



Kinetics Process Improvements, Inc.

Independent Consultants & Engineers

Serving to Improve, Decarbonize & De-bottleneck

- **Ammonia Plants** (Integration with gH₂)
- **Methanol Plants** (Oxygen Enrichment)
- **Ethylene Plants** (Electrification)
- **PDH Plants** (New Tech evaluations)
- **Decarbonization Solutions** (Green-Blue Ammonia & Methanol Plant Studies)

- Technology Evaluation
- Project Cost Estimate
- Risk Assessment
- Due Dilligence
- Economic Evaluation

PROJECT FEASIBILITIES

REVAMP STUDIES

- Capacity/Efficiency Improvements
- Plant Energy Audits
- Reformer Re-ratings
- MIC™ Revamp without major compressor upgrades
- Synloop Optimizer

- Process & Technology
- Equipment:
 - Monitoring Techniques
 - Reliability Reviews
- Plant Modeling

CUSTOM PROCESS TRAINING

PROCESS DESIGN & ENGINEERING

- Basic Engineering Pkg
- Pilot Scale Up
- Process Simulations
- Converter Modeling

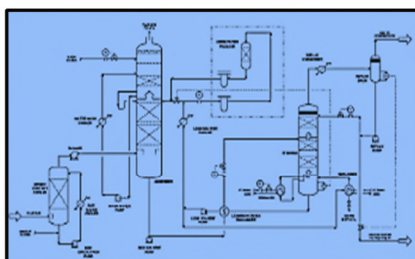


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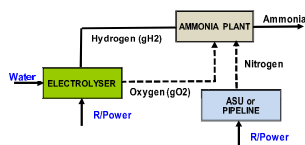
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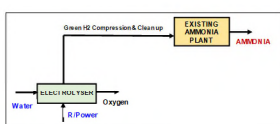
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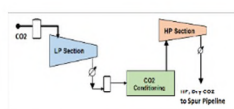
GREEN AMMONIA PLANT STUDIES



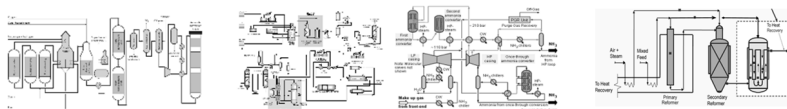
INTEGRATION STUDIES- gH2 & gO2



CO2 COMPRESSION & DEHYDRATION



TECHNOLOGY EVALUATION-RISK ASSESSMENT-MITIGATION



OWNER'S ENGINEERS FOR EVALUATING & EXECUTING DECARBONIZATION SOLUTIONS-STUDIES

SINCE 2005

Consulting to Decarbonize [Blue-Green Options]

by KPI Consulting, Houston

KPI has provided project development management and consulting services for over a dozen projects. KPI led the successful development of Four large projects as "Owner's Engineers" including a major Propylene derivatives complex in Saudi & ongoing green & Blue Ammonia plants at USGC. Our breadth of technology expertise coupled with our **experience in various Decarbonization options** provide the value addition for the new projects as well as upgrading the existing facilities.

Expertise

- Ammonia Tech & Economics
- Methanol Tech & Economics
- H2 Production Tech & Economics
- OTF H2 Cost & Economic Analysis
- SMR & ATR Syngas Technologies
- CO2 Capture Technologies (Pre & Post)
- CO2 Compression & Dehydration
- gH2/bH2 Integration Studies
- O2 Enrichment studies
- Green-Blue H2 & NH3 Evaluation
- Ethylene & PDH Technologies
- Strategic Project Planning
- Project definition & management
- Project Configuration Evaluations
- Technology & Risk Evaluation
- Due diligence- overall project
- Project Cost Estimates & Economics
- Project Pre-Feasibility
- Licensing/BEP Agreements reviews
- Project Execution support
- Critical Technical Reviews
- Simulation modeling

Resources

- Team of SME's- Houston office
- Working relations with Licensors
- Working relations Equipment Suppliers
- Proven modeling & sizing tools
- Cost data base (updated regularly)

Projects/Studies Handled

- Green-Blue H2/NH3/MeOH Studies
- O2 Enrichment Studies
- g/bH2-NH3 Integration Studies
- Electric Pre-reformer
- CO2 Capture Feasibility Study
- CO2 Compression & Dehydration
- New Decarb Tech options studies
- Ammonia plant studies
- Methanol & value chain Studies
- Pet coke to Chemicals Studies
- Propane Dehydro (PDH) project
- Ethylene & value chain study
- Propylene value chain Project
- Oxo-Alcohol & derivatives project
- Acrylic Acid & derivatives project

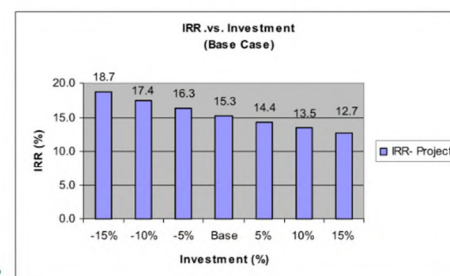
References

SABIC, Advance Petrochemicals, Saudi Chevron, Tasnee, Chemanol, Methanol Holdings, Modi Group, D7 Petrochem, YCI, CFI, Nutrien, Yara, OCI, Dyno Nobel, CSBP Chemanol, Statoil, PPGPL, USGC

Completed several Green & Blue Ammonia and gH2/gO2 integration studies as well as CO2 Capture, Compression and Dehydration with total Cost Estimates

Decarbonization Consulting Advisory & Engg. Studies

Project Definition & Planning
Project Configurations
Technology Assessment
Project Risks & mitigation
Project Pre-feasibility
Project Cost Estimates
Design & Engg. Management
Critical Technical Reviews



KPI Consulting

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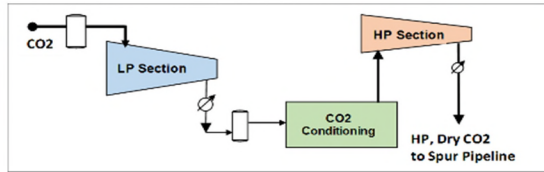
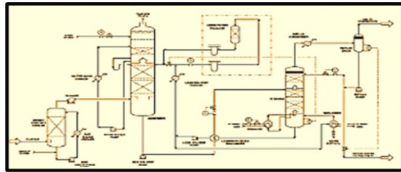
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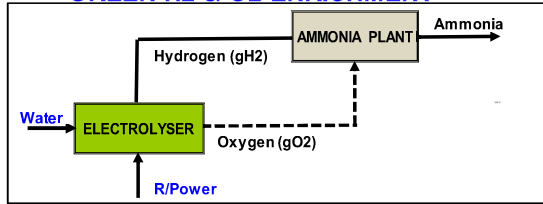
"Completed over a dozen Engineering studies and six successful upgrades of pre-combustion CO2 capture units"

CO₂ CAPTURE, DEHYDRATION & COMPRESSION STUDIES

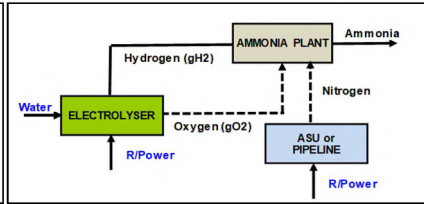


INTEGRATION STUDIES

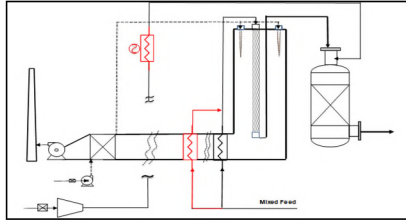
GREEN H₂ & O₂ ENRICHMENT



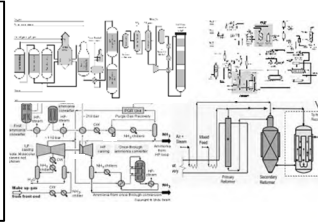
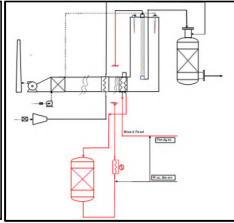
GREEN AMMONIA PLANT STUDIES



STUDY TO RECONFIGURE & ELECTRIFY FOR REDUCED FIRING



ATR & CO₂ REDUCTION TECHNOLOGY EVALUATION



COMPLETED SEVERAL DECARBONIZATION & CCS ENGINEERING STUDIES WITH COST ESTIMATES

Decarbonization Pathways & Solutions

by Kinetics Process Improvements, Houston

KPI-Houston is an Independent Process Technology & Consulting for in-depth analysis Studies for CO₂ abatement pathways in Ammonia, Methanol, H₂ & Petrochem plants. Also design and engg expertise in CO₂ capture, dehydration, Compression, Liquefaction including (g/b) H₂ integration, and O₂ Enrichment

Expertise & Services

- **Strategic Analysis & Studies**
 - ✓ CO₂ abatement Options
 - ✓ Green-Blue H₂/NH₃ options
 - ✓ gH₂/gO₂ integration studies
 - ✓ Ammonia Cracking
 - ✓ Plant Integration & Impact
 - ✓ New Technologies Evaluation
 - ✓ Project Risks & mitigation
 - ✓ Costs & Economics
- **CO₂ Capture Technologies**
 - ✓ Pre-Combustion (syngas)
 - ✓ Post-Combustion (Flue gas)
- **CO₂ Dehydration & Clean-up**
 - ✓ Glycol units
 - ✓ Adsorbents/Molecular Sieves
- **CO₂ Transportation**
 - ✓ CO₂ Liquefaction
 - ✓ CO₂ Compression
- Supercritical CO₂ Equip. specs
- H₂ & O₂ Compression Specs
- Owner's Engineers

"Two Patents pending- Reducing CO₂ footprint in Primary Reformers"

Methodology

- Integration with gH₂/bH₂
- Electrify & O₂ Enrichment
- Reconfigure to reduce Firing
- CO₂ Capture-Utilization or Seq
- gH₂ via Renewable energy

Tools

- Simulation modeling & sizing
- Extensive Cost database
- Rigorous Economic models

Studies/Projects References

- gH₂/NH₃ Engg Studies
- gH₂/NH₃ integration studies
- CCS study (2 x3000 tpd CO₂)
- CO₂ Capt/Comp/Dehy studies
- CO₂ Capture from Flue gas
- CCS study (3900 tpd CO₂)
- Electric Pre-reforming Studies
- O₂ Enrichment Studies

End Users Served

- CFI, Nutrien, Dyno Nobel, Yara, OCI
- Chemanol, CSBP, Statoil, USGC

Decarbonization via Blue & Green Solutions in Ammonia, Methanol & Petrochem Plants

Green-Blue Ammonia Feasibility
Green H₂ Integration Studies
Oxygen Enrichment Studies
CO₂ Capture Feasibility Studies
CO₂ Compression & Dehydration
H₂ Compression & O₂ removal
Oxygen Compression
New Technology Evaluation
Plant Impact & Engg Studies
Risk Assessment
Cost Estimates

SINCE 2005



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Completed several Green & Blue Ammonia and gH₂/gO₂ integration studies as well as CO₂ Capture, Compression and Dehydration with total Cost Estimates

"Completed over a dozen Engineering studies and six successful upgrades of pre-combustion CO₂ capture units"



KPI, Houston has been providing an **independent Project Consulting & Advisory Services for Business Solutions** since 2006. KPI's core strengths are in various process technologies in the Hydrocarbon sector, including the light Olefins, derivative Petrochemicals as well as Ammonia, Methanol & derivatives.

KPI has **completed over 150 projects globally for more than 60 clients**, including roles as **"Owner's Engineers"** for two large projects in Middle East. As **"Owner's**

Engineers", KPI team spearheaded the **development and implementation of a large Propylene derivatives complex** for a Saudi location to produce **Acrylic Acid, Oxo-Alcohols/Syngas and Acrylic Esters**. It is currently in operation. KPI also developed a new **Ammonia Project** utilizing off-gases from existing Methanol/CO plants for Saudi location. Lately, KPI handled various studies and projects related **Green and Blue Ammonia** including O2 enrichment and CCS- mostly in the US.

KPI has **completed over 100 project feasibilities, technology evaluations, due diligence & risk assessments** & strategic advisory for new facilities. KPI goes extra miles to investigate and generate creative options to provide real value as cost effective, practical and innovative solutions, often improving Capacity and Energy Efficiency for existing Ammonia, Methanol, Ethylene and PDH plants.

TECHNOLOGY- ENGINEERING-PROJECT MANAGEMENT
EXPERIENCE - KNOWLEDGE - EXPERTISE

Trusted Partner, "Owner's Engineers"

- ***Capital Project Development***
- ***Asset Performance Improvements***
- ***Facilitating Project Resourcing & Partnering***
- ***Strategic Advisory & Risk Assessment-Mitigation***
- ***Customized Plant Training***



OWNER'S ENGINEERS
PROJECT DEVELOPMENT
EXPERT CONSULTING & ADVISORY
GREEN & BLUE
AMMONIA, METHANOL & LIGHT OLEFINS

OWNER'S ENGINEERS

Independent Technology and Engineering Consultants
Technical, Commercial and Financial Due Diligence
Asset Performance Analysis and Improvements
Optimization of Resource Monetization

Supplement Your Scarce Key Resources
Global Reach - Global Value - Global Success

PROJECT CONSULTING FOR CLIMATE CLEAN UP



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SYNGAS & DERIVATIVES

Ammonia Plants
Methanol Plants
Hydrogen Plants
Oxo-Syngas
Syngas to Chemicals
Green & Blue Initiatives

PETROCHEMICALS

Ethylene Plants
PDH Units
Propylene Derivatives
Acrylic Acid
Oxo-Alcohols
Methanol Derivatives



FACILITIES SERVICES AS OWNER'S ENGINEERS

INITIAL PROJECT DEFINITION	BASIC DESIGN & ENGINEERING REVIEWS
PROJECT IDENTIFICATION & TECHNO-ECONOMIC PRE-FEASIBILITY	INDEPENDENT PROJECT CAPITAL COST ESTIMATES
DUE DILIGENCE, RISK ASSESSMENT & MITIGATION	REVIEW OF CRITICAL EQUIPMENT
LENDER'S ENGINEERS	ASSET PERFORMANCE ANALYSIS & IMPROVEMENTS
TECHNOLOGY & PROJECT RISKS ASSESSMENT & MITIGATION	PLANT START-UP ADVISORY
SPECIALTY CHEMICALS LICENSE SOURCING	PLANT PERFORMANCE GUARANTEE TEST OVERSIGHT
LICENSING & BEP AGREEMENTS REVIEWS SCOPING DEFINITION & RFP FOR EPC	CUSTOMIZED PLANT TRAINING
FACILITATING PROJECT RESOURCING & PARTNERING	INTEGRATED PROJECT MANAGEMENT SERVICES