«It’s all in the data»

-from improved well production to oil price forecasts

RYSTAD ENERGY

Erik Wold
Senior partner, Head of Technology

EnergyWorld, Stavanger, 20160310

Agenda

Introduction to Rystad Energy
Data analysis 1: Shale well production
Data analysis 2: Global oil supply and demand

Rystad Energy at a glance – an oil industry business intelligence company

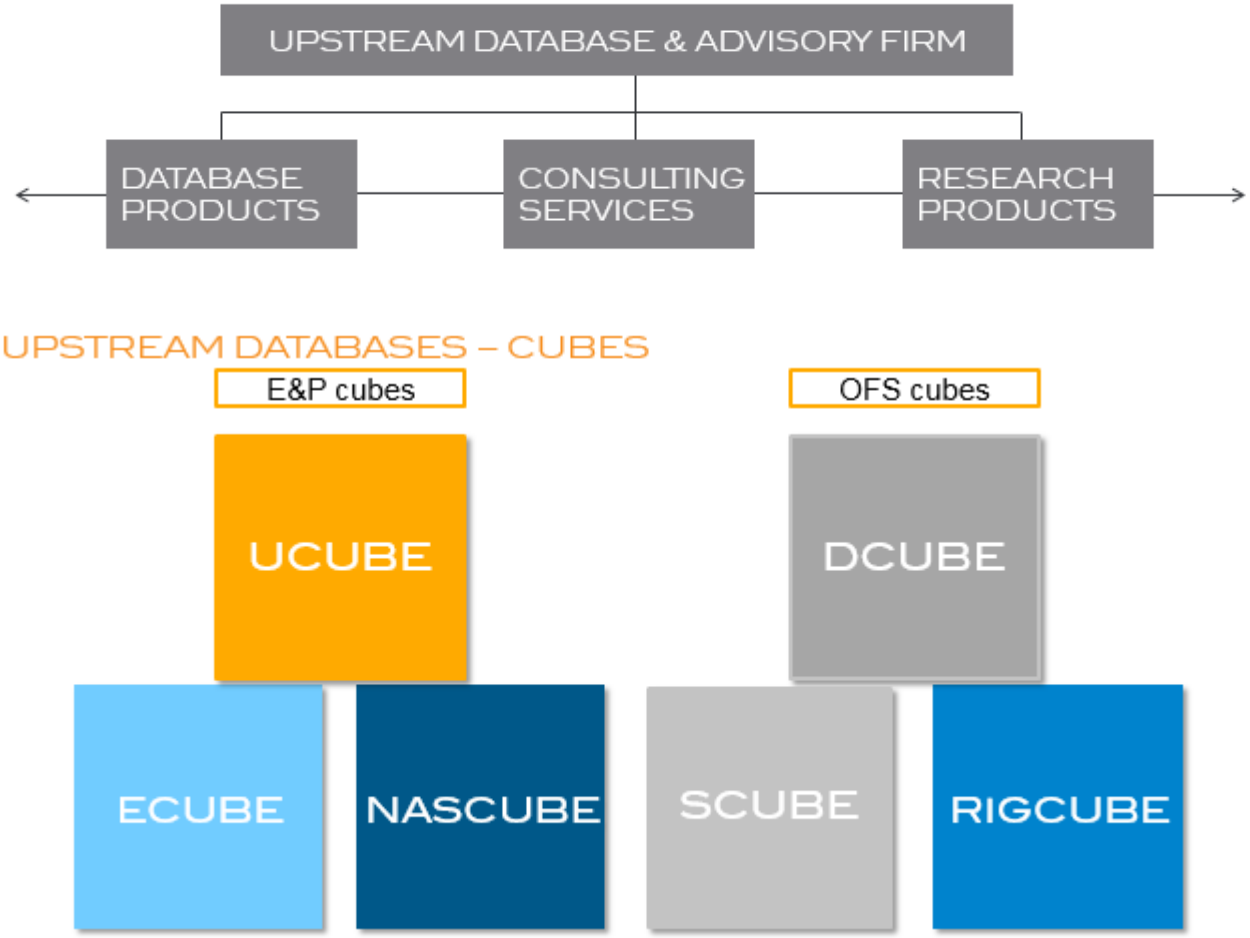
Rystad Energy (RE) has specialized in detailed analyzes of the oil and gas industry.

As a management consulting company RE has one of the largest teams of upstream specialists, and has won a reputation for a quantitative and data intensive approach.

As a data provider RE provides access to globally complete databases of field based production and investments, of demand for oil services, etc.

All databases are organized as OLAP* cubes**, which allow for rapid retrieval of multidimensional data. RE has built a BI client SW ("Cube Browser") to access the data.

RE are specialists in organizing data to make good OLAP cubes, and supports companies in making their own cubes. RE also installs Cube Browser on client data.



Some examples of RE cubes: Upstream cube, Exploration cube, North America Shale cube, oil service Demand cube, oil service Supplier cube, RIG demand and supply cube

*OLAP = OnLine Analytical Processing, Normally data are organized in relational (SQL) data, which are slow to retrieve data from. These databases can be processed into OLAP cubes for fast read-out
** cube = term used for OLAP databases

Agenda

Introduction to Rystad Energy
Data analysis 1: Shale well production
Data analysis 2: Global oil supply and demand

Data Analysis 1: Shale well production

The purpose of the next slides is to show how analyses of well production can be used to establish best practice.

Very often well production data are “locked down” in accounting systems and not available for inspection. We believe a lot is to learn by studying the data.

The following illustrations are based on Rystad Energy NASWellCube, which is a well based database for North American shale. While NASWellCube shows production only at monthly granularity. Company field data are expected to have much higher time resolution.

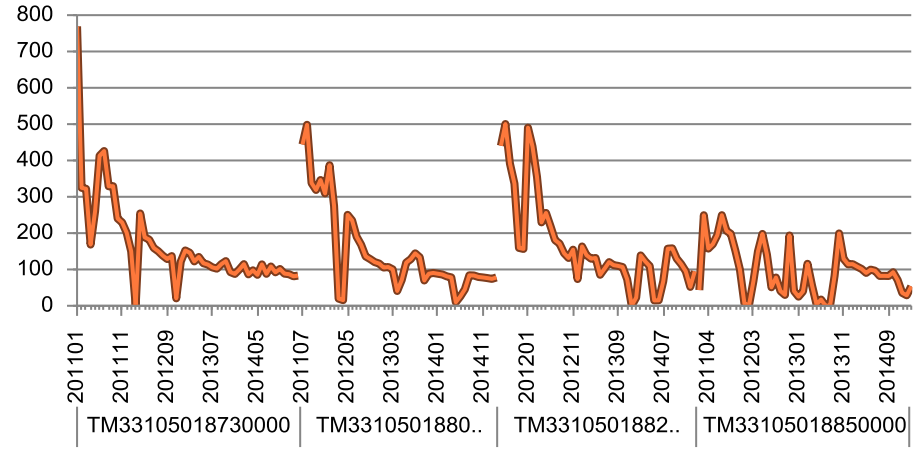
NASWellCube includes ~220 000 wells drilled in North American shale the last decade. Of particular interest to this data set is to study well performance in different plays and for different operators, to examine who are doing better, either technically by well completion, or are sitting on the best acreage. For investors this is important when selecting which companies to invest into. For Rystad Energy it is essential in order to precisely forecast the production contribution from shale in the global supply-demand picture.

As demonstrated in the presentation, all charts below were made in 1-3 seconds, retrieving data from a server in Oslo. The ability of working so easily with the data in itself strengthens the analytical capability, as response time is not constraining the user from asking more in-depth questions. Also, it is essential to organize the data in a way that allows for flexible analyses of the data.

Comparing wells on performance

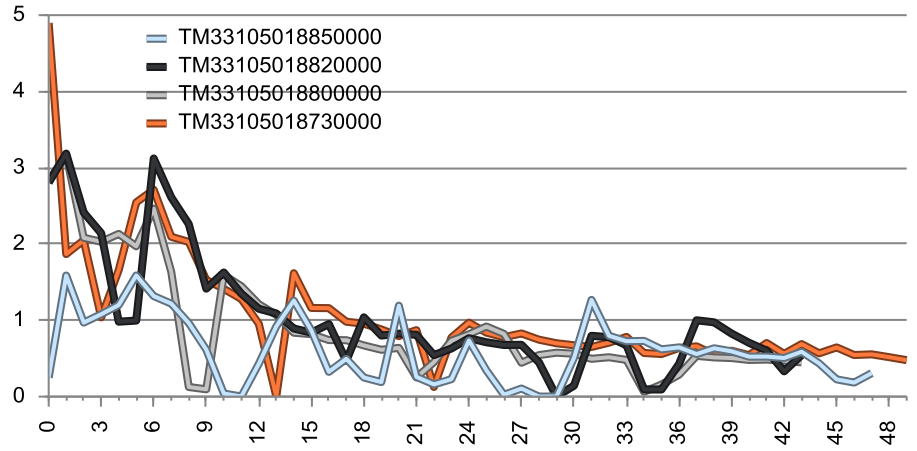
Compare well profiles side by side (4 Bakken wells)

Boe/d



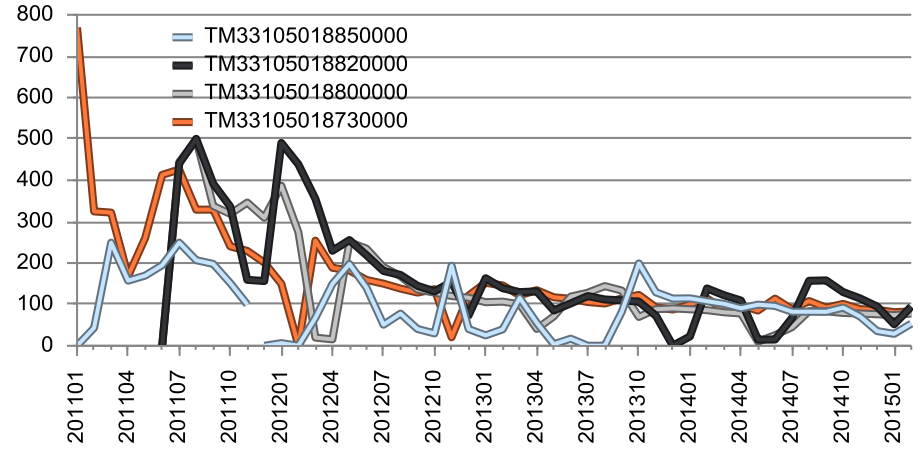
Compare well profiles by cumulative months on production

Boe/d



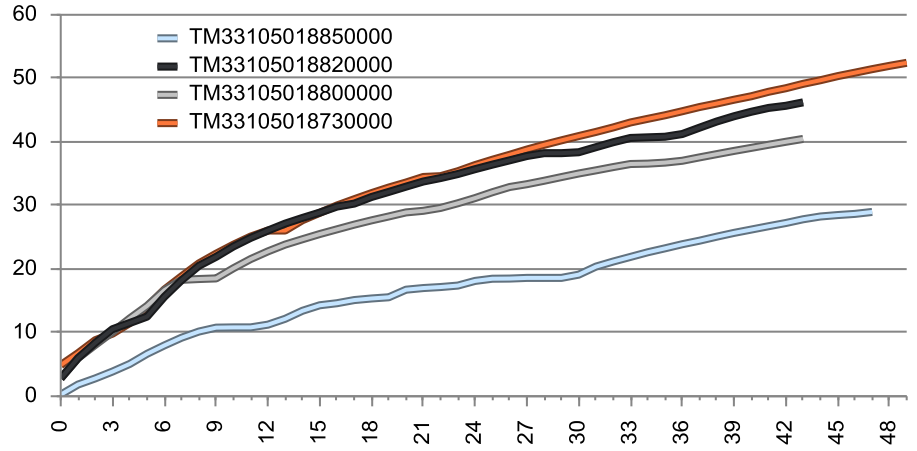
Compare well profiles on same time axis (4 Bakken wells)

Boe/d



Cumulative well production by cumulative months on production

Cumulative production



Source: Rystad Energy NASWellCube

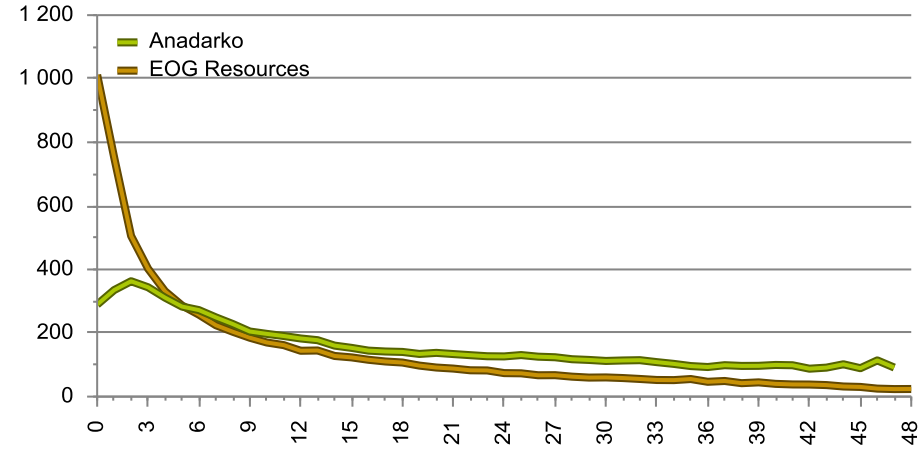
RYSTAD ENERGY

Average well curves can be used to study learning curves and to curve fit for forecasting

Eagle Ford average well curves for EOG and Anadarko

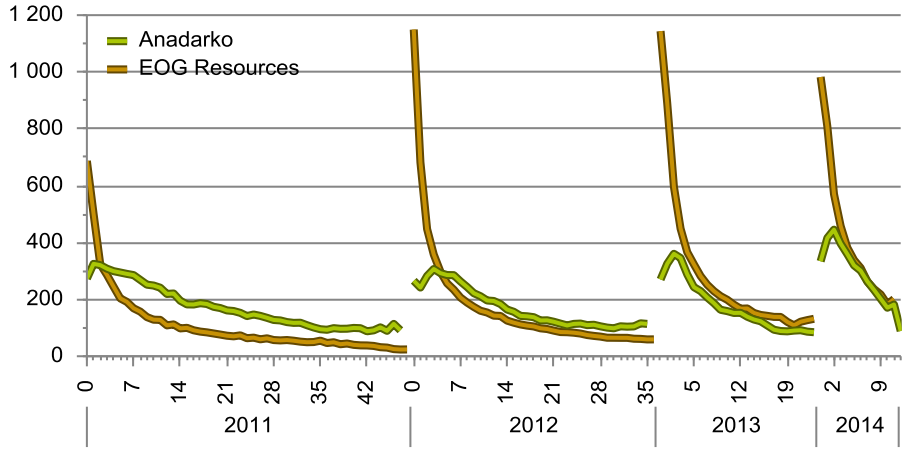
EOG and Anadarko obviously different compl./prod. strategies

Average well production by months on production



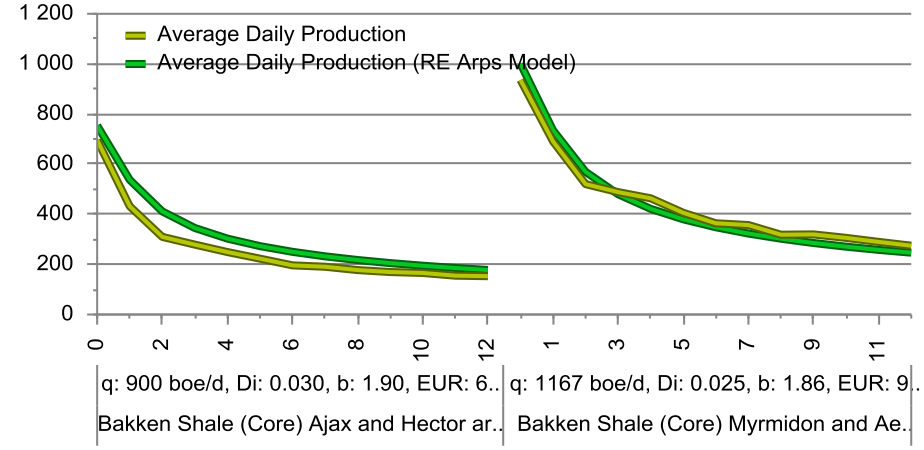
Well curves change with year showing learning process

Average well production by production start year



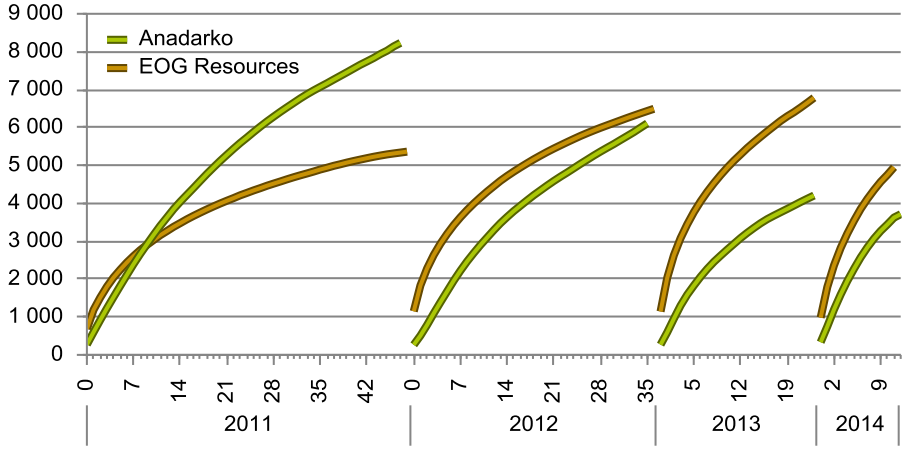
Curve fitting can be used to forecast future well production

Average well production and curve fit for two sample assets



EOG more successful in increasing well production

Cumulative well production by production start year



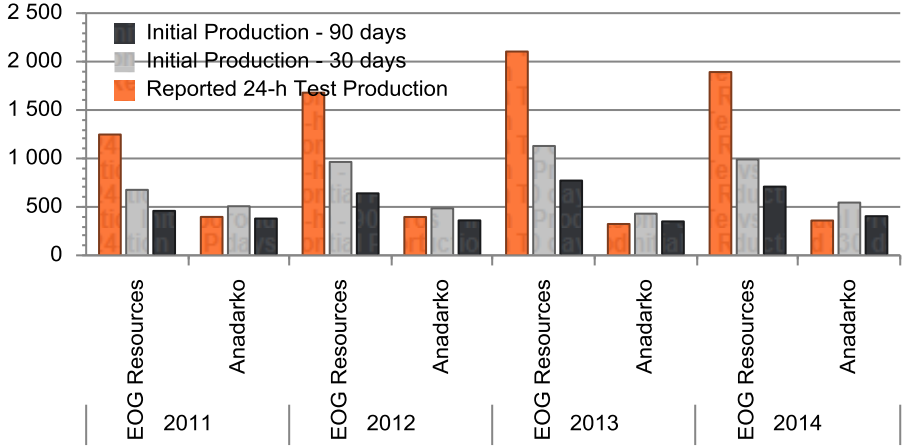
Source: Rystad Energy NASWellCube

RYSTAD ENERGY

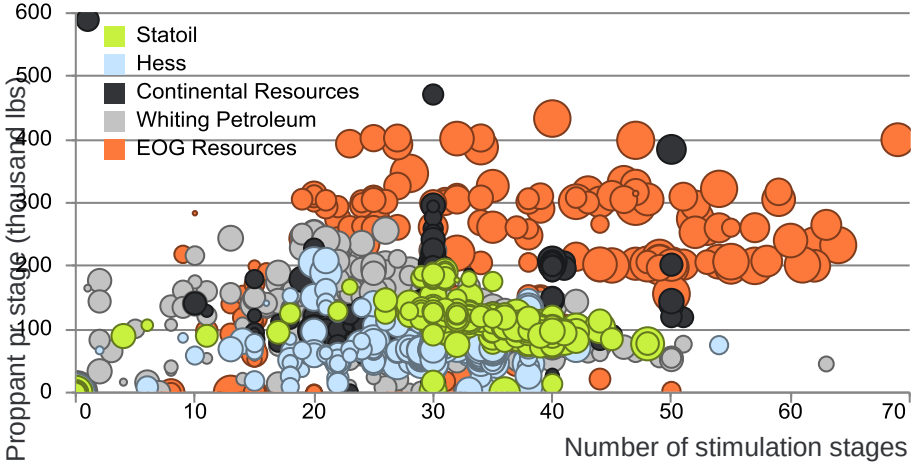
Why are some wells better? Is higher Ip obtained using more stages and proppants?

Comparing Ips for EOG and Anadarko by well start up year

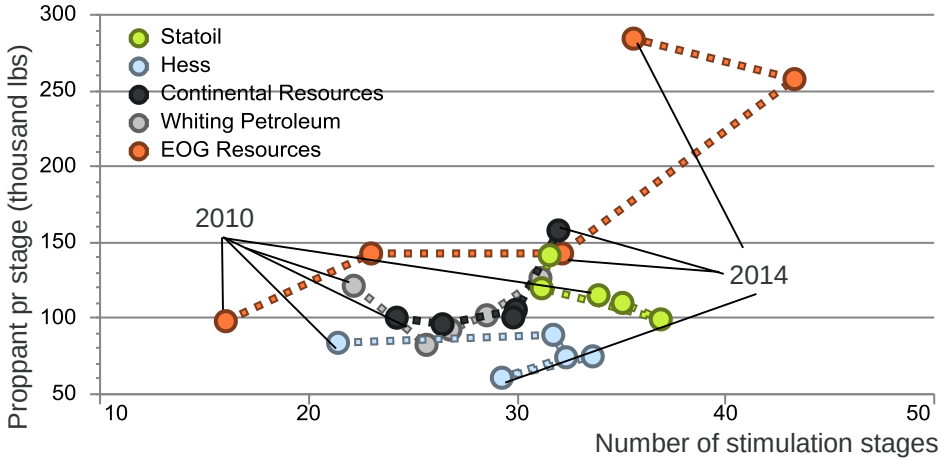
Initial production (boe/d)



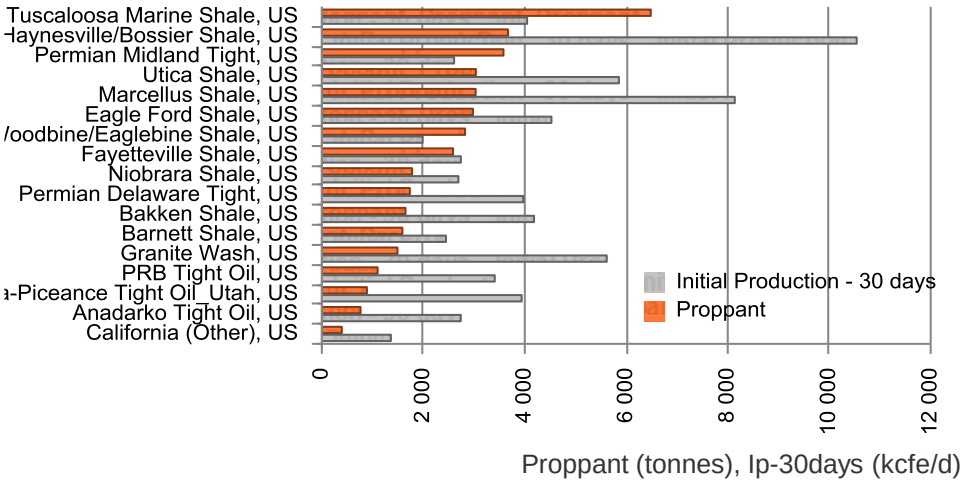
All wells for some operators. Bubble size scales with Ip.



Average number of stages increased since 2010, to stabilize at ~30 stages. Proppant use varies widely



Initial production and proppant use in different shale plays

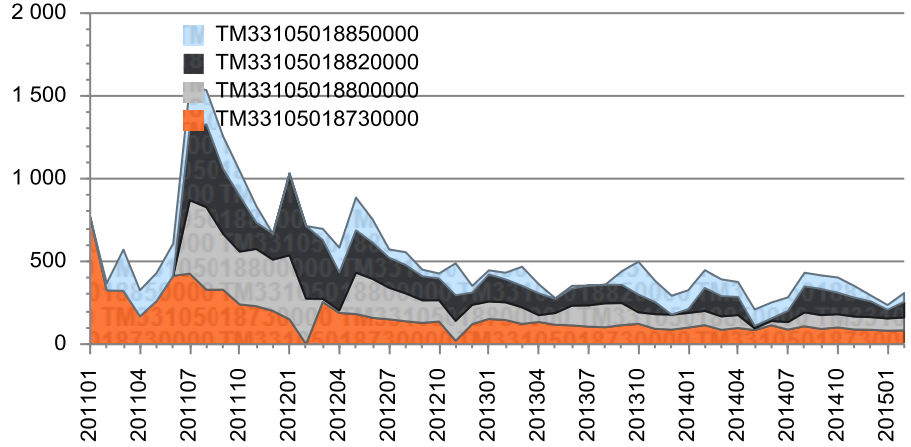


Source: Rystad Energy NASWellCube

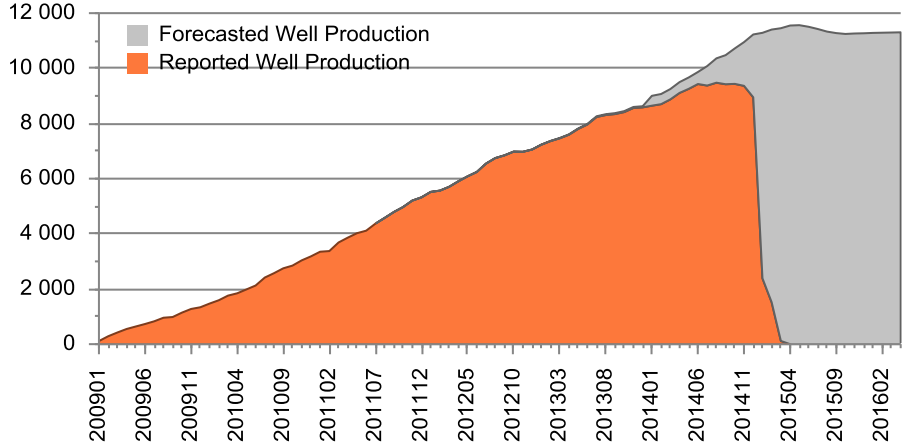
RYSTAD ENERGY

Production can be aggregated to desired level, forecast can be made at well level

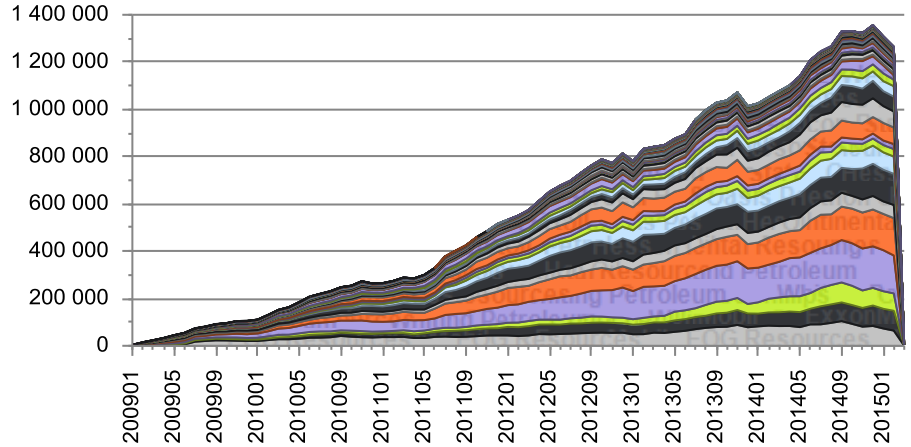
Aggregated production of the 4 wells shown on slide 7
Boe/d



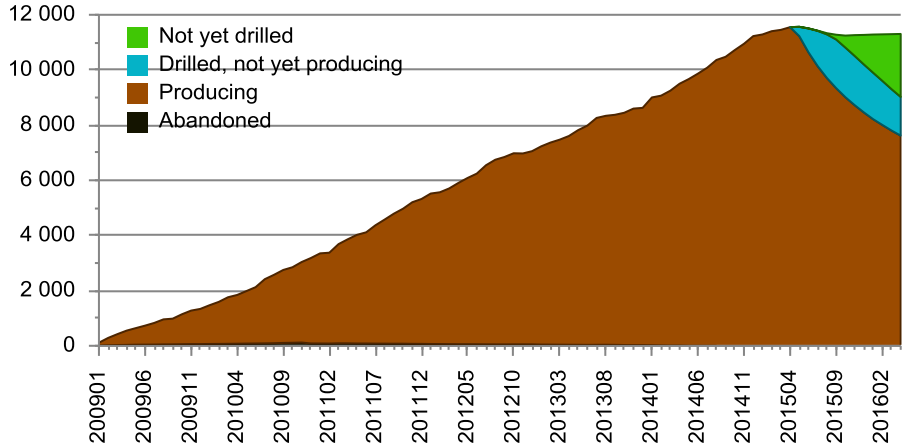
Using curve fitting and planned wells forecast can be made at well level (kboe/d)



Production can be aggregated at field level (here Bakken shale)
Boe/d (by operator)



Better forecast is achieved when drilled, but not producing and planned wells are included



Source: Rystad Energy NASWellCube

RYSTAD ENERGY

Agenda

Introduction to Rystad Energy
Data analysis 1: Shale well production
Data analysis 2: Global oil supply and demand

Data analysis 2: Global oil supply and demand

Today the oil supply and demand balance is a very hot topic.

Due to the shale revolution and Saudi Arabia/OPEC prioritizing market shares over keeping up the oil price, the oil price has dropped dramatically.

Analysts take a wide range of positions on whether the oil price will drop further, stay at current low levels, or increase. Currently more oil is produced than consumed. For the oil price to recover demand must grow and/or oil supply must decrease.

Rystad Energy bases its view on supply on analyses of all oil and gas fields globally, i.e. using their database UCube. Production is not independent of price, and it is essential to include price effects at field level (rather than using global “balloon models”). In a low oil price scenario all producing fields will continue to produce, but drill less, and thus decline faster. Many discoveries become unprofitable to develop, are shelfed, and will thus not compensate for the underlying decline in producing fields. As a result production will drop. At a level of 50 USD/bbl liquids production flattens out to 2018, after which it will drop.

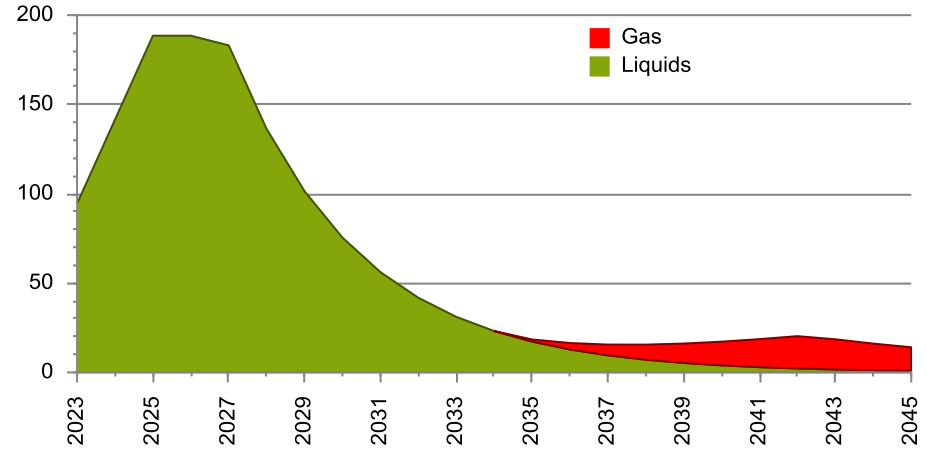
At the same time demand increases – expected to increase by 1 million bbls pr day in 2016 (IEA). Long term demand growth is robust. The large non-OECD population uses far less energy per capita than OECD.

When a growing demand passes a stalling or declining supply, market forces will again come into play and prices will go up. According to Rystad Energy analyses this will happen by the end of this year, and we should see prices up to 60 USD this year, and to pass 100 USD/bbl in 2020.

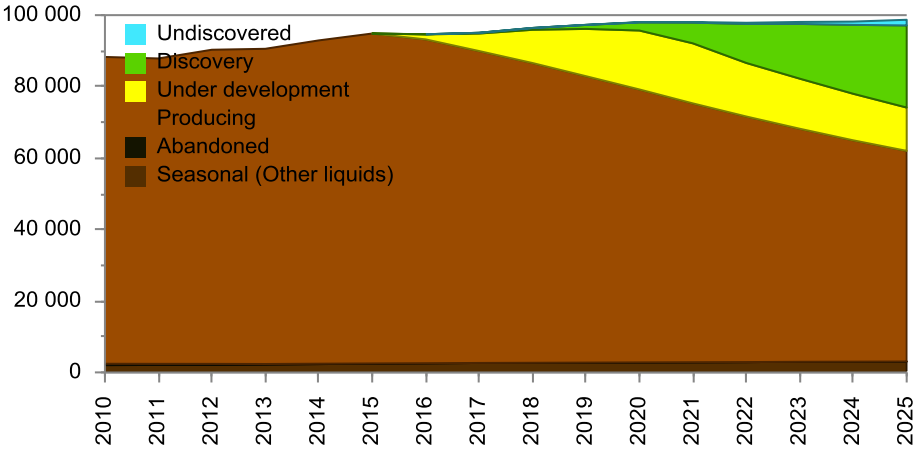
The current low oil prices are not sustainable.

UCube includes production from all fields globally. Shows that new fields must be developed to compensate for decline in producing fields

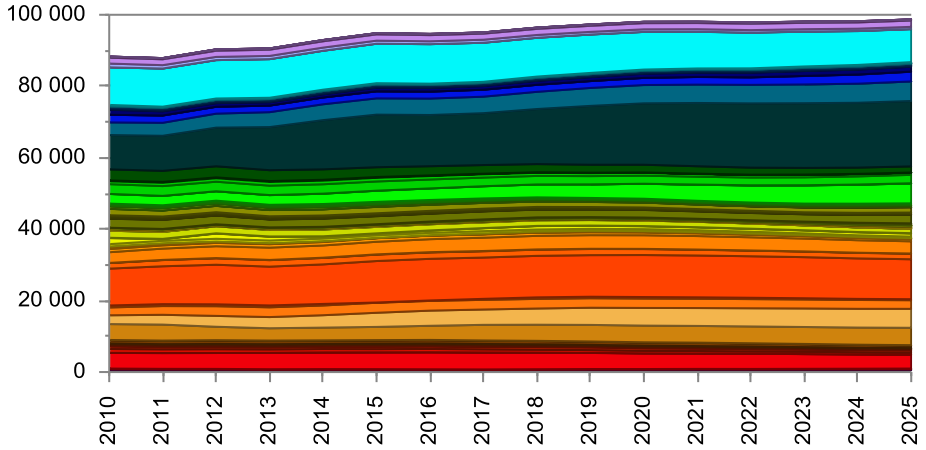
Field production – example Johan Castberg
Thousand bbl/d



Global production by current field maturity
Thousand bbl/d



Global liquids production is the aggregation from 60 000 fields
Thousand bbl/d (by country)



The following slides showed:

- In order to balance decline in producing fields new fields must be developed, both already sanctioned fields and discoveries
- A large share of the new volumes will come from shale and the Middle East
- On the demand side OECD demand is declining, while non-OECD demand has been steadily growing, and this is expected to continue.
- Oil supply has been higher than demand in 2014 and 2015, causing stock build-up and low prices. In 2016H2 this is expected to change, and the oil price is likely to increase.

Source: Rystad Energy UCube