

## Biased Fuel Price Forecasts

Danish authorities<sup>1</sup> publish 20 years fuel price forecasts every year. The forecasts are used as guidelines for the planning of public and private energy projects. Realistic forecasts are decisive conditions for optimal investments.

In a note<sup>2</sup> from 2016, I demonstrated that the expected crude oil price in 2020 varied between 50 and 110 US \$ per barrel in forecasts made in the years from 2011 to 2016.

This result calls for further scrutiny of the quality of the fuel price forecasts. A few new forecasts have been added, but the available data are still insufficient for an estimate of the quality of the forecasts at a reasonable level of significance.

### Carefully prepared price forecasts

DEA describes a complex procedure<sup>3</sup> for preparing the fuel price forecasts. Leading international references are used, such as the International Energy Agency (IEA) and World Energy Outlook (November 2017).

Unfortunately, I did not collect forecasts from before 2011. Fig. 1 shows forecasts made in the years 2011 to 2018. The price unit in the chart is DKK (Danish currency) per GJ, which has the same magnitude as US \$ per barrel.

For comparison, the chart includes actual average prices from US EIA<sup>4</sup> for the years 2009 to 2018. The energy prices were high in the first years after the financial crisis in 2008. Lower prices followed better trading conditions after 2014.

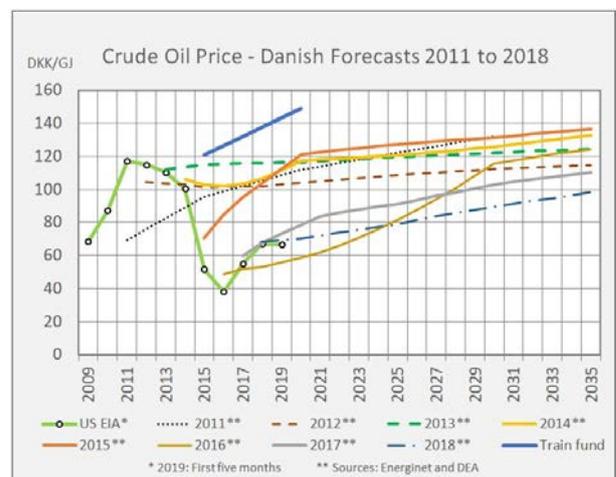


Fig. 1 - Transition to a normal price level after the peak in 2011

A steady increase is a common characteristic of all fuel price forecasts. "Peak oil" followed by oil shortage and increasing oil prices was expected several years ago. It has not yet materialized.

The 2015 forecast (fig. 1) indicates that the lower price level that year was a surprise. A speedy return to a "normal" high price was predicted. Since then, the start level was regularly adjusted, but the steadily increasing trend has been maintained.

### Planning with virtual money

The Train Fund DK is a political agreement from 2013. The Danish railway system is obsolete. It needs urgently improvements in order to reach a suitable European level. A national plan for fast trains in Denmark was outlined. However, the money was missing. A majority in

<sup>1</sup> Danish Energy Agency (DEA/Energistyrelsen) and Energinet (Danish TSO)

<sup>2</sup> [http://pfbach.dk/firma\\_pfb/pfb\\_misleading\\_fuel\\_price\\_forecasts\\_2016\\_08\\_13.pdf](http://pfbach.dk/firma_pfb/pfb_misleading_fuel_price_forecasts_2016_08_13.pdf)

<sup>3</sup> Samfundsøkonomiske beregningsforudsætninger for energipriser og emissioner, oktober 201 (in Danish)

<sup>4</sup> U.S. Energy Information Administration, Petroleum Marketing Monthly

the Danish Parliament decided to reserve the revenue from an additional tax on the extraction of oil in the Danish part of the North Sea for the purpose. The budget was based on unrealistic fuel prices (fig. 1), and there is no money left for rails and trains.

### The fluctuating crude oil price

Crude oil prices never increased steadily during 20 years (fig. 2). After decades with stable prices, a more volatile period began with the oil crises in the 1970s.

The fluctuations depend on international business conditions. They cannot be predicted. Therefore, a smooth price forecast seems to be a reasonable choice.

A smooth long-term forecast for a volatile period will be either too high or too low for a given year, but in a perfect world, the errors should be symmetrically distributed.

### Non-symmetric errors

Fig. 3 shows the errors, based on forecasts 2011 to 2016 and EIA prices 2013 to 2018.

The errors are predominantly positive, which means that the crude oil was cheaper than expected.

A possible consequence is that some new energy projects will be less profitable than expected, if the price forecasts were used for optimization of the investment.

It is possible that errors will be better balanced when data are available for a full cycle of international economic activity, but even then, large errors will occur for single years.

We do not know when the “peak oil” will occur, and we cannot predict the next international recession. Therefore, even the best long-term fuel price forecasts will be unreliable. Energy projects must be made robust to large price variations in the fuel markets.

Fig. 2 suggests crude oil prices up to 120 US \$ per barrel during international recessions and between 20 and 60 \$/barrel for normal years.

From 1974 to 2018, the crude-oil prices per barrel had an increasing linear trend at US \$ 0.40 per year. The expected growth per year of the Danish 2018 forecast (2018 to 2040) is 1.85 DKK/GJ (or app. US \$ 1.60 per barrel).

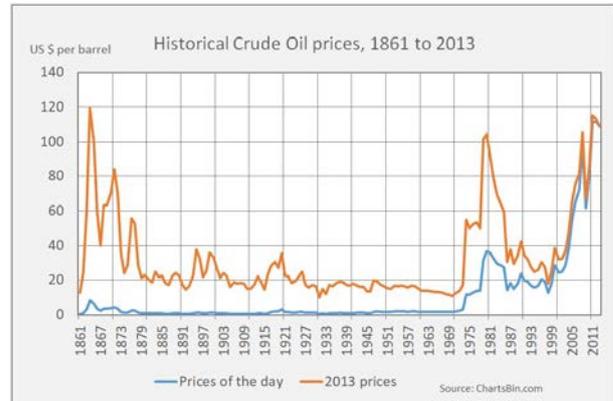


Fig. 2 - Fluctuations between 20 and 120 US \$/barrel within the last 40 years

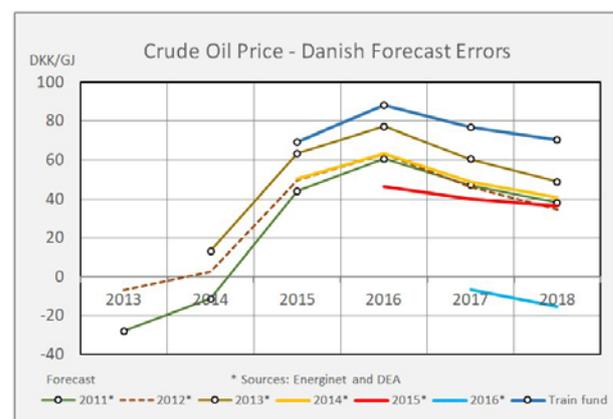


Fig. 3 - Mainly positive errors

## **Forecasts are always wrong**

The crude oil prices will probably fluctuate in the range between 20 and 100 US \$ per barrel depending on the international trading conditions. Consequently, the best possible smooth forecast may have errors up to 40 \$ up or down. Unbalanced forecast would give even larger errors.

Without a well-founded estimate of the time for the next recession and for the peak oil, any guess is as good as the official forecasts.

Private investors in energy project should make sure that their projects are sufficiently robust against large forecast errors.

Public investments are often required to have positive business cases. A biased fuel price forecast can support decisions on projects, which are not profitable in a narrow sense, but which have wider purposes. The bias is normally unintended, but it is hard to believe that the planners of the Danish train fund were in good faith.