



**Kinetics Process Improvements, Inc.**

## **Independent Consultants & Engineers**

*Serving to Improve, Decarbonize & De-bottleneck*

- **Ammonia Plants** (Integration with  $\text{gH}_2\text{L}^{\text{***}}$
- **Methanol Plants** fCI m[ Yb'9 bf]W a YbK'
- **Primary Reformers** (Electrification & Replacement with Electric Drivers)
- **CO<sub>2</sub> Removal Systems** (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

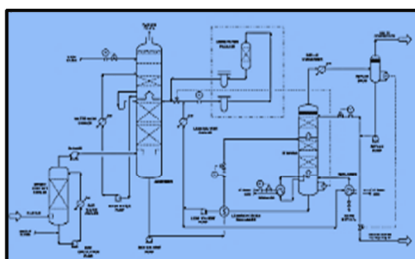


**Kinetics Process Improvements, Inc.**

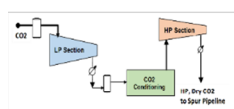
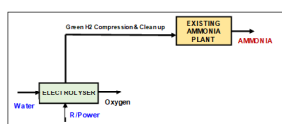
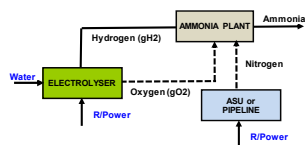
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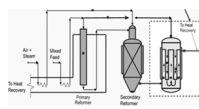
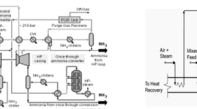
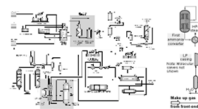
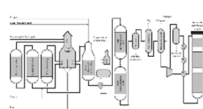
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GREEN AMMONIA PLANT STUDIES

INTEGRATION STUDIES- gH<sub>2</sub> & gO<sub>2</sub>CO<sub>2</sub> COMPRESSION & DEHYDRATION

TECHNOLOGY EVALUATION-RISK ASSESSMENT-MITIGATION



OWNER'S ENGINEERS FOR EVALUATING &amp; 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 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
- H<sub>2</sub> Production Tech & Economics
- OTF H<sub>2</sub> Cost & Economic Analysis
- SMR & ATR Syngas Technologies
- CO<sub>2</sub> Capture Technologies (Pre & Post)
- CO<sub>2</sub> Compression & Dehydration
- gH<sub>2</sub>/bH<sub>2</sub> Integration Studies
- O<sub>2</sub> Enrichment studies
- Green-Blue H<sub>2</sub> & NH<sub>3</sub> 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 H<sub>2</sub>/NH<sub>3</sub>/MeOH Studies
- O<sub>2</sub> Enrichment Studies
- g/bH<sub>2</sub>-NH<sub>3</sub> Integration Studies
- Electric Pre-reformer
- CO<sub>2</sub> Capture Feasibility Study
- CO<sub>2</sub> 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

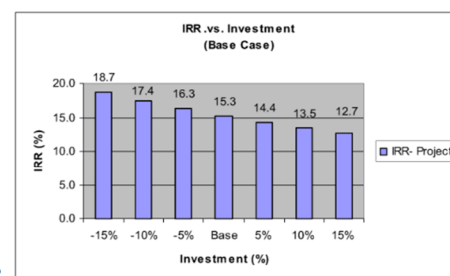
### References

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 gH<sub>2</sub>/gO<sub>2</sub> integration studies as well as CO<sub>2</sub> 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*



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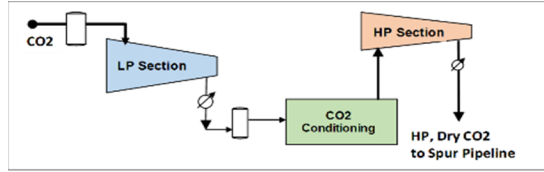
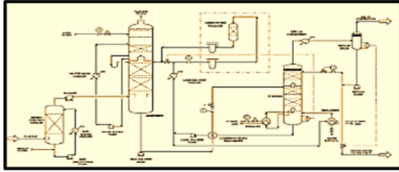
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*"Completed over a dozen Engineering studies and six successful upgrades of pre-combustion CO<sub>2</sub> capture units"*

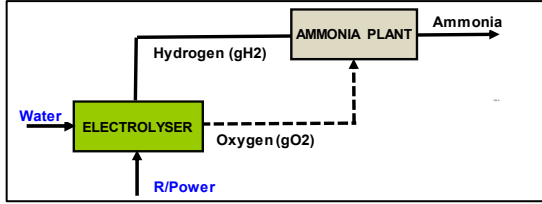


## CO<sub>2</sub> CAPTURE, DEHYDRATION & COMPRESSION STUDIES

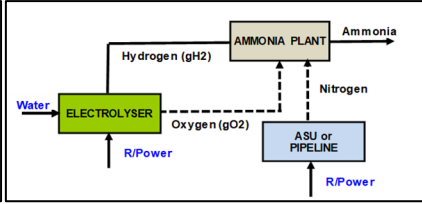


### INTEGRATION STUDIES

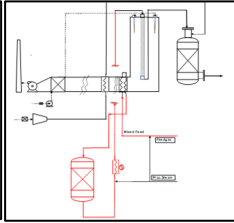
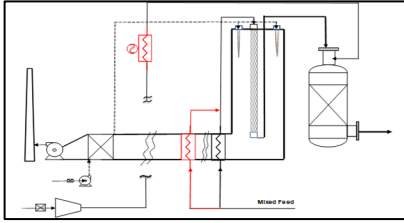
### GREEN H<sub>2</sub> & O<sub>2</sub> ENRICHMENT



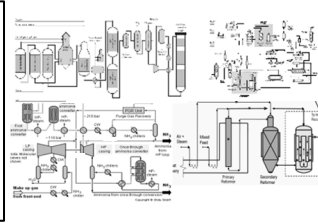
### GREEN AMMONIA PLANT STUDIES



### STUDY TO RECONFIGURE & ELECTRIFY FOR REDUCED FIRING



### ATR & CO<sub>2</sub> REDUCTION TECHNOLOGY EVALUATION



COMPLETED A DOZEN 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 CO<sub>2</sub> abatement pathways in Ammonia, Methanol, H<sub>2</sub> & Petrochem plants. Also design and engg expertise in CO<sub>2</sub> capture, dehydration, Compression, Liquefaction including (g/b) H<sub>2</sub> integration, and O<sub>2</sub> Enrichment*

## Expertise & Services

- **Strategic Analysis & Studies**
  - ✓ CO<sub>2</sub> abatement Options
  - ✓ Green-Blue H<sub>2</sub>/NH<sub>3</sub> options
  - ✓ gH<sub>2</sub>/gO<sub>2</sub> integration studies
  - ✓ Ammonia Cracking
  - ✓ Plant Integration & Impact
  - ✓ New Technologies Evaluation
  - ✓ Project Risks & mitigation
  - ✓ Costs & Economics
- **CO<sub>2</sub> Capture Technologies**
  - ✓ Pre-Combustion (syngas)
  - ✓ Post-Combustion (Flue gas)
- **CO<sub>2</sub> Dehydration & Clean-up**
  - ✓ Glycol units
  - ✓ Adsorbents/Molecular Sieves
- **CO<sub>2</sub> Transportation**
  - ✓ CO<sub>2</sub> Liquefaction
  - ✓ CO<sub>2</sub> Compression
- Supercritical CO<sub>2</sub> Equip. specs
- H<sub>2</sub> & O<sub>2</sub> Compression Specs
- Owner's Engineers

"Two Patents pending- Reducing CO<sub>2</sub> footprint in Primary Reformers"

## Methodology

- Integration with gH<sub>2</sub>/bH<sub>2</sub>
- Electrify & O<sub>2</sub> Enrichment
- Reconfigure to reduce Firing
- CO<sub>2</sub> Capture-Utilization or Seq
- gH<sub>2</sub> via Renewable energy

## Tools

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

## Studies/Projects References

- gH<sub>2</sub>/NH<sub>3</sub> Engg Studies
- gH<sub>2</sub>/NH<sub>3</sub> integration studies
- CCS study (2 x3000 tpd CO<sub>2</sub>)
- CO<sub>2</sub> Capt/Comp/Dehy studies
- CO<sub>2</sub> Capture from Flue gas
- CCS study (3900 tpd CO<sub>2</sub>)
- Electric Pre-reforming Studies
- O<sub>2</sub> Enrichment Studies

## End Users Served

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

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

Green-Blue Ammonia Feasibility  
Green H<sub>2</sub> Integration Studies  
Oxygen Enrichment Studies  
CO<sub>2</sub> Capture Feasibility Studies  
CO<sub>2</sub> Compression & Dehydration  
H<sub>2</sub> Compression & O<sub>2</sub> removal  
Oxygen Compression  
New Technology Evaluations  
Plant Impact & Engg Studies  
Risk Assessment  
Cost Estimates

SINCE 2005



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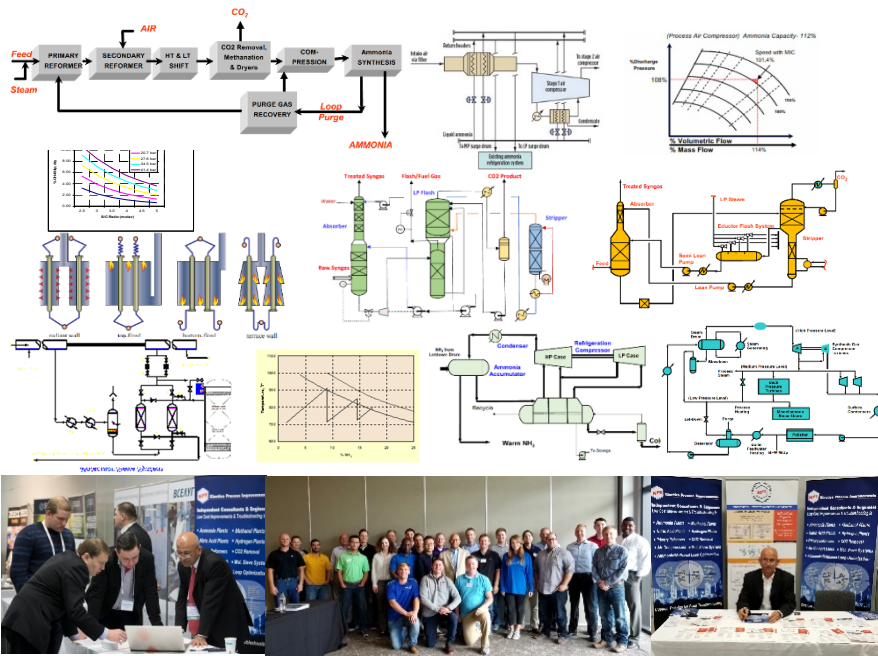
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Completed several Green & Blue Ammonia and gH<sub>2</sub>/gO<sub>2</sub> integration studies as well as CO<sub>2</sub> Capture, Compression and Dehydration with total Cost Estimates

"Completed over a dozen Engineering studies and six successful upgrades of pre-combustion CO<sub>2</sub> capture units"



# Ammonia Plants Audits, Revamps & Decarbonization Solutions & Services

*Practical & Cost-Effective Solutions to Improve Capacity, Efficiency, CO2 Emissions & Reliability*

REVAMP EXPERIENCE IN AMMONIA PLANTS FROM 400 TPD TO 4000 TPD

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## Ammonia Plants: Audits|Revamps|Decarb

by Kinetics Process Improvements, Houston

*KPI-Houston is an independent Process Design & Engineering Consulting group specializing in Ammonia & Methanol Plants Audits, Revamps, and Decarbonization solutions to improve Capacity, Efficiency, Reliability & reduce CO2 footprint*

### Objectives & Key Benefits

- To improve Capacity, Efficiency, Reliability & CO2 Footprint
- Identify Best Revamp Options using Cost-Benefit Analysis
- Practical & Cost-effective Solutions

### Resources & Expertise

- *Integrated Suction Chiller™* to upgrade Process Air Compressor
- Electric Pre-Reforming
- **Green/Blue Ammonia development**
- Reformer Re-rating and Re-harping
- CO2 Removal System Revamps - a/MDEA & Benfield systems
- Rating & Optimizing Converters
- Modeling of Complete Ammonia Plants of different Configurations
- Rigorous modeling of Reformers
- Re-rating with Compressor models
- Basic Design & Engineering
- Equipment sizing/rating
- Project Cost Estimation
- Experienced Team

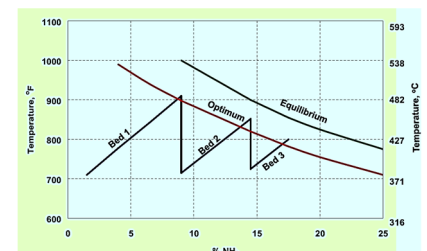
### Client References

CFI, NUTRIEN, OCI, SABIC, YARA, DYNO NOBEL, CNC N2000, AUM, PLNL, CHEMANOL, METHANOL HOLDINGS, LSB, CSBP

*Integrated Chiller™ Patent granted  
Pending Patent for Electric Pre-Reforming*

### Ammonia Plant Services

- Plant Performance Audits
- Plant De-Bottlenecking
- **Green H2 integration Studies**
- **O2 Enrichment Studies**
- **ATR based Ammonia Study**
- Revamp for higher Capacity
- Revamp for improved Efficiency
- Basic Engineering of Revamp
- Rating Primary Reformer
- Reformer Re-harping studies
- CO2 Removal System upgrades
- Mol-Sieve System upgrade
- Ammonia Loop upgrade
- Ammonia Refrigeration upgrade
- Compressors/Turbine upgrades
- Optimizing Steam System
- Cooling Water System upgrade
- Root-cause analysis
- **CO2 Capture & Compression**
- Value Engineering
- 3<sup>rd</sup> Party Design Reviews
- Critical Equipment Reviews
- **Green/Blue Ammonia Feasibility**
- Project Feasibility
- Technology/Project Evaluation
- Risk Assessment



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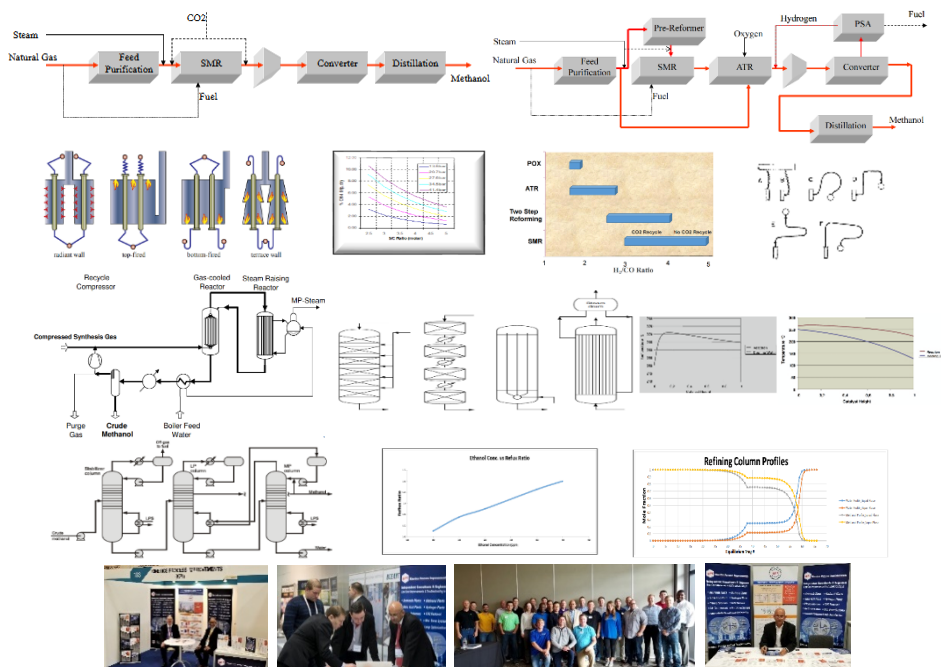
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# Methanol Plants Audits, Revamps & Decarbonization Solutions & Services

*Practical & Cost-Effective Solutions to Improve Capacity, Efficiency Reliability & CO2 Footprint*

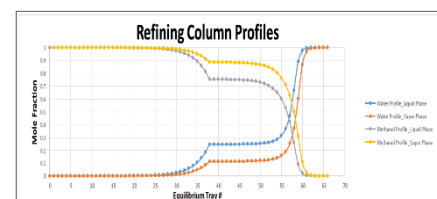
STUDIED METHANOL PLANTS FROM 300 TPD TO 5400 TPD. COMPLETED OVER 100 REVAMP STUDIES

SINCE 2005

## Methanol Plants: Audits|Revamps|Decarb

by Kinetics Process Improvements, Houston

*KPI-Houston is an independent Process Technology, Design & Engg Consulting group specializing in Ammonia & Methanol Plants Revamps since 2006 to improve Capacity, Efficiency, Reliability & CO2 footprint. Over 100 Revamp Studies completed*



### Objectives & Key Benefits

- To Improve Plant Capacity, Efficiency, Reliability & CO2 footprint
- Identify Best Revamp Options using Cost-Benefit Analysis
- Practical & Cost-effective Solutions

### Resources & Expertise

- Simulation modeling of Complete Methanol Plant for all Process Configurations including ATR
- Decarbonization Solutions
- Rigorous modeling of Reformers
- Re-rating Compressors
- Modeling Methanol Reactors
- Rating & Optimizing Synloop
- Methanol Distillation modeling
- Basic Design Package
- Equipment sizing tools
- Experienced Team

### Client References

Methanex, SABIC, Celanese, AMPCO, Koch Methanol, Methanol Holdings, Chemanol, Syngas Energy

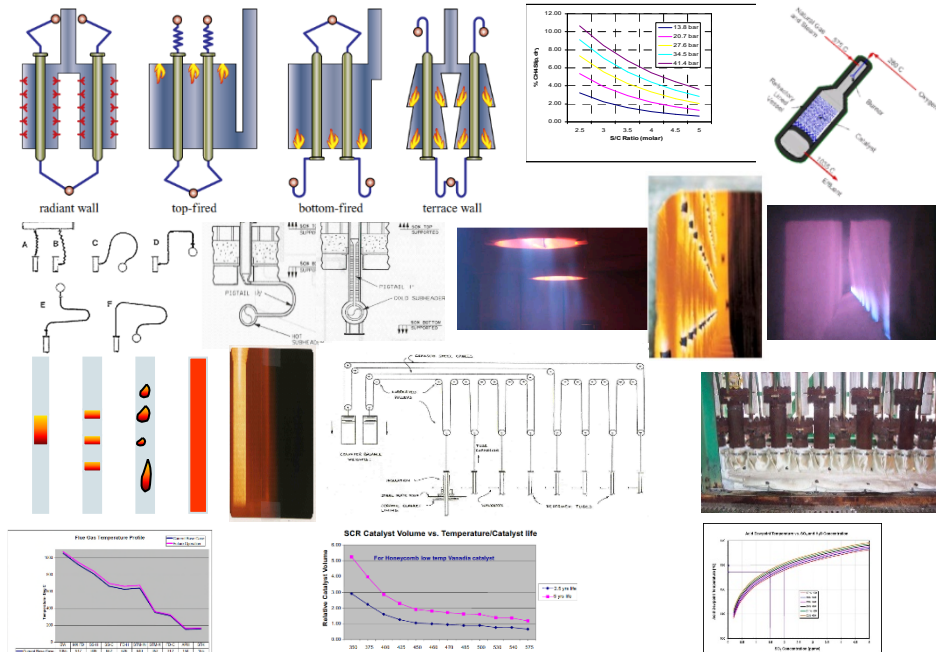
### Methanol Plant Services

- Revamp for higher capacity &  $\eta$
- Revamp for improved Reliability
- Upgrade to reduce CO2 footprint
- CO2 injection for higher capacity
- Co-production Ammonia study
- Upgrading Primary Reformer
- Plant Performance Audits
- Basic Engineering of Revamp
- Methanol Loop upgrade
- Methanol Distillation upgrade
- Optimizing Steam System
- Cooling Water System upgrade
- SCR for NOx Reduction
- Value Engineering
- Critical Equipment Reviews
- Equipment design upgrade
- Project Cost Estimate
- Risk Assessment
- Technology/Project Evaluation
- Derivatives Feasibilities

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**HOLISTIC APPROACH TO INCREASE REFORMING CAPACITY. OVER 60 REVAMP STUDIES COMPLETED**

# Reformers Revamping & Troubleshooting Services

for  
**Ammonia  
Methanol  
Hydrogen  
Oxo-Syngas Plants**

SINCE 2005

## Revamping & Re-Rating Reformers

by Kinetics Process Improvements, Houston

*KPI-Houston is an Independent Process Technology, Design & Engg Consulting group specializing in Ammonia & Methanol Plants Revamps since 2006 to improve Capacity, Efficiency, Reliability & CO<sub>2</sub> footprint. Over 100 Revamp Studies completed*

### Objectives & Key Benefits

- To Improve Plant Capacity, Efficiency, Reliability & Emissions
- Identify Best Revamp Options using Cost-Benefit Analysis
- Practical & Cost-effective Solutions

### Resources & Expertise

- Rigorous Reformer modeling
- Experience in all Reformer types
- Experience in Re-rating Radiant Section/Coils
- Experience in designing & optimizing Convection Section/Coils
- Experience in Burners & Combustion System upgrades
- Experience with APH, ID FD Fans
- Integrated Chilling\* (patented)
- Basic Design Package
- Experienced Team of Process, Technology, Thermal Engineering

### References

CFI, NUTRIEN, SABIC, OCI, CHEMANOL, METHANEX, METHANOL HOLDINGS, SYNGAS Energy, CSBP

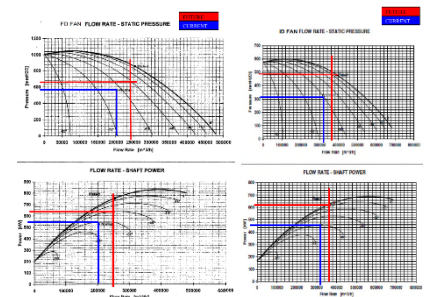
\* Two Patents granted and one pending to reduce firing & CO<sub>2</sub> footprint in Ammonia & Methanol plant Reformers

### Reformer Revamp Services

- Reforming System upgrades
- Radiant Section & Coil Re-rating
- Reformer Re-harping Studies
- Convection Re-rating Studies
- Convection section upgrades
- SCR configuration studies
- Reliability Review all systems
- Basic design & API datasheets
- Customized Training

### Reformer Troubleshooting

- Reformer Performance Audits
- Review & Analysis of Design & Operational Limitations
  - Process & Controls issues
  - Heat transfer limitations
  - WHB/Steam System issues
  - Pressure drop/draft issues
  - Temperature excursion issues
  - Combustion & Firing issues
  - Air Preheater issues
  - FD and ID Fan limitations
  - SCR/NO<sub>x</sub> issues



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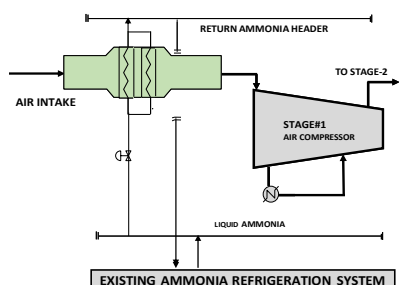
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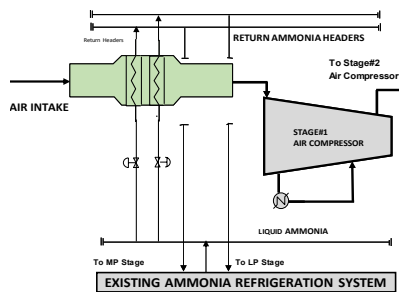
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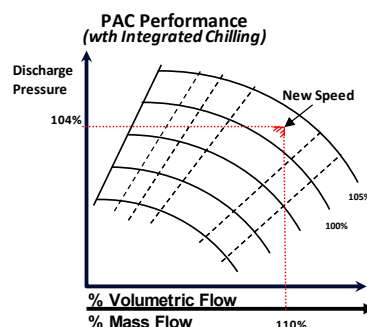
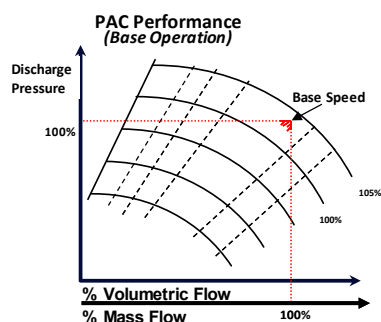




SIC™ - Single Stage Integrated Chilling



MIC™ - Multi Stage Integrated Chilling



'INTEGRATED CHILLING' PROVIDES MAXIMUM CAPACITY UPGRADE OF PAC WITH LEAST CAPEX & OPEX

SINCE 2005

## Integrated Chilling to Upgrade PAC\*

### Maximize Reforming with Lowest Capex & Opex

by Kinetics Process Improvements, Houston

KPI-Houston is an Independent Process Technology, Design & Engg Consulting group specializing in Ammonia & Methanol Plants Revamps since 2006 to improve Capacity, Efficiency, Reliability & CO<sub>2</sub> footprint. **Over 100 Revamp Studies completed**

#### Integrated Chilling

- Integrated Chilling uses existing Ammonia Refrigeration System with Process Air Compressor (PAC)
- Single or Multistage Scheme
- No Additional Compressor

#### Benefits of Integrated Chilling

- **110% PAC Capacity-with Single Stg**
- No Utilities for Integrated Chiller
- Least Cost & Space requirement
- Least incremental power for PAC
- Reduced firing in Reformer
- Reduced CO<sub>2</sub> footprint
- Efficient Synloop with lower inerts

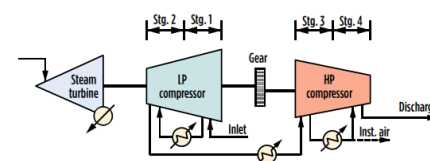
\*PAC- Process Air Compressor

#### Services

- Integration Study with PAC
- **Basic Design Package**
- **Provide Performance Guarantees**
- **Engineering & Supply thro' approved Vendors**

#### References

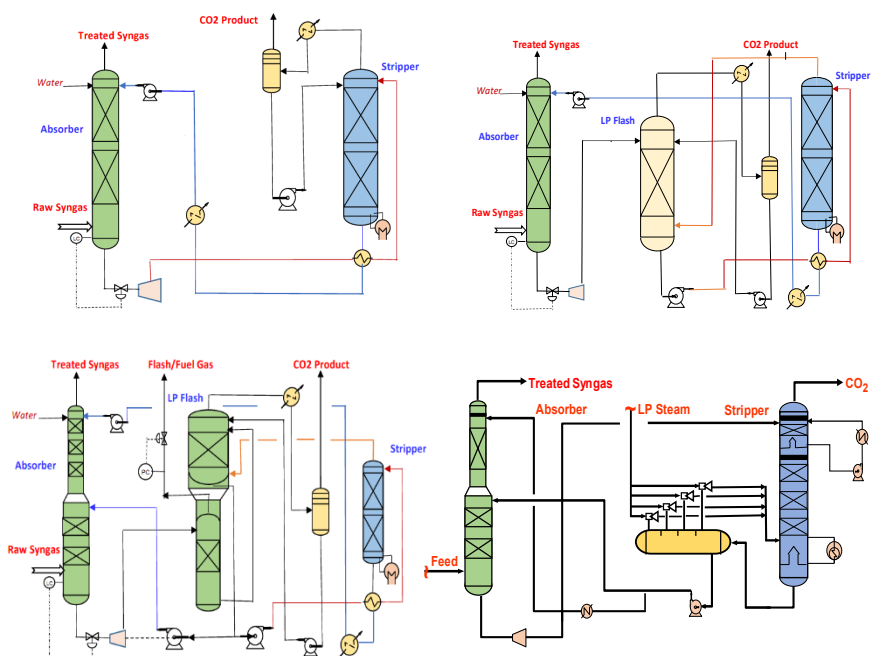
- *Approved for two large Ammonia Plants*
- *Three Patents granted (2017, 2019 & 2021)*
- *One Patent pending- Reformer CO<sub>2</sub> reduction*
- *Refer "Increase Reforming Capacity"*
- *"N<sub>2</sub> & Syngas Conference, 2018"*



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# CO2 Removal Systems Revamping & Upgrading

## *aMDEA & Benfield Systems for Higher Capacity Reduced CO2 Slip Improved Reliability*

IMPLEMENTED MANY SUCCESSFUL REVAMPS OF AMDEA & BENFIELD CO2 REMOVAL SYSTEMS

## Revamping CO2 Removal Systems

By Kinetics Process Improvements, Houston

*KPI-Houston is an Independent Process Technology, Design & Engg Consulting group specializing in Ammonia & Methanol Plants Revamps to improve the Capacity, Efficiency, and Reliability & CO2 footprint. Over 100 Revamp Studies completed*

### Revamp Experience

- **aMDEA Systems**
  - ✓ Single & Two Stages
  - ✓ Single-stage with LP flash
  - ✓ HP flash CO<sub>2</sub> recovery
  - ✓ Vac. Flash with LP Flash
  - ✓ Conversion of MEA to aMDEA
- **Benfield Systems**
  - ✓ With all Activators in use
  - ✓ All Process Configurations
  - ✓ Conversion to aMDEA study

### Expertise & Services

- **Proven Simulation modeling**
  - ✓ aMDEA Systems
  - ✓ Benfield Systems
- Holistic approach
- Evaluation of Column internals
- Evaluation & sizing Flash Drum
- Evaluation & Sizing Ejectors
- Evaluation & Sizing Reboilers
- Equipment evaluation & sizing
- Revamp Cost Estimates
- Basic Process Design Package

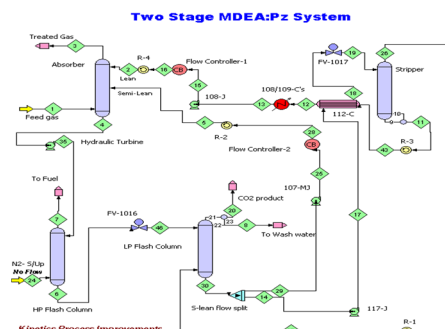
### References

- **Revamp Engineering Studies:**
  - ✓ aMDEA- 1200 tpd Ammonia \*
  - ✓ aMDEA- 3000 tpd Ammonia
  - ✓ aMDEA- 2520 tpd Ammonia \*
  - ✓ aMDEA- 1950 tpd Ammonia \*
  - ✓ Benfield-2200 tpd Ammonia \*
  - ✓ Benfield-2200 tpd Ammonia \*
  - ✓ Benfield-2250 tpd Ammonia \*
  - \***Successfully Implemented**
- **Revamp approach/scope:**
  - ✓ Simulation modeling
  - ✓ Engineering Study
  - ✓ Equipment Evaluation & sizing
  - ✓ Budgetary Cost Estimation
- **Revamp objectives included:**
  - ✓ Reducing CO<sub>2</sub> Slippage
  - ✓ Higher Capacity
  - ✓ Equipment adequacy & sizing

### Client References

CFI, Yara, LSB (for various sites)  
Nutrien, CNC, N2000

SINCE 2006

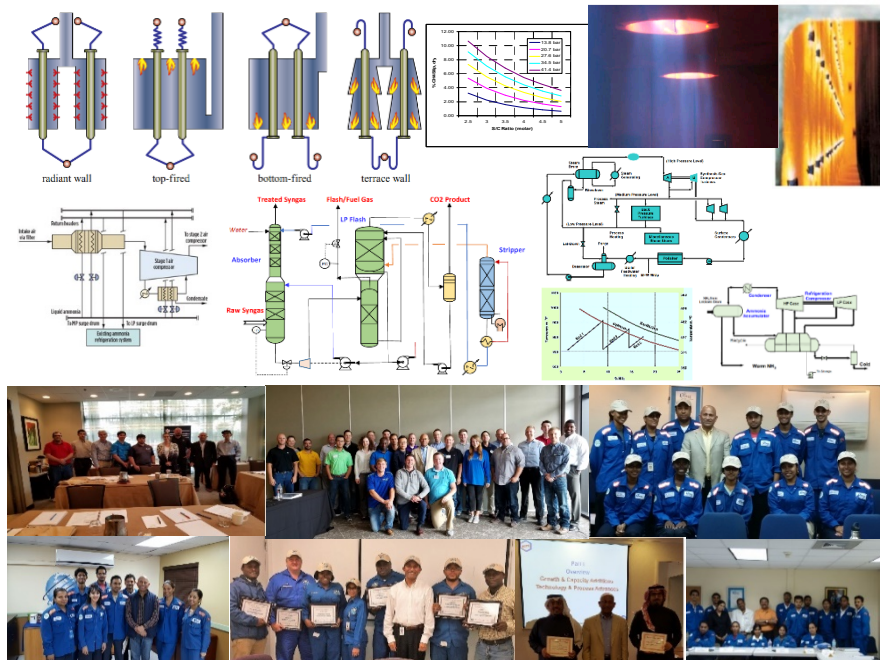


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# Ammonia Production & Troubleshooting Training

*Including  
Best Practices  
Lessons Learned  
Process Insights*

*Equipment Monitoring  
Improvements Tips  
(Customized, as needed)*

SIMPLE PRACTICAL IMPROVEMENTS & TROUBLESHOOTING TIPS

AMMONIA TRAINING SINCE 2006

## Ammonia Plant Training Workshop

by Kinetics Process Improvements

**OBJECTIVE:** *The comprehensive workshop provides practical insights with a focus on process, reforming, troubleshooting, performance improvements in Ammonia Plants to improve monitoring, maintenance, reliability & safety*

### OVERVIEW

- Process & Technology advances
- Process configurations & analysis
- Best Practices/Lessons Learned

### PROCESS & TROUBLESHOOTING

- Improve Reforming performance
- Minimizing inerts in MUG
- Minimizing pressure drop
- Improve Compressor capacity
- Improve CO<sub>2</sub> removal performance
- Options to reduce CO<sub>2</sub> footprint
- Cryogenic Purifier performance
- Optimize Synloop for max production
- Improve Ammonia Refrigeration
- Improve Steam system
- Process monitoring techniques
- Case studies/Lessons learnt
- Plant Modeling & Evaluation

### CATALYST CONSIDERATIONS

- Feed Purification
- Reforming- Pre/Primary/Secondary
- Shift- LTS/HTS
- Methanation
- Ammonia Synthesis

### PRIMARY REFORMER

- Thermodynamics and Chemistry
- Reformer Arrangements
- All about Radiant Tubes
- Critical design features
- Key Operating Variables
- Burners, Draft & Combustion
- Air Preheater & considerations
- Controls & Safety Systems
- NO<sub>x</sub> mitigation- pre- & post treatment
- Startup & Shut down consideration
- Re-harping considerations
- Catalyst evaluation techniques
- Efficiency evaluation & monitoring

### AMMONIA SYNLOOP

- Converter types & Loop configurations
- Ammonia Refrigeration
- Optimize loop for max production
- H<sub>2</sub> recovery improvements

### PERFORMANCE MONITORING

- Primary Reformer Heat Balance, ATE
- Reformer Thermal Efficiency
- Compressor/Turbine Efficiency
- Heat Exchanger/Convection Fouling

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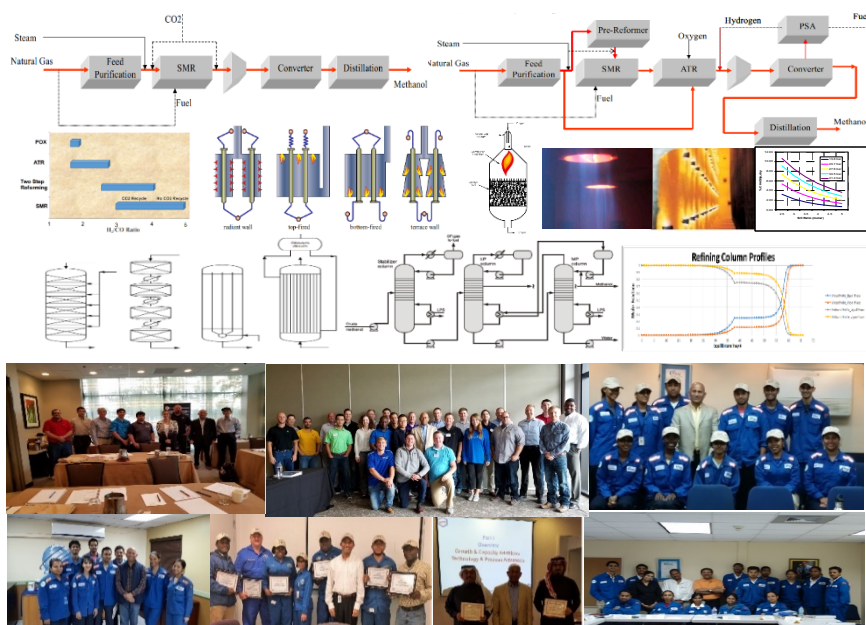
### TRAINING FORMAT

- Interactive Q&A for practical learning
- What-if scenarios for improvements
- Analysis of Practical Case Studies
- Models to demo Plant sensitivity
- Simple to follow Training material

### TARGET GROUP

- Process/Operation Engr's
- Production Sup't/Supervisors
- Project/Mechanical Engineers
- Reliability & Safety Engineers
- Business Development/Analysts

**REFERENCES:** CFI, NUTRIEN, SABIC, CNC, N2000, PLNL, AUM, ADVANSIX, MOSAIC (Trained over 600 candidates with many repeats)



# Methanol Production & Troubleshooting Training

*Including*  
**Best Practices**  
**Lessons Learned**  
**Process Insights**  
**Equipment Monitoring**  
**Improvements Tips**  
 (Customized, as needed)

## SIMPLE PRACTICAL IMPROVEMENTS & TROUBLESHOOTING TIPS

METHANOL TRAINING SINCE 2006

# Methanol Plant Training Workshop

by Kinetics Process Improvements, Houston

**OBJECTIVE:** The comprehensive workshop provides practical insights with a focus on process, reforming, troubleshooting, performance improvements in Methanol Plants to improve monitoring, maintenance, reliability & safety

## OVERVIEW

- Process & Technology advances
- Process configurations & analysis
- Best Practices/Lessons Learned

## PROCESS & TROUBLESHOOTING

- Improve Reforming performance
- Minimizing pressure drop
- Improve Compressor capacity
- Optimize Synloop for max production
- Improve Methanol Purification
- Improve Steam system
- Process monitoring techniques
- Case studies/Lessons learnt
- Plant Modeling & Evaluation
- Options to reduce CO2 footprint

## CATALYST CONSIDERATIONS

- Feed Purification
- Reforming- Pre/Primary/ATR
- Methanol Synthesis

## METHANOL DISTILLATION

- Distillation Schemes
- Methanol quality issues
- Minimize Energy consumption

## PRIMARY REFORMER/ATR

- Thermodynamics and Chemistry
- Reformer Arrangements
- All about Radiant Tubes
- Primary & ATR problem issues
- Critical design features
- Key Operating Variables
- Burners, Draft & Combustion
- Air Preheater & considerations
- Controls & Safety Systems
- NOx mitigation- pre- & post treatment
- Startup & Shut down consideration
- Catalyst evaluation techniques
- Efficiency evaluation & monitoring

## METHANOL SYNLOOP

- Converter types & Loop configurations
- Optimize loop for max production
- H2 recovery & CO2 addition

## PERFORMANCE MONITORING

- Primary Reformer Heat Balance, ATE
- Reformer Thermal Efficiency
- Compressor/Turbine Efficiency
- Heat Exchanger/Convection Fouling

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## TRAINING FORMAT

- Interactive Q&A for practical learning
- What-if scenarios for improvements
- Analysis of Practical Case Studies
- Models to demo Plant sensitivity
- Simple to follow training material

## TARGET GROUP

- Process/Operation Engr's
- Production Sup't/Supervisors
- Project/Mechanical Engineers
- Reliability & Safety Engineers
- Business development/Analysts

**REFERENCES:** METHANEX, METHANOL HOLDINGS, SABIC, CELANESE, AMPCO (Trained over 600 candidates with many repeats)





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 to **Green and Blue Ammonia** including O<sub>2</sub> enrichment and CCS in US, Europe, Australia, Trinidad and Africa.

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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**Kinetics Process Improvements, Inc.**

# **Independent Consultants & Engineers**

*Serving to Improve, Decarbonize & De-bottleneck*

- **Ammonia Plants** (Integration with  $\text{gH}_2\text{L}^{\text{***}}$
- **Methanol Plants** fCI m[ Yb'9 bf]W a YbK'
- **Primary Reformers** (Electrification & Replacement with Electric Drivers)
- **CO<sub>2</sub> Removal Systems** (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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