Refinery Petrochemical Integration: Crude to Chemicals, Hydrogen and Margin Screening

12 – 16 July 2027
Paris - Right Bank business hotel



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Ref: 760_19607 **Date:** 12 – 16 July 2027 **Location:** Paris - Right Bank business hotel **Fees:** 23500 SAR

Introduction:

Refinery petrochemical integration decides whether a fuels-oriented site keeps its margin as demand growth moves from transport fuels toward olefins, aromatics and polymers. Many sites still sell naphtha, LPG and off-gas at fuel value while a neighbouring cracker buys the same molecules at a premium. This Core Concept course equips planners, process engineers and strategy staff to map stream links, compare crude to chemicals configurations, balance hydrogen and utilities, cut CO2 intensity and test project economics. Participants build an Integration Option Screening and Margin Comparison Model for a case refinery.

Course Objectives:

- Quantify the shift in product demand from transport fuels to chemical building blocks and its effect on a site's long-run netback
- Map naphtha, LPG, reformate, FCC olefin and off-gas links between a refinery and steam cracker, aromatics and polymer units
- Compare crude to chemicals configurations by chemical yield per barrel, hydrogen demand, capital intensity and operability
- Design a site hydrogen, steam, fuel gas and power balance that supports higher chemical conversion with lower CO2 intensity
- Evaluate integration projects with integrated margin, discounted cash flow and scenario analysis under feedstock, spread and carbon price uncertainty
- Build an integration option screening and margin comparison model that ranks options for an executive investment decision

Target Audience:

- Refinery planning and economics engineers who value intermediate streams and prepare configuration cases
- Process and technology engineers who assess conversion routes, licensor proposals and revamp scope
- Corporate strategy and business development staff who frame downstream portfolio and investment choices
- Energy, hydrogen and decarbonisation leads who own site utilities, emissions targets and abatement plans
- Petrochemical interface and supply chain coordinators who manage stream transfers between refinery and chemical units
- Project development managers who steer front-end studies for integration and conversion projects

Course Outline:

Day 1: Fuels-to-Chemicals Demand Shift and Integration Drivers

- Oil Demand Outlook: Transport Fuel Plateau Versus Petrochemical Feedstock Growth
- Chemical Value Chain Map: Olefins, Aromatics, Polymers and Intermediates
- Refinery Netback Erosion Drivers: Vehicle Electrification, Efficiency and Fuel Specification Change
- Integration Maturity Levels: Stand-Alone, Stream-Linked, Co-Located and Fully Integrated Complexes
- Current-State Integration Scan: Stream Disposition and Fuel-Value Leakage Audit

Day 2: Integration Schemes and Crude to Chemicals Configurations

- Naphtha and LPG Links to Steam Cracker Feed Slates: Ethane, Propane, Butane and Full-Range Naphtha
- Aromatics Complex Links: Reformate, Pyrolysis Gasoline and BTX Extraction Routes
- Propylene Recovery from FCC Off-Gas and High-Severity Catalytic Cracking Concepts
- Crude to Chemicals Architectures: Residue Hydrocracking, Mixed-Feed Cracker and Direct Crude Cracking
- Chemical Yield per Barrel Benchmarking Across Integration Architectures

Day 3: Molecule Management, Hydrogen and Utilities Integration

- Molecule Management: Routing Each Molecule to Its Highest-Value Destination
- Stream Valorisation Matrix: Off-Gas, Dry Gas, C4 Cut and Heavy Aromatics Upgrading
- Site Hydrogen Network Balance: Reformer Hydrogen, Steam Methane Reforming and Purification
- Pinch Analysis for Refinery and Cracker Heat Integration and Steam Level Matching
- Fuel Gas and Power Balance with Cracker Tail Gas and Cogeneration Options

Day 4: Decarbonisation, Digital Operations and Transition Risk

- GHG Protocol Scope 1 and Scope 2 Baseline for an Integrated Refining and Chemicals Site
- Low-Carbon Hydrogen and Electrified Furnaces: Abatement Cost Curve Comparison
- Carbon Capture Readiness for Hydrogen Plant and Furnace Flue Gas Streams
- Digital Twin and Advanced Process Control for Cross-Unit Integrated Site Optimisation
- Transition Risk Register: Stranded Asset, Feedstock Price Spread and Chemical Market Cycle Exposure

Day 5: Case Refinery Integration Option Screening Build

- Case Refinery Data Pack: Configuration, Stream Balance, Utility Load and Emission Profile
- Model Build: Integrated Margin per Tonne for Three Integration Options
- Model Build: Capital Cost Factoring, Net Present Value and Payback Comparison
- Model Build: Carbon Price and Spread Sensitivity with Tornado Chart Output
- Integration Option Screening and Margin Comparison Model Presentation to an Investment Committee

Skills You Will Gain:

- Integrated Margin Analysis
- Stream Valorisation
- Crude to Chemicals Configuration Screening
- Hydrogen Network Balancing
- Heat and Utility Integration
- Abatement Cost Curve Analysis
- Transition Risk Assessment
- Investment Case Modelling

Why Attend This Course:

- Leave with an Integration Option Screening and Margin Comparison Model that ranks three options for a case refinery
- Challenge the practice of selling naphtha, LPG and off-gas at fuel value with a molecule-level valuation
- Speak with licensors, chemical partners and investment committees in a shared vocabulary of chemical yield, integrated margin and CO2 intensity
- Compare integration paths with peers from refining, petrochemical, gas processing and energy strategy functions

Conclusion:

Refineries that keep supplying only transport fuels face shrinking netbacks, while sites that route molecules to chemical units capture more value from each barrel. The course moves from the demand shift and integration drivers, through stream links and crude to chemicals architectures, to molecule management, hydrogen and utilities balance, and then to CO2 abatement, digital optimisation and transition risk. The final day produces an Integration Option Screening and Margin Comparison Model ready for an investment decision.