PV performance is affected by solar irradiance and module temperature. Therefore, it is difficult to evaluate the performance such as the degradation of the PV system. If all PV modules can be measured in indoor testing facility, influence of solar irradiance and temperature is reduced, but not all modules can be measured indoors. Therefore, evaluation of PV performance in outdoor is required. A modeling of I-V characteristics of PV arrays are essential for assessing their efficiency and performance under various solar irradiance and temperature condition. Reference I-V curve was created based on the nameplate value, solar irradiance and module temperature. Solar irradiance was measured by PV module irradiance sensors (PVMS). Since PVMS is a solar irradiance sensor using PV, it has high response speed. And it is installed at the same plane of the measured module, it is not necessary to make correction by angle of incidence. Reference I-V curves of the PV string under various irradiance and temperature condition are calculated by using one diode model. In this paper, Lambert's W function is used to calculate five parameters of one diode model as shown in figure 1. PV performance was quantitatively evaluated by comparing the measured I-V curve obtained by outdoor measurement and reference I-V curve. Until now, from 1 to 5 series of measured modules I-V curves were compared with calculated reference I-V curves. In this case, it was possible to create the reference I-V curve in which $P_{max}$ error is within 2% for module and within 3% for string. In this paper, mega solar which is installed in Hokuto city, Yamanashi prefecture in Japan is used. Measured I-V curves for each string in the array is compared with the reference I-V curves. The error of $P_{max}$ showed various values depending on the type of module. Good results showed 1.0% of error in $P_{max}$ as shown in figure 2. This project is supported by New Energy and Industrial Technology Development Organization (NEDO).

![Diagram of I-V curve calculation](image1.png)

**Figure 1:** How to calculate I-V curve

![Comparison of Measurement I-V curve and Calculated I-V curve](image2.png)

**Figure 2:** Comparison of Measurement I-V curve and Calculated I-V curve