Aquila Capital

RENEWABLE ENERGY INVESTMENTS – WHY ASSET MANAGEMENT OPTIMISATION MATTERS

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Executive summary

- AMO is more important than ever in today's renewable energy market, which is characterised by yield compression due to competitive power purchase agreements and a sharp reduction in equipment prices such as wind turbines and solar modules. The 'cost of capital' has become the single biggest cost in a renewable energy project and an unexpected rise will impact bottom line profitability and ROI.
- Successful AMO ensures the cost of capital is kept to a minimum. This involves paying attention to the fine detail of running renewable energy power plants as efficiently as possible.
- Asset managers practicing AMO need to exploit the benefits of scale: scale of experience in managing commercial and technical managers and PPAs; scale in negotiating commercial contracts from arranging refinancing and insurance, to repowering of the power plant; and geographic scale, which gives asset managers the local and regional expertise required to identify and manage real assets.
- Focusing on process is a crucial part of AMO and this involves two key elements in particular: Structured Asset Optimisation (analysis of the value chain to identify key value levers) and Continuous Improvement (sourcing value-adding ideas to drive efficiency).
- Managing real assets is a difficult undertaking due to their unpredictability. AMO at Aquila Capital involves taking a systematic approach to solving problems so nothing is left to chance.
- Aquila Capital's Asset Management Team delivers significant added value through its commitment to AMO: on average it has increased the yield on photovoltaic assets and wind assets by 11% and 24% respectively.

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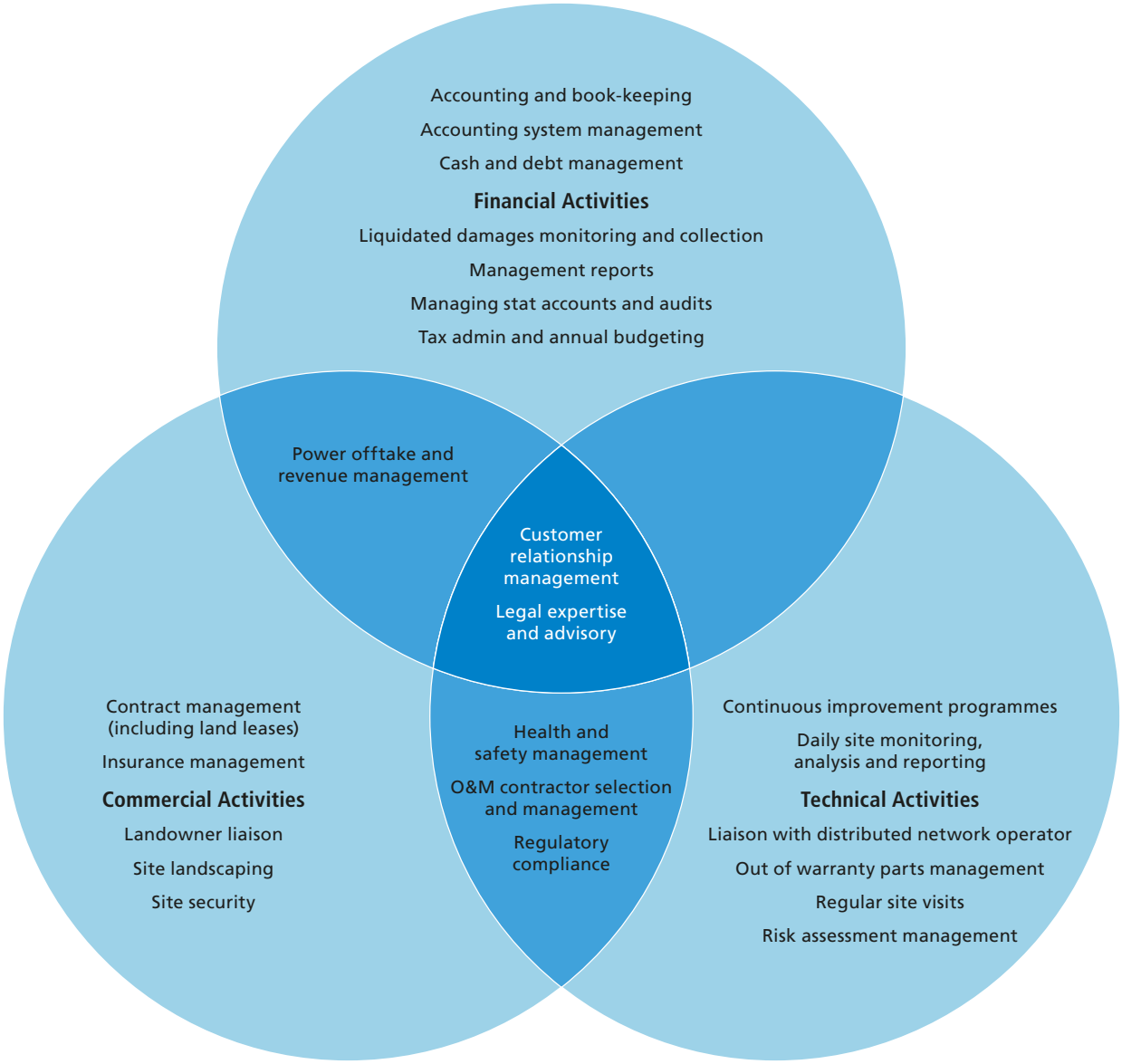
1. Introduction

Over the last decade, institutional investors have actively sought to expand their allocations to real Infrastructure assets, in order to benefit from high risk-adjusted returns and inflation-protected cash flows. As part of this trend, the market for direct renewable energy investments has grown markedly. However, renewable energy infrastructure remains a niche segment for institutional investors. There is a reason for this: successfully harvesting returns on renewable investments requires a unique set of in-house competencies.

In this briefing, we explore the importance of behind-the-scenes actions that can be unsung, but are increasingly critical to achieve out-performance in the management of renewable energy power plants, and deliver the expected return on capital invested. These actions are the focus of asset management optimisation (AMO). We examine real-life case studies which provide an overview of how successful asset management and optimisation at Aquila Capital ensures that value is captured systematically and sustained over the entire course of the asset's life, and across an entire portfolio.

Figure 1 – Managing complexity: Important activities associated with effective AMO



2. What is Asset Management Optimisation (AMO)?

Asset management is the continual supervision of the financial, commercial and administrative tasks necessary to achieve financial out-performance of a portfolio of renewable energy plants. Meanwhile, operational management is the supervision of the technical tasks associated with asset operation, and in particular the monitoring, analysis and reporting of risks and performance, to drive continuous improvement and to anticipate problems.

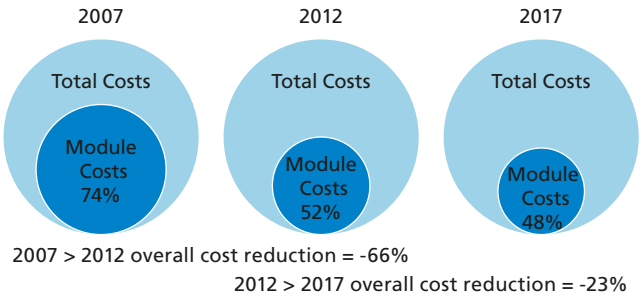
Together, sound asset and operational management will comprise a planned programme of asset management optimisation (AMO). We summarise below the main headline tasks associated with these financial, commercial and technical activities. These tasks serve as indicators for assessment and benchmarking of performance, to optimise asset operation and financial performance.

3. Why does AMO matter?

AMO is more important than ever in today's renewable energy market, characterised as it is by yield compression as a result of competitive tendering of power purchase agreements and growing appetite among institutional investors. The importance of AMO is heightened further by the sharp reduction in equipment prices, such as wind turbines and especially solar modules**. These reductions have made non-equipment costs the biggest cost component in renewable energy projects, with the cost of financing the biggest item of all. Furthermore, the advent of PPAs signals a higher demand for ongoing professional management services.**

Figure 2 below shows the contribution of modules towards the total installed cost of roof-top solar installations in Germany, one of the world's most mature markets. The share of modules has fallen, reflecting Moores law-like price reductions over the past decade. That has left a growing share for the remaining costs, and in particular the cost of capital, as well as the costs of remaining hardware and labour.

Figure 2 – Module costs are no longer the largest cost component for roof-top solar PV installations in Germany



Source: Fraunhofer ISE, Photovoltaics Report, February 2018

Today, the single-biggest cost of a renewable energy project is actually an invisible one: **the cost of capital**. Put simply, the riskier the investment, the higher the compensation fee demanded by an investor for making capital available. The cost of this compensation – commonly labelled as the cost of capital – must be paid from the revenues of the projects. Thus, the cost of capital has a direct influence on the project's return on investment (ROI). Riskier investments command a higher cost of capital, and any unexpected rise in cost of capital will impact bottom line profitability and ROI.

Asset management and operations management are about paying detailed attention to the fine detail of running renewable energy power plants in the most efficient way possible. By reducing the risk of things going wrong, such careful management can cut risk and increase returns.

Asset management refers to the "white collar" tasks of running a power plant, including financial, commercial and administrative activities. Operational management refers to the "blue collar", more technical tasks, such as performance monitoring and analysis, service reporting, managing of warranties and maintenance scheduling. Taken together, sound asset and operational management will assure a focused, continuing, centralised attention on performance, thus limiting downside risk, and where possible achieving additional upside.

Through coordinated activities, asset managers at Aquila Capital drive value in a number of ways. First, we are involved in a project from day one. In this way, we ensure timely and continuing attention to asset operations across the project lifetime, from the stage of equipment selection, through constant performance monitoring, to refinancing and repowering. Second, we are the lynchpin, working with all project participants, from the asset owners and debt providers to technical and commercial partners, thus sharing knowledge and competences to optimise performance, and drawing on all available skills when solving unexpected problems. Third, asset managers can draw upon economies of scale across their wider portfolios, for a greater breadth and depth of project management experience. These portfolios may benefit from a range of different renewable energy technologies, legal structures, support regimes and geographies, and can therefore be a source for value-adding ideas from all levels within the asset management organisation.

Aquila Capital is among the leading service providers that have experience in both wind and solar assets on different continents with an installed capacity of over 1.700 MW. We conduct all aspects of renewable energy project optimisation, drawing upon expertise from a portfolio across the renewables sector and multiple geographies.

In the following sections we detail how AMO is implemented at Aquila Capital. We highlight the services that external asset managers can offer, and we provide real-life case study examples. Ultimately, Aquila Capital's success in managing real assets stems from its

competences and approach. Its skills translate into a variety of cost-saving income streams, from lower cost of capital via smart, opportunistic refinancing, to value-adding activities and increased profitability as a result of contract management optimisation.

4. How optimised Asset Management adds value?

AMO adds value through increased productivity, enhanced efficiency and capital spend optimisation. AMO is a structured approach to optimising business operations by identifying, defining, planning and implementing initiatives capable of adding significant value and improving the potential of current assets.

How does AMO add value? We point to some key success factors.

4.1 Exploiting benefits of scale

In isolation, asset management is performed in reaction to specific events or immediate needs. However, at scale, these thought processes can become **systematic**, evolving into supporting a **proactive** and comprehensive vision, ultimately capable of delivering promised return on equity, and thus exemplifying successful asset management.

Smaller players are unable to offer the required depth of knowledge to successfully handle projects. With the trend towards competitive tendering of power purchase agreements (PPAs), spot price management and aging assets, AMO has taken on a more important role in the value chain.[1]

Asset managers can tap into economies of scale at various levels:

1. Scale of experience, for example in controlling commercial and technical managers; understanding of technical equipment; and managing PPAs.

2. Scale in commercial contracts, which allows asset managers to drive economies in contract negotiations, from arranging refinancing and insurance, to repowering of the power plant.

3. Geographical scale, which gives asset managers the local and regional expertise vital in identifying and managing real assets.

We can see from the discussion above that successful asset managers will be those that use technology platforms to blend their various portfolios, and then craft customised management solutions that meet the needs of individual clients on a scalable basis.

Regarding acquired scale in experience, at Aquila Capital we consider all aspects of the value chain from greenfield to the marketplace in pursuit of value adding opportunities. Regarding geographical scale, we have operational offices and local teams in the important renewable energy investment clusters, including southern Europe (Madrid); northern Europe (Oslo); Japan (Tokyo); and Southeast Asia (Singapore).

4.2 Focusing on process

In order to successfully manage real assets, asset managers have to master the requirements of separate organisational functions; the interaction between these; and specific features of different assets. Value is added by avoiding problems such as:

- "Silo" behaviour of individual functional departments, with a resulting misdirected allocation of resources to functions which could be shared across an organisation;
- Decisions based on incorrectly specified parameters for the assets in financial calculations;
- Uncertainty in decision-making.

We identify two principal elements in driving AMO: Structured Asset Optimisation and Continuous Improvement.

Structured Asset Optimisation (SAO) identifies the key value levers of the business by analysing the whole value chain of a process, from asset acquisition to the markets for products. Supported by an internal benchmarking process, such levers allow for the assessment of the value at stake which can be unlocked through deliberate intervention. At Aquila Capital we have developed procedures like **"tender of insurance services",** which are now being rolled out to the other asset classes as well to ensure that the single investor participates in the combined economies of scale of Aquila Capital.

Continuous improvement (CI) focuses on the generation of value-adding ideas from all levels within the organisation, in finding new ways to do things quicker and more efficiently. CI applies to everything from processes to projects and is typically an enabler for the SAO programme. Aquila Capital practises CI from pursuing refinancing ideas through to streamlining banking services.

[1] *"The probability that a loss will incur due to insufficient local expertise, inability to operate, inadequate maintenance of the plants, lack of suitable industrial presence, and limitation of infrastructure are parameters that are included in technical & management risks." https://www.ecofys.com/files/files/diacore-2016-impact-of-risk-in-res-investments.pdf*

Demonstrating asset management systems are in place shows that a company takes responsibility for effective management across its entire operation. At Aquila Capital, our investment belief involves combining macro insight, on trends, dislocations and tipping points, with bottom-up management, and drawing upon our highly specialised investment talent. We follow a multi-strategy, multi-team approach, according to type of asset and client advisory service. Our PV and wind real assets teams include "Energy and Infrastructure" in EMEA and APAC. Our client advisory teams cover the broad range of asset management, from Audit, Compliance and Finance to Product Marketing and Valuation. To integrate and benefit from our accumulated experience, we use standardized processes across our portfolio to leverage best practice from our various active asset classes and regions. We digitally integrate all processes and data, to compare financial and technical performance of assets.

4.3 The ability to pull it all together

In order to solve problems in the AMO context, the management of assets requires a systematic approach to being able to capture high quality information, process it, and communicate to decision-makers in a timely fashion through appropriate channels. Standardised IT structures, transparent management processes and tailored investor reporting contribute to these processes. AMO at Aquila Capital involves combining deliberate actions and responses to emerging events – we do not simply achieve success, we actively shape it.

5. Showing the way: our Case Studies

Investors in renewable energy projects are exposed to both price and volume risk. The price risk of a project can often be mitigated by a solid and stable regulatory framework or by long-term contracts. However, volume risk – that is, how much energy the installation will actually be able to produce – is an important target for AMO.[1]

During the operational phase of a renewable energy project, most of the capital investments will have been made. With a very large share of the capital already committed to the project, additional risks such as technical and management risks become all the more relevant. It is crucial that asset managers deliver promised returns during the operational phase.

Expert and effective asset management is needed not only to unlock opportunities, but also to balance risks and improve asset performance. We start with two case studies for solar PV. We then provide examples of successful asset management from three shorter case studies for wind assets. Finally, in a fourth general case study, we explain how Aquila Capital's standardised, portfolio-based approach enables Aquila Capital to deliver consistently rate of return improvements.

Our case studies point to significant value adding opportunities, moving from project definition to value delivery, where Aquila Capital's asset management makes the difference.

5.1 Case study 1: Working together to turn around an under-performing solar project

Project description
A new-build 20 megawatt (MW) solar PV project ran into difficulties as a result of malfunctioning solar modules and the simultaneous bankruptcy of the relevant module manufacturer. The difficulties highlighted the importance of having a single, central supervisory role, maintaining a tight focus on multiple, complex moving parts, including a contractual dispute, court case, equipment repowering and financial restructuring.

The thin-film solar PV project was commissioned in 2012. It was financed by two banks with EUR 25 million debt and some EUR 11 million equity financing supplied by several private investors. The financing was BaFin-regulated, which imposed some rules on the financing arrangements.

Approach taken
Problems emerged in the course of 2012, with a massive and worsening degradation of the solar modules, with resulting, accumulating revenue losses in 2013.

This problem crystallised three issues for reconciliation:

1. A dispute with the liquidator of the manufacturer, which had simultaneously filed for bankruptcy. The dispute escalated into a court case regarding an amount of EUR 14-20 million;

2. How to conduct a bank refinancing without a resulting reclassification of the fund under BaFin rules which would have led to default;

3. Overcoming a rule requiring that each module must be proven to be defective, to retain the feed-in tariff for the project, a must to maintain financial viability. The trouble was that testing each module was excessively costly.

[2] Complexity arises from the fact that while desirable outcomes are generally known, future problems are not always fully specified (or specifiable). Solutions to complex problems in this arena require testing and exploration and involve multiple stakeholders. This rules out locking in solutions in advance, or makes it a prohibitively expensive undertaking.

Figure 3 – Large and worsening degradation of the solar modules led to three separate problems, and corresponding solutions

Problem 1
The need to retain the feed-in tariff for the project, which would require a very costly demonstration that every module was defective

Problem 2
The need to achieve bank refinancing without a resulting reclassification of the fund under BaFin rules

Problem 3
A dispute with the manufacturer, which had simultaneously filed for bankruptcy, escalating into a court case

Solution 1
Demonstration to the regulator of 'systematic fault' of the PV modules - i.e. that all were defective, without having to prove the same for each individual module

Solution 2
Successful refinancing after transfer of asset ownership, to the fund company which operates free of BaFin regulations

Solution 3
Clear oversight of complex costs and revenues including legal costs, leading to a court case win, which freed up cash to invest in refurbishment, thus unblocking a refinancing by banks and renegotiation of service contracts

Solution achieved

Viable solutions began to emerge in 2015. We note that this was three years on, underscoring the importance of having a single committed manager continually driving progress towards a solution.

The first step forward was agreement by regulatory bodies that all modules were defective, without having to prove the same at each individual module. This solution emerged only after protracted discussion with the grid operator and government bodies, after we had demonstrated a systematic production fault.

The second step forward was the transfer of the asset holding companies into the fund company, turning this into an operation free of BaFin regulations and independent from a holding company, thus avoiding default.

The third and critical step forward was a victory in the court case, which freed up cash to invest in the refurbishment, thus unblocking a refinancing by banks and renegotiation of service contracts.

The project was a good example of how asset management excellence can make the difference, and preserve the attractiveness of an investment, even in the face of severe obstacles. Critical roles that Aquila Capital as asset manager fulfilled included:

1. A central role consolidating the input of the various interfaces and steering the repowering/restructuring process;

2. Transparent communication with all parties, and especially the banks;

3. A handle on contractual obligations, and where necessary, joining lawsuits;

4. Clear oversight of complex costs and revenues including legal costs, planning permission, upfront banking fees, scrap values, storage costs and new production values. Furthermore, production in the first year of refurbishment was 40% higher compared with the production in the last year of the old, degraded modules and hence helped prevent potential losses of equity EUR 11.7 million.

5.2 Case study 2: Refinancing

Aquila Capital's activities also lead to successful refinancing of a PV project in 2014. This entailed the termination of an initial loan, through an extraordinary dismissal which then was replaced by a loan at lower interest.

The refinancing unlocked an additional positive effect with a net benefit for the investors of over **EUR 1 million** (or 5% of the initial financing amount) over the duration of the loan.

5.3.1 Case study 3a: Technical and commercial excellence to correct a failing gearbox

Project description
In this project, Aquila Capital used its capability in wind turbine monitoring to identify and correct a gearbox failure, and ensure the recovery of losses indemnified by the supplier.

Approach taken
Remote sensors installed at the wind turbine generated error messages revealing that the gearbox lubricant was contaminated with metal particles. The messages indicated possible gearbox damage. As the asset manager operating the asset, Aquila Capital alerted the technical manager, who in turn contacted the servicing company. The team used gearbox video endoscopy to confirm abnormal cracks in the gearbox, and proceeded to replace the gearbox. We recovered lost production and revenues during downtime through the exercise of indemnities provided by the turbine supplier.

Solution achieved
The case study highlighted the importance of strong operational monitoring/predictive systems, an understanding of potential technical remedies, in this case initiating endoscopy, and contractual awareness to minimize losses. As an attentive asset manager, Aquila Capital acted quickly and ensured that costs for downtime and repairs of at least EUR 45,000 were avoided.

5.3.2 Case study 3b: Commercial awareness to anticipate a wind wake problem

Project description

In this project, Aquila Capital achieved a substantial payout from an indemnity provider against wake losses. The construction of a neighbouring wind farm led to revenue losses at an existing wind farm managed by Aquila Capital, through a phenomenon known as wake losses. Wake losses refer to the impact that one turbine has on others nearby, disrupting the flow of air and thus potentially resulting in lower electricity output and revenues.

Approach taken

Through close eyes on a contract indemnifying the wind farm against such wake losses, Aquila Capital launched a process to recover its losses. First, we established the losses by mandating a technical expert to update an existing yield assessment of the turbines, to estimate the additional wake losses. Second, we negotiated compensation. And third, we optimised those proceeds to obtain the most favourable tax treatment.

Solution achieved

This project illustrated the value of collaborating across management capabilities, including technical services (measuring wake losses); financial services (for favourable tax treatment), and legal services (understanding and exercising our indemnity). The approach taken led to a 0.75% increase in IRR.

5.3.3 Case study 3c: Commercial awareness to change a technical and commercial management agreement (TCMA)

Project description

In this project, Aquila Capital's commercial awareness identified that an after sales services contract for the technical and commercial management (TCM) of the windfarm offered poor value. We achieved a better outcome by leveraging our experience of typical contracts and market rates, our attention to the details of the proposed contract, and our economies of scale in contract negotiation.

Approach taken

The initial status of the project was with a TCM provider offering fees at approximately double the market rate. Aquila Capital first acted to secure a short notice period to terminate the contract and find an alternative provider. We tendered for multiple alternative offers, and through our insight into market rates achieved improved terms.

Solution achieved

By switching the service provider we achieved a 60% reduction in service fees, and cost savings of more than EUR 3 million throughout the project lifetime. The improved service contract also included improved terms and conditions. The approach taken led to a 0.05% increase in IRR.

5.4 Case study 4: Successfully managing financial risk

Project description
As module prices have plummeted in solar projects, the non-module costs have assumed an ever rising slice of the overall project cost. Now, the cost of capital is the biggest cost of all: some 60-70% of cash flows are used for capital servicing.

Investor returns depend in part on the amount of debt used to finance the plant – debt financing increases risks for equity investors.[3,4] A recent study by Grant Thornton showed that at German renewables projects in 2017, levered discount rates (a proxy for the cost of capital) were about 30% higher than unlevered ones for solar PV, onshore and offshore wind projects.[5] As a result, securing the best financing can have a huge impact on returns: investors will want to minimise these costs as far as possible.

Approach taken
Securing the best financing deal will depend on accurate record-keeping, attention to monitoring software and performance management from day one. In other words, this is a task that depends on sound asset management.

When considering the refinancing of a renewable energy asset, a lender will shine a light on every dark corner of a project. Asset managers therefore need to be preparing for this moment years ahead: to consider what software systems are needed, and what first-class preventative maintenance the O&M should provide. All energy production data and warrantees must be centrally managed, to provide O&M records of how the plant has been maintained. Assets can only be refinanced if they are proven to be of higher-quality than what was expected at the onset of the project, often several years before.

Solutions achieved
Aquila Capital's experience shows that as a result of refinancing, we can increase investor returns materially. Asset insurance and O&M expenses are two key areas where Aquila Capital can consistently deliver rate of return improvements. In this project the reduction of costs are expected to total up to EUR 4.5 million over the lifetime of the asset.

Insurance brokering – exploiting the portfolio effect
Aquila Capital approaches its insurance tenders in the same way as it analyses asset operations: it exploits the greater reliability of a portfolio and the benefits of scale to negotiate more advantageous terms. Besides resulting in an overall reduction of insurance premiums, this approach has yielded enhancements in insurance conditions for Aquila Capital's portfolio of assets, for example a no-claims bonus, reductions in the retention of both total amounts and days and reductions in the overall administrative costs with regards to insurance management. All in all, inviting insurance bids for a pooled portfolio of assets has resulted in cost savings of around 20% on premiums.

O&M and components – stabilising cash flows, sharing risk, and saving time and money on replacements
Aquila Capital's management optimisation approach also extends to O&M expenses. For example, Aquila Capital agreed with an O&M provider to share weather-related risks: the provider takes a part of the upside in exchange for covering part of the downside, thus enabling us to offer a more stable cash flow for the overall project as well as an enhanced relationship with the O&M operator.

Aquila Capital's market intelligence and skills have also allowed us to reduce costs when it comes to the purchasing or substituting of components. Aquila Capital has been able to realize greater revenues in part because the market for components is relatively thin and illiquid. Aquila Capital turned this to an advantage because we understand better than others how to time our purchasing commitments, for example by obtaining a "fast track" for replacements. Given its size and collective experience as an asset manager, Aquila Capital also knows how to sign more attractive bilateral contracts than would be achievable by a smaller, less expert, less diversified player.

Overview IRR development at Aquila Capital

	Acquisition yield	IRR gain during aquisition	IRR effect through exogenous factors	IRR increase during runtime	Current IRR
PV	7.15%	0.46%	-0.32%	0.25%	7.08%
Wind	7.97%	1.08%	0.98%	0.50%	9.44%

Source: Aquila Capital Management GmbH as at 31.12.2017
Note: Performance data before fund costs or structure effects (tax, cash traps,…) Asset performance is driven by exogenous factors (e.g. power prices, certificate prices, multiple changes (logistics), extended lifetimes (PV, Wind), currencies, inflation rates, tax regime changes) and active asset management.

[3] Since bondholders have a claim on operating earnings (via interest expense), the net income available to equity capital is reduced even though equity holders in the investment bear the entire variability of operational earnings.
[4] In a recent study, the Fraunhofer Institute reports that for Germany the capital structure could have as much as an 80% share of debt for utility scale PV projects, 60% for offshore wind and 70% for onshore wind. https://www.ise.fraunhofer.de/content/dam/ise/en/documents/publications/studies/Fraunhofer-ISE_LCOE_Renewable_Energy_technologies.pdf
[5] https://www.grantthornton.co.uk/en/insights/renewable-energy-discount-rate-survey/

6. Who is Aquila Capital?

Launched in 2001, Aquila Capital is an alternative investments asset manager. We have 17 years' experience in alternative investment solutions, with close proximity to our assets and our investors.

Significant milestones in our history include our first renewable power sector investments in hydropower in 2008, our entry into solar PV and in wind energy in 2009. As of march 2018, we managed some 1.015 megawatts (MW) of wind energy, 624 MW solar PV and 430 MW hydropower.

We have a combined EUR 6.2 billion assets under management (AuM, EUR 4.5 billion) and under administration (AuA, EUR 1.7 billion) as at 31.03.2018.

We have more than 200 employees located in ten investment centres in Europe and Asia, including investment centres in London, Luxembourg, Madrid, Hamburg and Oslo in Europe, and in Tokyo, Singapore and Invercargill in Asia and Australasia.

We have an extensive operational management capability, a prerequisite in the real assets sector if we are to create and sustain value for our investors. 45 employees are active in the asset management process during the investment runtime.

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Watch our video

https://www.aquila-capital.de/en/insights/ninetynine-seconds/

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