Global Trends in Syngas

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Who We Are

- Stratas Advisors is a global consulting and advisory firm that covers the full spectrum of the energy sector and closely linked industries.

- The world’s leading businesses, governments and institutions turn to us for data, analysis and insight (IOCs, NOCs, independents, energy consumers and financial entities).

- We help our clients achieve tangible results through informed strategic decision-making and implementation planning.

- Key differentiators include:
  - Global coverage with deep local knowledge
  - Integrated analysis across the entire energy value chain, including macro-level analysis (geopolitics, macro-economics, policies and regulations).

- Our research and consulting staff are located on the ground in key global energy market centers.

- Combined, our team brings over 500 years of combined energy industry expertise, including:
  - Technical (Petroleum Engineers, Geologists, Process Engineers)
  - Economists
  - Political Scientists
  - Financial Analysts.

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Global Syngas Service

- Understanding the key drivers, metrics, and developments across processes in the Global Syngas industry
  - Methanol, GTL & CTL, Ammonia, UCG, Direct Reduced Iron, and many more

- Evaluating projects and proponents through qualitative and quantitative metrics
  - Corporate and process analysis

- Forecasting plant developments, capacity additions, and changes in output

- Evaluating economics with consideration of production costs, CAPEX, OPEX, and potential project revenue and pricing

- Anchored by industry-leading database of syngas projects across feedstocks and outputs worldwide.
  - Natural Gas, Coal, Waste, Biomass, Residuals, coke-oven gas.
Global Gasification Trends

What Are the Key Gasification Applications and Growth Areas?
China Leads Global Syngas Investment to 2026

China to Represent 57% of Global Syngas Industry in 2026

- In China, coal represents 1.9 billion tonnes of oil equivalent per year in total primary energy consumption.

- China’s coal gasification industry began rapid commercialization in 2007, particularly for CTC.

- Late 2000’s build-up in coal, steel, fertilizers, methanol, and dimethyl ether led to overcapacity.

- China has prioritized emissions and particulate reductions, water reutilization processes in latest Five-Year Plan.

- China expects domestic coal consumption to peak in 2020.
Coal-to-Chemicals is China’s Leading Operational Application

Manufacturing and Population Growth Stimulated Chemicals Investment

- In the years to 2007 to 2013, China’s coal gasification industry growth represented 24% of the global total. 2015-2025: 75%.

- Consumer goods manufacturing growth supports demand for methanol, olefins, acetylcs, and Oxo chemicals.

- China has prioritized larger-scale projects, particularly by the large oil, gas, coal, and power companies.

- Power capacity not projected to make significant contributions via syngas. Renewables, high-efficiency pulverized coal, and natural gas take greater share.
Gaseous and Liquid Fuels Lead Capacity Additions

Low Oil Price But Supportive Secondary Conditions

- Lower petroleum price puts coal-to-liquids and synthetic natural gas projects under pressure, but there are other factors.

- Lower coal prices, steel prices. Capital investment intensity overall is lower than in other countries.

- Water resource issue: large-scale SNG in particular consumes vast quantities of water. ZLD investment adds 2% to 3% to CAPEX.

- SNG addresses smog woes but exacerbates meeting CO₂ reduction goals.

- Reportedly, Chinese government prioritizes SNG capacity as leverage in natural gas pricing.

China Projected (to 2026) Capacity Investment by Application (US$273 billion)

- Chemicals 44%
- Gaseous Fuels 33%
- Liquid Fuels 23%
- Power 0.30%
Rapid Build-Up of Methanol-to-Olefins Capacity

MTO Continues Rapid Growth Track

- 2010-2023 coal-to-olefins investment of US$13.16 billion. $122 billion in China’s projected gasification investment to 2026.
- Combination of integrated and merchant methanol from coal and some natural gas-based methanol olefins capacity.
- Methanol and methanol derivative dimethyl ether are in overcapacity with utilization rates reportedly between 25%-50%.
- Lower crude pricing narrows CTO arbitrage relative to crude-based olefins.
- MTO build-up strengthens crude: methanol correlation.
Refinery Gasification Applications

Three Largest Refinery Gasification Applications Now Under Construction

- Leading indications: proposals announced in climate of higher natural gas and crude oil prices.
- Largely predicated on replacing natural gas with petcoke or visbreaker unit-derived syngas.
- Increased demands for product purity drive hydrogen production through refinery gasification.
- Largest applications are under construction (Canada, India, and Saudi Arabia).
U.S. Coal Gasification Disadvantaged on Several Fronts

Natural Gas, Regulatory, and Technical Hurdles

- Edwardsport IGCC- $1.1 billion over original estimate.
- Kemper County IGCC- $3 billion plus over original estimate. CCS integration (65% of CO₂)
- Coal-based gasification will have minimal development opportunities in the U.S.
- As with coal combustion, competition with natural gas, new regulations, and CCS complexity and cost are remaining impediments.
- 1H 2016: One large-scale IGCC+CCS project scrapped; another likely so (DOE pulls funding).

Source: Southern Company
Natural Gas-based Syngas Projects

Where Are the Leading Opportunities in Natural Gas Diversification?
North American Syngas: Fertilizers

Declining Arbitrage Since 2012 (Natural Gas Vs. Ammonia)

- Natural gas represents the majority of projected syngas-based capacity additions in the U.S. to 2026.
- U.S. positioned to become net exporter of methanol, ammonia, direct-reduced iron, and other chemicals in timeframe.
- Eight new projects projected, representing $10.5 billion in investment.
- Since 2013, the arbitrage between natural gas and ammonia has narrowed ~68%.
- Two solids-based fertilizer capacity additions have progressed: Great Plain Synfuels (upgrade) and Phibro Group (repurposing).
North American Syngas: Methanol

Largest Projected U.S. Capacity Addition Potential

- U.S. capacity additions already rapidly reducing methanol import levels.
- Four of eight in-development methanol proposals are not assessed to move forward.
- Total investment of $3.6 billion from 2016 to 2026 based on announcements.
- China continues to dominate demand context. Emerging methanol utilization drives growth: blending, potential marine fuel.
- U.S. MTG not assessed likely in assessment timeframe. Small-scale gas monetization: GTM potential.
Asia-Pacific Natural Gas Diversification

Upgrading Natural Gas to Chemicals is Increased Priority


- Chemicals dominates production slates in both contexts (95%), particularly nitrogenous fertilizers and methanol.

- Small-scale biomass and waste-based gasification is an emerging context but represents a marginal contributor to overall capacity. Exclusively for power applications.
Middle East Natural Gas Diversification

Middle East Nations Seek Greater Participation in Gas-to-Chemicals Markets

- Middle East trends by projected syngas investment is 43.98% fertilizers, 32.03% methanol, 6.62% power, and 17.37% industrial chemicals.

- Power-based capacity additions largely refinery gasification IGCC and waste-to-energy.

- Several GCC countries have identified opportunities for natural gas diversification beyond raw resource exports.

- Iran has robust plans for methanol and olefins industry development. Total of 70 syngas projects in-development/operational.

Middle East Natural Gas-based Syngas Growth

Billion British Thermal Units Per Day

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Emerging Syngas Opportunities and Market Shifts

What Key Factors Are Affecting Emerging Syngas Market Contexts?
Biomass Gasification in Continental Europe

Biomass-to-Power Leading Operational and Projected Application

- Total projected biomass-based gasification demand is estimated at 140,351 million British thermal units per day (MMBtu), with the UK representing 90,494 MMBtu/d.

- Finland, Sweden, and UK are primary projected locations for biomass gasification, particularly integrated capacity at the site of feedstock production.

- Bio-based transport fuels from syngas not assessed as commercially significant to 2026.

- A large-scale proposal in Finland (Kaidi) represents a 388% scale-up and novel application for plasma gasification.
Bio-Based Syngas-to-Liquids Assessment

Cancellations and Technology Hurdles

• With facilitating contexts such as positive tipping fees, assessed internal rates of return for bio-based liquids are marginal and only likely in Europe.

• Cost positive agricultural residues exacerbate economics. Still, plenty of available harvest residuals in key European transport fuel markets.

• Bio-based liquids not expected to make more than 1,000 b/d of Fischer-Tropsch liquids in the U.S. to 2026. This may change on the success of an initial three projects.

• Cost of production must come down for returns to be attractive for financing in current petroleum markets.

Note: Bubble size indicates on-road diesel consumption  
Source: Stratas Advisors
Waste-to-Energy in the UK

Positive Indications but Mixed Bag

- Expected rapid build-up of small-scale waste/biomass-based syngas to power projects.

- Scales between 7 MW and 25 MW. Above this, several factors create issues: feedstock sourcing, technology commercialization and availability.

- Air Products departed its two under construction projects, focusing on industrial gases division.

- Green Investment Bank backs six of the high-viability WTE proposals.
Investment Outside of China to 2023

Identifying Current Investment Decisions

- For coal gasification, after China, Japan, Indonesia, South Korea, and India are the next largest investment zones.
- Japan has two operational coal-based IGCC projects, three others for development in 2022-2023 timeframe.
- Projected natural gas investment is largely slated for the U.S., China, Algeria, India, Indonesia, Iran, Nigeria, Turkmenistan, and Uzbekistan.
- China’s refinery gas and coke oven gas represents significant gaseous fuels feedstock utilization.
- India natural gas investment still robust despite cost advantage of coal vs ng.
Syngas Market Trends

Key Emerging and Maturing Commercialization Trends

• Global methanol demand is expected to see unprecedented growth between 2015 and 2025. From late 2013 to late 2015 demand rose by 23%. China and U.S. expected to lead capacity additions.

• Carbon capture and storage is an expensive commercial reality. Efficiency improvements and innovations such as integrated fuel cells are seen as necessary for IGCC to compete going forward. Unlikely in U.S. context. No new coal-based IGCC proposals in last five years.

• Downscaling of gas-to-liquids and gas-to methanol by a handful of developers may offer opportunities for monetizing stranded/remote natural gas. These are in the early stages.

• The U.S., India, and Iran are the largest growth areas for natural gas-based syngas capacity additions.

• Coal emerges as dominant syngas feedstock before 2020. 65% of capacity addition expected through coal gasification, largely in China, of which 36% of capacity is under construction.
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