

Environment



Note: Photo supplied from Sakhalin Energy Company

Since its inception, TOYO has been providing solutions to clients backed by comprehensive integrated engineering technologies and project management skills in execution of projects.

Through such execution, TOYO promotes development, introduction and improvement of technologies in a wide spectrum: Approaches to new and clean energy, CO₂ reduction and energy conservation, Recycle technologies applicable to effluent and waste water, Technologies for eliminating hazardous / toxic substances, Construct plants to reduce environmental impact.

TOYO's site construction work realizes following objectives: Reduce environmental impact, Prevent pollution, Proper management of construction wastes.

TOYO, as Global enterprise continues to fulfill corporate social responsibilities of domestic as well as international Clients on basis of accumulated knowledge and experience, by offering technologies that contribute towards conservation of environment.



Earth-Friendly Environmental Technology

While presenting engineering solutions to our clients, TOYO integrates proprietary technology within TOYO as well as cutting edge technology available worldwide to fulfill client needs. Here, we would like to introduce a few of TOYO's contribution concerning environment, namely technology of CO₂ reduction, energy saving and that about treating hazardous substances.

CO₂ Reduction / Saving Energy

Technology for High Efficiency Power Plant using Natural Gas

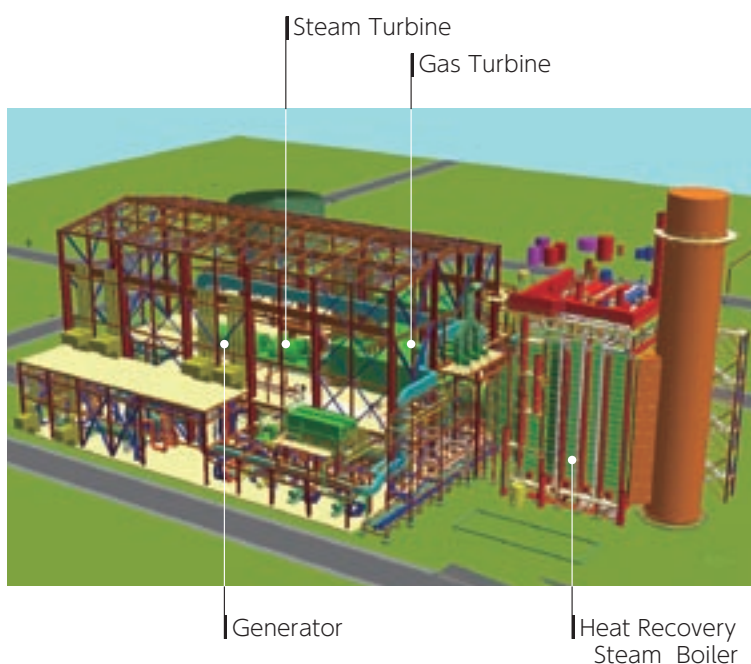
TOYO is executing power plant project in Republic of Azerbaijan, jointly with Azenco for Azerenerji, a Joint Stock Company of Azerbaijan.

This project is to construct a 400 MW combined cycle power plant using natural gas as fuel. Construction work has commenced since September 2011 and is slated to be completed by December 2013.

Natural gas, containing less impurities than petroleum-delivered products, is source of clean energy causing less environmental load. The

combined cycle power plant using natural gas is high efficiency power plant of world-class level (400 MW X 1 Block), comprises of Gas Turbine and Steam Turbine along with Heat Recovery Steam Generator and achieves 58% of efficiency (Lower Heating Value base). This is a bench mark for high efficiency power plant system the world over.

TOYO is applying eco-friendly technology in this high efficiency power plant by applying low NO_x burner to reduce CO₂ and NO_x.



Graphic image of complete construction in the suburbs of Baku as the 2nd Shimal Gas Combined Cycle Power Plant in Republic of Azerbaijan

Energy saving urea process (ACES21®)

It is said that the world population will continue to increase to 9.3 billion by 2050 from 7 billion in 2011. Accordingly, food production should meet the needs of the increase in population.

As for food production, fertilizer, especially Nitrogen based fertilizer increases grain harvest dramatically.

Urea as fertilizer has high Nitrogen content and has added feature to prevent oxidization of soil.

TOYO has been a leader in licensing of Urea technology worldwide, designing, engineering, constructing and commissioning over 100 urea plants on its own process since its establishment in 1961.

The history of development of urea plants correlates to energy consumption. In the past, production of 1 ton of Urea required 0.93 tons of steam and 140 kWh of electric power. Compared to this, TOYO's own process technology (ACES 21), 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 CO₂ and savings in electrical energy.



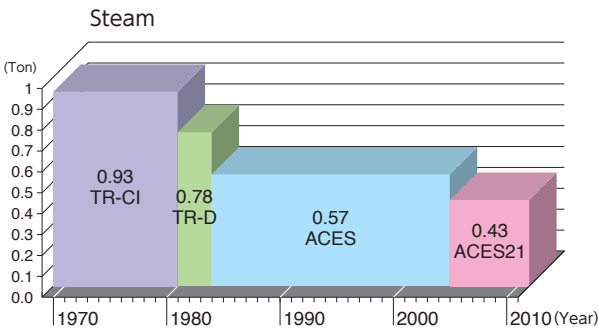
View of whole plant: ACES21® P.T. Pupuk Kujang, Indonesia



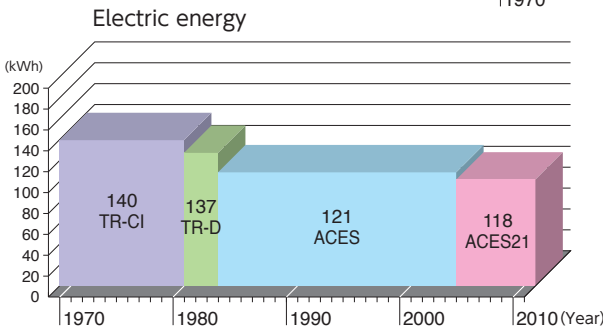
Urea product

TOYO's Urea process development and performance of energy saving

Reduction of steam consumption by half



Reduction of power consumption by 20%





Efforts for Eliminating MURI, MUDA and MURA

TOYO makes best efforts starting at engineering stage to ensure less environmental impact during plant operation. TOYO also strives to reduce environmental impact by eliminating 3 M's (Muri-overdoing, Muda-wasting, and Mura-irregularity) in engineering.

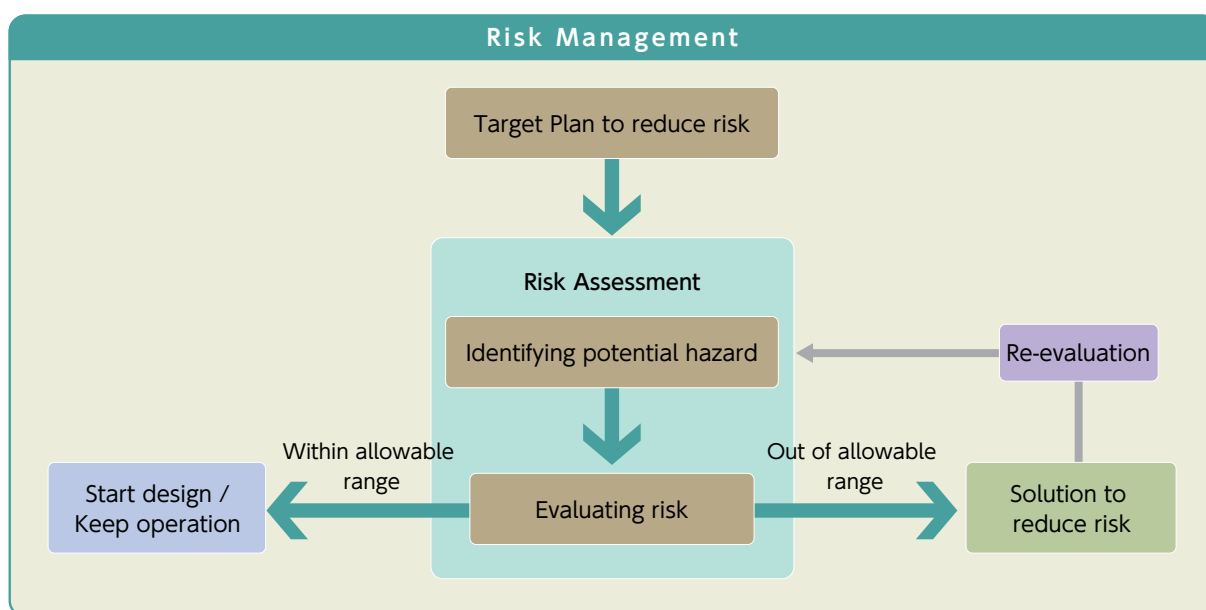
HSE (Health, Safety, Environment) effort in design stage

Chemical plants, due to the characteristics of chemical substances it handles, possess occupational safety hazards due to fire, explosion, which may affect worker's health and cause safety and environment related risks. These risks are categorized as HSE risk depending on their impact.

TOYO implements safety design during plant design stage, incorporating local regulation, international codes/standards and design specifications (abbreviated as STD). Such safety design considers avoiding of irregularities. In the unlikely event of an accident such as leakage of

chemicals taking place even after such design considerations, measures to prevent their further spread could be taken sooner. Such countermeasures provide us an opportunity to introspect and come closer to HSE objectives.

TOYO establishes multi-faceted protection for achieving various HSE targets by implementing these measures. We keep in mind that STD need not necessarily alleviate potential risks in the system design. Thus safety design is realized by evaluating identified risk related to HSE, and considering reduced risk to acceptable level.



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Efforts for Eliminating MURI, MUDA and MURA

Information Technology contributing improvement of Engineering efficiency

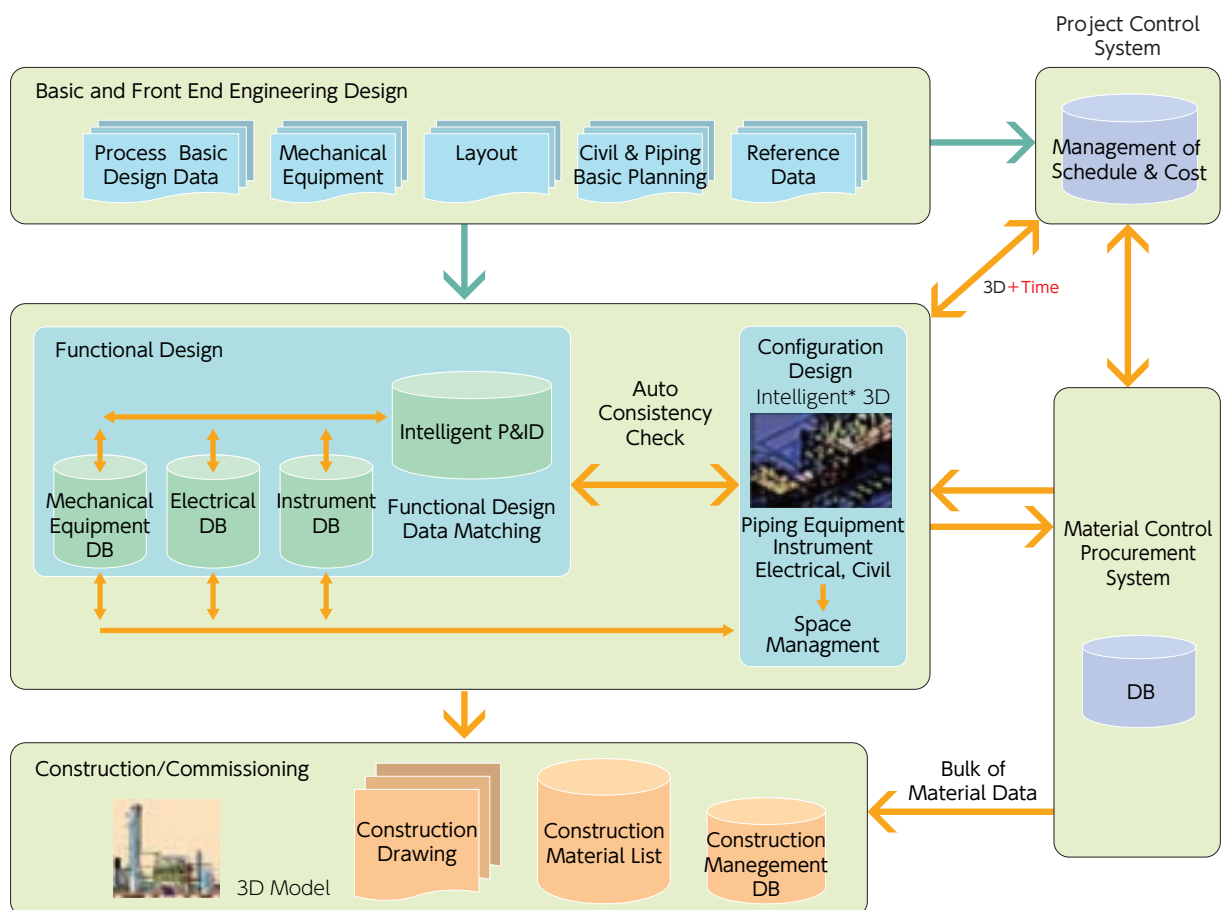
Many IT tools and systems have been employed to the engineering work to handle enormous volume of information and data. In early stage of the project, each discipline performs basic design or preliminary study independently. Later, as the design work proceeds, both functional design data and spatial design information will be accumulated in each data base.

Functional design data base, represented by Intelligent P&ID will handle functional design data, such as mechanical, electrical and instrumentation parameter related data. On the other hand, Spatial Design DB, represented by Intelligent 3D Model, will handle all the spatial and dimensional information provided by Piping design, Equipment design, Civil design, Architecture design, Electrical design, and Instrument design.

High quality engineering deliverables are assured by the consistency of the data handled by the both Functional and Spatial DBs. This

contributes to minimizing the change and re-do of field work and helps fast track project completion as well as minimizing losses due to unnecessary works. Output of drawings necessary for construction are issued from the Spatial Design DB, and necessary bill of construction material is also extracted from the DB, and linked with material procurement and delivery, and construction management system. Moreover these Engineering DBs also provide data to the Project Management System used for managing the schedule and cost of the project.

Nowadays, these IT tools and systems are shared within TOYO. For example, in an Indian Project, design information from India and Japan office, procurement information from Japan, Europe, United States, Korea and India are all shared among the offices and construction site through common material control database system.



*Intelligent: including not only data on shape (2D or 3D), but also attributes of the object.

Construction activities

Among TOYO's sphere activities, site construction work is the one which is likely to create the maximum environmental impact. Efforts are made to reduce the impact on environment. Also, following environmental targets are set

- (1) Appropriate treatment and disposal of construction waste
- (2) Appropriate treatment and disposal of chemicals (paint, etc.)
- (3) Use of environmentally conscious methods
- (4) Transportation using environmentally conscious methods
- (5) Water treatment for turbidity and oil-water separation



General wastes from site office are disposed at holder box in China site.



Construction wastes are collected at designated area in Venezuela site.



Construction wastes are disposed in drums / cans in Brazil site.