Process Intensification and Chemical Engineering Innovation Training Course

02 - 06 Nov 2026

Kuala Lumpur

5200 € (Per Person)

Ref: #ACE2230_256030

Course Introduction / Overview:

This course provides a comprehensive exploration of Process Intensification (PI), a revolutionary paradigm in chemical engineering that aims to develop substantially smaller, cleaner, safer, and more energy-efficient process technologies. Moving beyond traditional, large-scale unit operations, this training delves into the innovative design and engineering principles that are reshaping the chemical industry. As detailed by pioneers like Andrzej Stankiewicz and Jacob A. Moulijn in their seminal work, "Re-Engineering the Chemical Processing Plant: Process Intensification," the field combines novel equipment, processing methods, and process synthesis to achieve dramatic improvements in performance. This BIG BEN Training Center program is meticulously designed to equip participants with the knowledge to identify intensification opportunities, select appropriate technologies, and manage the implementation of innovative processes. We will cover everything from fundamental concepts and advanced PI hardware, such as microreactors and reactive distillation columns, to the critical aspects of process simulation, scale-up, economic evaluation, and safety analysis. The curriculum is structured to bridge the gap between theoretical understanding and practical application, empowering professionals to drive efficiency, sustainability, and competitive advantage within their organizations through cutting-edge process innovation and sustainable engineering practices.

Target Audience / This training course is suitable for:

- Chemical Engineers.
- Process Development Chemists and Scientists.
- Research and Development (R&D) Managers.
- Process Engineers and Designers.
- Plant Managers and Operations Supervisors.
- Project Engineers and Managers.
- Technical and Engineering Consultants.
- Environmental and Safety Engineers.

Target Sectors and Industries:

- Pharmaceutical and Biopharmaceutical Manufacturing.
- Petrochemicals and Refining.
- Specialty and Fine Chemicals.
- Agrochemicals and Fertilizers.
- Polymers and Materials Science.

- Food and Beverage Processing.
- Water and Wastewater Treatment.
- Governmental Bodies and Environmental Regulatory Agencies.

Target Organizations Departments:

- Research and Development (R&D).
- Process Engineering and Design.
- Plant Operations and Production.
- Capital Project Management.
- Process Control and Automation.
- Environmental, Health, and Safety (EHS).
- Corporate Strategy and Innovation.
- Quality Assurance and Control.

Course Offerings:

By the end of this course, the participants will have able to:

- Identify the key drivers and benefits of process intensification in modern chemical manufacturing.
- Differentiate between various PI equipment and methods, including multifunctional reactors and hybrid separations.
- Apply fundamental principles to analyze existing processes and identify opportunities for intensification.
- Utilize process simulation and modeling techniques to evaluate the performance of intensified systems.
- Develop strategies for the successful scale-up of PI technologies from laboratory to industrial scale.
- Conduct preliminary economic and safety analyses for proposed process intensification projects.
- Integrate principles of green chemistry and sustainable engineering into innovative process design.
- Evaluate future trends in process intensification, such as modular chemical plants and the circular economy.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to foster a deep and practical understanding of process intensification through an immersive and interactive learning environment. Our approach moves beyond traditional lectures to emphasize active participation and real-world problem-solving. The course is built upon a foundation of expert-led instruction, where complex theoretical concepts are broken down into understandable and applicable modules. This is heavily supplemented with detailed case studies from various industries, showcasing both the successes and challenges of implementing PI technologies. Participants will engage in collaborative group workshops and brainstorming sessions to analyze process design problems and propose innovative, intensified solutions. Interactive discussions are encouraged to facilitate knowledge sharing and peer-to-peer learning. Practical exercises, including conceptual process modeling and economic evaluation scenarios, will be used to reinforce key skills. Continuous feedback from the instructor ensures that participants can confidently apply their new knowledge to drive process innovation and efficiency within their own professional contexts.

Course Agenda (Course Units):

Unit One: Fundamentals of Process Intensification

- Introduction to Process Intensification (PI).
- Historical Context and Evolution of Chemical Processing.
- Key Drivers for PI: Economic, Environmental, and Safety.
- Core Principles: Miniaturization, Multifunctionality, and Integration.
- Classification of PI Technologies: Equipment and Methods.
- Introduction to the Work of Stankiewicz and Moulijn.
- Comparing Conventional vs. Intensified Processes.
- The Role of PI in Green Chemistry and Sustainable Engineering.

Unit Two: Process Intensifying Equipment and Hardware

- Microreactors and Microfluidic Devices.
- Spinning Disc and Rotating Bed Reactors.
- Reactive Distillation and Reactive Absorption Columns.
- Membrane Reactors and Pervasive Engineering.
- Compact Heat Exchangers and Static Mixers.
- Supercritical Fluid Extraction and Reaction Systems.
- Application of Ultrasound and Microwave Energy in Reactors.
- Selection Criteria for PI Equipment based on Process Requirements.

Unit Three: Process Intensifying Methods and Synthesis

- Hybrid and Integrated Separation Processes.
- Multifunctional Reactors: Combining Reaction and Separation.
- Alternative Energy Sources for Process Activation.
- Task-Integrated Process Design and Synthesis.
- Process Streamlining and Reducing Unit Operations.
- Dynamic Operation of Processes: From Batch to Continuous.
- The Concept of the "Plant on a Chip".
- Integrating PI with Renewable Feedstocks and Bioprocessing.

Unit Four: Modeling, Simulation, and Scale-Up of Intensified Processes

- Introduction to Modeling PI Systems.
- Computational Fluid Dynamics (CFD) for Reactor Design.
- Process Simulation Software for Intensified Processes (e.g., Aspen, HYSYS).
- Developing Kinetic and Transport Models.
- Challenges and Strategies in Scaling Up PI Technologies.
- Pilot Plant Testing and Data Collection for Intensified Systems.
- Process Control and Automation Strategies for PI.
- Risk Assessment in the Scale-Up Process.

- Project Management for PI Implementation.
- Capital and Operating Cost (CAPEX/OPEX) Estimation for PI.
- Techno-Economic Analysis and Investment Justification.
- Process Safety Management and HAZOP for Intensified Systems.
- Regulatory Considerations and Intellectual Property.
- The Future of PI: Modular Plants and Distributed Manufacturing.
- Integrating PI with Industry 4.0 and Digitalization.
- The Role of PI in Advancing the Circular Economy.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

How can the principles of process intensification be leveraged to accelerate the transition to a fully circular economy in the chemical industry?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by providing a holistic and implementation-focused perspective on process intensification, moving far beyond a purely theoretical overview of technologies. While other programs may focus narrowly on specific equipment, this training, curated by BIG BEN Training Center, integrates the critical domains of process synthesis, modeling, economic analysis, and safety management into a single, cohesive curriculum. We emphasize the "why" and "how" of implementation, not just the "what". Participants will learn to build a robust business case for PI projects by mastering techno-economic evaluation and risk assessment techniques tailored to novel systems. The curriculum is enriched with contemporary case studies that illustrate the practical application of PI principles in solving real-world industrial challenges across diverse sectors like pharmaceuticals and petrochemicals. Furthermore, the course is distinctly forward-looking, dedicating significant attention to emerging trends such as modular chemical plants, the integration of PI with Industry 4.0, and its pivotal role in enabling a sustainable, circular economy. This strategic, business-oriented approach ensures that graduates are not just knowledgeable about PI but are fully equipped to champion and lead transformative innovation within their organizations.