

# Medium- to Long-term Outlook

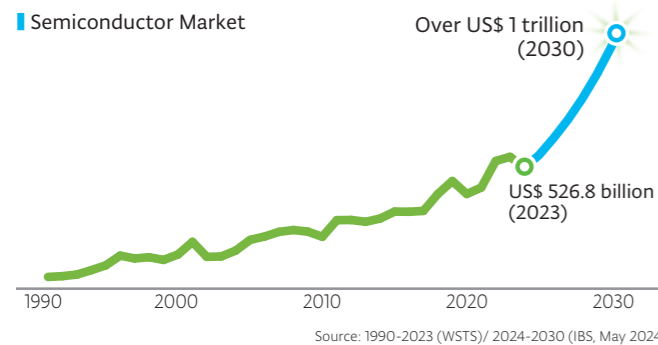
## Evolution of Technology and Future of Semiconductors

In recent years, the practice use of innovative technologies has further accelerated the digitalization of the society and computer technology to perform information processing has been further evolved as well. In addition to the increase of data traffic caused by the expansion of services and platforms using the Internet, applications that require a large scale of computation such as AI, autonomous driving and virtual reality<sup>1</sup> become technology drivers and the market is expected to further grow.

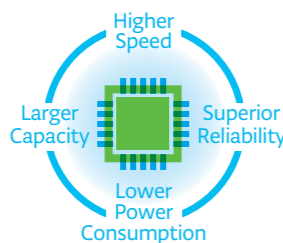
This trend is supported mainly by semiconductors. Technology evolution and demand increase of leading-edge semiconductors used for smartphones, PCs and servers in data centers as well as devices for MAGIC<sup>2</sup> supporting a data-driven society such as IoT are driving the semiconductor market size in the world to exceed US\$1 trillion in 2030, and the semiconductor and related industries including production equipment are expected to grow strongly in the future as well.

<sup>1</sup> VR (Virtual Reality), AR (Augmented Reality), MR (Mixed Reality) included.

<sup>2</sup> Expansion into the Diversified Semiconductor Market P. 40



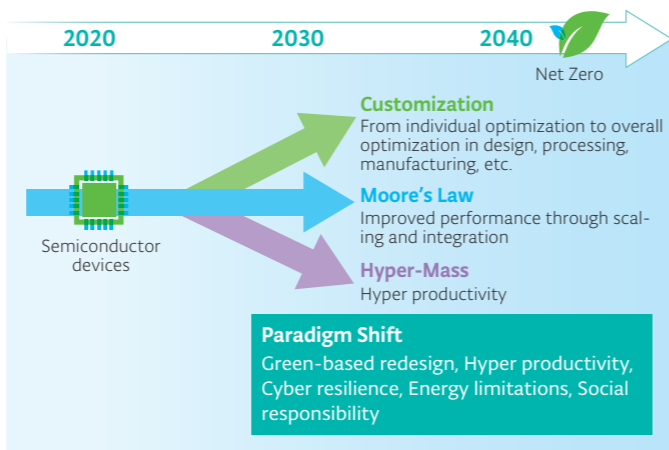
While the semiconductor industry has a large growth potential, there is an issue of electric power consumption in computing. If power consumption continues to grow at the current pace exponentially, the demand may exceed the supply, causing power shortage worldwide in the near future. In addition, as the demand for electric power increases, there is the worry that global environmental preservation might be affected



such as by the increase of greenhouse gas emissions. For the development of a digital society, lower power consumption of semiconductors is essential in addition to higher semiconductor speed, larger capacity and superior reliability.

Semiconductors, which support the lives of people, are expected to evolve in more diverse ways, going forward. The performance of semiconductors has been improved through scaling and integration, but the demand for further performance improvement to realize computer technology that can process large amounts of data at higher speed and with lower power consumption is increasing (Moore's Law). In addition, with the diversification of applications and services, it is necessary to optimize semiconductor design, manufacturing technology and the entire system according to the application (Customization). Furthermore, larger capacity data traffic and their processing and analysis require an enormous amount of semiconductors. To realize a world in which everyone can enjoy the benefits of computer technology, it is necessary to reduce the cost of semiconductors through economies of scale (Hyper-Mass).

While various paradigm shifts in the market are expected to happen in the medium term, the key to value creation in the future for semiconductor production equipment manufacturers will be to solve the technological and cost challenges of scaling and integration, to quickly propose the best solutions to meet the diverse needs of customers and to provide manufacturing methods that achieve extremely high productivity and optimize environmental impact.



## Development of Semiconductor Production Equipment

Toward the US\$1 trillion era and beyond, semiconductor production needs to solve issues such as advanced technology for device structures and integration, cost and time for development and production, human resource shortage and increased processes. In such a situation, it is considered important for an equipment manufacturer to provide solutions

based on digital transformation (DX) that makes full use of AI and digital technology.

Going forward, a key in equipment development will be digital twins, which integrate various simulations and make digital prototypes in cyber space. Currently, repeating trial and error processes using real prototypes is a common practice,

requiring a lot of resources and labor. Creating prototypes by digital twins instead of making real prototypes allows optimal design to be completed quicker with less effort.

Another keyword for equipment used for the mass production of devices is "autonomy." Each equipment senses various data from temperature, pressure to processing conditions and performs analysis using AI under the control of its operator. When process conditions change, adjustment to maintain the process quality is completely automated such as



by autonomously recovering the optimal conditions.

In addition, time lags in engineers reaching the sites are an issue in maintenance and management, and remote operation is a solution to this. When an equipment fault occurs, an engineer visually checks the situation via an AR glass and the like and performs operations using gestures, and a robot on-site is synchronized with them and performs repair, adjustment and parts changing work. Problems can be handled via virtual space, allowing timely handling irrespective of the time and location.



## Aiming to Be a Company Filled with Dreams and Vitality

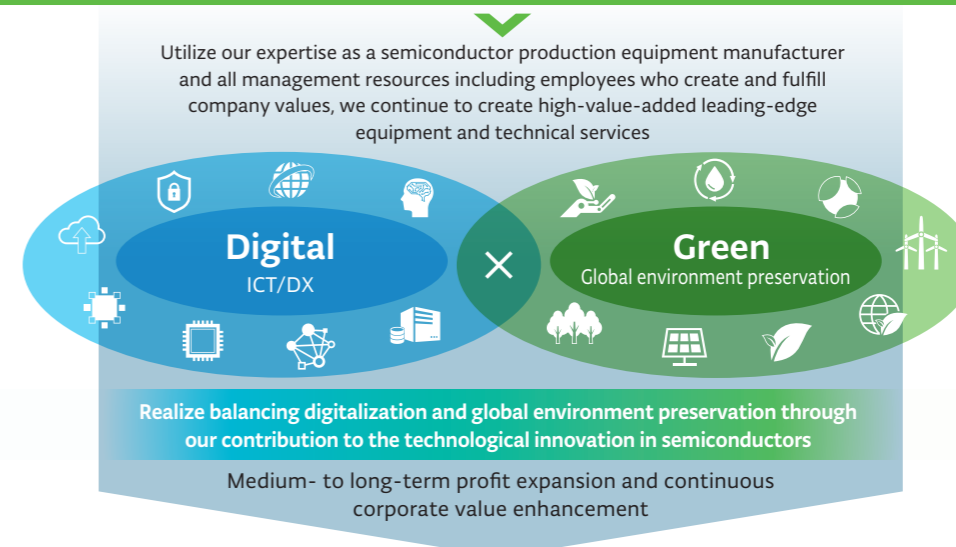
The world continues to push firmly ahead with implementing ICT (information and communication technology) as well as taking action to realize decarbonization in order to build a strong and resilient society in which economic activities do not stop under any circumstances.

Utilizing our expertise as a semiconductor production equipment manufacturer and all management resources including employees who create and fulfill company values, Tokyo Electron continues to create high-value-added leading-

edge equipment and technical services. And to surely assume our roles and responsibilities in society, we will help realize a digitalization and global environment preservation through our contribution to the technological innovation in semiconductors.

We work hard to expand medium- to long-term profit and to continuously enhance our corporate value, leading to the practice of our Corporate Philosophy through the realization of our Vision, and will meet the expectations of all stakeholders surrounding the Company.

To build a strong and resilient society in which economic activities do not stop under any circumstances



Meet the expectations of all stakeholders surrounding the Company by practicing our Corporate Philosophy through the realization of our Vision