REAL ASSETS – HYDROPOWER INVESTMENTS

1. Introduction

Long-term investors with defined commitments face substantial challenges in the financial market environment of mid-2015.

- Up to 50% of all government bonds are paying negative interest and 20-year government bonds are paying less than 1% p.a.
- Valuations on U.S. and Central European equity markets are in their top historical quartiles or deciles.
- Core real estate assets are being traded at historically low returns.

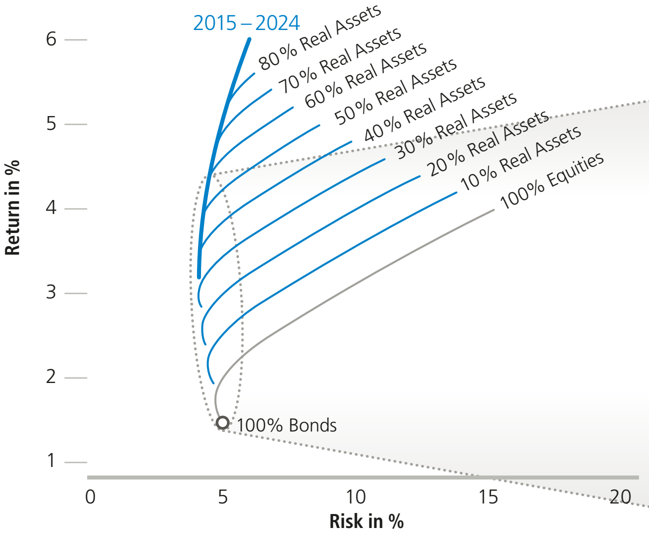
Given ongoing payment obligations and the need to generate income, sitting out this phase is only a short-term option.

Since the risk-return profile of real assets is likely to be considerably better than that of equities and fixed income securities in the coming decade, capital flows are increasingly being directed into infrastructure investments that offer stable cash flows. A simple estimate illustrates[1] that portfolio structures along the efficient frontier will differ sharply from those of the past 30 years and that, for the next decade, an increased allocation to real assets in a mixed portfolio will significantly improve the portfolio's overall risk-return ratio.

Accordingly, the optimum minimum-variance portfolio – until now dominated by bonds – already includes a real asset allocation of 35% and its overall performance is largely determined by the size of the real asset allocation. A 30% allocation to real assets in a portfolio with a target volatility of 7%, for example, will increase its returns by over 50%, from about 2.4% p.a. to 3.7% p.a. (figure 2). The question is whether a dominant allocation in conventional capital investments is still defensible at all.

[1] *Aquila Group, Real Assets – The New Mainstream, 2015*

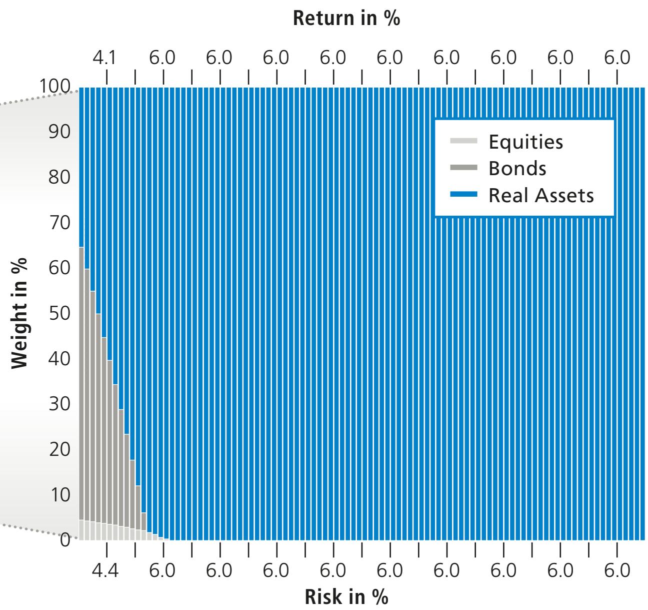
Figure 1: Efficient frontiers, 2015 – 2024



Source: Bloomberg, proprietary calculations

Efficient frontiers of mixed equity and bond portfolios with varying real asset allocations

Figure 2: Asset allocation of efficient portfolios, 2015 – 2024



Source: Bloomberg, proprietary calculations

The calculation is based on historical data for 1982 – 2014 and on the following assumptions for 2015 – 2024: return and annualised volatility for equities (4% p.a.; 15%); bonds (1.5% p.a.; 5.5%); real assets (6% p.a.; 6%); correlation equities to bonds (0.5); equities to real assets (0.2); bonds to real assets (0.2).

Renewable energy investments represent a significant subset of the infrastructure sector. Photovoltaic and wind power investments have already become well established in the asset allocations of institutional investors in the past decade, albeit with comparatively minor exposures at first. Hydropower, by contrast, has only gained the attention of institutional investors in the past few years. This is due to a number of reasons that make access to hydropower as an investment opportunity more difficult:

- Hydropower tends to require significantly higher up-front investment per capacity unit, making it less scalable than wind power or photovoltaic plants.
- The technical know-how required for hydropower investments is more challenging since the success of a power plant depends not only on technical and structural components but also on active management of the hydropower plant and negotiation of power purchase agreements.
- Accessing investment opportunities is significantly more complex than in other renewable energy sectors.

Given its meteorological and technical complementarity with photovoltaic and wind investments – and its economic viability without having to rely on government subsidies – the additional cost and complexity is justified for many investors, leading to increasing demand.

Table 1 illustrates the characteristics of photovoltaic and wind power versus hydropower investments and showcases the complementarity element, and thus the diversification potential, that hydropower can add in a diversified infrastructure portfolio.

Table 1: Comparison of renewable energy systems

	Photovoltaics	Wind power	Hydropower
Feed-in remuneration	Yes	Yes	Rarely
Concession duration	Up to 20 years	Up to 20 years	50 years to perpetuity
Base load capacity	No	No	Yes[1]
Residual value	Very low	Low	Generally higher than purchase price
Correlation with other renewable energies	Low	Low	Low
Market price risk	No	Low	High[2]
Debt financing (average)	60–75%	50–65%	Approx. 50%
Inflation protection through price of electricity	No	Low	High
In industrial use for	Approx. 15 years	Approx. 20 years	Approx. 120 years
Expected return (IRR)	6–7% p.a.	5–8% p.a.	6–9% p.a.

The above is an illustrative representation of core markets in Europe. Details may vary. *Source: Aquila Group*
[1] Particularly reservoir power plants and pumped-storage power plants.
[2] In the absence of power purchase agreements.

2. Market overview

Hydropower continues to account for a significant share of the world's global energy production. Hydropower stations have been built in approximately 100 countries and make up an average of 15% of the total energy mix. This share varies significantly from country to country and can reach up to 99% in Scandinavia. The importance of hydropower stations has increased further in recent years in response to the promotion of renewable energy to help fulfil political goals of reducing CO_2 levels.

2.1 Hydropower in the renewable energy sector

Installed capacity and production quantities
Hydropower's share of total electric power production from renewable energies remains considerable. With 1,000 GW of installed capacity at the end of 2013, hydropower accounted for two-thirds of the total renewable capacity of 1,560 GW despite the massive expansion in alternative energy sources.

As a result, securing investment opportunities represents a substantial challenge in this area.

Table 2: Installed renewable energy capacity

GW	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Photovoltaics	2.6	3.1	4.6	7.6	13.5	21	40	71	100	139
Solar thermal	0.4	0.4	0.4	0.4	0.5	0.7	1.1	1.6	2.5	3.4
Wind power	48	59	74	94	121	159	198	238	283	318
Biomass	39	41	43	45	46	51	70	74	78	88
Geothermal	8.9	9.8	10	10.4	10.7	11	11.2	11.4	11.7	12
Hydropower	715	–	–	920	950	980	935	960	990	1000

Source: REN21/UNEP: The First Decade: 2004–2014

Table 3: Renewable energy capacity growth

GW	2004	2005	2006	2007	2008	2009	2010	2011	2012	estimate 2013
Photovoltaics	–	35 %	32 %	40 %	44 %	36 %	48 %	44 %	29 %	28 %
Solar thermal	–	5 %	0 %	23 %	14 %	24 %	54 %	31 %	36 %	26 %
Wind power	–	19 %	20 %	21 %	22 %	24 %	20 %	17 %	16 %	11 %
Biomass	–	4 %	5 %	6 %	2 %	10 %	27 %	7 %	4 %	12 %
Geothermal	–	0 %	2 %	4 %	3 %	3 %	2 %	2 %	2 %	3 %
Hydropower	–	–	–	–	–	–	–	3 %	3 %	1 %

Source: REN21/UNEP: The First Decade: 2004 – 2014

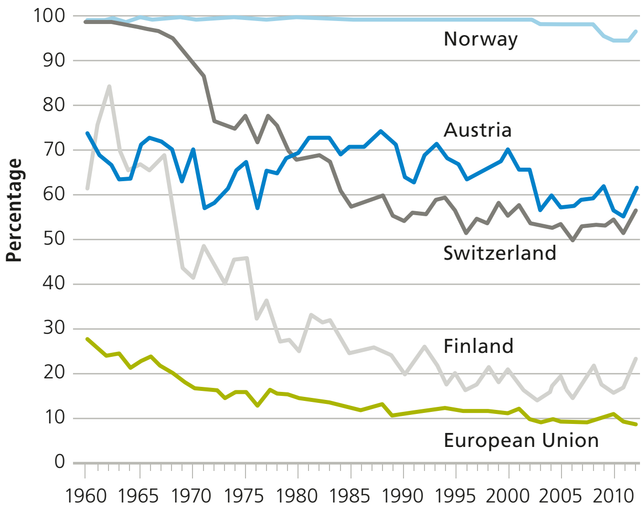
Remuneration and concessions
Remuneration of hydropower plants is generally unsubsidised (small plants with an output below 10 MW are a frequent exception). Concession periods tend to be long and are normally extended on expiry.

Table 4: Support schemes and concession periods in selected regions

Region	Remuneration scheme (mechanism)	Concession period in years
Scandinavia	Electricity market/ certificates	60 to perpetuity
Germany/ Austria	Electricity market/feed-in remuneration	30 to perpetuity
Switzerland	Electricity market/feed-in remuneration	60 to perpetuity
Italy	Electricity market/feed-in remuneration/certificates	30 to perpetuity
Turkey	Electricity market/feed-in remuneration	50 – extendible

This above is an illustrative example. Details may vary.
Source: Aquila Group

Figure 3: Hydropower as share of total renewable energy generation



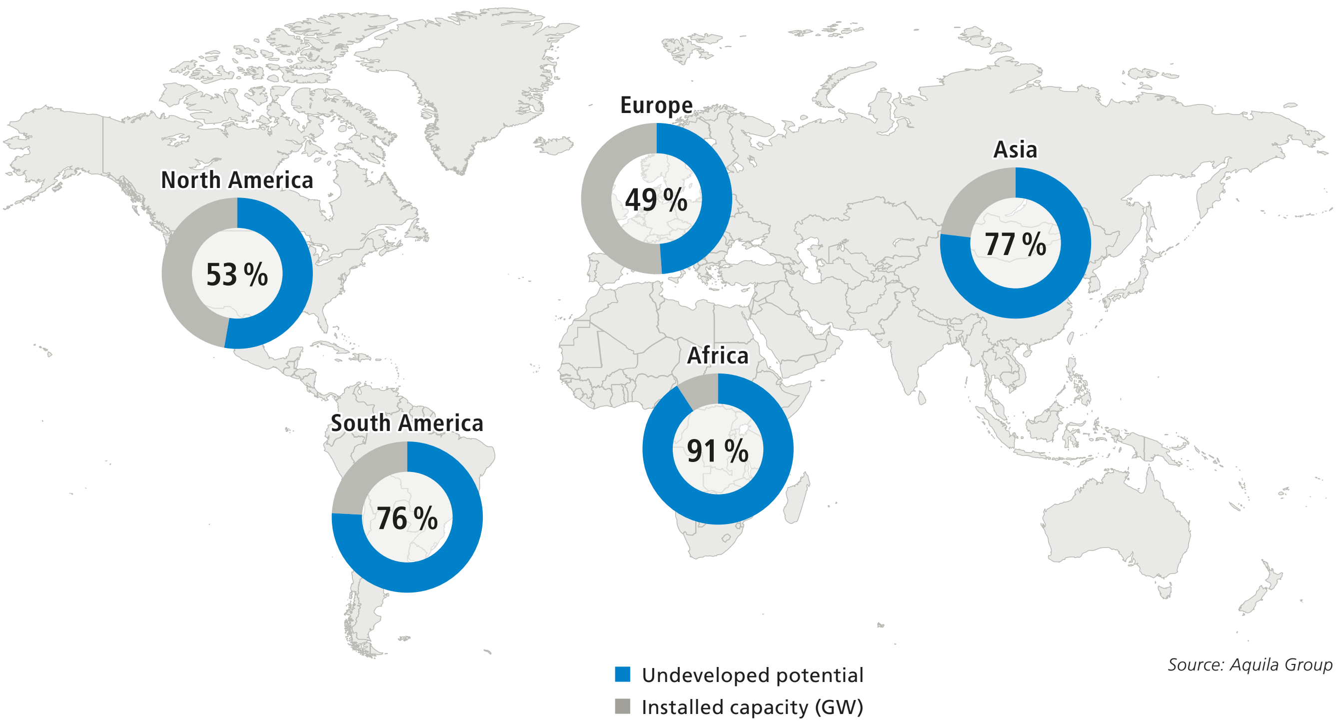
Source: World Bank, electricity production from hydroelectric sources (% of total), 2015

As the above figure illustrates, hydropower's share of energy production in many European countries has hardly changed in the past 50 years, reflecting its high acceptance.

2.2 Global hydropower potential

From a global perspective, Europe has the lowest potential for additional hydropower expansion in the world. For this reason, buying existing plants is the most important acquisition strategy in this region.

Figure 4: Hydropower potential



Source: Aquila Group

In contrast, less established markets such as Asia and Africa still have an expansion potential of 77% and 91% respectively but rarely tend to be part of a core investment strategy for institutional investors.

Table 5: Hydropower potential in comparison to existing installed capacity

Region	Installed capacity (GW)	Technical potential (GW)	Undeveloped potential
North America	183	388	53 %
South America	143	608	76 %
Europe	172	338	49 %
Africa	26	283	91 %
Asia	487	2104	77 %
Total	**1,011**	**3,721**	**73%**

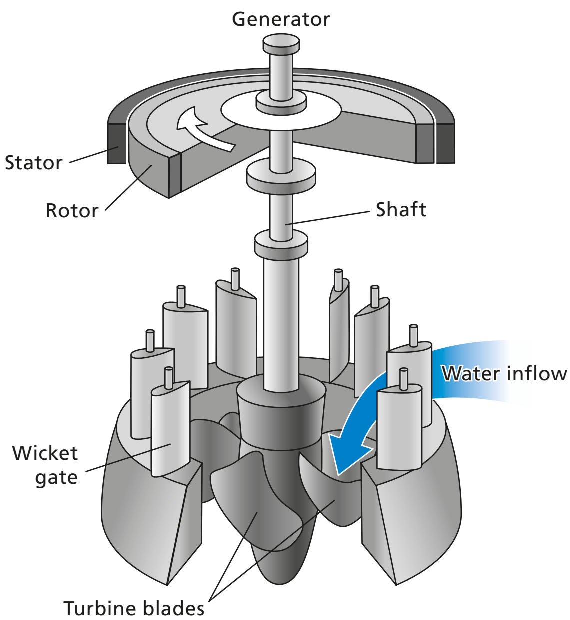
Source: Aquila Group

3. Characteristics of hydropower

3.1 Technological background

Hydropower plants have always operated according to the same fundamental principle. In similar fashion to a dynamo, water in hydroelectric plants flows over turbine runners whose movement drives a generator. The generator converts kinetic energy to electricity by contact-free induction. As a result, wear on the generators is very low. Efficiency gains from improved materials over the past 100 years have amounted to only a few percent and efficiency is near the theoretical upper limit of 100%.

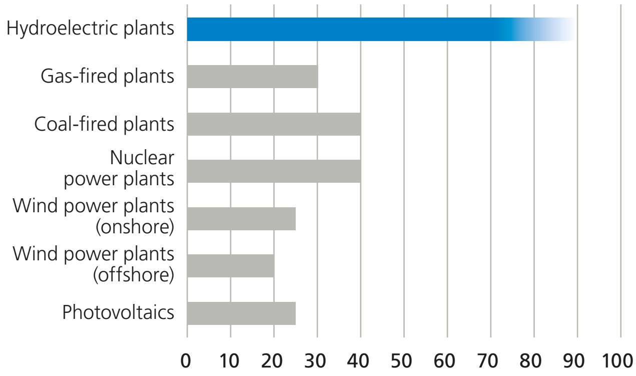
Figure 5: Illustration of a hydroelectric turbine



Source: Illustrative example based on a Kaplan turbine

Hydroelectric plants have been used to generate electricity in Europe since the late 19th century. The average service life of the electromechanical equipment is between 60 and 80 years (or longer – the oldest turbine Aquila Capital operates dates to 1906), far longer than the lifetime of other types of power-generating equipment.

Figure 6: Average service life of different types of power generating equipment in years



Source: Aquila Group

3.2 Types of hydroelectric plants

There are different types of hydropower plants (of which some examples are provided in the appendix), including pumped storage, tidal, reservoir and run-of-the-river plants.

Run-of-the-river plants tend to be built on running streams and consist of a weir that provides a controlled damming of the water and guides the flow to a turbine generator. Beyond this, however, they have little or no effect on the water level behind the dam. They are compact in construction and generally blend into the landscape.

Pumped-storage power plants, by contrast, tend to be filled artificially and not by a natural inflow such as a river. The water volume required for operation is pumped up from a basin at a lower level. Because of the quantities of energy required to pump water to the upper basin, this type of power plant is mainly used for energy storage. When energy demand is low, the upper reservoir can be filled for later use when demand is high. Operating pumped-storage power plants is economically viable because electricity can be produced and sold depending on spot market prices.

Tidal power plants require a sufficiently wide tidal range in order to be economically viable. There are therefore only a few potential sites. A further disadvantage of this form of hydropower technology is that its time of maximum capacity utilisation shifts in parallel with the tides.

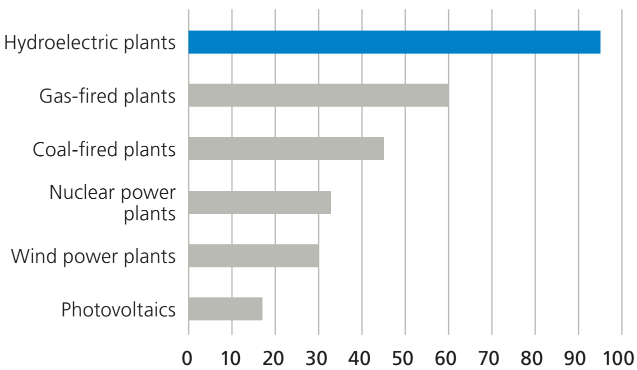
Reservoir power plants function in a similar way as pumped-storage power plants but are often connected to an artificial lake that is filled by flowing water, such as a river. The water is retained by a dam and powers the hydropower plant's turbines via large pressure pipes. The turbines are not designed for uninterrupted operation, as the flowing water tends to supply less water than the plant is capable of processing. This type of plant is therefore used to smooth peaks in energy demand.

Run-of-the-river power plants are the preferred investment vehicle for financial investors. They are available in large numbers and a wide range of sizes. Small power plants with an investment volume below EUR 10 million, for example, lend themselves very well to the construction of diversified portfolios. For financial investors, they are of interest if they form part of a bundled sale so that the necessary ancillary investment costs are spread out. For individual transactions, typical investment volumes are in the range of a few tens of millions of euros.

3.3 Efficiency

In addition to being a very economically viable technology in terms of maintenance and operating costs, hydropower has among the best conversion efficiencies of all energy sources with an efficiency factor of between 90% – 95%.

Figure 7: Comparison of efficiencies of different energy sources in percent



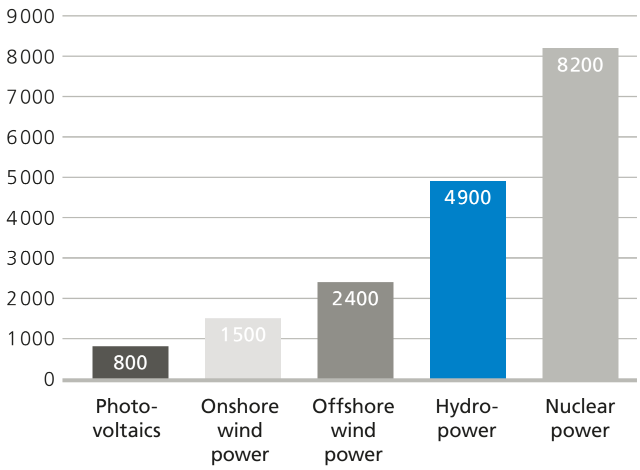
Source: EURELECTRIC (2011), Hydro in Europe: Powering Renewables

On average, a hydropower plant generates approximately five gigawatt-hours of electricity per megawatt of installed capacity per year, which is around five times as much as a photovoltaic plant. Hydropower also exhibits the highest peak load hours within the renewable energy subset, which indicate the degree of utilisation of a power plant.[2]

Table 6: Comparison of peak load hour percentages

	Hydropower	Wind power	Photovoltaics
Peak load hours	50 – 60 %	20 – 30 %	10 – 15 %

Figure 8: Median peak load hours of electric power generating plants (hours per year)



Source: Renewable Energies Agency

The combination of a long service life and high efficiency results in "harvest factors" that are 100 to 200 times higher than all other forms of energy generation (see section 4.1).

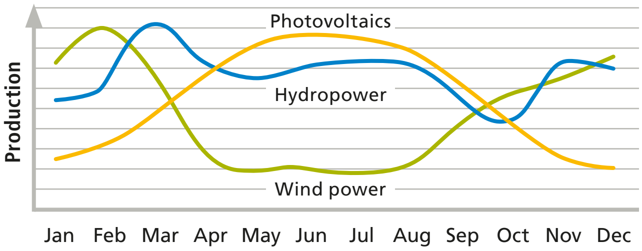
[2] *Renewable Energies Agency: Evolution of peak load hours of power plants in Germany, Source: http://bit.ly/1kDwde4*

Diversification effects

As figure 9 illustrates, hydropower is well suited as a diversifier across a variety of renewable energy investments. As with wind power and photovoltaic plants, volatility tends to decrease when a portfolio of plants, rather than an individual plant, is analysed. This is especially the case with wind power, which is highly dependent on micro location. Photovoltaic plants, by contrast, structurally exhibit significantly higher volatility over the course of the day. As a result, the load profiles of the three forms of renewable energy differ significantly – making them all the more attractive as elements of the same portfolio.

A largely negative correlation is typically observed in the capacity utilisation of wind (winter, spring) and photovoltaic plants (summer). When the asset classes are viewed in isolation, hydropower displays the best volatility-utilisation relationship in comparison with wind power and photovoltaics.

Figure 9: Typical average production volatility (illustrative)



Illustrative example, details may vary
Source: Aquila Group

3.4 Hydrology

Hydrology has a significant effect on the quantity of energy a hydropower plant can produce. It describes the distribution and quantity of precipitation and has a decisive influence on the production figures of a given hydropower plant. In contrast to the newer renewable energy types, however, actual historical measurements tend to be available for many decades and don't need to be extrapolated on the basis of models. This enhances planning certainty.

Since run-of-the-river plants produce electricity from a flowing stream, they are dependent on flow volumes and speeds, which in turn depend on the amount of precipitation. In many countries, snowfall in the mountains in winter followed by the spring thaw results in high water levels, which also affects the water cycle for hydropower plants. The same natural variation that gives rise to flooding can also cause lower production figures for hydropower plants during an extended drought.

An in-depth understanding of hydrology is therefore crucial in assessing a plant's value.

4. Economic viability of hydropower

4.1 Comparison of investment costs

Up-front investment in hydropower plants per kilowatt of installed capacity tend to be higher than with other energy investments, as demonstrated by the following table.

Table 7: Investment costs of different energy sources

Specific investment costs (EUR/kW)	Min.	Max.
Photovoltaics	1,000	1,800
Wind power (onshore)	1,000	1,800
Wind power (offshore)	3,400	4,500
Biogas	3,000	5,000
Coal	1,250	1,800
Gas	550	1,100
Hydropower	1,500	6,000

Source: Fraunhofer Institute: Stromgestehungskosten Erneuerbare Energien (Electricity Production Costs for Renewable Energies), 2013

The investment costs for hydropower plants vary from EUR 1,500 to about EUR 6,000 per kilowatt of installed capacity depending on size, construction type and region. Initial higher investment costs are more than offset by factors such as the technology's long service life.

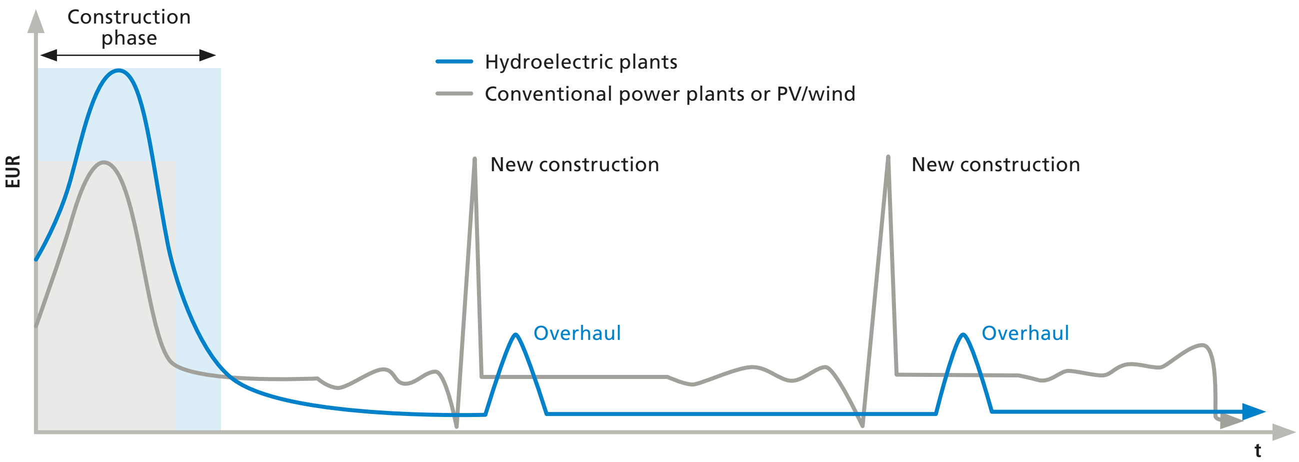
In addition, overhaul intervals for hydropower plants are comparatively long. The technology is standardised and, aside from routine testing, it requires few capital-intensive replacements of individual components. As demonstrated by the example in figure 10, the overhaul interval for hydropower plants is longer than the entire service life of most other forms of energy. Whilst hydropower plants require an initial higher investment, they are economically self-sufficient and, if well maintained, can generate electricity for many decades and often for more than 100 years. In terms of life-cycle costs, hydropower makes a very convincing investment case, with annual operating costs being a fraction of the capital investment.

Table 8: Comparison of investment costs

	Hydro-power	Wind power	Photo-voltaics
Construction costs, EUR/kW	2,500	1,600	1,000
Total investment costs, EUR/kW	3,000	2,500	1,100
Investment costs, EUR/kWh/year	0.62	1.14	1.05
Investment costs, EUR/kW/ lifecycle	**0.010**	**0.064**	**0.042**
Wear and tear	Very low	High	Moderate

Source: Aquila Group

Figure 10: Electric power production costs



Source: Fraunhofer ISE (2013) Stromgestehungskosten Erneuerbare Energien; http://www.world-nuclear.org (07/2014); Pöyry (2010)

5. Portfolio construction

Hydropower exhibits a low correlation to wind and photovoltaic investments, with typical correlation coefficients of below 0.3. Combining these three asset classes therefore yields distinct diversification advantages, namely a decrease in overall portfolio volatility and an increase in overall portfolio returns. A study by Vienna University of Technology quantifies these effects. According to the study, diversifying across the three asset classes and across geographies results in distinct stabilisation effects at the portfolio level.[3]

A diversified portfolio of renewable energy investments can therefore provide investors with a number of advantages. A key advantage of hydropower is that its energy production is not as reliant on what time of day or season of the year it is, thereby making it a perfect fit for a diversified portfolio that also includes photovoltaic and wind investments.

Table 9: Complementary renewable energy technologies

Annual fluctuation	Run-of-river power	Wind power	Photo-voltaics	Production mix	
Location	–	19.5%	7.8%	–	↓ Inter-connection
Region	10.4%	15.5%	4.6%	5.0%	
Austria	5.6%	8.4%	4.4%	3.3%	
	→ Generation mix effect				

Source: Technische Universität Wien (2011), Untersuchung der Standardabweichung österreichischer Niederschlagsabfluss-Ist-Daten im Zeitraum von 1994 – 2008 im Kontext von Wind und Solar (Analysis of the Standard Deviation of Actual Austrian Precipitation Run-off Data Between 1994 and 2008 in the Context of Wind and Solar)

[3] *Source: Technische Universität Wien (2011), Untersuchung der Standardabweichung österreichischer Niederschlagsabfluss-Ist-Daten im Zeitraum von 1994 – 2008 im Kontext von Wind und Solar (Analysing the Standard Deviation of Actual Austrian Precipitation Run-off Data Between 1994 and 2008 in the Context of Wind and Solar)*

Table 10: Diversification effects at the portfolio level

	Hydropower	Wind power	Photovoltaics
Seasonal dependency (highest revenues)	Spring, autumn, winter	Spring, autumn, winter	Spring, summer, autumn
Dependency on the time of day	Very low	Low	Very high
Annual production (full load hours)	4,700–5,200	1,300–1,700	700–1,000
Generation volatility	Moderate	Moderate	Low
Predictability	Moderate	Moderate	High
Operational complexity	Low	Moderate	Low
Regulatability	Moderate to high	Low	Low
Dependence on subsidies	Low	High	Very high

Source: Aquila Group

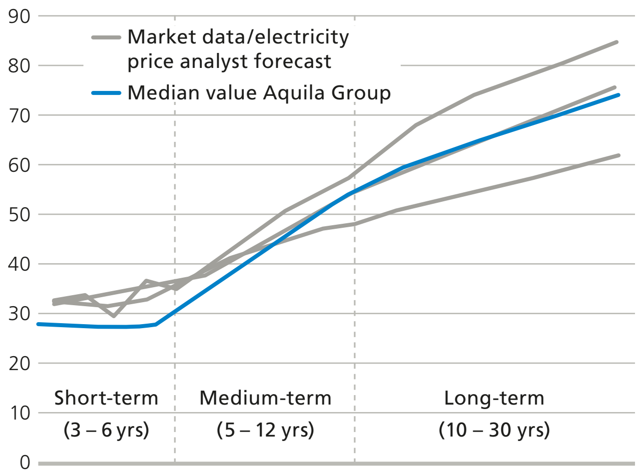
5.1 Project viability

Hydropower plants tend to operate on an economically self-sufficient basis without state subsidies or cross-subsidies. Hydroelectric power is sold on the spot electricity market and therefore is not greatly exposed to the political or regulatory risks of other power sources which are more dependent on state-guaranteed fixed feed-in remuneration. This means, however, that investors are exposed to market price risk. As a result, the share of debt financing for hydropower plants is usually significantly lower than for photovoltaic or wind power investments and is secured with power purchase agreements.

Electricity price assumptions

Changes in the price of electricity are the primary factor in modelling future expected returns from a hydropower plant. Aquila Group uses a combination of objective market data and independent forecasts by established electricity price analysts to determine appropriate price assumptions. The analysts develop long-term forecasts based on fundamental supply and demand models along with planned new power plant construction and closures. The models are based on the median value of several forecasts.

Figure 11: Electricity price assumptions (EUR/MWh)



Illustrative example *Source: Aquila Group*

5.2 Potential returns from hydropower in different regions

This approach, for example, can be used to determine the current expected return ranges for five typical hydropower regions.

Table 11: Returns from hydropower plants by region

	Initial cash returns	Equity IRR
Scandinavia (existing installations)	2 – 4%	5.5 – 8.5%
Scandinavia (project development)	0%	7.5 – 9.5%
Turkey (existing installations)	6 – 10%	9 – 13%
Italy (existing installations)	3 – 6%	7 – 9%
EU periphery (existing installations)	5 – 8%	8 – 11%

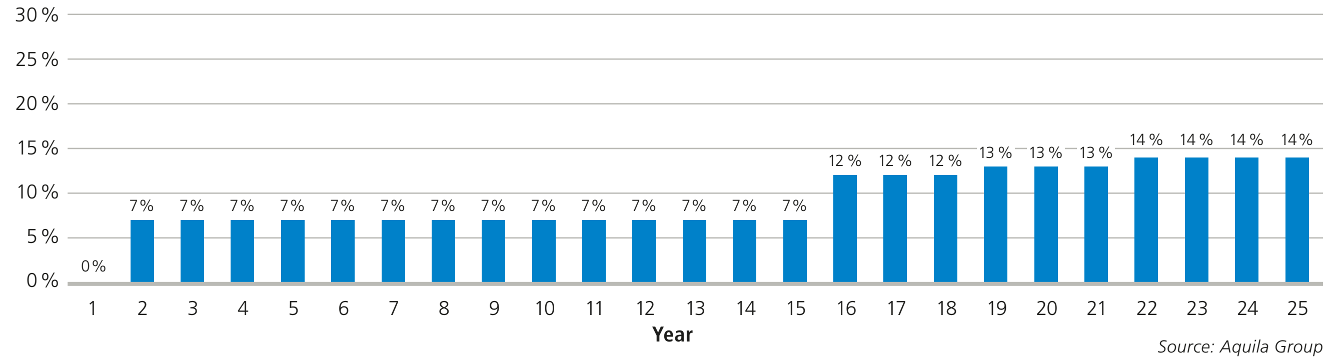
Source: Aquila Group

5.3 Typical repayment flows

Just like their regulatory characteristics, the capital repayment profiles of renewable energy investments also differ. Wind power and photovoltaic plants tend to deliver cash returns of approximately 5 – 7% p. a. Once the debt capital is repaid, these returns increase significantly to approximately 12 – 30% p. a., depending on the debt financing structure.

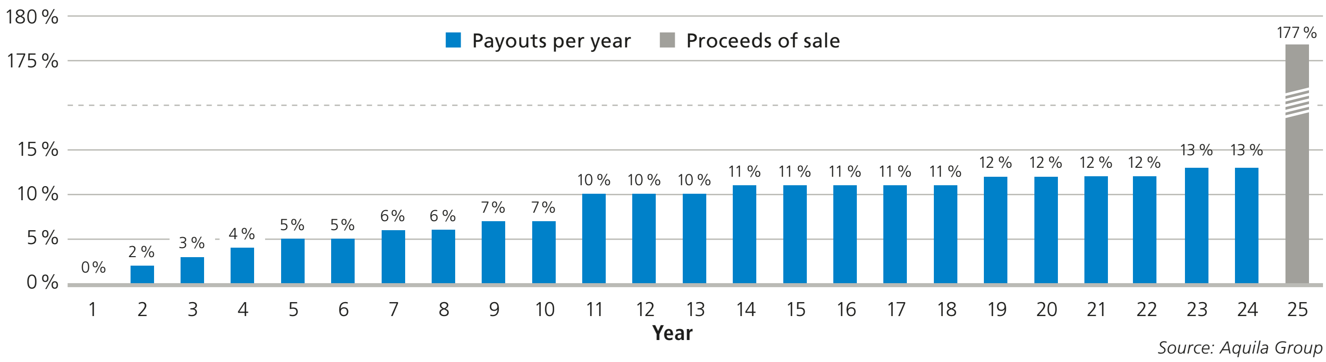
The cash returns generated by hydropower investments are lower at first due to a lower electricity price in comparison with the rates set under the Renewable Energy Act. Since debt financing of hydropower investments is generally lower, the interest and debt repayment burden tends to be smaller and payouts grow more steadily. The key difference can be seen at the end of the observation period: due to the long service life of the technology and the very long or perpetual operating licence periods, the "residual" value of hydropower plants is generally (significantly) higher than at purchase (the amount depending largely on movement in the price of electricity). The residual value of photovoltaic and wind plants, by contrast, tends to be low.

Figure 12: Average cash return per year of photovoltaic/wind power investments with moderate debt financing



Source: Aquila Group

Figure 13: Average cash return per year of hydropower investments



Source: Aquila Group

From this perspective, an investment in a hydropower plant is most comparable with a real estate investment, where depreciation is also very low due to the long life and high efficiency of the asset.

5.4 Investment opportunities/deal flow

Compared to wind power and photovoltaic investments, the number of transactions in the hydropower sector is significantly smaller. This is partly due to the various hydrological requirements for suitable power plant sites. The long average service life and durability of hydropower plants exacerbates this scarcity on the supply side. Existing plants are mostly owned by large and medium-sized energy suppliers.

As a result, the share of institutional investors invested in hydropower is currently significantly lower than in wind power and photovoltaics, for example.

Along with limited access opportunities, the barriers to market entry are also considerably higher than for other renewable energy investments. The successful implementation of these long-term projects requires significant expertise in different fields: asset managers or investors must possess technical know-how about their operation and potential weaknesses; they must be capable of performing hydrological assessments or at least of evaluating their results; and they have to be able to devise scenarios involving potential future output pricing or volume agreements. This expertise cannot be left exclusively to external service providers. The final assessment of the profitability of a potential investment, for example, can only be made in-house.

In order to capture investment opportunities, as much direct market access as possible and an extensive sector network are key. Existing power plants tend to be sold through a tendering process or at auction. Potential participants must already have undertaken a preliminary appraisal through a due diligence process. Whilst this entails a certain cost risk, since the process implies extensive analysis, it is the only way to decide how high the maximum purchase price can be to allow a given rate of return. In a few cases, direct purchases are also possible.

Whilst sales of hydropower plants have been relatively rare until recently, the situation has begun to change. One reason for this is that hydropower plants are beginning to be sold because the owners need to offset losses in other areas of business. Low electricity prices have turned the gas sector, for example, into a loss-making business for some electricity suppliers. As a result, hydroelectric plants are being sold off to shore up balance sheets. Furthermore, plants are being sold off for purposes of consolidation, as the examples of major European energy suppliers in Southern Europe and Scandinavia have shown in recent years.

These enterprises are shifting the essentially regional focus of their business with a view to making their processes and operating structures more efficient. Hydropower plants located outside their core focus may therefore be offered for sale.

6. Theory and practice

Aquila Group's dedicated hydro team has been investing in hydropower assets since 2009. Since then, the Group has acquired various projects and project portfolios, making it the largest European financial investor in the Norwegian hydropower segment. The Group's structured hydropower investment process, as illustrated below, ensures a maximum of synergetic effects and efficiency.

Figure 14: Capabilities across the entire value chain

Strategy	Sourcing	Assessment	Execution	Integration
■ Research ■ Market intelligence ■ Competitor analysis ■ Strategy ■ Business planning ■ Resourcing ■ Periodic review	■ Market screening ■ Relationship management ■ Active sourcing ■ Indicative valuation ■ Precontractual negotiations ■ Investment committee documentation ■ Consortium building	■ Service provider selection ■ Scope and budget negotiations ■ Budget approval ■ Due diligence supervision (technical, legal, tax, financial) ■ Risk assessment ■ Risk mitigation ■ Financial model (incl. audit)	■ Investment decision(s) ■ Sales process management ■ Tax and legal structuring ■ Board decisions ■ COI, KYC, MRC, etc. ■ Contract negotiations (SPA, SHA, etc.) ■ Refinancing ■ Signing ■ Closing	■ Post-closing adjustments ■ Board elections ■ e.g. Framework agreements ■ e.g. Power purchase agreements ■ Portfolio management hand-over ■ Board representation ■ Strategic alignment ■ Efficiency enhancements & economies of scale

Source: Aquila Group

The Aquila Group's acquisition process follows a predefined structure, designed to ensure maximum investment oversight. During the entire investment process, the investment teams work closely with the investment management company in order to ensure a comprehensive review of each asset.

The integration of the investment management company into the entire value generation process ensures that risk management is incorporated from the beginning. Risk analysis and assessment of real asset investments is highly complex, since it cannot be undertaken on the basis of purely quantitative value-at-risk assessments. It requires modelling using tested and standardised models, coordinating due diligence partners and an internal two-person verification rule at all times. In addition, dedicated technical and finance specialists work closely with tax experts, internal and external legal advisors and structuring specialists. The result is a multi-team approach under the leadership of the hydro team.

Since 2009, Aquila Group's hydro team has analysed over 300 hydropower projects with an installed capacity of over 6 GW. Out of over 800 individual power plants, approximately 80 – about 10% of the total - were analysed more closely and 57 have been acquired to date.

The hydro team's investment appraisal criteria include project size and remuneration systems, verifiable long-term hydrological assessments and experienced local project partners.

Selection criteria

The hydro team has an extensive catalogue of criteria for selecting suitable target investments, which include:

Project status	Existing installation, finished power plant, under construction, project development
Plant size	An annual output of at least 10 GWh
Remuneration	Not tax-financed, no economic dependency
Electricity market	Regulated and liquid
Hydrological assessment	Availability of long-term historical data
Geology	Availability of independent assessments
Partners	Availability of credit rating, track record in hydropower
Project costs	Comparison with market data possible
ESG standard	Environmental impact assessment available, prepared according to IFC or comparable standard
Financing	Availability of long-term non-recourse financing
Technology	Quality criteria for components and manufacturers, comprehensive maintenance contracts
Legal requirements	Clear title, all permits and licences secured, manufacturer's warranties in place

6.1 Case Studies

The following section provides two case studies of recent projects as well as a "lessons learned" analysis for the Jørpeland plant. For real asset investments it is of key importance that both structural and operating problems are not only rectified, but also taken into account in the assessment and implementation process for future investments. This is essential for improving efficiency and improving the process for the long term.

6.2 Norsk Grønnkraft (NGK) project

Aquila Capital acquired the Norsk Grønnkraft project from four major Norwegian regional suppliers in November 2014. APG, Europe's biggest pension fund, and a German institutional investor were co-investors in NGK. APG Asset Management and Aquila Capital formed a partnership in 2014 to invest a targeted EUR 500 million in the acquisition and development of European hydropower plants.

Figure 15: Attractive hydrological and topological investment locations in Europe

From its founding in 2004 through to 2014, Norsk Grønnkraft AS successfully planned, secured permits for, built and brought on-line over 15 hydropower stations with an average annual production of 160 GWh. Prior to the acquisition, the project development company was separated from the existing portfolio and spun off as a separate unit, NGK Utbygging. This unit remains under the ownership of the four Norwegian regional suppliers; only the existing installations were acquired.

The Norsk Grønnkraft (NGK) project consists of a regionally diversified portfolio of 33 run-of-the-river power stations in Norway. A framework agreement negotiated afterwards grants an option to purchase further power plants until 2020. As NGK continues to avoid exposure to development and construction risks, the company has entered into a master agreement with NGK Utbygging. This grants NGK exclusivity for a pipeline of some 40 additional projects to be built by NGK Utbygging between 2015 and 2020, which are to be taken over on a turnkey basis by NGK. This master agreement, therefore, sets out pre-emption rights for one of Norway's largest development pipelines - with a volume of up to EUR 180 million – without the risk of a tendering process.

Key figures:

- Average annual production: 212 GWh
- Installed capacity: 60.8 MW
- Number of existing installations: 33

Investment process

Sourcing

In June 2014, during a different transaction in Norway, the hydro team was told that one of NGK's four owners was considering selling. Aquila Capital was already familiar with a few of the power plants in the portfolio and its initial positive impression was confirmed by independent industry insiders from the hydro team's network. Initial information was gathered and the project's basic appeal was reviewed even before the start of the official sale process.

Process

At the start of July 2014, a due diligence budget was compiled on this basis. In consultation with Aquila Group's investment committee it was decided to pursue the project further and to establish contact with the sellers. Once the industry-standard confidentiality agreements had been executed, Aquila Capital obtained an investment memorandum and process letter later in the month. These documents – together with the information previously compiled by the hydro team – formed the basis for an initial appraisal model, internal decision processes and a non-binding offer.

Based on the data obtained along with experience-based figures from a review of several hundred hydropower transactions, the investment team presented an indicative offer in the form of a bid letter to the seller's advisor on 1 September 2014. After a review of the bids submitted, Aquila Capital was invited to Phase II of the sale process in mid-September. The number of interested parties was not officially disclosed but it was internally estimated at three or four. This later proved accurate.

Due diligence

With the commencement of Phase II of the process, the seller provided additional information, such as a vendor due diligence report. At this point, the team had approximately six weeks to review the data and add its own due diligence results. The technical, legal, financial and tax reports identified a few deviations from the vendor due diligence. It was, however, possible to quantify and build all of these deviations into the price or address them in the negotiations for the purchase agreement.

Final bid, exclusivity and signing

Once the comprehensive reviews and subsequent assessment of the results were completed, various specialist departments of the Aquila Group became involved, with the approval process involving the Group's risk and portfolio management teams, the legal department, the investment committee and the board of directors. Following a successful approval process, Aquila Capital submitted a binding offer for 100% of shares in Norsk Grønnkraft AS on 24 October. After a review period of about a week, Aquila Capital was granted exclusivity for negotiating the purchase agreement. The talks were successfully concluded on 7 November and all necessary contracts signed. The purchase agreement included a few conditions, as is customary. The closing took place in Oslo on 18 December once these conditions had been fulfilled.

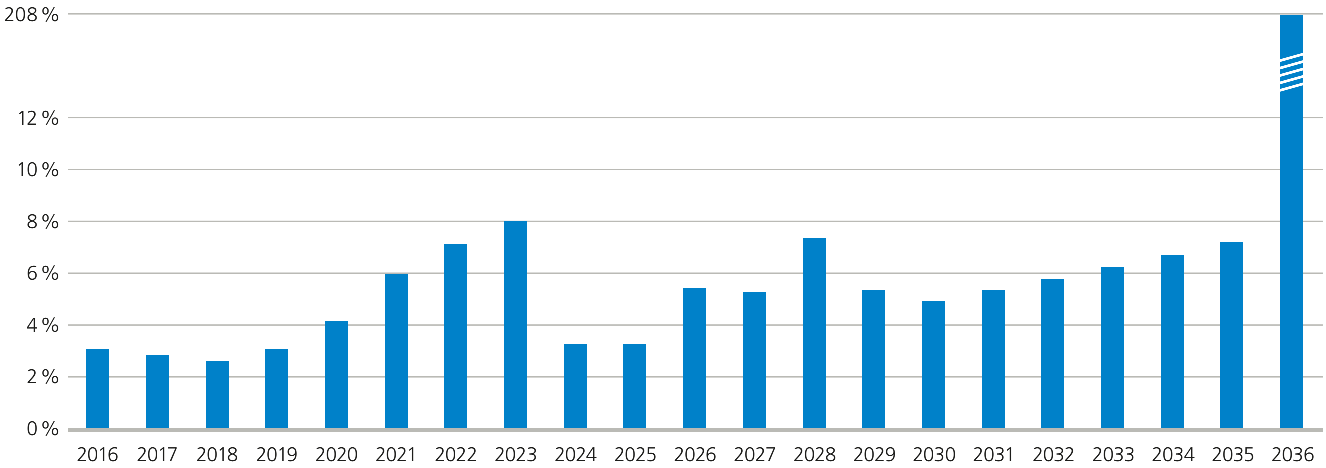
Partners

Given the complexity of the projects, successfully concluding an agreement requires not only comprehensive in-house expertise and experience, but also close collaboration with external partners. Aquila Group was supported by a number of industry specialists, especially while performing due diligence. Thommessen, a law firm, was hired to perform legal due diligence and draft the contracts. Thommessen has extensive experience in assisting with transactions such as mergers and corporate acquisitions in the energy sector. Legal aspects relating to both the target company and the transaction were analysed with respect to Norwegian law.

Regarding the technical due diligence, Aquila Capital worked with Multiconsult, one of Scandinavia's most experienced technical consulting firms. A team of hydrologists, electrical engineers and business specialists analysed production expectations in comparison with the seller's assumptions, together with an estimate of the investment costs for mechanical components, electrical components and wiring as well as civil engineering.

Tax and financial aspects were reviewed by PricewaterhouseCoopers in Oslo, who reviewed the balance sheets for the most recent financial years and a year-to-date report for 2014, along with a forecast for the remainder of the financial year. In addition, estimates were made of off-balance-sheet liabilities, profit and loss, earnings quality and an expanded view of assets and liabilities.

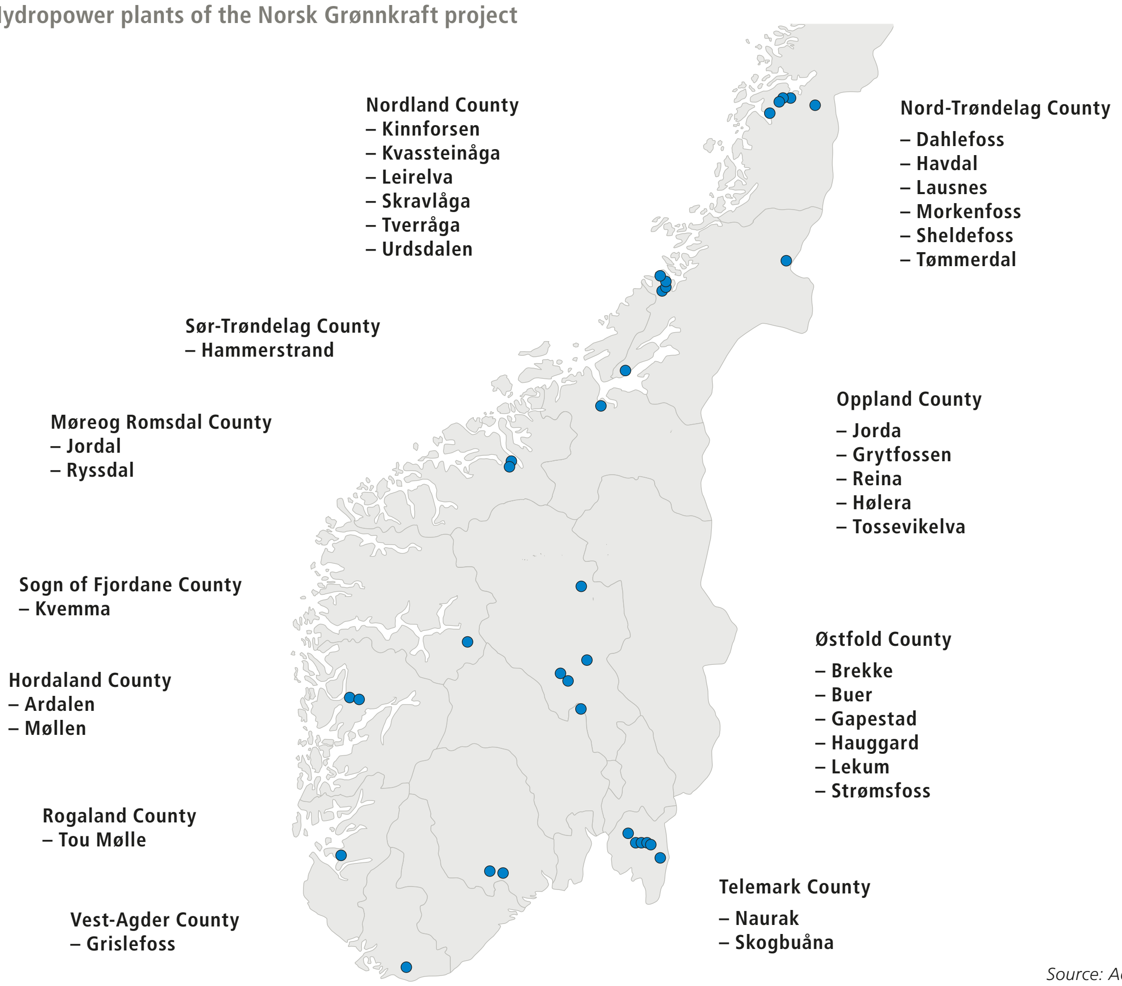
Figure 16: Indicative cash flow profile



Illustrative example, after taxes and costs; details may vary

Source: Aquila Group

Figure 17: Hydropower plants of the Norsk Grønnkraft project



Source: Aquila Group

6.3 The Jørpeland project

Aquila Capital acquired 33% of Norway's Jørpeland Kraft AS in June 2011. This hydropower company operates two run-of-the-river power plants with an installed capacity of approximately 40 MW near Stavanger, in western Norway. The main shareholder, Lyse Produksjon AS, is a wholly-owned subsidiary of a leading Norwegian energy supplier.

Sourcing

Aquila Group's hydro team has been in contact with the former minority owner and with Norwegian regional energy supplier Lyse, the majority owner of Jørpeland Kraft AS, for many years. After Lyse undertook a two-year assessment of the importance of activities outside its core business and options for foreign co-owners, Aquila Capital was able to secure an exclusivity agreement. A due diligence process followed for acquisition of a 33% interest in Jørpeland Kraft AS.

Process

The due diligence process took place between December 2010 and February 2011. Legal due diligence was performed by Bull & Co., a firm with mergers and acquisitions support experience. KPMG was tasked with tax due diligence and structuring. Technical appraisal was undertaken in-house under the guidance of the hydro team.

In assessing risk, the following aspects were identified as contractually relevant: remediation of old pressure pipes and soil, as well as ongoing negotiations with certain landowners and the possibility that the hydropower plant might not be fully operational at execution of the contract. The majority owner, Lyse Produksjon AS, was able to resolve the pending environmental, safety and operating issues in full.

Closing

Once all risks had been quantified and considered in the price or resolved during the due diligence process, the purchase agreement was signed in March 2011. As is customary, the purchase agreement included a few conditions precedent. Closing took place once all conditions had been fulfilled in May 2011.

Key figures:

- Ownership interest: 33%
- Average annual production: 114 GWh
- Installed capacity: 40.0 MW
- Number of power plants: 2

Table 12: Lessons learned, Jørpeland project

Challenge	Solution
Legal: Right of pre-emption	The majority owner, which held a right of pre-emption, faced reputation risks. For a municipally owned energy supplier, participation by foreign financial investors is often viewed critically. This conflict was resolved through an intensive exchange of views and bilateral negotiations.
Legal: Approval by the regulatory authority	Owners of large hydropower plants are required to meet various conditions set by the regulatory authorities. With support from our legal advisor, Bull & Co., Aquila Capital was able to meet all requirements before execution of the contract (i.e. to demonstrate sufficient experience and present environmental and legal assessments).
Technical: Change in safety guidelines	After the purchase, the safety guidelines for construction work were made considerably more stringent at one of five dams. The work was performed by the state operator Lyse. It was not possible to offset the added costs completely. However, a significant reduction was accomplished on the basis of technical input on implementation from Aquila Capital.
Technical: Turbine malfunction	A defect was found in one of the turbines shortly after the purchase. As an experienced operator, Lyse was able to take charge of negotiations with the manufacturer and oversee the replacement of the defective components. A few technical modifications were necessary to prevent future malfunctions.

Source: Aquila Group

The case study illustrates that problems can occur at various levels following an acquisition despite detailed planning and calculations when investing in real assets. These include not just legislative changes and stricter regulatory requirements but also unforeseeable technical problems which can both delay implementation and increase ancillary costs of investment or operating costs. Deviations in terms of production and costs can also occur in the operating phase. Changes in the operator's management, potential variances from hydrological assessments prepared years ago and technical defects can all have negative impacts on earnings in current operation and pose challenges to portfolio management. Being aware of these eventualities is of great importance so that they can be offset through appropriate reserves or built into the price of the next project.

7. Team & partners

Aquila Capital has been making hydropower investment opportunities available to investors since 2009. Since then, a team of industry and financial experts has dedicated itself to implementing the Group's hydropower strategy and has built an extensive track record with a focus on combining well-founded technical expertise with comprehensive finance industry know-how.

Thanks to an extensive sector network and long-standing relationships with project developers, industrial enterprises and banks, the team has built a steady pipeline of European greenfield and brownfield projects in the 2 – 3 TWh annual production size range. The Group's experts have been involved in developing over 20 hydropower projects from the planning phase to commercial operation and have successfully concluded five significant transactions involving existing hydropower installations. Aquila Group's current hydropower portfolio comprises a total of 57 run-of-the-river power plants with a total installed capacity of over 200 MW and approximately 920 GWh average annual production.

Partners
A number of experienced partners support Aquila Group in realising hydropower investments:

Analysts
- SKM Market Predictor AS
- Thema Consulting Group AS
- Markedskraft AS

Technical advisors
- Bernard Group
- Multiconsult AS

Auditors
- Deloitte Touche Tohmatsu Limited
- Ernst & Young
- KPMG AG
- PricewaterhouseCoopers

Laywers
- Advokatfirmaet Thommessen
- Baker & McKenzie LLP
- CMS Hasche Sigle
- Heuking Kühn Lüer Wojtek
- Clifford Chance LLP

8. Conclusion

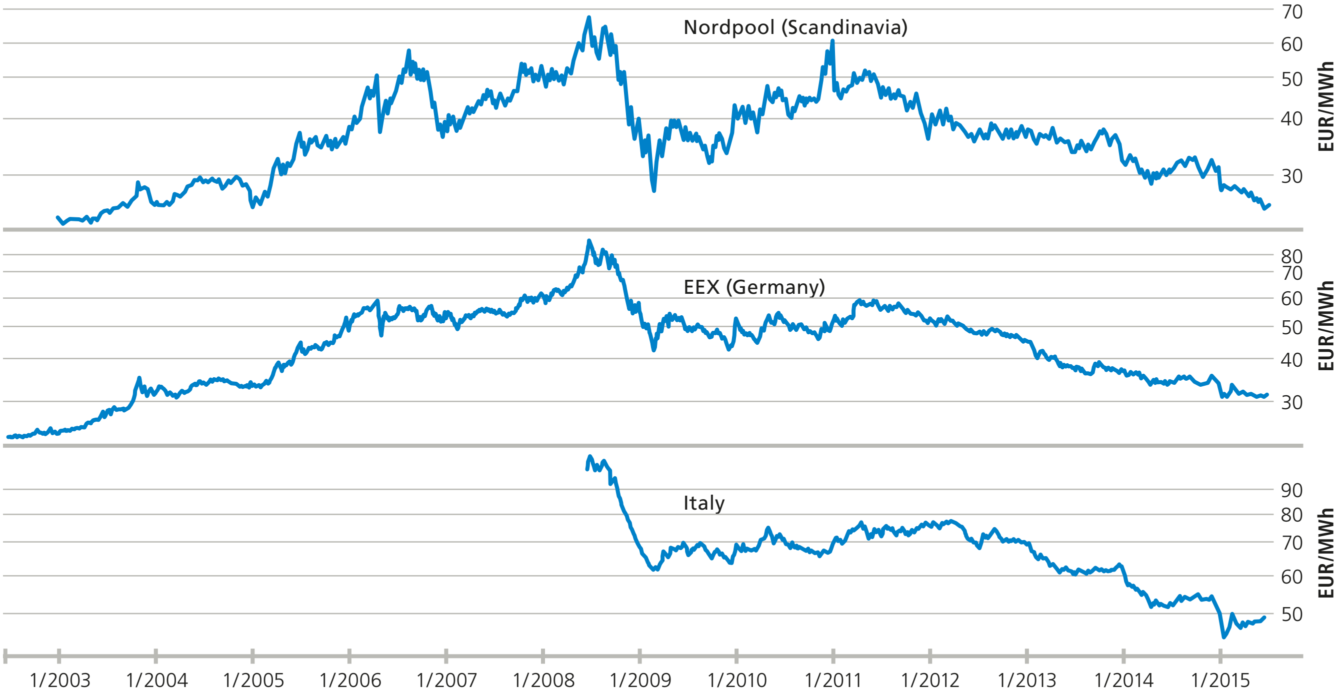
Hydropower investments are distinguished by characteristics that cater to the requirements of many institutional investors: even in times of economic weakness and rising inflation, they deliver long-term, stable cash flows. As the returns they generate are uncoupled from the financial markets, hydropower investments can reduce the overall risk of a portfolio. For an investment in hydropower to be successful, however, projects must be actively managed over their entire lifetime, which not only demands extensive know-how, but also requires significant portfolio management, valuation, controlling and risk management resources.

Aquila Group, which comprises Aquila Capital and the fully licensed alternative investment manager Alceda, offers attractive real asset investment opportunities that are embedded in a fully AIFMD compliant infrastructure. The results are real asset investment solutions, tailor-made to meet the diverse needs of our investors globally.

9. Appendix

The figure below illustrates how electricity exchanges across Europe move roughly in parallel and are currently at a multi-year low. Prices of hydropower plants have followed this trend (with a certain lag), so that attractive returns are available today despite lower electricity prices.

Figure 18: Development of European electricity prices over time



Source: Bloomberg

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