

# Environment



We recognize the challenge to humanity as the prevention of global warming and the preservation of the global environment. It has been resolved "to contribute to sustainable development capable of both environmental protection and development of mankind," as well as "to contribute to environmental protection by providing engineering services in harmony with the global environment as prime international company."

In order to realize this philosophy, TOYO Group will continue to work to solve environmental challenges of our customers actively in the future.





## Contribution to Environment by Technologies

TOYO actively promotes development, introduction and improvement of technologies that contribute to the environment. By applying best suitable technologies, TOYO provides to clients variety of solutions contributing environmental conservation and preventing pollution.

### CO<sub>2</sub> Reduction and Saving Energy

#### Energy Saving Distillation System *SUPERHIDIC*<sup>®</sup>

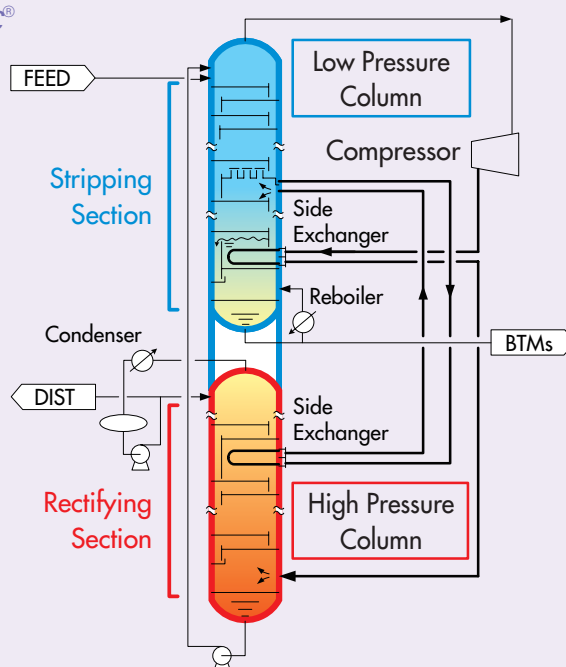
Distillation<sup>(\*)</sup> is recognized as generally well proven technology and still plays an important role in the separation unit operation in the industry. However it is also well recognized as a unit operation that consumes a large amount of energy. Clearly energy saving in distillation process can contribute largely to reduction of the overall operating cost. Numerous energy saving technologies have been proposed in distillation so far. TOYO developed a technology which provides more than 50% energy saving compared to conventional distillation system in various industrial applications. It was evolved as *SUPERHIDIC*<sup>®</sup> (Heat Integrated Distillation Column: **HIDiC**) in collaboration with National

Institute of Advanced Industrial Science and Technology, Japan.

*SUPERHIDIC*<sup>®</sup> uses simple structure while applying well proven technology related to distillation and heat transfer, without utilizing special equipment. Moreover good maintainability can be achieved with *SUPERHIDIC*<sup>®</sup> that bring out performance of saving energy more effective resulting in research based on a theoretical background of heat transfer and thermodynamics.

(\*) Distillation: It is a unit operation that separates liquid mixtures of different components by evaporation and condensation, utilizing the difference in boiling temperatures of components.

#### ● Illustration of *SUPERHIDIC*<sup>®</sup>



## Energy Saving Urea Process (ACES21®)

Urea is a common type of Nitrogen base fertilizer produced by reaction of Ammonia and CO<sub>2</sub>. It is used for not only as fertilizer but also as a raw material for the industrial production of other chemicals feed stock, resins, and adhesives. Urea is also used as a deNO<sub>x</sub> agent by selective catalytic reaction to prevent the emission of diesel engines. Urea is so much important chemical product that it is discussed from different viewpoints like [Food Problem], [Environment Problem], [Energy Problem].

TOYO, since its establishment in 1961, has been a leader in the licensing of its own Urea technology in Design, engineering, construction and commissioning of over 100 Urea plants all over the world.

It is said that the history of Urea plant is closely related to the history of energy conservation. TOYO, in the beginning of the 1980's, established its own Urea synthesis technology named ACES (Advanced Process for Cost and

Energy Saving), which reduces energy consumption significantly. Later in the 1990's and towards the 21st century, TOYO developed and offered ACES21® Urea synthesis technology, which maintained dominant features of ACES process and further reduced the facilities costs and energy consumption. Urea projects with this technology began their operation.

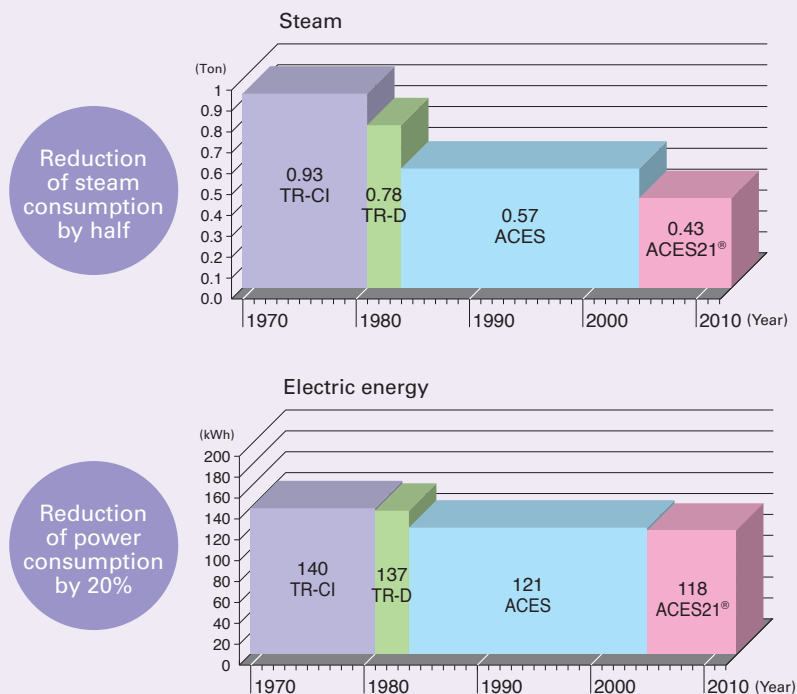
In the past, production of 1 ton of Urea required 0.93 tons of steam and 140kWh of electric power. Compared to this, TOYO's own process technology (ACES21®), to produce 1 ton of Urea, only 0.43 of steam (54% reduction) and 118 kWh of electric power (16% reduction) is necessary, thereby contributing large scale reduction of CO<sub>2</sub> and savings in electric energy.

Currently with the growth in size of plants progressing, those using this process typically reach 4,000 tons per day and are even able to produce up to 6,000 tons per day in a single train.



View of whole plant: Methanol Holdings (Trinidad) Limited, Point Lisas, Trinidad and Tobago

## TOYO's Urea process development and performance of energy saving



Urea Product



Fertilizer made with urea



## Hazardous Waste Treatment

### ● Detoxifying Disposal of Low Concentrated Poly Chloride Biphenyl (PCB) (PCB contaminated matter)

Recently, it became obvious that electrical components like transformers, capacitors, cables which have not been supposed to contain PCB, had actually contained a small amount of PCB, through investigations of the national and industry group. Since PCB have been considered as “difficult items to dispose off properly”, government requires such electrical equipment to treat and render them to harmless and has entrusted the responsibility to the equipment holders.

For Ehime Waste Treatment Center in Ehime prefecture, Japan, TOYO built and handed over disposal facilities which render low concentrated PCB including a small amount of PCB harmless, in March 2012, and currently it is under operation.

The process include facilities to incinerate electrical equipment such as transformers at high temperature in continuous furnace and to evaporate insulation oil contaminated with a small amount of PCB, then to decompose vaporized PCB safely at high temperature of 1,100°C.

TOYO hopes that such PCB disposal facilities construction will reduce burden on environment and would like to utilize experience gained to contribute to the society.



Transformer before incineration at high temperature



Transformer after incineration at high temperature



Building of facility for disposal of low concentrated PCB



## Efforts for Eliminating MURI, MUDA and MURA

TOYO responds in design stage to reduce the environmental burden during plant operation. Fulfilling clients requests of quality, TOYO aims to establish optimized design by plant design with application of technologies by eliminating 3 M's (MURI-overdoing, MUDA-wasting, and MURA-irregularity) in engineering.

### Application of Heat Transfer Enhancement Technologies

While plant facilities are getting bigger and more efficient, engineering of heat exchangers is required to meet more strict conditions such as, larger shell size, lower pressure, lesser pressure drop, as well as lower temperature difference, etc. To meet these changing needs, in addition to the conventional design, TOYO actively selects and utilizes applications of heat transfer enhancement technologies. These technologies can reduce the number and size of heat exchangers which result in the smaller installation area and reduced plot size for new plants.

Heat Transfer Enhancement Technologies include:

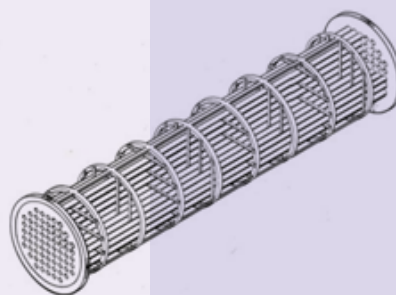
- Increasing heat transfer surface area  
(for example, Low Finned Tube: Picture 1)
- Improving fluid flow condition  
(for example, Rod Baffle: Picture 2, Helix changer: Picture 3)

TOYO provides efficient and compact equipment by applying these technologies to its heat exchanger design.



Picture 1: Low Finned Tube

Fins provided by machining outer surface of a normal tube to increase heat transfer area



Picture 2: Rod Baffle

Improving heat transfer and reducing pressure drop by using rods instead of plate baffle



Picture 3: Helix changer

Improving heat transfer by inducing spiral flow over helical baffle