

EZER

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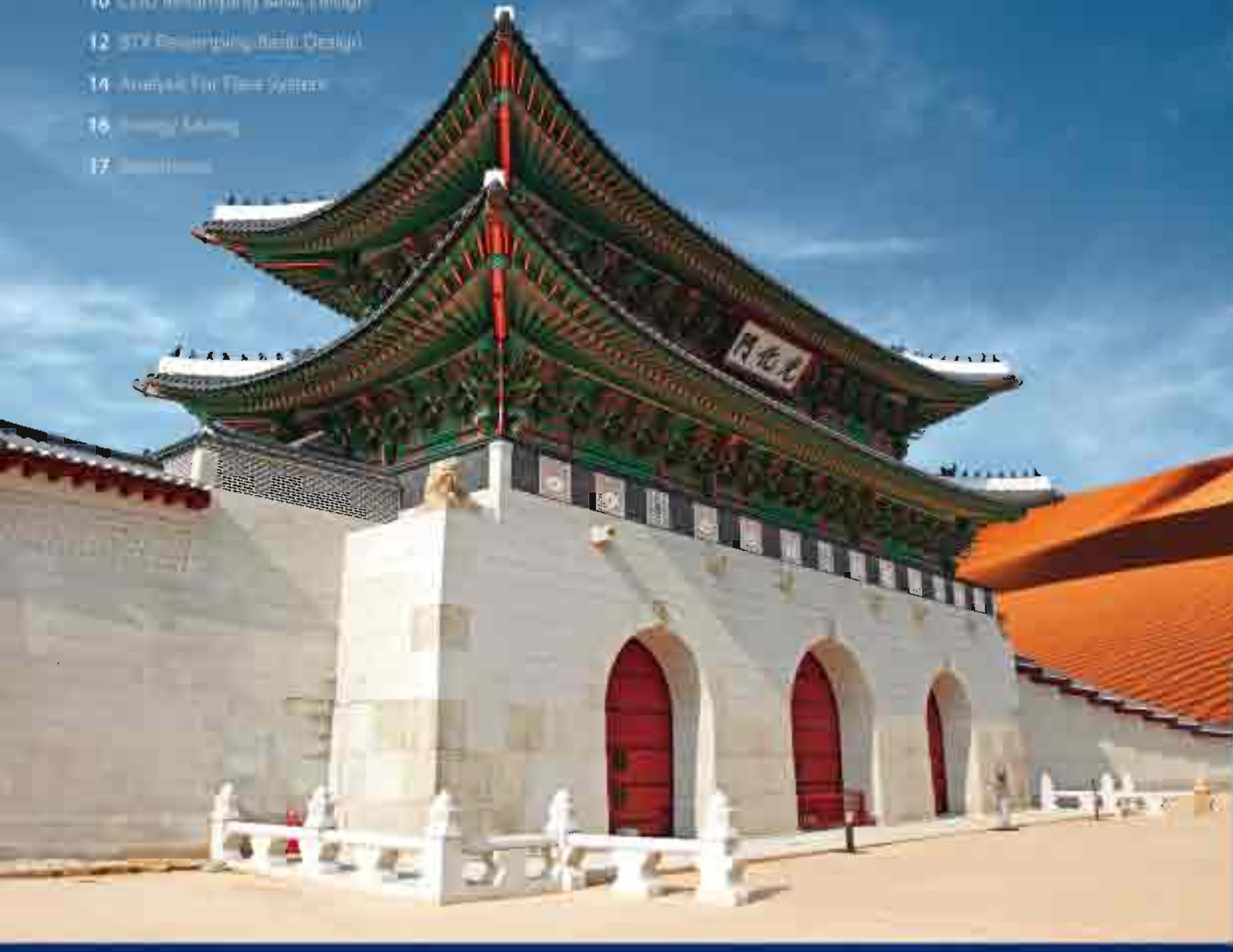
EZER

ENGINEERING & CONSULTING

Inspiring our Partners, Creating Value

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*Inspiring our Partners,
Creating Value* **EZER**

Who we are

EZER is a company based in Korea. With a global mindset, EZER works vigorously to seek solutions for clients, while providing customer service based on Korean traditional values such as respect, dedication, and trust. This synthesis of thinking helps us to define who we are.

Through world-class, innovative engineering, EZER is helping to design and implement global energy infrastructure, one successful project at a time.

From the moment EZER was founded in 2002, we knew that we had to be unique. From the outset, our company has relied on a core set of values instilled by our company's founders. Words like peace, harmony, sincerity, and diligence are not words we throw around lightly. They are the foundation of who we are and what we strive to be each and every business day.

Where do our values come from?

The founders of EZER grew up in the shadow of the Korean War. The power of Korean reconstruction comes from long lasting history and perseverance. This experience of having watched Korea transform itself from an undeveloped country into a global leader in business, IT, and engineering has been an instructive one.

The values that have helped Korea to develop are the same values that have allowed EZER to flourish in a competitive, ever-changing business environment.

How can we help you?

EZER works diligently side by side with each of its clients to find solutions to complex engineering problems. We do so by combining our knowledge of advanced technologies with an educated, dedicated, and experienced work force.

Our staffs are passionate about helping you, our respected clients, find the solutions that will help you move forward. So come...let us "walk with you" Let us show you first hand what EZER can do for you!



Mission

- Explore Possibilities for Client, Society and Humanity
- Challenge $\Delta S=0$ for Nature, Culture and Life
- Research for a Prosperous Future

Vision

- We become a Leader in Basic Design
- Research bridge between Concept and Reality

Value

- Sharing Knowledge
Our Achievements are handed down to Future Generations
- Reliability
We always work with Honesty and Responsibility
- Passionate Workforce
We walk together with you feeling Inspired
- Devotion
We are committed to our Clients and Society

Service

Ezer is readily prepared to satisfy client with quality service at any stage of project, at any circumstance and at any place worldwide

Planning Stage

Consulting Service

- Process Development Support
- Construction Planning
- Existing Plant Re-use Plan
- Preparation of Pre-FEED
- Environmental Preservation

FEED Stage

FEED Service

- Basic Engineering
- FEED

EPC Stage

EPC Service

- Engineering
- Procurement
- Construction
- Project Management

EPCM Service

- Design
- Procurement Service
- Construction Management
- Project Management

Operation and Maintenance Stage

Operation & Maintenance

- Training
- Transfer Technology
- Shut-down Maintenance
- Urgent Maintenance
- Spare Parts Management

Asset Management Service

- Risk and Reliability Management
- Energy Saving
- Equipment and Machine Diagnostics
- Advanced Process Control



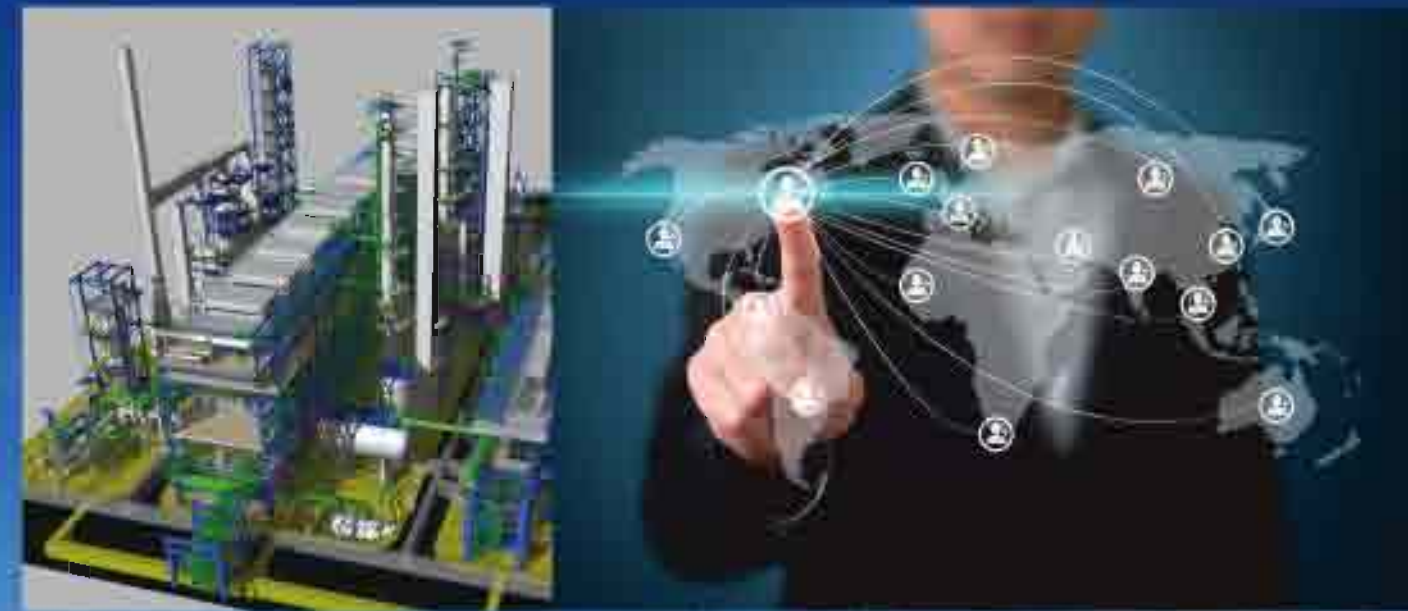
Research Plan

We strive to contribute to the utilization of beneficial processes for clients, humanity and nature. We hope that our invention and innovation will change the earth better.

EZER will investigate and develop the technology for Membrane, Catalyst, and Biofuel. Furthermore, we are to search for new ways that Membrane and Catalyst may be applied to the existing processes.

Particularly in regard to Biofuel, we are currently making an effort to produce biobutanol from biomass. We have already finished the pilot plant design, lab testing and preliminary commercial basic design. We are planning to construct a demo plant in cooperation with Korean government.

Along with fulfilling the above urgent tasks, our capability would not be limited to categories above. We ceaselessly expand our horizon into areas not touched by others before. We explore even the smallest possibilities to pave the way for unprecedented technological innovation.





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NCC Revamping *Basic Design*

Needs

The needs of client (YNCC) were as follows

- 15% Capacity upgrading of whole plant without modification of flare system, cold box and charge gas compressor
- Quantification and minimization of energy inefficiency in NCC plant
- Fast decision whether the recommendation from the licensor about applying the ripple tray to the quench tower should be adopted or not because of long delivery for ripple tray

Problems

Some problems came out as we tried to meet client's needs

- Compressor turbine power limitation
- Safety system limitation caused by small space for flare stack and pipe rack

Solutions

In order to solve the problems and to meet the client's needs, Ezer performed the following works as below

- Modeling more elaborate simulation of whole NCC plant
- Applying pinch technology to identify energy inefficiency
- Lower temperature energy changed into higher temperature energy by means of that quench water duty was transferred to quench oil duty
- Capacity upgrading without flare system (flare stack, K/O drum, flare header) modification, which safety was still assured, with DYNAMIC SIMULATION and SIS
- No changing quench tower internal led to saving investment cost and shortening the schedule



Relevant Projects

The following list summarizes the major projects to be applied to NCC plant

Project Name	Plant	Description	Work Scope	Client Country	Completed
HPC Energy Saving Project	NCC / BRU BD / EG	Energy Saving : 70.5 MMkcal/hr	BE	HPC / Korea	2011.01
NCC Advanced Energy Saving Project	NCC	Energy Saving : 18.6 MMkcal/hr	BE	LG Chem / Korea	2010.10
NCC Energy Saving Project	NCC	Energy Saving : 30.8 MMkcal/hr	BE	STC / Korea	2010.01
YNCC #3NCC 2nd Debottleneck Project	NCC	Naphtha Feed Rate : 155 to 175ton/hr	BE	YNCC / Korea	2010.01

[BE : Basic Engineering | DE : Detail Engineering | FS : Feasibility Study | EPC : Engineering / Procurement / Construction]



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CDU Revamping *Basic Design*

Needs

The needs of client (H-Oil Bank) were as follows:

- Maximum capacity without crude heater modification
- Method for assuring safety without flare system modification
- Change of operation mode compared to the existing design
- For solving the small space issue, the plate type HX application
- The solution for caused trouble from plate type HX operation because heat is transferred between pump-around and heat train

Problems

Some problems came out as we tried to meet client's needs

- Space limitation
- Opposition by production department to plate type HX application not used in general

Solutions

In order to solve the problems and to meet the client's needs, EZER performed the following works as below

- Tuning of simulation modeling based upon the existing data
- Column internal loading analysis, heat train rearrangement with pinch technology, optimum operation mode changing for energy saving and prediction of trouble from plate type HX application should be totally analyzed in order to prepare for solution by each case
- No changing safety system except adding safety valves
- 67% of capacity upgrading compared to design capacity without crude heater modification
- Maximization of energy efficiency through HX rearrangement and addition of plate type HX
- Modifying crude tower internal
- Adjusting vapor feeding tray of ATM tower using flash drum



Relevant Projects

The following list summarizes the major projects to be applied to CDU:

Project Name	Plant	Description	Work Scope	Client Country	Completed
SK Energy CLX Project	NHT	Energy Saving : 7.0 MMkcal/hr	BE	SK Energy / Korea	2010.11
H-Oil Bank #1 CDU Optimization Project	CDU VDU	Energy Saving : 18.6 MMkcal/hr	BE	H-Oil Bank / Korea	2010.04
Kero-Merox Revamping Project	Kero-Merox	Energy Saving : 30.8 MMkcal/hr	BE	H-Oil Bank / Korea	2007.12
Lube Base Oil Project	Lube	CDW 9,000 BPSD	BE	SK Energy / Indonesia	2006.05

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BTX Revamping *Basic Design*

Needs

The needs of client (HPC) were as follows

- 60% Upgrading of whole plant capacity compared to design capacity without compressor modification
 - Existing BRU plant should change to BTX plant so that production expands from only benzene to toluene, xylene
 - Maximization of energy efficiency in BTX plant
- Revamping basic design for 1, 3-Butadiene and BTX plant was carried out and management and consulting for flare analysis on total complex (NCC, BD, BTX, EB/SM, etc) revamping project was performed

Problems

Some problems came out as we tried to meet client's needs

- Reactor operating pressure decreased through no modification of compressor
- Shortage of column diameter and height
- Difference in safety analysis basis among licensors and basic engineering companies

Solutions

In order to solve the problems and to meet the client's needs, Ezer performed the following works as below

- Changing operating condition for efficient energy saving
- Predicting no problem for lowering pressure in the reactor through analyzing client's operation data and communicating between EZER and licensor
- Changing optimum operating condition through the simulation model for energy saving
- Capacity upgrading without flare system (flare stack, K/O drum, flare header) modification, which safety was still assured, with DYNAMIC SIMULATION and SIS
- Rearrangement of HX with pinch study and simulation modeling for energy saving
- Unifying the different safety analysis basis among companies



Relevant Projects

The following list summarizes the major projects to be applied to BTX plant

Project Name	Plant	Description	Work Scope	Client/Country	Completed
HPC BTX Modification Project	BTX	Modification BRU to BTX Feed 73.1 ton/hr	BE	HPC / Korea	2010.01
M-X & Energy Saving Project	NCC BRU	Energy Saving : 15.4 MMkcal/hr Modification BRU to BX	BE	LG Chem / Korea	2008.03
HPC BD / BRU Revamping Project	BD / BRU	BRU Feed 57 to 96 ton/hr BD Product 176,000 MTA	BE	HPC / Korea	2007.12

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Analysis for Flare System

Environment around Safety

- More severe basis for safety analysis and demand for rigorous calculation because of awareness of problem caused by short-cut calculation in the past
- Difficulty from flare modification when capacity of revamping plant was upgraded
- Demand from government and client about acquiring flare load calculation basis
- Need for safety load re-calculation emerged by feed composition change, small modification, utility change by energy saving

Study Approaches

- Steady state simulation for rigorous calculation (conventional method) in terms of normal and abnormal conditions
- Reanalyze the whole plant data (PFD, Equipment & Instrument DS, P&ID, Utility System and others)
- Supply and instruct specifically suitable basis on flare analysis to client
- Program customization for DYNAMIC SIMULATION based on the consideration of limitation in simulators
- SIS application based on the consideration of safety and economic feasibility



Relevant Projects

The following list summarizes the major projects to be applied to flare analysis

Project Name	Plant	Description	Work Scope	Client Country	Completed
HCC Orange Project	Poly-Silicon	Flare System Desing for Grass Root Plant & SIS Application	BE	Hanwha / Korea	2012.10
YNCC #3NCC 2nd Debottleneck Project	NCC BTX	Dynamic Simulation & SIS Application 2,396 to 901 ton/hr	BE	YNCC / Korea	2010.01
S-Oil Flare Load Analysis Project	Total Refinery Complex	Dynamic Simulation & SIS Application 2,196 to 1,473 ton/hr	BE	S-Oil / Korea	2009.12
HPC Flare Load Analysis project	NCC / BD BRU / EO EG Polymer	Dynamic Simulation & SIS Application 3,078 to 1,732 ton/hr	BE	HPC / Korea	2007.12
STC Aromatic Flare Load Analysis	Total Aromatic Complex	Dynamic Simulation & SIS Application 1,182 to 642.5 ton/hr	BE	STC / Korea	2007.08
GS Caltex Flare Load Analysis	Total Refinery Complex / RFCC	Dynamic Simulation & SIS Application	BE	GS Caltex / Korea	2005.08

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Energy Saving

Objectives

The objectives of client (LG Chem) were as follows

- Quantification and minimization of energy inefficiency in BTX and NCC plant
- Manipulation of utility network in whole plant for operating cost minimization
- Optimization of operation mode in BTX and NCC plant
- Investigating available points for energy saving in the whole plant

Study Approaches

In order to realize client's objectives, Ezer performed the following works as below

- Maximizing energy efficiency through elaborate simulation modeling, HX addition, operating condition optimization
- Applying pinch study to investigate minimum temperature approach
- Utilizing recovered heating source for NCC from BTX energy, which led to about 15.4 MMkcal/hr energy saving
- Obtaining the licenses about technology of energy saving in NCC and BTX plant



Patent list

Title of Invention	Patent Number	Plant	Description	Registration Date
Energy recovery technology in BTX and NCC plant	10-1171986	NCC / BTX	Heat transfer between BTX and NCC Plant	2012.08.01
Improving energy efficiency in BTX plant	10-0894400	BTX	BTX modification for energy saving	2009.04.14

Relevant Projects

The following list summarizes the major projects to be applied to energy saving

[BE : Basic Engineering]

Project Name	Plant	Description	Work Scope	Client Country	Completed
H-Oil Bank #1 CDU Optimization Project	CDU VDU	Energy Saving : 14 MMkcal/hr Crude Feed 67,000 to 112,000 BPSD	BE	H-Oil Bank / Korea	2010.04
HPC Energy Saving Project	NCC / BRU BD / EG	Energy Saving : 70.5 MMkcal/hr	BE	HPC / Korea	2011.01
SM Energy Saving Project	EB / SM	Energy Saving : 5.9 MMkcal/hr	BE	STC / Korea	2008.12
M-X & Energy Saving Project	NCC BRU	Energy Saving : 15.4 MMkcal/hr Modification BRU to BX	BE	LG Chem / Korea	2008.03

Experience

BE: Basic Engineering | DE: Detail Engineering | FS: Feasibility Study | EPC: Engineering / Procurement / Construction

Grass Root Plant

Project Name	Plant	Description	Work Scope	Client Country	Completed
IPA Project	IPA	IPA Product 30,000 MTA	BE	STC / Korea	2012.01
Biobutanol Commercial Plant	Biobutanol	Biobutanol Product 120,000 MTA	BE	GS Caltex / Korea	2012.12
Biobutanol Pilot	Biobutanol	Biobutanol Pilot Basic Design & Rab Test	BE	GS Caltex / Korea	2011.08
STC Jet Fuel Project	Refinery	Crude Kerosene Splitter 800,000 MTA Feed 800,000 MTA	BE	STC / Korea	2009.02
HPC BD Project	BD	1, 3 Butadien Product 140,000 MTA	BE	HPC / Korea	2008.12
Lube Base Oil Project	Lube	CDW 9,000 BPSD	BE	SK Energy / Indonesia	2006.05

Capacity Upgrading

Project Name	Plant	Description	Work Scope	Client Country	Completed
BN-1 Capa-up Project	BN-1	Raffinate Feed 9,000 to 14,000 kg/hr	BE	HPC / Korea	2012.04
H-Oil Bank DCU Cold VR Operation Mode Project	DCU	Cold VR Feed Operation Mode Study	BE	H-Oil Bank / Korea	2011.05
YNCC BN-1 Expansion Project	BN-1	Raffinate Feed 17,560 kg/hr	BE, DE	YNCC / Korea	2010.08
C3 LPG Treatment Project	C3 LPG	Heavy HC Feed 4,500 kg/hr	BE	YNCC / Korea	2010.08
STC C3 Fractionator #3 Project	NCC	Product LPG 150,000 MTA	BE, DE	STC / Korea	2010.05
BD Process Upgrade Engineering Study Project	BD	1,3 Butadien Feed 39 to 54.45 ton/hr	BE	STC / Korea	2010.01
HPC BTX Modification Project	BTX	Modification BRU to BTX Feed 73.1 ton/hr	BE	HPC / Korea	2010.01
YNCC #3 NCC 2nd Debottleneck Project	NCC	Naphtha Feed 155 to 175 ton/hr	BE	YNCC / Korea	2010.01
STC N-Hexane Capacity Upgrading	N-Hexane	N-Hexane Feed 8 to 10.3 ton/hr	BE	STC / Korea	2008.02
HPC BRU/BD Revamping Project	BRU / BD	BRU Feed 57 to 93 ton/hr BD Product 176,000 MTA	BE	HPC / Korea	2007.12
Kero-Merox Revamping Project	Kero-Merox	Kerosene Product 7,000 to 10,000 BPSD	BE	H-Oil Bank / Korea	2007.12
Crude Unit Capacity Upgrading Study	CDU / NHT	Simulation Modeling of #3 CDU, NHT	BE	GS Caltex / Korea	2006.08
#3 CDU improvement Project	CDU / VDU NHT	Basic Design	BE	GS Caltex / Korea	2005.11
YNCC #1 NCC Process Simulation for Capacity Upgrading	NCC	Simulation Modeling for Capacity Upgrading	BE	YNCC / Korea	2005.08

Experience

(BE : Basic Engineering | DE : Detail Engineering | FS : Feasibility Study | EPC : Engineering / Procurement / Construction)

Flare Load Analysis Project

Project Name	Plant	Description	Work Scope	Client Country	Completed
HCC Orange Project	Poly-Silicon	Flare System Design for Glass Root Plant & SIS Application	BE	Hanwha / Korea	2012.10
HPCEM2 (Flare)	NCC / BTX	Dynamic Simulation & SIS Application 3,688 to 1,175 ton/hr	BE	HPC / Korea	2011.03
HCC EVA Flare Load Analysis	EVA	Flare Load Analysis & SIS Application	BE	Hanwha / Korea	2010.11
STC C4 Plant Dynamic Simulation for Flare Load Calculation	BD	Dynamic Simulation & SIS Application 139.2 to 42.3 ton/hr	BE	STC / Korea	2010.08
YNCC #3NCC 2nd Debottleneck Project	NCC / BTX	Dynamic Simulation & SIS Application 2,396 to 901 ton/hr	BE	YNCC / Korea	2010.01
S-Oil Flare Load Analysis Project	Total Refinery Complex	Dynamic Simulation & SIS Application 2,196 to 1,473 ton/hr	BE	S-Oil / Korea	2009.12
HPC Flare Load Analysis Project	NCC / BD BRU / EO EG / Polymer	Dynamic Simulation & SIS Application 3,078 to 1,732 ton/hr	BE	HPC / Korea	2007.12
S-Oil Flare Load Analysis (Ph II)	Refinery	Dynamic Simulation & SIS Application 944.5 to 740 ton/hr	BE	S-Oil / Korea	2007.12
STC Aromatic Flare Load Analysis	Total Aromatic Complex	Dynamic Simulation & SIS Application 1,182 to 642.5 ton/hr	BE	STC / Korea	2007.08
LG Chem Polymer Flare Load Analysis	PP / HDPE SM / LDPE LLDPE	Dynamic Simulation & SIS Application 2,234 to 1,188 ton/hr	BE	LG Chem / Korea	2007.02
KPIC Flare Load Analysis	NCC / C4 NHP / PGH	Dynamic Simulation & SIS Application 1,780 to 998 ton/hr	BE	KPIC / Korea	2006.12
HPC Flare Load Analysis	NCC / PE PP	Dynamic Simulation & SIS Reduction Application 3,078 to 1,732 ton/hr	BE	HPC / Korea	2006.11
STC HDPE / PP Flare Load Analysis	HDPE / PP	Dynamic Simulation & SIS Application	BE	STC / Korea	2006.02
GS Caltex Flare Load Analysis	Total Refinery Complex / RFCC	Dynamic Simulation & SIS Application	BE	GS Caltex / Korea	2005.08

Feasibility Study

Project Name	Plant	Description	Work Scope	Client Country	Completed
LG Chem NCC Advanced Energy Saving Project	NCC	Energy Saving : 18.6 MMkcal/hr Economic Effect : KW 10,321 MM/year Pre Investment Cost : KW 10,396 MM	FS	LG Chem / Korea	2010.09
STC C3 Cracking Feasibility	C3	Feasibility Study	FS	STC / Korea	2009.12
BTX Byproduct Fuelization	BTX	Feasibility Study	FS	KIC / Korea	2009.09
GS Caltex Biobutanol Project	Biobutanol	Biobutanol 100 kg/hr Pilot	BE	GS Caltex / Korea	2008.07

Energy Saving

Project Name	Plant	Description	Work Scope	Client Country	Completed
HPC Energy Saving Project	NCC / BRU BD / EG	Energy Saving : 70.5 MMkcal/hr	BE	HPC / Korea	2011.01
SK Energy CLX Project	NHT	Energy Saving : 7 MMkcal/hr	BE	SK Energy / Korea	2010.11
NCC Advanced Energy Saving Project	NCC	Energy Saving : 18.6 MMkcal/hr	BE	LG Chem / Korea	2010.10
SM Energy Saving Project	EB / SM	Steam Grade Change HPS to MPS : 5.7 MMkcal/hr	BE	STC / Korea	2010.05
H-Oil Bank #1 CDU Optimization Project	CDU / VDU	Energy Saving : 14 MMkcal/hr Crude Feed 67,000 to 112,000 BPSD	BE	H-Oil Bank / Korea	2010.04
NCC Energy Saving Project	NCC	Energy Saving : 30.8 MMkcal/hr	BE	STC / Korea	2010.01
SM Energy Saving Project	EB / SM	Energy Saving : 5.9 MMkcal/hr	BE	STC / Korea	2008.12
M-X & Energy Saving Project	NCC / BRU	Energy Saving : 15.4 MMkcal/hr Modification BRU to BX	BE	LG Chem / Korea	2008.03

EPC

Project Name	Plant	Description	Work Scope	Client Country	Completed
H2 Plant	H2 Plant	H2 Plant Construction	EPC	Chang Shin Chem / Korea	2013.03
Biomass Pilot Plant	Biomass Pilot	Pilot Plant	EPC	GS Caltex / Korea	2012.09
Solvent Dehydration Pilot Plant	Solvent	Solvent Dehydration Pilot Plant	EPC	GS Caltex / Korea	2012.05
Biobutanol Project	Biobutanol	Biobutanol Pilot Plant	EPC	GS Caltex / Korea	2011.12
R2 Project	EB / SM	SM 420,000 to 490,000 MTA	EPC	HPC / Korea	2011.04
N-Hexane Revamping Project	LLDPE	#1 Capa-up Project	EPC	STC / Korea	2008.10