

# Product-related Initiatives for the Environment

In accordance with Tokyo Electron's Environmental Commitment, the TEL Group aims to halve the total environmental impact of customer factories through measures such as reducing energy requirements during the usage phase of a product's lifecycle and minimizing the use of regulated chemical substances.

## Initiatives for Products with Less Environmental Impact during Use

### Approach to Reducing the Environmental Impact of Our Products

The TEL Group believes it is important to promote environmentally conscious designs within our business activities, as is clearly stated in the TEL Group "Credo and Principles on Environmental Preservation." We give top priority to supplying energy-saving equipment and to reducing or finding alternatives to the regulated chemical substances contained in our products.

### Organizations for Reducing Environmental Impact

Two working groups, the Chemical Substances Steering Team and the Product Working Team have been established to promote the TEL Group's efforts to reduce the environmental impact of its products. The Chemical Substances Steering Team works to reduce or substitute the use of regulated chemical substances in our equipment parts and components. The Product Working Team has developed and started to implement roadmaps for each business unit to reduce its environmental impact. In preparing these roadmaps,

the business units were required to address the following mandatory items: reducing equipment energy requirements, addressing chemical substance-related matters, reducing the number of parts and processes required, reducing the use of processing gases and liquid chemicals, and improving the environmental performance of existing equipment. In addition, they were encouraged to cover voluntary items, such as reducing the number of processes required for equipment installation. Progress toward achieving the prescribed goals is reviewed under the Group's medium- to long-term plan.

#### Environmental Roadmap

1. Reducing our products' energy requirements
2. Addressing matters related to chemical substances
3. Reducing the number of parts and processes required
4. Reducing the use of processing gases and liquid chemicals
5. Improving the environmental performance of existing equipment

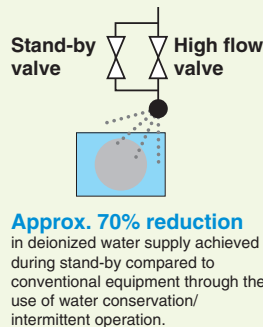
### Technology Symposium

Following on from 2008, in December 2009, the TEL Group held its 12th Technology Symposium at the Tokyo Electron Nirasaki Arts Hall. Presentations were made on environmental technologies and a poster area was also set up, enabling the

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### The EXPEDIUS™ + Cleaning System Reduces the Amount of Deionized Water Required

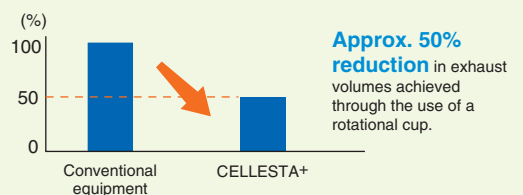
Cleaning systems use deionized water (DIW)<sup>1</sup> during the wafer rinsing process. Even in the stand-by mode, when wafers are not being processed, a small amount of DIW is continuously consumed to control the generation of bacteria in the DIW pipes. Reducing the amount of DIW used when the system is in stand-by mode has therefore become an issue. We conducted a survey to identify the time it takes for bacteria to be generated after the DIW supply has been stopped, and based on the survey results, we have adjusted the system so that DIW is supplied only as long as is necessary to control the generation of bacteria. As a result, we have been able to reduce the amount of deionized water used by approximately 70%.



<sup>1</sup> DIW (deionized water): used in semiconductor manufacturing processes to clean wafers and in the manufacture of pharmaceutical products. Deionized water is extremely high-purity water, theoretically close to 100% pure water, containing virtually no impurities such as metal ions or microorganisms.

### Reducing Emissions by Downsizing Spinners

In addition to the high controllability required for miniaturizing and enhancing the performance of devices, the CELLESTA+ single wafer cleaning system enables a smaller footprint (installation area) with 12 spinners<sup>2</sup> by reducing the size of the process chambers. Wafer spin chambers require spatter control of process liquids and atmosphere control, but the input and output of large amounts of air are necessary to control these during high-speed spin processing. The CELLESTA+ uses the "rotational cup concept," in which the spin chambers rotate in synchronization with the wafers. This provides not only a 50% reduction in exhaust air compared with conventional systems but also enables downsized process chambers and enhanced productivity per unit area and C.o.O.<sup>3</sup>



<sup>2</sup> Spinner: a device that creates thin films through centrifugal force by rapidly rotating flat and smooth base materials  
<sup>3</sup> C.o.O (cost of ownership): total expenses required for installing, operating and managing facilities/equipment, etc.



The TEL Group's Technology Symposium

divisions and departments to engage in a lively exchange of ideas and information.

### Energy-saving Measures for Products

Our technology development efforts to reduce product energy consumption focus on the following five areas: (1) reducing the energy used by the product itself; (2) reducing the energy used by peripheral devices; (3) managing the product in an energy-saving manner; (4) reducing the energy used in the clean room<sup>4</sup>; and (5) managing the clean room in an energy-saving manner (planned operation and proper management). Energy-saving management of the clean room necessarily involves our cooperation with customers and facility manufacturers. We will work to further reduce the energy

consumption of our products in close cooperation with these partners. In addition, as one measure to reduce device energy consumption, we are working to make measuring the amounts of energy consumed by devices that use electricity, water, dry air, cooling water, and exhaust heat, as well as supplementary devices (e.g. vacuum pumps and cooling equipment) more accurate by following the SEMI S23<sup>5</sup> guidelines.

- 4 Clean room: a room in which dust floating in the air is controlled at or below a defined cleanliness level and in which the temperature/humidity is maintained at a certain standard temperature. Dust can easily cause defects in precision machinery or cause errors in operation, and so clean environments are vital to ensure that the machinery operates correctly.
- 5 SEMI S23: guidelines for energy conservation for semiconductor production equipment issued by Semiconductor Equipment and Materials International (SEMI), an international industry organization for semiconductor/FPD production equipment and material manufacturers

### CELLESTA™ Single Wafer Cleaning System



#### [Features of CELLESTA+]

1. High throughput: maximum 333 wafers/hour
2. New spinner model: 12 process spin chamber
3. Enables built-in chemical supply circulation unit
4. TEL original IPA drying technology enables watermark-free drying
5. New atomized spray (AS3) for high particle removal efficiency (PRE) with fine patterns and non-damaging cleaning
6. Utilizes the highly reliable CLEAN TRACK™ LITHIUS Pro™ coater/developers handling technology

### Thermal Processing System that Reduces Greenhouse Gas Emissions Using Fluorine (F<sub>2</sub>) Cleaning Technology

In semiconductor/FPD manufacturing processes, PFC<sup>6</sup> gases such as NF<sub>3</sub> and SF<sub>6</sub> are widely used in etching and CVD chamber cleaning processes. These gases have a global warming potential (GWP<sub>100</sub>)<sup>7</sup> more than 10,000 times higher than CO<sub>2</sub> and their impact on global warming is posing serious concern. In response to this, we have developed dry-cleaning technology that utilizes fluorine (F<sub>2</sub>) gas, which has a GWP of zero, instead of PFC gases, and we use it in our vertical LPCVD (low-pressure chemical vapor deposition) systems. In addition, compared with conventional wet cleaning technologies, this fluorine cleaning technology not only reduces downtime but also extends chamber life by eliminating quartz damage, thereby contributing to further reductions in environmental impact.

#### Global Warming Potential of Cleaning Gases Used in Semiconductor/FPD Manufacturing

Cleaning gas	Global warming potential (GWP <sub>100</sub> )	Lifetime (years)
SF <sub>6</sub>	23,900	3,200
NF <sub>3</sub>	10,800	740
F <sub>2</sub>	0	0

- 6 PFC (perfluorocarbon): a fluorocarbon compound containing absolutely no hydrogen or chlorine that is one of the six gases subject to restriction under the Kyoto Protocol. Although PFCs do not harm the ozone layer, their greenhouse effects are several thousand times that of CO<sub>2</sub>.
- 7 GWP<sub>100</sub> (Global warming potential): a measure of how much impact a greenhouse gas has on global warming. It is a relative scale that considers a 100-year time span when the GWP for CO<sub>2</sub> is 1.

## Initiatives Related to Regulated Chemical Substances in Products

### Reducing the Use of Regulated Chemical Substances in Equipment

Against a backdrop of growing concern over the impact that harmful substances contained in parts and materials have on the environment and ecosystems, many countries are working to regulate the use of these substances in automobiles and electrical products. The TEL Group is also introducing measures to reduce the amount of regulated chemical substances contained in its products. One of the best-known regulations on chemical substances is Europe's RoHS Directive<sup>1</sup>, which came into effect in July 2006. Although semiconductor and FPD production equipment is currently exempt from the directive, the Group is taking proactive measures to comply with it.

We have already met all of the requirements for China's RoHS, which was issued in March 2007 and applies to TEL's products.

In order to meet regulatory requirements in a prompt manner, the TEL Group established a Chemical Substances Steering Team comprising representatives from TEL's headquarters and manufacturing subsidiaries. The team shares essential information and investigates the use of regulated chemical substances in our products in cooperation with our suppliers, and also introduces alternatives to replace regulated chemical substances. In addition, the team uses a dedicated database to manage the chemical substances contained in units and the parts used in our products. In fiscal 2007, we voluntarily developed a timetable to phase out the use of regulated substances used in our products (excluding certain products) subject to EU RoHS standards. From the second half of fiscal 2009 successively, we began shipping equipment containing fewer regulated chemical substances, which we define as products containing 98.5% or more parts that meet the EU RoHS standards.

<sup>1</sup> RoHS: Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment

#### Chemical Substances to Be Reduced

##### First Priority

<b>Cadmium</b>	Pigments, stabilizers, and resins
<b>Hexavalent chromium</b>	Chrome plating
<b>Lead</b>	Solders, paints, electrical wire coating, and free-cutting metal
<b>Mercury</b>	Batteries and fluorescent lamps
<b>PBBs</b>	Resin parts
<b>PBDEs</b>	Resin parts

##### Second Priority

Substances designated as Level A substances in JIG<sup>2</sup> (The TEL Group has already implemented measures for many of these substances)

<sup>2</sup> The JIG (Joint Industry Guide for Material Composition Declaration for Electronic Products) was prepared by Japanese, American and European private trade associations. The guide lists the chemical substances for which conservation measures should be implemented. It classifies the substances into Level A and Level B; 16 substances are listed as Level A substances, including cadmium, hexavalent chromium, lead, mercury, PBBs and PBDEs, while more than 400 substances are listed as Level B substances.

### Construction of a Management System for Regulated Chemical Substances

The TEL Group operates a chemical substances management system that can be used to register and view information on the use of chemical substances according to individual parts. This system allows us to check easily whether parts to be used in our products contain regulated chemical substances or not, and control the manufacture or shipment of products containing chemical substances regulated by the EU/China RoHS and other laws.

### Activities to Reduce the Use of Other Chemical Substances

Most nations have begun to implement the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)<sup>3</sup> based on the recommendation of the United Nations. In order to comply with this system, the TEL Group has begun to obtain chemical substance safety information (e.g., MSDS) classified and created in accordance with the GHS and has not only made this information available within the Group, but has also begun distributing labels for chemical substance containers.

In Europe, companies will be increasingly required to fulfill their responsibilities as manufacturers and follow the principle of taking precautions, under regulations such as REACH<sup>4</sup>, the EU's New Batteries Directives<sup>5</sup>, and the new CLP<sup>6</sup> regulations. All TEL Group departments are making concerted efforts to comply with these regulations, from product development, design and manufacture to procurement, quality assurance, and environmental and safety performance. We have started surveying substances of very high concern (SVHC) regulated under REACH and are providing information on parts that have been found to contain 0.1% or higher percentages of these substances.

We will also explore the optimal management of chemical substances by participating in the activities of JAMP<sup>7</sup> and other forums.

<sup>3</sup> GHS (Globally Harmonized System of Classification and Labelling of Chemicals): a globally harmonized system related to classification and labeling of chemicals agreed by the United Nations that is intended to harmonize and integrate various countries' classification standards for chemical harmfulness and toxicity, labeling and MSDS details.

<sup>4</sup> REACH (Registration, Evaluation, Authorization and Restriction of Chemicals): a set of regulations pertaining to the registration, evaluation, authorization and restriction of chemicals. For products containing SVHC (Substances of Very High Concern) in particular, manufacturers are required to provide information on the SVHC content of their products as well as information to ensure the safe use of the products.

<sup>5</sup> The EU's New Batteries Directive: regulates the collection and recycling of batteries, requiring batteries to be labeled with a designated recycling mark to facilitate collection and recycling.

<sup>6</sup> New CLP (EC No 1972/2008 Regulation on Classification, Labelling and Packaging of Substances and Mixtures): EU regulations concerning the classification, labeling, and packaging of chemicals and mixtures

<sup>7</sup> JAMP (Joint Article Management Promotion-consortium): promotes appropriate management of chemicals contained in products and smooth information distribution within the supply chain.



## Logistics-related Initiatives

### Approach to Addressing Environmental Impact Stemming from Logistics

The TEL Group has established a Logistics Working Team and the relevant divisions and departments have created action plans and are implementing them.

In April 2006, Japan's Act Concerning the Rational Use of Energy was revised and regulations concerning logistics were strengthened with the aim of reducing global warming. Accordingly, there is now greater demand for reducing the environmental impact of logistics operations. In response, the TEL Group has been actively reducing the environmental impact caused by the transport of its products. For example, we are promoting a modal shift<sup>8</sup> for domestic and overseas transport and adopting packaging methods with less environmental impact. We will continue these environmental measures in logistics in order to fulfill our environmental commitment.

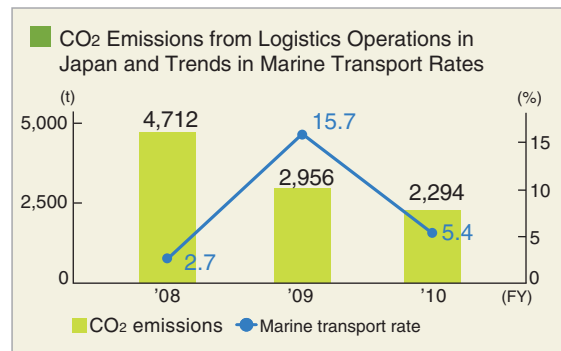
<sup>8</sup> Modal shift: a shift in the mode of transportation (e.g. switching from conventional freight transportation by truck or aircraft to marine and rail transportation, which have a lower impact on the environment)

### Reducing the Environmental Impact Stemming from Logistics

In fiscal 2010, TEL transported 11.96 million ton-km of freight in Japan (on a non-consolidated basis), resulting in 2,294 tons of CO<sub>2</sub> emissions. Due to reductions in production and shipment caused by decreased sales, this was a reduction in ton-km of approximately 30% compared with fiscal 2009. The marine transport rate for domestic logistics activities in fiscal 2010 was 5.4%, down from 15.7% in fiscal 2009. This is thought to have resulted from decreases in total actual freight as well as in the quantity of shipments sent via related routes. Modal shifts helped us to reduce CO<sub>2</sub> emissions from our domestic logistics activities by 106 tons.

Our export-related logistics activities emitted approximately 140,000 tons of CO<sub>2</sub> in fiscal 2008, 30,000 tons in fiscal 2009, and 29,000 tons in fiscal 2010. CO<sub>2</sub> emissions decreased in fiscal 2010, due in part to decreases in sales. Although CO<sub>2</sub> emissions per unit of sales have decreased

compared with the base year of fiscal 2008, we will continue to promote modal shifts to prevent increases in CO<sub>2</sub> emissions in the future as our sales and shipments rise. The marine transport rate for export-related logistics activities in fiscal 2010 was 37%. We estimate that increasing marine transport to 60% of our total transport needs would enable us to meet our goal; we will therefore encourage our customers to switch to marine transport and optimize our packaging methods.



### Green Packaging

Most of the TEL Group's products are precision machines, which means they require special packaging to maintain precision and keep them in a clean condition. We use special wooden frames and steel-reinforced corrugated cardboard as packaging materials. As a way to reduce the resources used for packaging, we have begun using reusable corrugated cardboard boxes when shipping large parts to customers inside Japan. After the parts are delivered to customers, the reusable packaging materials are returned to us for reuse. We also collect casters used for moving products and bring them back to our plants for reuse, thereby reducing resource usage.

## TOPICS

### Logistics Measures at Our New Plant

At our new plant in Taiwa-cho, Miyagi Prefecture, which is currently under construction (as of August 2010), we are considering introducing a more environmentally friendly cooperative distribution system for delivering procured material. We plan to introduce this system to more than 100 of our suppliers for delivering materials to the new plant that will develop and manufacture etch systems. We estimate that this system will enable us to reduce CO<sub>2</sub> emissions from logistics activities by more than 50% compared to having materials delivered individually to the new plant. The cooperative delivery system is also expected to bring cost reductions and enable products to be delivered even more swiftly to our customers. After evaluating the outcome at the Miyagi Plant, we will consider expanding the use of this system to other plants.

