Energy market models at Wood Mackenzie - applications and challenges

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Agenda

Energy market models at Wood Mackenzie - applications and challenges

- Overview of Wood Mackenzie
- Energy Market Models - Applications
- Energy Market Models – Current Challenges

Overview of Wood Mackenzie

We are a Verisk Analytics business

Helping risk-bearing businesses understand and manage their risk

WoodMac joined the Verisk family in May 2015, forming a strategic alliance between two industry leaders.

Through a partnership with Verisk and Verisk Maplecroft, we deliver an unrivalled commercial intelligence portfolio for the world's natural resource markets, helping clients make complete risk-adjusted decisions that will strengthen their operations.

Verisk Analytics

Verisk™ Maplecroft

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Trusted commercial intelligence
www.woodmac.com

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Building a competitive advantage on strong foundations

About Wood Mackenzie

Over the last 40 years, Wood Mackenzie has evolved naturally along the energy value chain to capture all the key components affecting global markets.

Our integrated approach allows us to spot trends and forecast future dynamics before anyone else

1973

2015

Trusted commercial intelligence
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Promoting integration and collaboration
with the client at the centre of it all

About Wood Mackenzie

We work closely across all teams to foster internal relationships and build long-term client relationships.

Trusted commercial intelligence
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Forging deeper connections **across the globe**

About Wood Mackenzie

...with more being planned

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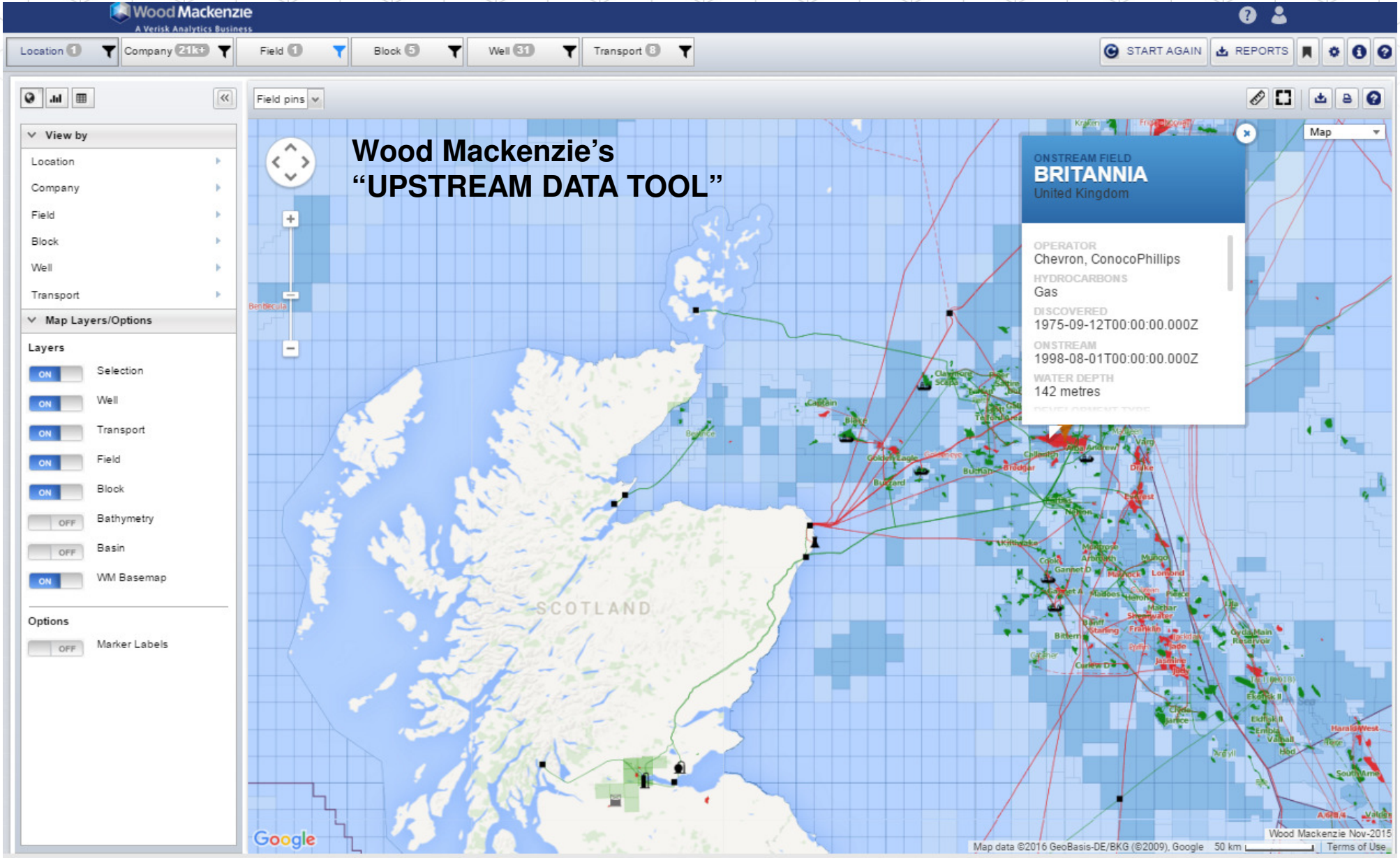
Energy, Metals and Mining Market forecasting to 2035

Ingredients: Data, Models and People

- Methods used:
  - Various Statistical Methods
  - Optimisation Type Models
- Data, detailed and bottom up:
  - Publicly available
  - Proprietary with a particular strength on the supply side



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The Wood Mackenzie Portal

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Reports ▾ Search reports, insights and data

Table of contents

- Key facts
- Summary and key issues
- Location maps
- Participation
- Geology
- Well data
- Exploration
- Reserves and resources
- Production
- Development
- Infrastructure
- Costs
- Sales contracts
- Fiscal and regulatory
- Economic assumptions
- Economic analysis

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Condensate ('000 b/d)	18	14	13	12	9	6	5	4	3	3
Sales Gas (mmcfd)	535	420	391	375	304	257	223	207	146	152

Source: Wood Mackenzie

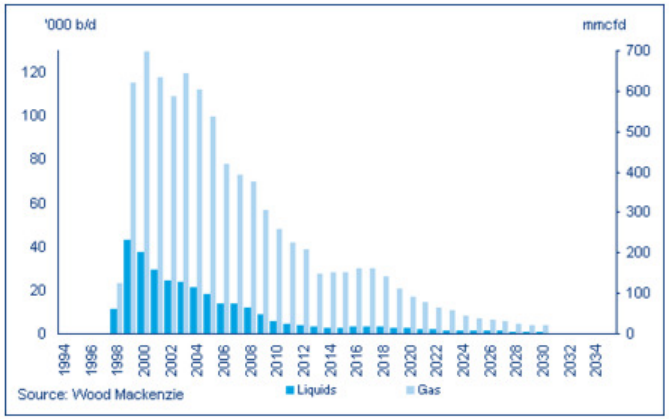
Production (2015-2024)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Condensate ('000 b/d)	3	3	3	3	3	2	2	2	2	1
Sales Gas (mmcfd)	150	160	160	140	112	90	76	64	56	44

Source: Wood Mackenzie

Please refer to our Upstream Data Tool (UDT) for life of field production data.

Britannia Production Profile



Development

Key Development Metrics

- Two wells per year are expected to be drilled between 2015 and 2019.
- We assume these will cost £21 million per well.
- We also assume £50 million for rig reactivation in 2014.

Platform Details

Britannia 822.50 KB (xls)

DOWNLOAD ALL (1.43 MB)

Analysts

Related tools

- Upstream Data Tool
- Asset Valuations – Upstream
- Global Economic Model - Upstream (Desktop)
- PathFinder (Desktop)

Upstream Asset Valuation

- Launch Asset Valuation
- Britannia BASE UK Concession Calc File November 2015 4.81 MB

Related searches

- Asset report: Upstream oil and gas United Kingdom
- Country report: United Kingdom
- Insight: Upstream oil and gas United Kingdom
- Asset report: Upstream oil and gas Chevron ConocoPhillips Mitsui E&P UK

Tags

All Regions | Asset report | Britannia | Central North Sea | Chevron | ConocoPhillips | Costs | Europe | Exploration | Field | Gas | Infrastructure | Mitsui E&P UK | Moray Firth | Northern Europe | Operational | Production | Reserves and resources

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Other Wood Mackenzie Products and Database

Non-exhaustive list

- Global Economic Model (GEM) for Oil & Gas and Mining (Coal/Metals) Valuations
- Refinery Valuations
- Country-by-county energy balance forecast
- Global Oil Supply
- North American tight oil and shale gas databases
- Power Plant Databases
- Chemicals markets forecasts
- …. and many more….

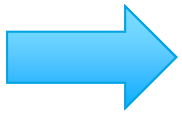
- And of course optimisation models

Energy Market Models - Applications

Optimisation Models at Wood Mackenzie - Overview

Proprietary models developed by Wood Mackenzie

- Internal Models:
  - Regional power models
  - Regional gas and power models
  - Regional coal and power models
  - Coal trade model



- Internal and Commercial Models:
  - Global Gas Model
  - Refinery model
- Consulting solutions:
  - Bespoke models
  - Bespoke analysis based on models

3rd Party Modelling solutions used at Wood Mackenzie

- Regional pipeline utilisation model
- Regional power model

There is clearly a demand for commercial off-the-shelf modelling solution and we believe that Wood Mackenzie with it's rich data is ideally place to offer more energy market models.

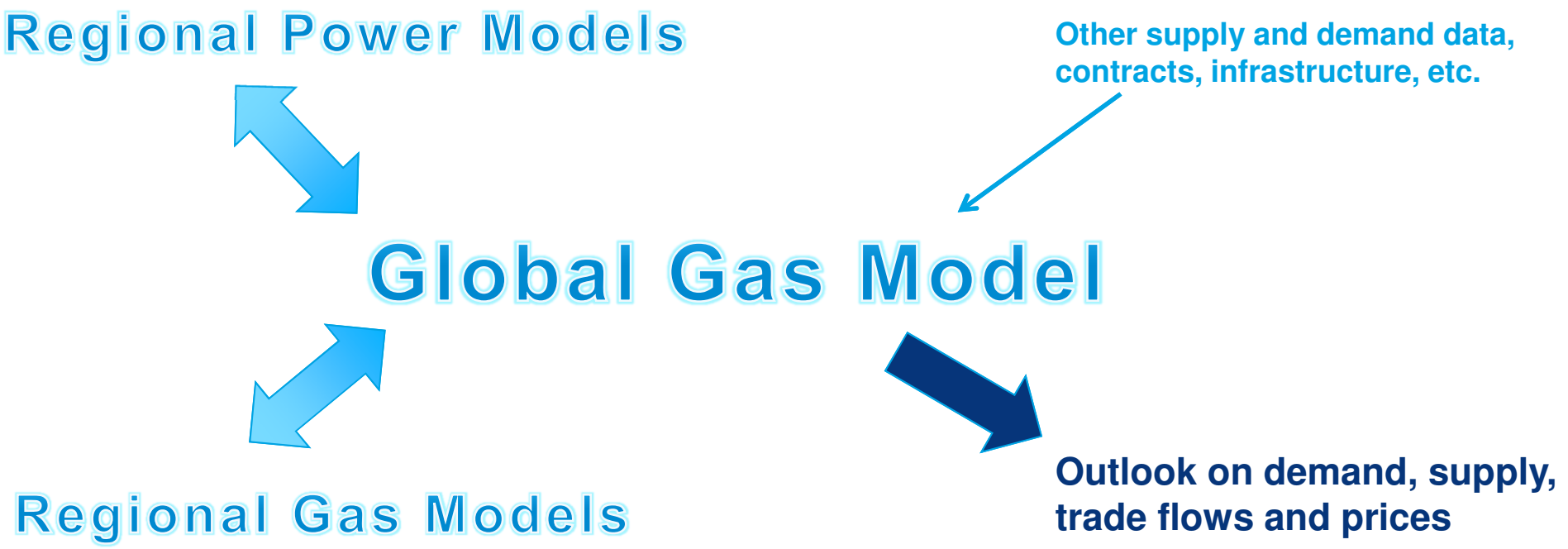
Optimisation Models at Wood Mackenzie - Techniques

Types of Models Used

- Energy market models, mainly LPs with additional heuristic elements
- Power market models, LPs and some IPs
- Refinery models, NLPs

Case Study: Wood Mackenzie's Global Gas Model

Optimisation models are an integral part of the forecast creation



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Case Study: Wood Mackenzie's Global Gas Model

General Overview of the Model

- Fairly standard supply and demand network model
- All aspects of the infrastructure (pipelines, LNG terminals) included
- Demand Response via stepwise demand function

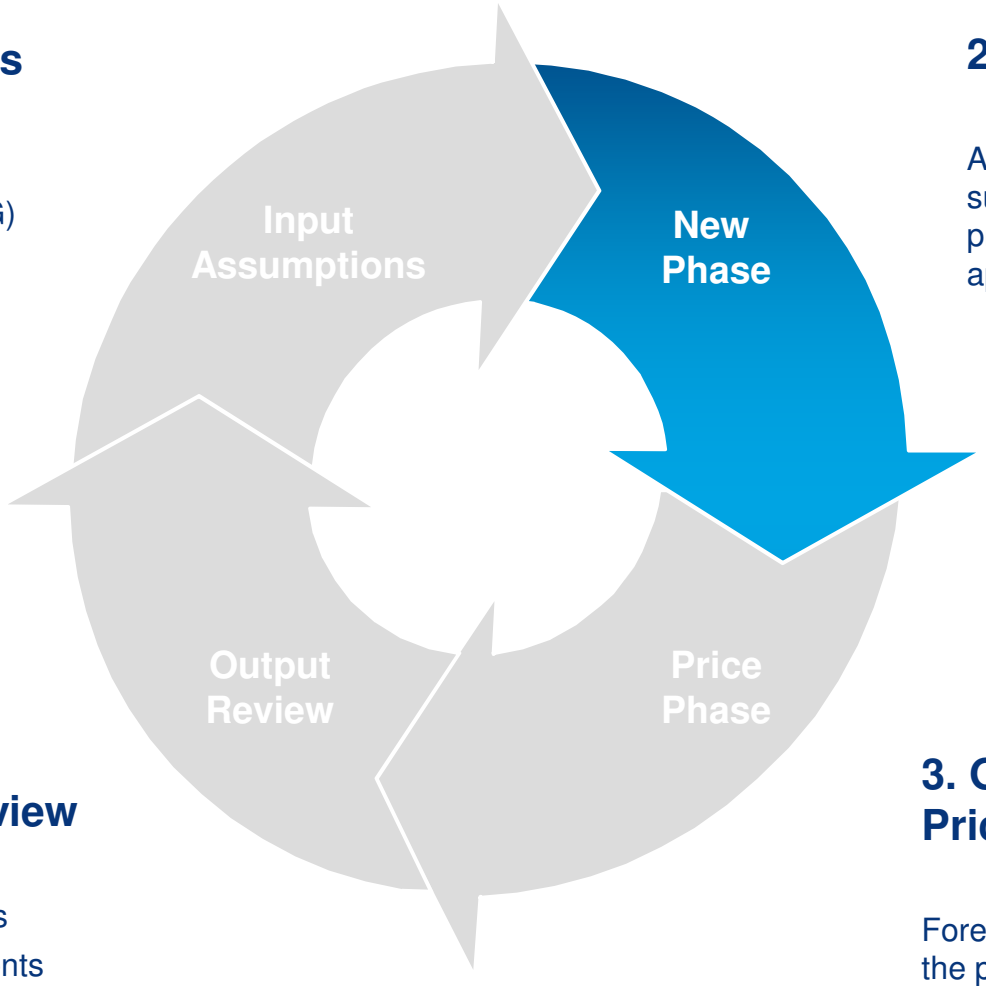
- LP setup allows you to integrate elements of expert knowledge:
  - » Contracts via a database of more that 800 contracts
  - » Basic representation of producer market power

- Main difference with academic resource models is the investment mechanism
  - » Driven by data: we know the production profiles and cost breakevens
  - » No broad-brush marginal investment mechanism X$ investments -> X added capacity
  - » Mechanism is closer to a scheduling mechanism
  - » Could have been implemented as an IP but an approach of sequentially solving LPs with some post-processing heuristics works faster.

Global Gas Modelling Process

1. Input Assumptions

- Supply and demand
- Infrastructure (pipe/LNG)
- Contracts
- Storage
- Producer power
- etc



2. Supply Scheduling

Automatic scheduling of new gas supply resources / gas fields (in the presence of producer power where appropriate)

3. Gas Flows and Clearing Prices

Forecasting flows and clearing prices (in the presence of producer power where appropriate)

4. Reporting and Review

- Manual review of outputs
- Identification of refinements
- (Optional) Modification of inputs for new run

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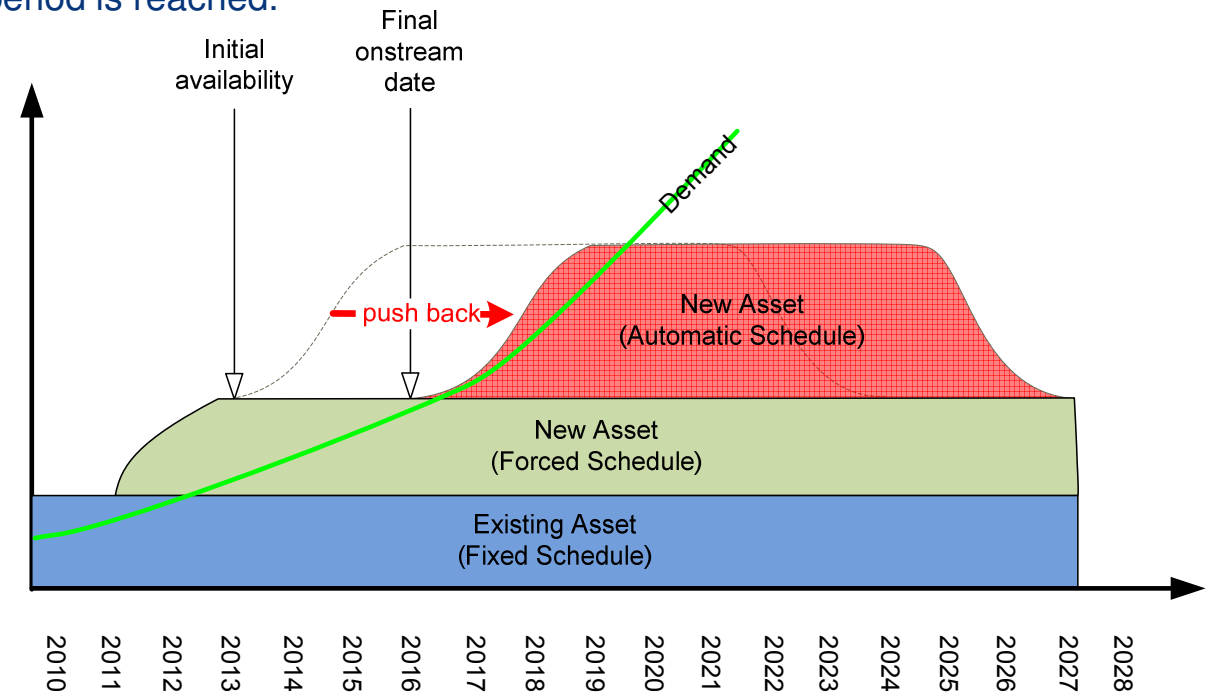
Supply Scheduling: Competition Between New Build and Existing Assets

- During supply scheduling ("New Phase"), the GGM meets demand with the least cost combination of existing or forced schedule assets offered at Short Run Marginal Costs and new/unscheduled assets offered at Long Run Marginal Costs (overwritten by appropriate market power element if present)
- In any year when an unscheduled new asset is not required, its production profile is pushed back by a year. This "push back" decision process continues until the asset is either used for the first time (and its profile is fixed) or the end of the forecast period is reached.



Energy Market Models –Challenges

Optimisation Models at Wood Mackenzie – Challenges I

Not hard problems – recurring problems…

- Data and data management:
  - Volume of data from different sources (DBs, regions, units, etc.)
  - Integration for data flows in and out of models
- Market knowledge:
  - Integrating soft market knowledge
  - Getting non-modellers comfortable with the models and their outcomes

Optimisation Models at Wood Mackenzie – Challenges II

What is the best modelling platform?

- Wood Mackenzie is a data and analysis company, not a software company
- Models used and built in different platforms reflect the historical evolution of our analysis:
  - Internally we use GAMS or AIMMS + ACCESS
  - 3rd party platforms
  - Python for prototypes
- Goal is to create a new modern modelling platform for data management, running the model and result visualisation
  - Flexible for internal use and model development
  - Intuitive and easy to use for clients even without a hard modelling background through a graphical user interface

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