# Next-Generation Digital Infrastructure Construction (Amount covered by the government: Up to 141.0 billion yen)

## [Next-Generation Green Power Semiconductors]

- Power semiconductors are **used to control various electrical products** related to everyday life, such as automobiles and industrial equipment, electric power generation and railways, and home appliances. For example, **about 20% of the power loss of electric vehicles is** said to be **caused by power semiconductors**. That means they **have significant implications for the energy efficiency of various electrical devices**.
- This project will work toward **reducing the power loss** of next-generation power semiconductors (SiC, GaN, etc.) **by more than 50%** and **reducing their cost to achieve similar cost levels to those of Si power semiconductors**, in order to promote their social implementation in **the fields where innovative improvements in energy efficiency are required toward carbon neutrality, such as electric vehicles, electric power generation (e.g., by renewable energy) and server power supplies**.

## [Next-Generation Green Data Centers]

- **In response to the surge in power consumption by data centers** due to social and industrial digitalization, **international efforts** are ongoing **to achieve ultra-low power consumption and ultra-fast processing** by **introducing photonics-electronics convergence technology**.
- This project aims to **significantly improve the energy efficiency of data centers** (i.e., data aggregation hubs) **by over 40%** through innovative **photonics-electronics convergence technology** that replaces electrical wiring inside servers with optical wiring.

## ◎ Next-generation green-power semiconductors

- In order to **improve performance and reliability**, develop **technologies that are closely related to defect rate reduction**, and **that are closely related to control technologies**.
- In order to **reduce costs**, **develop manufacturing technologies to increase the wafers' diameters (from 150 mm to 200 mm) and improve their quality, while also making use of AI**.

### ○Expected approaches (examples)

**NB: Assuming SiC for the medium- and large-power ranges and GaN for the small-power range**

Small-power range (For server power supplies, etc.)

**High-efficiency, compact power supplies**

- 750-V class or lower
- Improved performance and reliability
- High-quality crystal growth technology
- High-efficiency control functions (e.g., measures against electromagnetic noise)
- Developing circuit technology (e.g., high-efficiency power sources)

Medium-power range (For xEVs / industrial equipment)

**Inverters for electric vehicles**

- 1.2-kV class
- Improved performance and reliability
- High-quality wafers with larger diameters
- High-efficiency control functions (e.g., high-efficiency motor drives)

**Inverters for industrial equipment**

- 1.7-kV class
- Improved performance and reliability
- High-quality wafers with larger diameters
- High power density (e.g., rapid charging)
- Module technology (e.g., improved heat dissipation)

Large-power range ((Electric power generation such as by renewable energy)

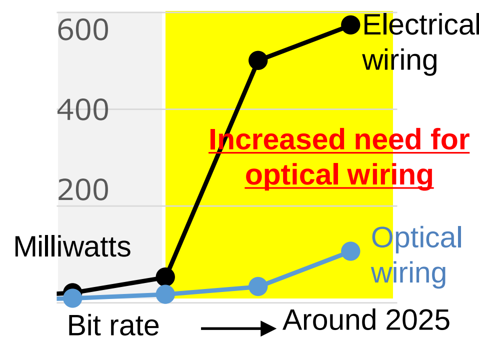
**Electric power systems**

- 3.3-kV class
- Improved performance and reliability
- High-quality wafers with larger diameters
- Module technology (e.g., reliability in the event of a failure)
- High breakdown voltage (e.g., high power conversion for grid networks)

## ◎ Next-generation green data centers

- **Photonics-electronics convergence technology has emerged as a game changer** for **innovative improvements in the energy efficiency of data centers**.
- Photonics-electronics convergence technology **combines optoelectronics** with electronic devices, replacing electrical wiring with optical wiring. This **results in improved energy efficiency, higher capacity, and lower latency (with the power consumption of the entire network system reduced to 1/100)**.

### ○ Power consumption of chip-to-chip wiring




### ○ Photonics-electronics convergence within a server