

# **Self Sufficiency in PVC – Route to Reality**

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## Refining

- ROSE®
- VCC™
- FCC, MAXOFIN, MAXDIESEL
- Hydroprocessing
- MTBE/ETBE
- K-SAAT™



## Ammonia and Fertilizers

- Ammonia
- Weatherly Nitric Acid
- Weatherly Ammonium Nitrate
- Weatherly UAN
- Syngas, Coal Gasification
- Hydrogen
- Methanol



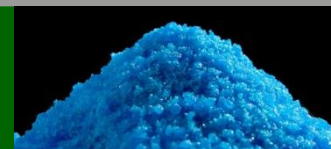
## Olefins

- SCORE™
- K-COT™
- MTO Recovery



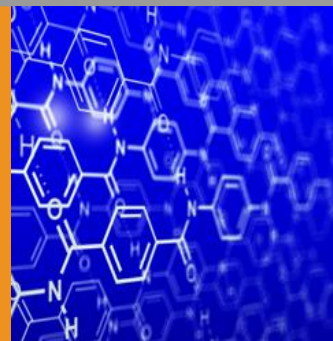
## Evaporation and Crystallization

- KBR EcoPlanning



## Chemicals

- Phenol/Acetone
- BPA
- Polycarbonate
- PVC
- Acetic Acid
- Vinyl Acetate Monomer



## Acid Treatment

- Plinke



## Automation and Process Technologies

- InSite™ Performance Monitoring
- OTS
- OMS
- Technical Services



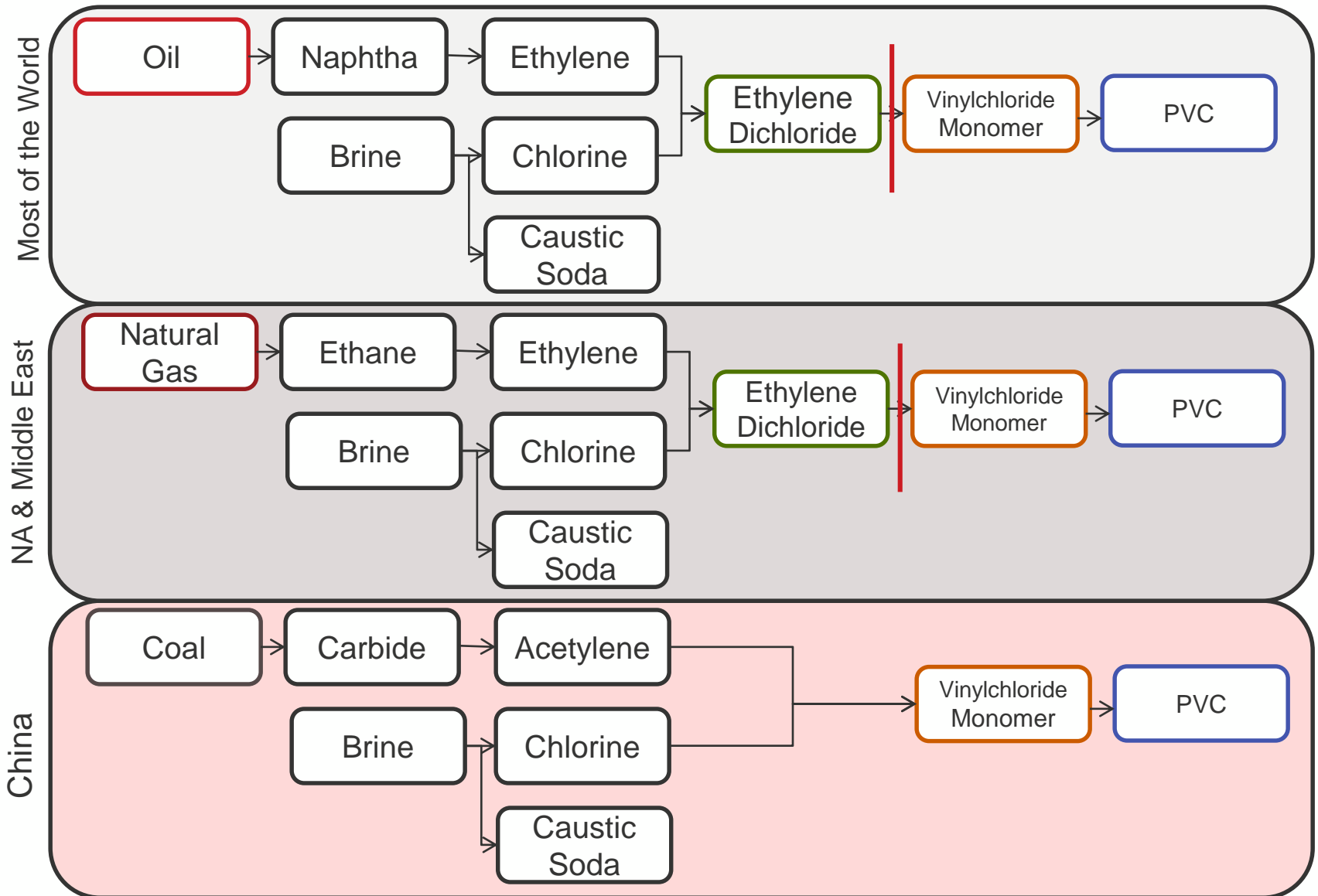
## Proprietary Equipment

- Refining
- Olefins
- Chemicals
- Ammonia and Fertilizers
- Evaporation and Crystallization
- Acid Treatment

- ◆ Over 50% of PVC demand is met via imports
  - Largest importer of PVC in the world
  - Double digit percentage demand growth AND double digit percentage import growth
  - Gap between domestic PVC production capacity and demand will widen
  
- ◆ How will growing domestic needs be met?
  - Infrastructure is growing
  - Agriculture is growing
  
  - **All driven by a growing population and growing middle class**
  
- ◆ Conclusion: Need for sustainable solution for domestic PVC production

- ◆ Solution: Domestically produce PVC
  
- ◆ Necessary prerequisites for PVC sustainability
  - Governmental support
    - Provide support and incentives for PVC producers – in progress
  - Feedstock
    - Import EDC or VCM
    - Starting from ethylene will require reliable access to ethylene and reliable infrastructure plus outlets for caustic and chlorine
  - Reliable and economical attractive technology to produce PVC

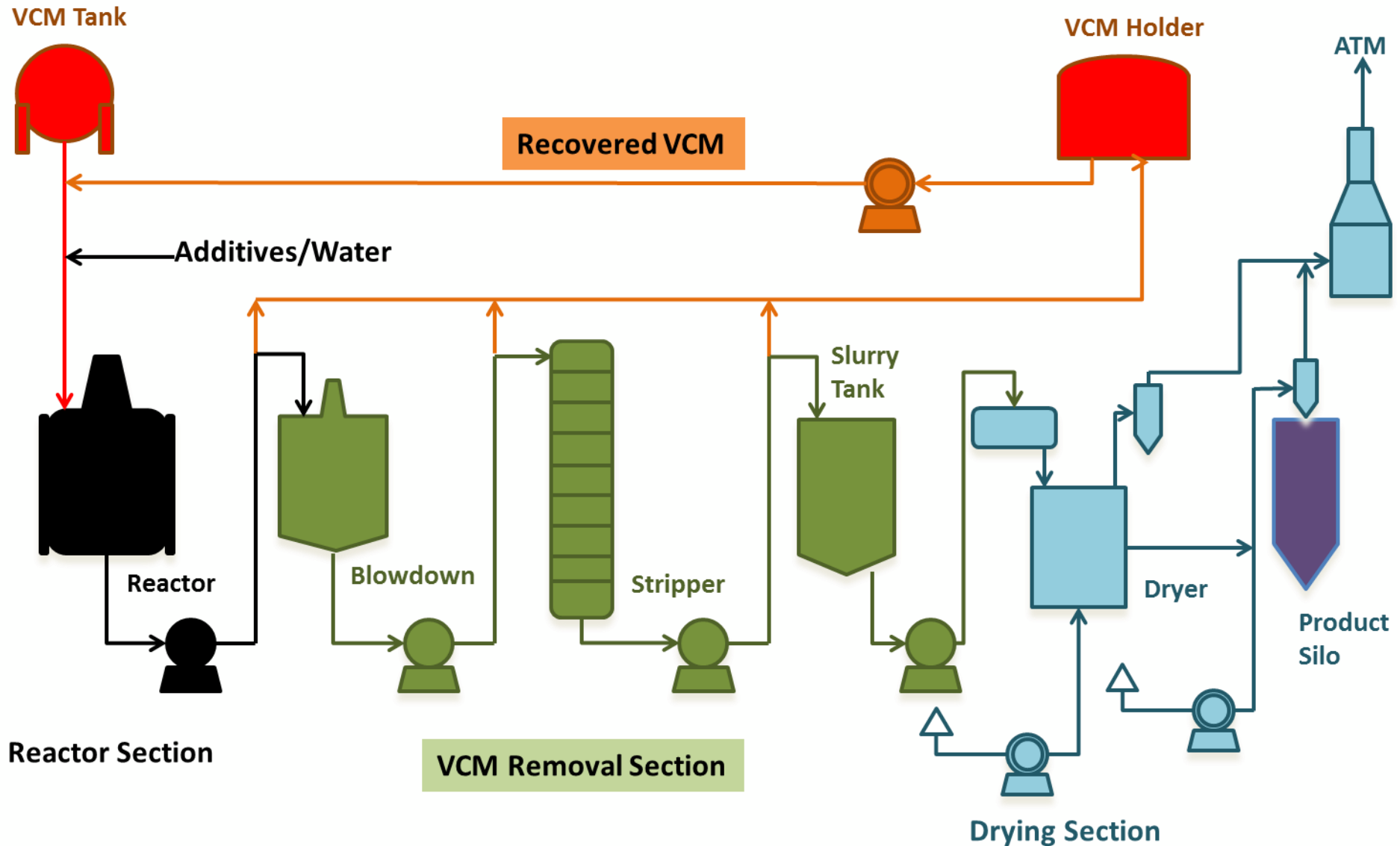
# Routes to PVC



# Technology Owner & Alliance Partner – JNC Corporation

- ◆ JNC Corporation (Formerly: Chisso)
- ◆ Multi-year alliance agreement to market and sell PVC technology
- ◆ JNC is major producer of liquid crystals and fabricated products with a long history in PVC
- ◆ Produced PVC from 1941-2000s
- ◆ Licensed 31 PVC plants and 120+ VCM removal units

# PVC Process Flow



# KBR-JNC PVC Advantages

## High Quality PVC

Mechanical properties, heat stability, electrical stability, color, etc. are of the highest quality. Quality was developed by servicing the Japanese domestic market

## Wide Range of PVC Types

Many 'recipes' are available from commodity to specialty PVCs with a wide range of K values and bulk densities. Commodity, high-K, low-K, matted, copolymer

## Efficient Use of Raw Materials and Utilities

Contributes to competitive operating costs (VCM, steam, electricity, chemicals)

## Well Proven Capabilities

A long history of licensed plants has contributed to an optimally designed process that makes operations easy and safe

## Economical

Competitive TIC as the process is simple and compact



# Types of PVC produced

## Commodity

K56 (Rigid)  
K57 (Rigid)  
K60 (Rigid)  
K66 (Rigid)  
K66 (Flexible)  
K72 (Flexible)  
K74 (Flexible)

### **Uses**

Piping, film, sheet, injection  
molding, cable

## Specialty

Low molecular - K51 (Rigid)  
High Molecular – K80 (Flexible)  
High Molecular – K83 (Flexible)  
High Molecular – K91 (Flexible)  
High Molecular – K97 (Flexible)  
Matted – K57 (Rigid)  
Matted – K65 (Flexible)  
Matted – K72 (Flexible)  
Copolymer – K60 (Rigid)  
Copolymer – K68 (Flexible)  
Copolymer – K75 (Flexible)  
High-Impact – K67 (Rigid)

### **Uses**

Car interiors, building materials,  
flooring, cable, medical

# VCM Stripper Technology

- ◆ KBR-JNC also licenses its unique slurry VCM stripping system
- ◆ Generally sold to existing PVC plants as a retrofit to help meet stringent environmental compliance
  - Reduces VCM content in final PVC product
  - Reduces VCM emissions from dryers
- ◆ System includes
  - Stripping Column
  - Slurry Heat Exchanger
  - Slurry Pump
  - Vacuum Pump
  - Flushing System



# KBR-JNC VCM Removal Advantages

- VCM is a known human carcinogen
- Handling and emissions of VCM is closely regulated and therefore recovery is a critical step of the PVC process

## High Efficiency

<1 ppm of VCM in the final PVC product

## Completely Closed System

The closed system with a VCM Gas Holder allows VCM emissions to be greatly reduced and facilitates operations

## Low Energy Consumption

Steam use: < 130kg/ton of PVC (stripping only)

## Reliability

Long run times contribute to reduced maintenance costs

## Easy Grade Change

<1.5 hours to make appropriate changes for a new grade

# PVC Technology License Experience

- > 30 years of Licensing Experience
- 31 Licensed Units (~5.7 M Tons)

Country	Capacity (t/yr)
Taiwan	226,000
Indonesia	530,000
China	4,520,000
Thailand	240,000
India	40,000
Iran	50,000
Japan	70,000
Total	5,676,000

# Summary & Conclusions

- Peace of mind with well proven technology.
- Environmental and safety performance with favorable capital investment and low operating costs.
- A multitude of high quality PVC products from JNC suspension process.
- Address most important need of domestic sustainability