tough situation, we have been able to keep the impact of the chip shortage issues small up to this day.

However, saying that, of course, there are limits in the supply capacity as well. There will be some impact to Toyota as well. However, also for this issue, we are working closely with our suppliers in order to stabilize the supply situation as quickly as possible. That will be the basic direction that we are working on.

However, in addition to the chip shortage that has happened originally, in addition to that, we are now seeing the impact coming from the spread of COVID-19 in the Asian regions. This is an impact that is caused to the total auto industry. Therefore, we will continue to work with our partners for these issues as well in order to recover the situation.

**Q. You are expecting 200 GWh this time, but previously, this used to be 180 GWh. But your BEV target assumption has actually not changed. In terms of raising the battery capacity target, can you just elaborate what kind of assumption has changed, whether that's regional mix or just general underlying assumption?**

A. Masamichi Okada, CPO:

We announced 180 GWh at the time of May. And after that, we made a more detailed discussion based upon the situational changes in many regions, including the United States. And in order to supply 2 million units of BEVs and FCEVs and also 8 million units of electrified vehicles in total, if we want to be sure to deliver these units, we thought that we would need a larger volume of batteries. Based upon these numbers, we thought that 200 GWh will be necessary.

We do expect that these kind of changes will occur also in the future. There will be some changes in the regulation and the legal status of the electrified vehicles in each region. Also customer needs and infrastructure status would change as well in the future.

We did say that our baseline would be 2 million of BEVs and FCEVs and also 8 million of electrical vehicles in total. But these also, they could change. And also the allocation to each region also might change. We would need to flex cater to those changes in order to speedily deliver those units to customers.

**Q. Regarding CapEx intensity, JPY7.5 billion per GWh is fairly low compared to what peers have announced and also when we think only JPY1 trillion of that is from production capacity. It seems very efficient. Does it mean that you guys are pushing a lot more JV format going forward? Can you just elaborate on that high efficiency and whether that is sustainable?**

A. Masamichi Okada, CPO:

We pursue what's called small base units. Base unit means the production volume for each line or investment amounts per each line or the staff involved working in each line as well as the lead time to create each production line. We call those things base units, and we try as much as possible to minimize these base units.

Toyota has been making cars based upon this concept. And this concept has also been applied to the production lines of hybrid or the battery lines of hybrid, which we've been producing in the past 20 years. I think this will be connected and relevant also in the electrification, which will be bigger in the future.

This initiative will be applied to the in-house line of Toyota and Toyota Group, but also, we'll be working with the partner companies who are the experts of battery making. And they have their original strengths. By collaborating with these partner companies and also by exhibiting each other's strengths, we would like to improve each other's capability so that we can come up with more competitive batteries and more competitive cost.

**Q. There are 2 aspects from the presentation that I just wanted to touch on. One was where you said that the energy situation and infrastructure of each region will continue to change. And the second one soon after, that Toyota is aiming for the fundamental widespread acceptance of ever better electrified vehicles. What role Toyota sees for itself in terms of responsible advocacy and lobbying in order to make those conditions a reality?**

A. Kenta Kon, CFO:

For Toyota, we have explained that we are going to proactively work to be able to supply BEVs further in the future. Especially in Japan, we are a leading company in the automobile industry. Therefore, because of this position, we think that we have a big responsibility in working to promote BEVs.

In addition to that, we conduct business in all parts of the region globally. Therefore, in each region, according to the situation that each region has, we think that we need to take the appropriate measures for each region toward carbon neutrality and also to reduce CO2 in that region. That will be also a necessary initiative for us to take.

At the end, for carbon-neutrality targets, one maker like us will not be able to achieve those targets alone. We think it's important that we play our own role and then there are things that the national government needs to do. Also, there will be some of the contributions from the consumer side. Everyone in each of their positions will take their actions. And I think at the end, it will all combine together. In that sense, we will have responsibility to play our role.

Finally, you did mention about the lobbying activities for Toyota. In spring, we have made a commitment that we will disclose our lobbying activities plans or report for this fiscal year. And therefore, we are now preparing that disclosure or that report. That will be all for my response.

A. Masahiko Maeda, CTO:

I would like to make some additional comments from the technical side.

We did talk about different regions having different energy situations. To give you one example, for Brazil in Latin America, the bioethanol carbon-neutral fuel is already commercialized and used.

For these kinds of regions, for us OEMs, it will be important to prepare and develop the technology so that we will be able to adapt to the bioethanol fuels and also further to commercialize that. Toyota has already been taking initiatives in this direction.

On the other hand, for these types of carbon-neutral biofuels, I also understand that in Europe, there is the biodiesel that maybe not has penetrated too much yet, but I understand that the biodiesel has started to be introduced to the market.

In China, there is also an active movement of utilizing hydrogen. Hydrogen for the fuel cell commercial vehicles. There is a movement to introduce these types of hydrogen fuels to commercial vehicles already.

And even in the world of races, sport car races, there are movements to introduce the e-fuels to racing cars as well. For Toyota, we have started to use the hydrogen engine in Japan for these racing cars.

Therefore, I believe that while we place BEVs at the core of what we promote, in addition to that, we'll need to carefully watch the energy situation and the infrastructure situation of each country and be able to prepare and provide products, specific products to meet the individual needs. That will be important for us to do. Toyota will be working on development projects to be able to do that and also to deal with these different situations.

**Q. Can you quantify the degree of performance improvement of the bipolar nickel-hydride battery versus the previous nickel-hydride battery? When was this new battery used in other HEVs?**

A. Keiji Kaita, President of CN Advanced Engineering Development Center:

The nickel bipolar compared with the existing current nickel metal hybrid battery, the performance increased up to twice. Regarding the release date of next HEV, after Aqua, which is equipping this new battery, is delicate question so hard to say. However, probably very soon, maybe next year or the year after next.

**Q. When did the first hybrid using the all-solid-state battery appear? I understand the all-solid-state battery could appear in hybrid before BEV.**

A. Keiji Kaita, President of CN Advanced Engineering Development Center:

As we promised probably several years ago, the all-solid-state battery will be equipped on hybrid in early 2020. As we explained today, the performance of the all-solid-state is very good, it charges and discharges very fast, so good for the HEV battery. We will discuss to use the all-solid-state battery for both HEV and BEV.

**Q. Regarding the JPY1.5 trillion investment on the battery plants, roughly what percent of battery cell economics will Toyota have on the 200 GWh by 2030?**

A. Masamichi Okada, CPO:

The JPY1.5 trillion investment include the development and production facilities, also the dedicated investment needed for hybrids and plug-ins. Therefore, it's quite difficult to respond to your question about per GWh investment.

If I can explain a little about our approach to this investment. For Toyota, our plan is to secure 200 GWh of battery capacity by 2030. And in doing so, we would like to make this investment as compact as possible, to make it competitive as possible, and also work in parallel, the 50% reduction for the battery cost as well. Approaching this investment from these various factors, we would like to make the per GWh investment small as possible. This will be the approach.

**Q. What percent ownership will Toyota have on the battery cell? Because you have 50% JV with Panasonic. I understand Toyota will have 51% economics of battery sales. With future partnerships you're going to have on the 200 GWh, how much ownership will Toyota have?**

A. Masamichi Okada, CPO:

First of all, for the group companies of Toyota, we do have a joint venture with Panasonic. We are working also with our partner group companies to set up these production lines for the batteries. When we talk about the capital expenditures, the investments to set up these lines for the battery production, basically, the carmakers, we will be bearing the investment that is necessary to set up these lines.

Therefore, for the lines that we have invested in to construct and set up, at the end, it will be owned by Toyota.

**Q. Please tell us about the patent. Who ends up owning the patent on these battery investments? Because many of your partners also have partnerships with other auto producers. And they also have similar target of 50% cost reduction on battery cells. I just wonder, is it the battery company that owns the patent and they just share it with everybody in the industry? Or does Toyota have the patent? And is there any way we can gain some technological edge with this investment?**

A. Keiji Kaita, President of CN Advanced Engineering Development Center:

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This is some of the matrix. We are doing the test for the lithium-ion battery. At first, in order to run the lithium-ion battery, there are various kind of situation for the battery because maybe for sensing the situation with the battery, we only can know the temperature or voltage and the electrical current. That is maybe very similar to that where we are judging the health condition of the people by the temperature and blood pressure and heartbeat. It's very important to make the model for each part of the large cross-section of the battery electrodes. And we have more than 10,000 channels to test the battery.

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This is a kind of the analysis or the development means that we are taking. Maybe from the 7 nano meter like maybe the atom scale analysis to the very large-scale analysis, we are doing in order to visualize that. This kind of experiment is, I think, taken by most of the major battery suppliers. But exclusively, we are measuring and developing the image and methods by ourselves.

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This is a big area, typical, they circulate the experiment or development, maybe we are taking the method of AI or material informatics. Also, maybe we are doing some kind of abuse test. There are many kind of abuse tests to ensure the safety of the battery.

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We have also the HILS(Hardware In the Loop Simulation), that is a hard loop in the loop system between the vehicle and the battery development. Actually, we have some very unique usage of the vehicle and from that vehicle, we are taking the data. Precisely, that data is introduced into the battery pack chamber. And repeatedly, completely the same condition is realized for this. And then also maybe our feature is we are developing this kind of test instrument by ourselves.

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This is the number of the applications of the patent each year. Toyota and the Toyota Group is holding more than the battery patent than the top patent holder of the battery manufacture. I don't think this shows the height of the technology. But maybe this is kind of the symbol that our engineers are steadily making a great effort for finding even a small improvement will steadily improve the battery.

And then for your questions, when we develop our battery, the patent is owned by ourselves. When we order some battery to be our battery partner or maybe battery supplier, at first, we will show them the specification, which has to satisfy our safety or quality standard. Some of the parameters, if they cannot meet, then we will propose them the method to meet that. If they themselves can improve their features, then maybe such patent is held by them, but if they think that our method we offer is acceptable for them and they use this, then the patent is held by ourselves.

We have a very good relationship with respect to each other, between us and our battery partner companies. Such may be very fair; the patent right is understood by themselves.