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2nd-generation solar charging system

- Development of new solar roof and lightweight charging system -

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In response to the gradual progress of global warming, efforts aimed at achieving carbon neutrality have become active. At Toyota Motor Corporation, we have developed an in-vehicle solar charging system that utilizes the generated solar energy to drive the vehicle. The 1st-generation solar charging system implemented in the Prius PHV was the first mass-produced in-vehicle solar charging system in the world. However, we believe that further enhancements are necessary to facilitate the adoption of in-vehicle solar charging systems, as well as to realize carbon neutrality. Therefore, we have developed the 2nd-generation solar charging system currently implemented in the bZ4X, making performance improvements through a newly designed solar roof and lightweight charging system.

The solar charging system adopt in the bZ4X can generate energy equivalent to about 1,750km in one year. It consists of a solar roof equipped with two solar panels and a solar ECU that controls the generated power. (Fig.1) While IG-OFF, the solar DDC (DC/DC converter) in the solar ECU takes out the maximum power generated by the solar panel under MPPT (Maximum Power Point Tracking) control and charges the main battery through the boost DDC. At the same time, the power required for solar charging is supplied to the 12V system through the 12V DDC. While IG-ON, energy generated from the solar panel is supplied to the 12V system to reduce consumption of the main battery energy.

Next, we describe the details of solar roof development using a newly designed photovoltaic cell. In the bZ4X, a high-performance back-contact photovoltaic cell is adopted. (Fig.2) The area of the photovoltaic cell is increased because the string length can be adjusted by half-cutting and shingling technology. Due to the increased area, the generated power improve from 180W for the Prius PHV to 225W for the bZ4X.

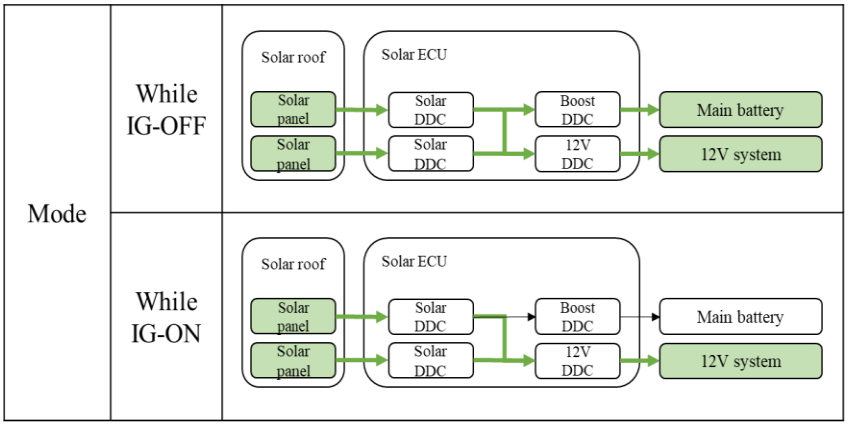

Fig.1 2nd-generation solar charging system

Next, we describe the details of lightweight charging system. The 1st-generation solar charging system utilized a solar battery to temporarily store energy before charging the main battery or 12V system. However, the added weight of the solar battery proved to negatively impact the mass of the vehicle. Therefore, we consider a solar battery-less system to decrease the overall weight.

Finally, we believe that the 2nd-generation solar charging system facilitate the adoption of in-vehicle solar charging system. The in-vehicle solar charging system can bring environmental friendliness to reduce CO_2 emissions, economic efficiency by reducing the frequency of plug-in charging, and a sense of security that power can be secured in the event of a disaster. There are various ways to achieve carbon neutrality, but we believe that the adoption of in-vehicle solar charging systems is one of the options for achieving carbon neutrality. We plan on making continuous improvmenets and further innovations to truly achieve carbon neutrality.

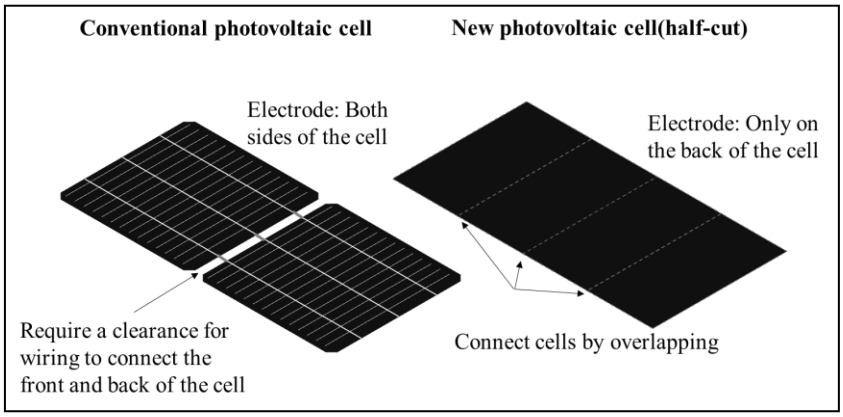

Fig.2 Conventional and new photovoltaic cell