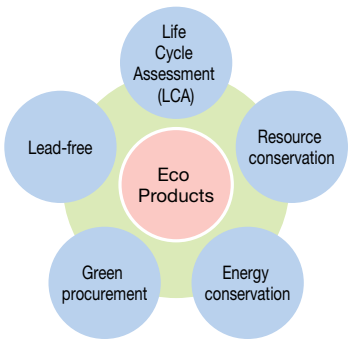
Reducing the Environmental Impact of Products (Part 1)

We are introducing Life Cycle Assessment for all new products we develop, and designing products to minimize environmental impact.

TEL Stance on Eco Products

TEL has worked to incorporate suggestions from customers in its products, and has promoted reduction of environmental burden during semiconductor production and elimination of hazardous substances from the materials used to make equipment. We respect the customer's needs to know about environmental impact of products throughout the life cycle, and work as quickly as possible to collect data relating to these impacts—from the manufacturing stage through to disposal. As a result, TEL has become an industry leader in terms of accumulating product LCA data for use when designing products.

Eco Product Concept



Organization in TEL

TEL is defining its actions and priorities in terms of reducing the environmental burden of its equipment, and is working to improve environmental performance.

Regarding Eco Products, the Eco Design Working Group has been established under the Product EHS Technical Committee (see page 21) and is now functioning. This working group started from creating an "EHS road map" for equipment, and is working to apply it to achieve energy and resource conservation. In addition, in each business unit, we are gathering LCA data on new equipment being developed and learning about the environmental impact, and are reflecting those findings in equipment improvements and next-generation models.

Due to the need to consider the environmental impact of the raw materials we procure for equipment production, we established a Green Procurement Working Group, which has clarified TEL procurement standards. This working group is investigating the environmental efforts of suppliers and contractors, and where necessary, supporting them by offering environmental education. We have also established a Lead-Free Task Team and aim to implement lead-free policies starting with products produced in 2006.

Major Efforts in Each Business Unit—A Sampling of Targets and Results

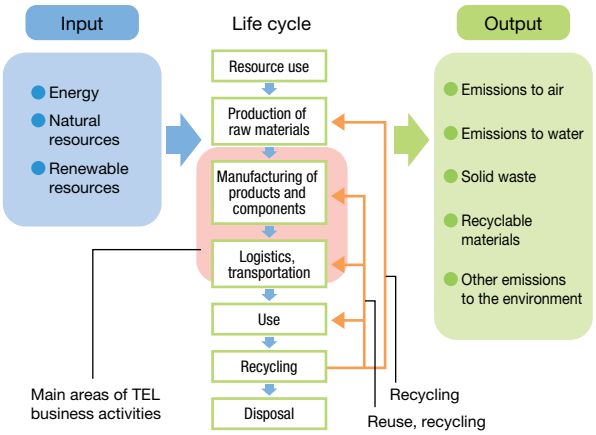
Business Unit	FY 2003 Target	Results	Targets for FY 2004 and beyond
Etch Systems	Reduce power consumption	Reduced power consumption of chillers by 40%	Reduce equipment power consumption by 3%
Test Systems	Reduce power consumption	300 mm equipment: 10% below 1999 levels	300 mm equipment: 50% below 1999 levels
Single Wafer Deposition	Reduce power consumption	300 mm equipment: 40% below 1999 levels	300 mm equipment: 50% below 1999 levels
FPD Systems	Reduce chemicals used	Developed equipment to reduce liquid chemical consumption	Continue efforts
Cleaning Systems	Reduce amount of liquid chemicals used	UW equipment: 64.4% reduction	Continue efforts
	Reduce amount of pure water used	UW equipment: 28.2% reduction	Continue efforts
Clean Track	Reduce use of liquid chemicals (resist)	300 mm equipment: 35% below 1999 levels	Consider ways to reduce amounts of other liquid chemicals used
	Reduce power consumption	300 mm equipment: 5% below 1999 levels	300 mm equipment: 20% below 1999 levels
	Conduct product assessments (preliminary)	After trials, start full operation	Continue operation, reduce environmental impact
Thermal Processing Systems	Reduce equipment footprint	300 mm equipment: compared to existing α-301 model, reduced by about 10% in α-303i	Implement when developing new models

Life Cycle Assessment (LCA)

TEL has launched efforts to conduct LCA as a way to objectively evaluate the environmental impact of equipment, using common criteria that we can share with our customers.

To begin with, we started by establishing common methodologies for whole TEL and getting a general grasp of the environmental impact of equipment, and then implementing an LCA for the major models in each business unit. We compared new and old models using LCA methods and confirmed that the overall environmental impact lower in new models. Now we are applying complete LCAs on all newly-developed equipment, and making continuous improvements of environmental performance by feeding the findings of assessments back into new product development.

Product Life Cycle Assessment



LCA Case Study (Thermal Processing System)

As the silicon wafer size used in semiconductor production continues to grow, the production equipment itself also grows larger. Also, as the market demands semiconductors with increasingly higher performance, the processes for production are also becoming more complex, and various additional features are also demanded of the production equipment. In this context, if equipment is not designed with the environment in mind, there will be a general tendency for increasingly severe environmental impact. LCAs implemented to date have shown us that more than 90% of the environmental burden during the entire life cycle of our equipment occurs during operation of the equipment.

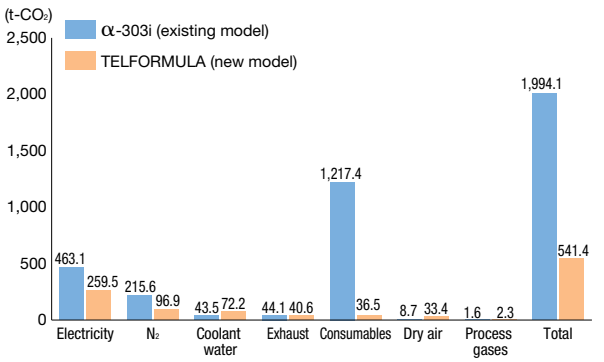
Below we introduce an example of LCA implementation by comparing the new model TELFORMULA (Thermal Processing System) with an existing model, the α-303i.

As shown in the graph, we learned that for the existing model, the consumable supplies accounted for the vast majority of the environmental burden incurred during operation of the equipment. Of this, the consumption associated with the quartz chamber and non-production wafers, known as "dummy wafers," was considerable. In comparison, the TELFORMULA has a completely revised quartz chamber structure and cleaning methodology introduced in-situ dry cleaning that uses the latest technology to replace wet cleaning. As a result, we were not only able to reduce the quanity of dummy wafers, but this also effected a large improvement in the life of the quartz chamber. At the same time we improved equipment specs like the utilization rate and process performance, we were able to significantly reduce the environmental impact.

α-303i (existing model)

TELFORMULA (new model)

Comparison of Energy Consumption (CO_2 Equivalent) during Operation Using Same RUN* Coefficient



*RUN: Refers to the series of steps in one cycle of process implementation of equipment, including heating, wafer input, processing, and wafer removal.

Reducing the Environmental Impact of Products (Part 2)

We are designing semiconductor production equipment to conserve resources and reduce hazardous substances, and have ongoing efforts to minimize the environmental burden that arises during use.

Approach Lead-Free

Lead can cause nervous system disorders if it accumulates in the body. Under the normal conditions of equipment use, there is no concern about injury arising from lead. However, the potential exists for impact on human health through the pollution of ecosystems if acid rain falls on disposed equipment and waste and then seeps into the environment. The European Union's WEEE Directive*1 and RoHS Directive*2 ban the use of hazardous substances such as mercury, cadmium and lead in electrical equipment, starting in June 2006. Although semiconductor production equipment does not fall under these directives, in order to be proactive in preventing pollution, TEL is promoting its own voluntary and systematic efforts to go lead-free.

TEL has begun to consider the introduction of lead-free solder for products manufactured by TEL Group companies. We are also investigating the status of solder use by our suppliers and urging them to cooperate in this initiative.

*1WEEE : Waste Electrical and Electronic Equipment

*2RoHS : Restriction of the use of Hazardous Substance in electrical and electronic equipment

Lead-Free Implementation Plan

Action Plan	FY 2004				FY 2005				FY 2006			
	Apr.	July	Oct.	Jan.	Apr.	July	Oct.	Jan.	Apr.	July	Oct.	Jan.
Establish Lead-Free Task Team, start work	→											
In-house awareness-raising	→	→	→	→	→	→	→	→	→	→	→	
Supplier survey, technical cooperation, action plan	→	→	→	→	→	→	→	→				
Consider technologies and materials used	→	→										
Evaluate, summarize the potential for lead-free		→	→	→	→	→	→	→				
Prepare for mass production		→	→	→	→	→	→	→	→	→	→	
Trial production and evaluation of boards and assemblies (practical training about soldering)		→	→	→	→	→	→	→	→	→	→	
Mass production									Starting January 2006 →			

TOPICS

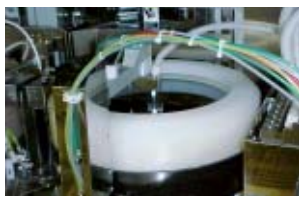
Developing Coating Methods for reducing Photoresist

The developing process during semiconductor production uses an organic photosensitive chemical, known as photoresist, for coating the wafer surface. This photoresist accounts for a relatively large portion of the equipment running costs. For that reason, and also from the perspective of saving resources, it would be valuable to reduce the amounts used.

TEL has developed a prewet coating method that reduces the amount of photoresist used to less than one-fourth of what is conventionally used, by applying a solvent immediately before applying the photoresist, improving the bond with the wafer. This method is being used in the major coater/developer line, the CLEAN TRACK ACT series. Today, our customers around the world are using this process.

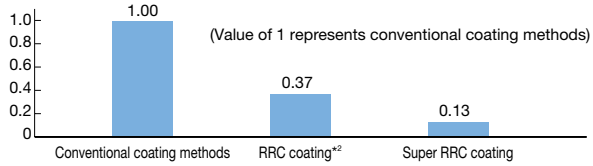
The rising performance of semiconductors requires larger dies. In order to economically produce equal number of dies per wafer, wafer sizes increases. Because of this, TEL will continue with its efforts to find ways to reduce the amount of photoresist used and save resources in other ways.

Coater/Developer
(CLEAN TRACK ACT 12)



Prewet Coating Method

Reducing the Use of CAR Photoresist*1



*1Chemically amplified photoresist for fine processing that has been popular in recent years.

*2Acronym for "Reduce Resist Consumption."