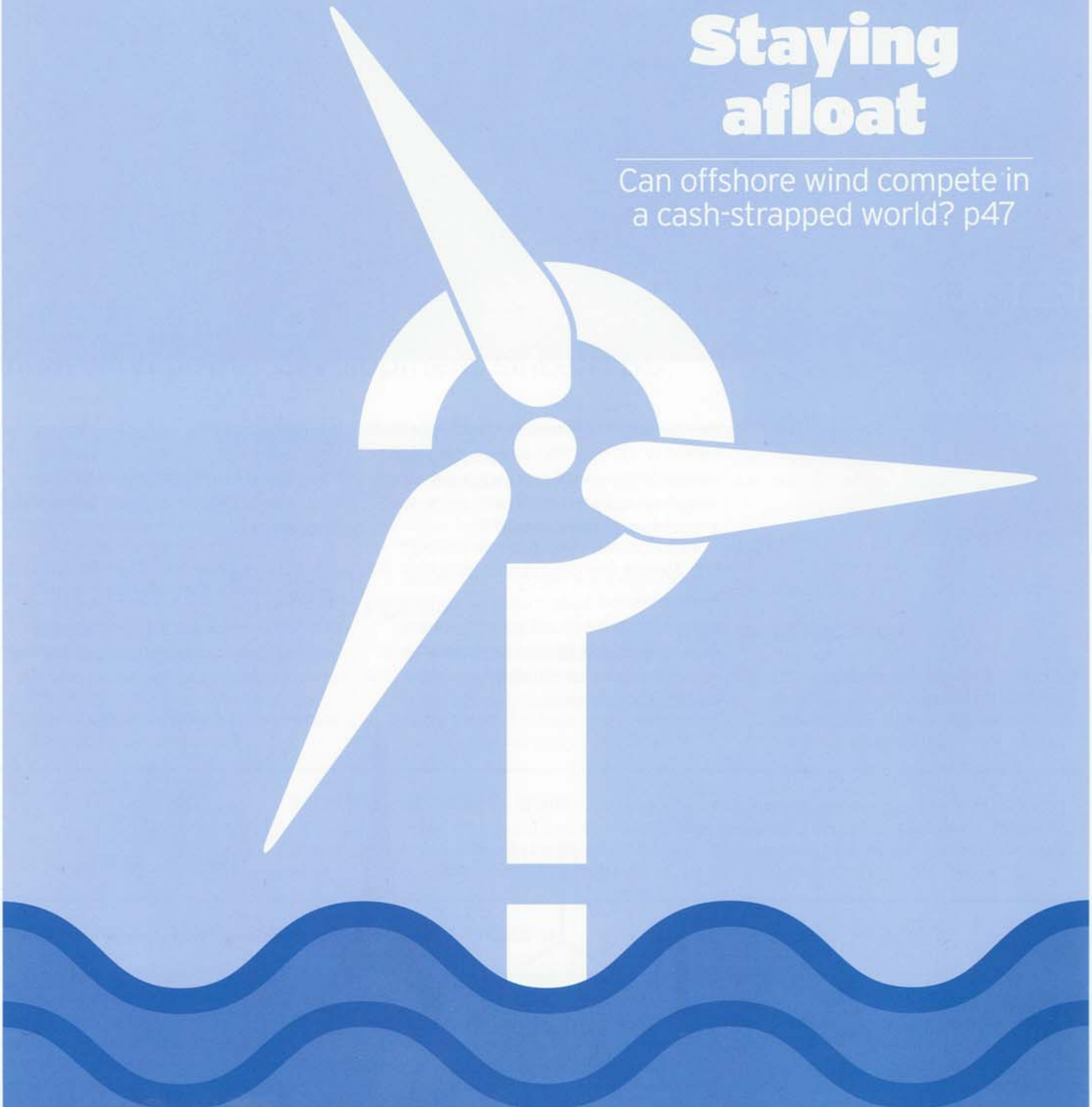
WIND POWER MONTHLY

December 2011
Est. 1985

Volume 27/ No. 12 / $30
www.windpowermonthly.com

Staying afloat

Can offshore wind compete in a cash-strapped world? p47



PPA AWARDS 2011 MONTHLY BUSINESS MAGAZINE OF THE YEAR

On land or sea: the business case for wind

Investors faced with the choice of backing an offshore wind energy project or staying on terra firma need to think carefully. Johannes Ritter explains the many factors that need to be taken into consideration to reach a sound decision

Increasingly, investors in wind energy face a key question: whether it would be more profitable in the long run to fund offshore developments, which offer higher wind yield rates, or stay on dry land, where the conditions — and the risks — are better understood and more easily managed. Before capital is handed over, investors need to reach a well-informed decision.

One way to do this is to make use of business-case methodology, which measures the lifetime risks and returns of both options, offshore and onshore.

The primary difficulty for investors considering offshore developments is how to accurately judge the financial implications of engineering challenges in order to differentiate between what is technologically possible and what is financially feasible. Coming up with solid calculations of risk factors and capital returns is essential in a risk-averse global economy.

The numbers have to be convincing, which means eliciting the expertise of engineers and scientists and translating their conclusions into numbers that can be trusted by a diverse range of appraisal specialists. It is important to recognise that both types of figures — technical and monetary — depend upon each other and are equally valid contributions to the overall calculation.

Building the evidence base

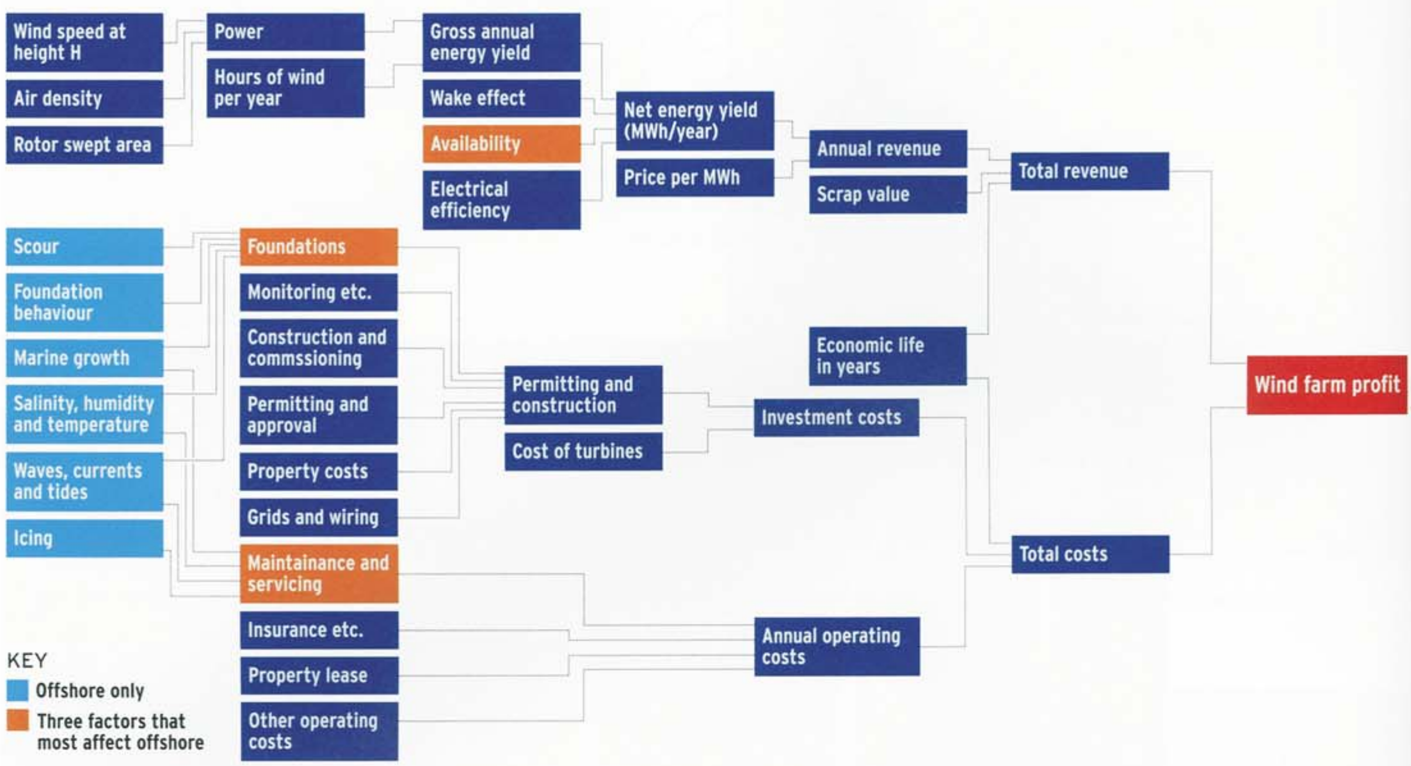
A business-case approach translates technical data into financial information. So oceanographic survey findings contribute to construction-cost estimates, while environmental-impact analyses are monetised as offset costs and wind-speed frequency-distribution data is used to generate electricity output figures. The business case then moves on to cover operational costs, taking turbine availability and reliability data into account when determining up-time and maintenance costs. The scrap value of turbines is also considered.

Ultimately, figures for both revenue and costs emerge, allowing the profitability of each alternative — offshore and onshore — to become a matter of simple deduction. Once the trade-offs between engineering and finance become apparent, investors have the cost transparency

(CONTINUED)

THINK CAREFULLY

The factors that impact revenue and costs



they require to make an informed decision.

The costs of the planning and permitting phases of both types of wind developments are substantial. For offshore wind farms, as much as 6% of the total project budget may be spent determining the location and design of a development. The early-stage costs of onshore projects are often driven by zoning law requirements as much as by local wind conditions and other topographical factors.

Construction and maintenance are the next phases to be scrutinised, with plant design and maintenance demanding particular attention due to their impact on energy generation, service costs and downtime. For offshore projects, construction and maintenance costs will, naturally, be higher due to distance from shore and rough surroundings. Meanwhile, turbine scrap value is factored into acquisition and operational figures, allowing the lifecycle costs — or the total cost of ownership — to be judged.

All of these factors are referred to as "uncertainties" in the business case and can be visualised in an influence map (see above). This map provides an overview of all the factors that impact revenue and costs and presents them in a hierarchical structure. Some uncertainties are expressed as scientific formulae or constants, while others are displayed as a currency. Regardless of their form, it is important to include all relevant factors for validity purposes. They all lead towards the "value" that constitutes the ultimate object of the calculations; in this case the profit of the wind-power development under construction.

Lifetime revenue and costs

It is the uncertainties that have the most significant potential impact on revenue that should be prioritised for further research. For instance, examining a site's wind-speed distribution involves taking in issues that include form parameter, scaling factor, wind speed, hub height, reference height/measuring height and roughness length. Together, these factors add up to a wind speed at the height H, to which air density and rotor disk area are added in order to determine wind power. Generally speaking, wind speeds achieved on the water can be up to 30% higher than onshore speeds.

For each project, the goal is to arrive at a figure for gross energy per year, expressed in megawatt hours, from which uncertainties such as wake effect, availability and electrical efficiency are deducted to determine the net energy yield per year. Multiplying this with the feed-in tariff per megawatt hour provides a figure for revenue, to which the scrap value is added. This figure is then multiplied by the number of operational years forecast for the project in order to gain a lifetime perspective on project revenue.

Some uncertainties are shared by both offshore and

(CONTINUED)

onshore projects, while others only come into play in an offshore environment. Considering the costs of wind turbines and foundations, it is clear that specific offshore uncertainties include issues such as salinity, waves/currents/tides, marine growth and scour. Planning and construction costs are significantly higher. Some of these offshore uncertainties also have an adverse effect on the cost of maintenance and servicing. Offshore projects will also feature higher costs for grid connection and site-related costs such as transport and assembly.

Adding total investment costs to total operating costs per year provides a figure for the total costs over the economic lifetime of each project. Unsurprisingly, the costs of an onshore venture are dwarfed by the costs of developing offshore. At this stage, an investor could be forgiven for doubting whether any extra gains in wind power offered by an offshore location could ever outweigh the added costs.

Experts on board

Cracking the next part of the numbers game requires the input from a range of experts in fields such as oceanography, surveying, environmental impact assessment, wind-speed forecasting, engineering and utility finance. They will help identify any errors and omissions and their estimates will form the basis for the financial model. Identifying the right experts and carrying out the interviews may seem a cumbersome task, but it is a small price to pay in exchange for securing the information necessary to ensure the right investment decision is made. Desk research is an option if relatable studies have been published. When carrying out interviews, each of the experts should be asked to estimate uncertainties using a range of probable values within an 80% confidence interval. The data for each uncertainty is expressed according to three values: minimum, most likely and maximum.

Collecting data in this way allows a probability distribution to be developed, so that the outcome of the financial model can be statistically validated. Clearly, onshore projects tend to have the highest probability of return, as there is far less risk involved in land-based developments. The range of returns for offshore projects tends to be wider and can include a small chance of a negative outcome, leading to a loss of invested capital. On the other hand, potential profits are larger. Provided the increase in risk that comes with offshore development is minor, the prospect of large profits means there remains a strong case for offshoring.

Different challenges Construction is more expensive offshore (top), but transport costs can also mount up for hard-to-reach inland sites (below)

Having established that the offshore project is likely to yield superior financial gains, it is essential to look again at the potential impact of uncertainties. The uncertainties that bring the biggest risks and impact often require area strategies to be drawn up. Typically, the uncertainty associated with offshore maintenance and repair costs is most significant. If these costs can be successfully kept to a minimum, perhaps through a fixed-price servicing contract, financial gains can be substantial.

Another crucial issue is turbine availability. Minimisation of downtime is a priority, given the impact on net profits of even small amounts of downtime. Typically, the third most-significant risk affecting the profitability of offshore farms is cost per foundation, making it essential to undertake research and agree a cost-effective design.

When assessing the investment case for offshore wind farms, there is no denying that a higher element of risk is involved. There are also greater initial investment requirements. However, return on investment can easily exceed that of a land-based alternative provided developers thoroughly investigate the uncertainties that will influence profit and risk — and calculate their impact. When scientific formulae and engineering knowledge are converted into financial figures, the result is a clear picture that will not only appeal to investors, but will also help establish a consensus on means and ends within the project group. W

Johannes Ritter is a senior partner at consultancy Solution Matrix and a leading authority on business case methodology. He can be contacted on windpowermonthly@solutionmatrix.de