Developing oil and natural gas supply models to meet user needs

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Models and forecasts – some basic reflections

- Models should not be expected to produce predictions of the future
  - They depend on a combination of historical data, observed relationships and reasonable assumptions
  - Models can only partially capture the complexity, rate of change and emerging factors which are a constant in the real world

- Models are a useful tool for exploring alternative futures, by varying assumptions and the specification of relationships
  - Scenario and sensitivity analyses are made more robust and credible by consistent modelling
  - But usually, scenario and sensitivity definitions chosen are a small sub-set of the possible universe

- Back-casting is a useful tool for testing a model's representation of the existing world
  - Future changes in relationships, or the emergence of new drivers, can still cause the real world to diverge from modelled output

Role of EIA energy models

- The EIA plays a vital role in modelling and analyzing energy supply and markets, both in the US and globally
  - Public and freely available
  - Updated and published on a regular schedule
  - Transparent methodologies, modelling architecture and assumptions
  - Have flexibility to run cases with alternative assumptions and to isolate analysis of specific sub-sets of supply or markets

- There are few, if any, other modelling and analysis platforms with these characteristics

- Commercial models exist, but are generally high-cost with only limited accessibility to the general user

- Significant changes in hydrocarbon supply, both geographically and by resource type, are driving all modelling and analysis producers to revamp and update their toolkits
  - It is encouraging that the EIA is starting this effort

What questions should oil and gas supply models address?

- Diverse user sets naturally have very diverse needs with respect to supply analysis
  - Short-term or long-term focus
  - Macro or micro level analysis
  - Company strategy and portfolio support or industry-level activity analysis
  - Country or region level outlooks or global trends
  - Operational detail or strategic focus
  - Focus on oil and gas production or on wider set of inputs and outputs (eg emissions, water etc…)
  - Large diversity of sensitivity and scenario analysis along many different parameters

- Public sector modelling and analysis should not attempt to answer all these types of questions
  - Focus on macro picture for short-term and long-term
  - Avoid company-level analysis and outlooks
  - Country-level and global roll-ups usually sufficient (except for US)
  - Sensitivities and scenarios on a limited number of dominant variables

What questions should oil and gas supply models address?

- Sample questions to be addressed by the EIA might be:

  - What is the supply outlook for a specific basin, country or region?
  - What is the supply outlook for a particular resource type?
  - What are the new supply sources which could come into play over a modelling time horizon?
  - What is the economic ranking of supply sources, either in terms of production cost or full-cycle development and production cost?
  - How would a supply outlook change as a function of market price?
  - Will the pace of supply growth be sufficient to meet the pace of demand growth, either regionally or globally?
  - What is the impact of constraints on development, infrastructure or trade on supply potential?

Attributes of credible oil and gas supply models

- Based on relevant, recent, transparent, historical data
  - At appropriate level of granularity for model specification
  - Oil and gas production history
  - Oil and gas wells drilled
  - Discoveries history
  - GORs and liquids content
  - Best-fit decline curves
  - Recoverable resources
  - Full-cycle development costs, and production costs
  - Identified projects under development
  - Infrastructure

- Exogenous assumptions clearly identified, showing magnitude and timing of impact
  - Geopolitical disruptions
  - OPEC policies
  - Infrastructure constraints
  - New technology, and/or new resource type
  - Access

Attributes of credible oil and gas supply models

- Clarity of presentation
  - Production wedges (fields in production, identified new projects, yet to find)
  - Production by resource type (conventional, EOR, deepwater, tight, shale, Arctic, any new…)
  - Cost of supply stacks for remaining resource

- Ability to run sensitivities/construct scenarios on key variables e.g.
  - Oil/gas prices
  - Development costs/supply chain capacity
  - Access and fiscal terms
  - OPEC policy
  - Technology
  - Other constraints
  - Geopolitical variables

Issues/pitfalls to consider in oil and gas supply modelling

- Oil and gas price levels
  - Not supply-driven – depend on disequilibrium between demand growth and supply growth
  - Price assumptions for investment not always identical to market price as revealed by forward strip
  - Can be input exogenously with sensitivities for different price levels

- New/emerging fields with little or no historical data
  - Can use analogues from similar more mature fields for main parameters, adjusting for country-specific cost, fiscality and access characteristics

- The sum of economic supply from each component basin/country may not equal total production
  - Portfolio optimization behavior may result in under-investment in some areas

Issues/pitfalls to consider in oil and gas supply modelling

- Market balancing
  - After inventory and trade effects, supply should always equal demand.
  - Requires iterations and price adjustments between supply and demand components of market models

- New resource types or technologies
  - Eg oil shale, methane hydrates
  - Must be assumption driven, using a reasonable timeframe

- Field NGLs and condensates
  - Data is often a constraint
  - Develop, verify and refine assumptions

Concluding remarks

- Users are diverse, so focus on central questions of supply potential

- Future is uncertain, so make assumptions transparent and modifiable

- Engage in constructive dialogue with users and practitioners for ongoing learning and continuous improvement

- Public sector energy modelling has great value; oil and gas supply is a key part of this.

- Best of success to EIA in this effort.

Andrew Slaughter

- 30 years in the oil and gas business
  - Upstream and downstream
  - Consulting and corporate roles
  - Focus on markets, economics and strategy

- Most recently, Vice President, Energy Insight, IHS
  - Leading analysis of upstream issues, policy and social license to operate

- 15 years with Shell Upstream Americas

- Significant roles with industry/government studies and professional associations
  - National Petroleum Council
  - International Association of Energy Economists
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