

## Hydrogen Industry Fundamentals: Production Technologies, Applications, and Energy Markets

### Course general description:

This comprehensive 5-day course provides participants with extensive knowledge of hydrogen production, handling, and utilization across traditional and emerging industries. The course covers fundamental principles, production technologies, infrastructure requirements, safety considerations, and market dynamics. Participants will gain practical insights into both conventional hydrogen production methods and cutting-edge technologies for the growing hydrogen economy, including green hydrogen initiatives and energy storage applications.

### Audience:

This course is designed for:

1. Process and chemical engineers
2. Energy sector professionals
3. Project developers and managers
4. Technical consultants
5. Research and development specialists
6. Investment analysts in energy sector
7. Environmental engineers
8. Industrial plant operators

### Course objectives:

By end of the course participants will gain:

1. Understand the fundamental principles of hydrogen production and handling
2. Compare and evaluate different hydrogen production technologies
3. Analyze technical and economic aspects of hydrogen infrastructure
4. Assess safety considerations in hydrogen systems
5. Evaluate hydrogen's role in renewable energy systems
6. Understand hydrogen market dynamics and future trends
7. Apply knowledge to project development and operations.

### Course duration:

5 days

### Course location:

Cairo-Dubai-Istanbul

### Course contents:

#### **Day 1: Hydrogen Fundamentals and Traditional Production Methods**

- Physical and chemical properties of hydrogen
- Historical development of hydrogen industry
- Traditional production methods overview
- Steam methane reforming (SMR) process fundamentals
- Partial oxidation processes
- Coal gasification technology
- Purification and separation methods
- Storage and transportation basics
- Tutorial: Production process calculations
- Case Study: Traditional plant operations

#### **Day 2: Modern Production Technologies and Green Hydrogen**

- Electrolysis technologies (alkaline, PEM, SOEC)

- Renewable energy integration
- Green hydrogen production systems
- Energy efficiency considerations
- Solar-powered hydrogen production
- Wind-to-hydrogen systems
- Biomass-based production
- Emerging technologies and innovations
- Tutorial: Electrolysis system design
- Case Study: Renewable hydrogen project

### **Day 3: Infrastructure and Applications**

- Storage technologies and systems
- Transportation and distribution networks
- Compression and liquefaction
- Material considerations and compatibility
- Industrial applications
- Fuel cell technology
- Transportation sector applications
- Power generation systems
- Tutorial: Infrastructure planning
- Case Study: Application implementation

### **Day 4: Safety, Regulations, and Environmental Impact**

- Safety properties and risk assessment
- Handling procedures and protocols
- Emergency response systems
- Regulatory frameworks
- Environmental impact assessment
- Carbon footprint analysis
- Sustainability considerations
- Certification and standards
- Tutorial: Safety system design
- Case Study: Environmental compliance

### **Day 5: Market Analysis and Future Trends**

- Global hydrogen market analysis
- Supply chain economics
- Investment considerations
- Project development strategies
- Future market trends
- Policy and incentive frameworks
- Hydrogen economy roadmap
- International collaboration initiatives
- Comprehensive Final Examination
- Course Review and Closing Discussion

### **Methodology:**

- 50% lectures & concepts

- 10% Videos
- 15% Case studies
- 15% Exercises & Quizes.
- 10% Discussions

**Course code: (TPR0012)**