



VISION PAPER

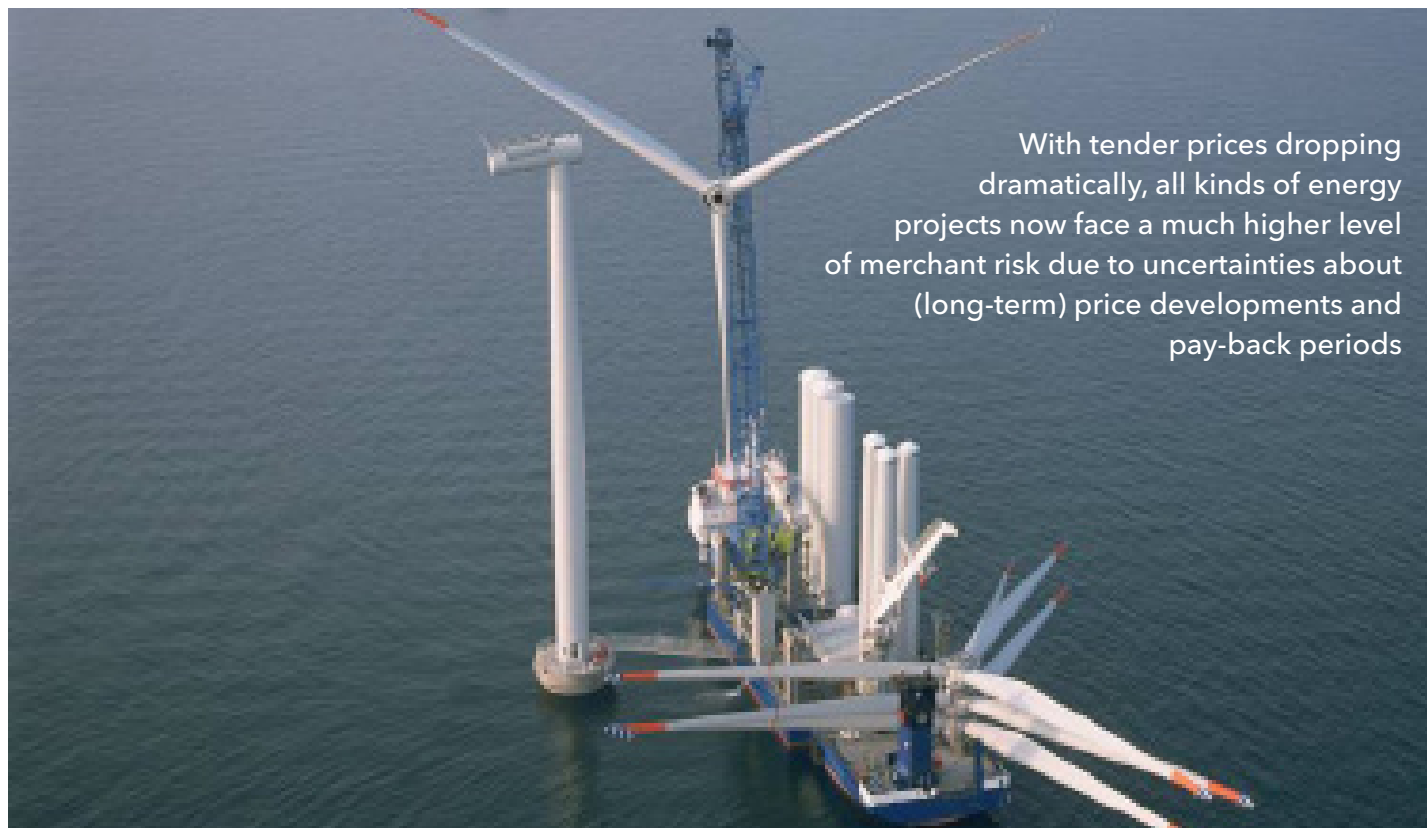
POWER PRICE FORECASTING

Deeper understanding of merchant risk to support decision making in energy investments

The landscape for investing in energy projects has changed radically in recent years. The players, the technologies, the market forces have all evolved considerably. This makes it both more challenging and more crucial to accurately determine the risk associated with investing in a particular energy project.

With low interest rates limiting the potential returns in other areas, energy projects are increasingly seen as an attractive investment to a much wider range of potential investors. This has changed the dynamic of the energy investment market. Previously, planned energy projects fought for a share of a limited finance pot. Today, potential investors compete for the chance to invest their money in the most promising projects – which brings pressure to deliver the most competitive bid. To do that within a risk profile with which you are comfortable means you have to be sure those risks are clearly understood.

At the same time, environmental concerns have made renewable energy projects such as wind and solar farms, a much bigger part of the energy market as countries rush to reduce emissions in line with the Paris Agreement. Initially, governments used subsidies to stimulate investment and kick-start the transition to renewables. However, as the adoption of renewables has grown, maturing technologies and increasing economies of scale have dramatically cut the cost of installing renewable energy projects.



Consequently, governments are now looking to reduce or even eliminate renewable energy subsidies. In 2017 we have seen several subsidy-free bids for developing renewable energy projects in northwest Europe, which indicates that the average cost per unit of energy for (some) renewable technologies is approaching average wholesale market price levels in this region - so-called *grid parity*. This fundamentally changes the nature of the risk such projects face. Where before subsidies offered a guaranteed level of income, projects and their investors are now fully exposed to the dynamics of the energy market including competition and consequent price pressure.

In the long term, there is also likely to be an impact on the economics of conventional power generation assets. Currently, power prices are determined mainly by fuel prices (in the future, DNV GL expects that emissions costs levied on fossil-fuel-fired technologies, will play an increasing role in this price formation). Today's low electricity prices however mean that there is very little room for healthy margins for conventional energy on the wholesale market. Increasing levels of renewables entering the market and generating at close to zero marginal costs, are also likely to increase downward pressure on wholesale prices in the long-term.

Hence all kinds of energy projects now face a much higher level of merchant risk due to uncertainties about (long-term) price developments and pay-back periods. This makes trustworthy long-term power price projections essential for potential investors looking to assess the value/risk profile of specific projects. Of course, investors can mitigate some or all of the risk by sharing it with utilities through power purchase agreements (PPAs). However, the risk still needs to be considered, and a consensus on future power price evolution is required to set the level of the PPA in the first place. What's more, current low wholesale prices and the long-term impact of low marginal cost renewables will increase pressure on PPA pricing levels.

Price forecasting or crystal ball gazing?

Forecasting wholesale power price development is extremely complicated and must take into consideration a huge number of influencing factors - technical, economic, environmental, political, legal and social. Typically, power price forecasters today handle that complexity by developing multiple scenarios and producing power price curves for each one. This usually means each forecast includes a low, central (or 'business as usual') and high forward price curve.

However, this multiple-scenario approach can lead to wildly differing valuations of the same project as each stakeholder uses the curve that best suits their own interest. Specifically, investors who are trying to identify their maximum exposure to risk will use the lowest curve (worst-case scenario), while project developers who want to present their project in the best possible light will naturally base their valuation on the highest price curve. This can lead to significant delays in negotiations and the realization of the project.



What's worse, the approach gives users of the curves very little insight into the assumptions behind those curves or the factors that could influence actual power prices within a given scenario. This makes it very difficult for potential investors to really understand the risks they are taking on and thus assess whether they are comfortable with the project's risk profile. Insight into price dynamics (volatility, granularity and sensitivity) provides more comfort and support in the decision-making process. Hence it is crucial to understanding market and price forecasts, and making the right choices.

A new vision on price forecasting

DNV GL has been providing tailor-made electricity market modelling and forecasting services to individual clients for over twenty years. Drawing on this experience, and based on requests from players across the energy investment market, we believe a new approach to generalized power price forecasting is urgently needed.

A multitude of investors asked for our view on power price evolution because of our reputation and global engagement in the energy industry – including renewable and conventional generation, transport & distribution, storage, energy usage and emerging technologies. With our combination of deep technical and market understanding, regulatory know how and track record in due diligence, we are ideally placed to deliver independent insight on power price development that all industry players can trust.

A single specific scenario, regularly updated

Rather than follow the standard multi-scenario forecasting methodology, we have decided to base our predictions on a single scenario: our vision of the most likely future of the energy market as published in our recently released Energy Transition Outlook 2017. This scenario was developed drawing on the expertise across the DNV GL group – including oil & gas and maritime and (renewable) energy experts – plus thousands of interviews with key stakeholders in the energy market. It is a scenario we have full confidence in, and discuss extensively in our Energy Transition Outlook (ETO 2017) report – providing complete transparency on the assumptions that underpin our resulting power price curves.

From this high-level, global scenario, we have created a quantitative, European market model. To do this, we add in detail such as the amounts of the various generation and storage technologies installed in each country within the region being modelled as well as parameters such as fuel and CO₂ prices. Integrated modelling of the European system is essential due to the increased interconnectivity of national power systems: for example, the high levels of wind energy are already influencing energy markets across northwest Europe.

We can then generate power price curves for each country. Having a single curve per country or price region, helps to standardize investment bidding, giving all stakeholders the same base point for negotiations.

To ensure that we give the most reliable forecasts possible, we regularly review our past projections against historical wholesale price developments. This allows us to better understand any deviations in previous forecasts, and improve our simulations and resulting forecasts where necessary.





Delivering deeper insight into risks

A key element in our vision of power price forecasting is to help users of the curves to develop a much greater understanding of the risk factors and levels impacting a specific project, so that they can make investment decisions with confidence. Specifically, that means providing insight into the various factors that could influence the actual power price evolution in that market (the drivers and sensitivities of the curves).

These could include:

- network, storage and generation technologies
- fuel, emissions and other operational costs
- weather profiles
- demand-side developments (e.g. electrification of transport and industrial processes, and demand response)
- political and social events such as Brexit
- policy decisions (e.g. phasing out coal or changing levels of nuclear power)

Understanding these drivers and sensitivities is essential in helping investors determine both the risks related to a project and how to mitigate them. This in turn is essential in ensuring investors are comfortable with the risk they are taking on, and that they can make informed strategic decisions on their investment portfolio.

While it is not unusual to provide some explanation of these drivers and sensitivities in the reports that accompany price forecasts, we believe this does not go far enough. In our opinion, supporting the report with interactive workshops gives investors a much better opportunity to deepen their understanding of the drivers and sensitivities in power price forecasts. In such a workshop, we present and discuss the fundamental elements of wholesale price formation in the target markets, helping investors to understand these elements, their important interrelations and our vision on their development. The overall goal is to ensure that investors' key decision makers have the information and insight necessary to fully understand the risk landscape they are operating in.

Do you understand the risk in your investment portfolio?

Based on this vision, DNV GL will launch a power price forecasting service in the beginning of 2018. However, interested parties can already contact our power market modelling and price forecast experts to discuss our novel approach and how it can help them to better understand risk in energy investments, so they can make the right investment decisions for their risk profiles.



ABOUT DNV GL

DNV GL

DNV GL is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

In the power and renewables industry

DNV GL delivers world-renowned testing and advisory services to the energy value chain including renewables and energy efficiency. Our expertise spans onshore and offshore wind power, solar, conventional generation, transmission and distribution, smart grids, and sustainable energy use, as well as energy markets and regulations. Our experts support customers around the globe in delivering a safe, reliable, efficient, and sustainable energy supply.