

BOOSTING THE PROFITABILITY OF SOLAR ASSETS THROUGH INNOVATION AND DATA





CONTEXT

Despite the USD10 trillion of new investment expected within the renewable energy industry over the next 20 years, asset managers face key challenges that are putting profits and performance at risk. Key trends that we have observed over the last years:

1. Prices of O&M activities have been steadily falling: In Europe, prices have plummeted 28% since 2016 while in the US they have dropped by 25%, according to a recent report by Bloomberg New Energy Finance and Mercatus. Such price decreases have been driven by the progressive

disappearance of public subsidies, an increasing number of players entering and competing across the energy sector, the increasing economies that have been realized by the experienced incumbents, as well as constant and continued technical and financial innovation. For emerging markets, downward pressure on prices has been less dramatic because of the lower number of local asset management and operations and maintenance (O&M) service providers. However, with the acceleration and progressive maturation of the emerging markets the price difference between the regions is decreasing.



2. Profit margins for asset managers are decreasing and the trend is not meant to stop. According to Morgan Stanley's base case, a further 13% erosion on industry revenues is expected by 2020. As they feel this squeeze, asset managers also feel further pressure from their investors who have increased expectations regarding data transparency and performance visibility.
3. Investment funds that have traditionally outsourced asset management are starting to bring it in house as they diversify their assets under management (AUM) and reach critical mass while continuing to outsource O&M activities. According to Mercatus, after asset managers reach any combination of 500 million assets under management (irrespective of regional currency), multiple asset classes, or across multiple regions, the level of complexity becomes such that growing numbers of investment funds decide to perform their own asset management. However, such companies continue to rely on those engineering, procurement, and construction (EPC) companies that constructed their assets, especially during the first years of operation.
4. The competitiveness of asset managers is increasingly driven by the better management of data and performance visibility to optimize their most critical activities and expenditures across financial, commercial, and technical asset management and maintenance. Asset managers now have to deal with the underlying theme of driving better data management by integrating often disconnected and siloed data sources across systems and spreadsheets to drive integrated management, tracking, and performance monitoring.
5. **DNV GL observed that O&M contracts are evolving with higher added value, higher flexibility, and cost competitiveness. In particular:**
 - O&M contracts are not standardized and vary from one plant to another. Indeed, O&M providers are increasingly incorporating higher added-value activities, such as **asset performance management**, to differentiate themselves from their competitors and maintain high prices.

- **The duration of O&M contracts has been decreasing** as a result of competition between asset managers and O&M providers who prefer to have more flexibility with their subcontractors. Indeed, while O&M contracts traditionally lasted about five to ten years in developed markets, their duration today is closer to two to three years, and can be expected to drop to one to two years in the coming years. Only in emerging markets do contracts still last about five years, in order to provide confidence to lenders on the continuity of O&M services.
- O&M contracts are **increasingly using KPIs to measure the availability** of the assets rather than their production performance. Indeed, production performance typically falls under the scope of the EPC over one year upon commissioning, whereas the assets' availability falls under the competence of the O&M provider at the handover between the EPC contractor and the O&M contractor. **The definition of "availability," and thus the related potential bonuses and penalties, could be significantly different from one contract to another.**
- However, although bonus and penalty mechanisms are widely used to incentivize O&M providers based on these KPIs, **the definition of "availability" is still different from one contract to another** and results in various ways to calculate these KPIs.

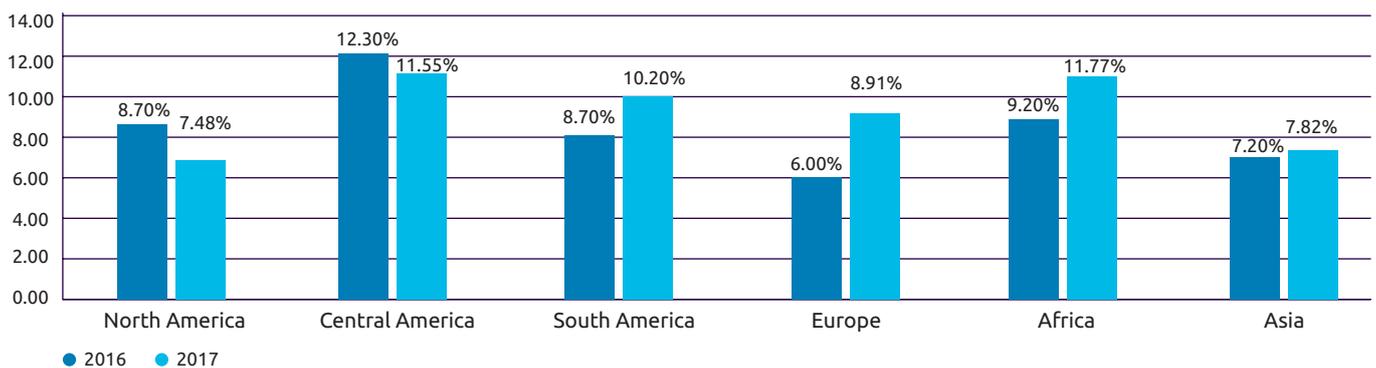
Recent history

By region:

Mercatus observed a significant variability in energy project profitability across well-established and top-emerging markets. For example, from 2016 to 2017, unlevered pre-tax project returns dropped on average by 100 basis points in North and Central America, while Europe, South America, Africa, and Asia saw average improvements of as much as 200 bps.

According to Mercatus' 2018 annual report, declining off-take rates were seen in North America from saturated tender markets and deflated returns, as cash flow forecasts for solar and wind assets weakened around the region. However, the slight decline in returns indicates stabilization and signals newly available lower cost capital in the market as investors have started to assign lower risk factors to renewable energy projects. Despite hardening interest rates, investor confidence has blossomed as improved, more granular reporting practices on asset performance have helped remove much of the uncertainty previously associated with clean power-generating assets.

Average IRR by region



Across the investment lifecycle:

From 2015 to 2017, project returns dropped, on average, over 100 basis points (bps) irrespective of region across an energy project's lifecycle, from its final investment committee approval and notice to proceed for construction through a project's commercial operation date and first year in operation. To put this in perspective, for an asset manager with \$1 billion in assets under management, which would represent 750 to 1,000 megawatts, a 100 bps drop across

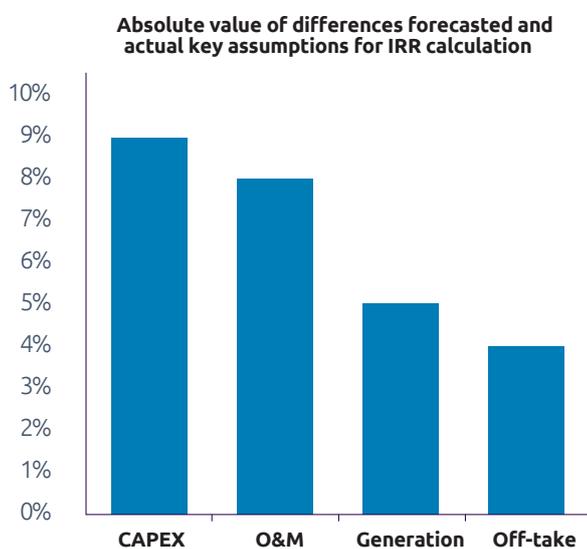
a portfolio could represent \$10 million in lost profits due to poor assumptions made during a project's investment approval phase. We call this drop in profitability "IRR deal leakage" or the over-estimation of an asset's ultimate profitability or internal rate of return (IRR).

Today, as Mercatus looks across over 10,000 renewable energy assets across 210 gigawatts managed within the Mercatus' platform, the key drivers of IRR deal leakage have

stemmed from the inaccurate estimation and forecasting across four key project assumptions:

- the cost of operations and maintenance (O&M)
- the cost of energy (off-take)
- estimation of production
- estimation of capital expenditures (CAPEX).

The following chart showcases the range of both overestimations and underestimations observed from 2015 to 2017 on key assumptions for IRR calculation.



As shown in the above figure, off-take rates and generation are the highest and most commonly misestimated values. O&M-forecasted costs and CAPEX also differ significantly from reality after one year of operation. These mistakes in the investment lifecycle can be devastating to project IRRs and must be more closely monitored and managed in order to prevent such wide variances of leakage.

As a result of such variability in project returns, asset managers have been driven to continuously monitor profitability of operational assets and the key levers that have the greatest impact across project revenues and costs.

Improving profitability in renewables

For example, when looking across both technical and financial drivers, Capgemini determined four key efforts asset managers could drive for increasing a project’s internal rate of return (IRR) within an estimated 50 basis points (0.5 percentage point):

- Increasing in **asset availability** by 3%, e.g. from 96 to 99%
- Increasing **performance ratio**⁽¹⁾ of 3%
- Decreasing O&M costs by 10%
- Reducing the **IRR deal leakage** by 10%
- Even though many factors determine a project’s IRR, these examples underline the many opportunities asset managers have to impact project and portfolio profitability.

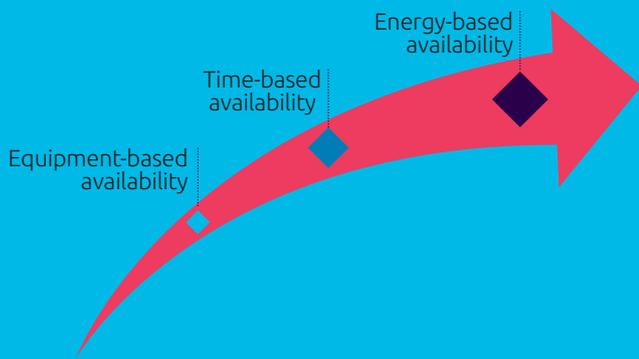
To achieve such increases, we have detailed specific actions that can be taken by asset managers and O&M providers at the project level covering: (1) technical and operations, (2) financial and economic, and (3) generally, across organizations.

1. TECHNICAL AND OPERATIONAL RECOMMENDATIONS:

Asset managers can optimize their O&M contracts by:

- **Conceiving a bundled strategy for CAPEX and OPEX:** DNV GL observes that O&M costs depend greatly on the quality of purchased components. It is thus recommended to buy components with high reliability to minimize O&M costs and take into account impact on O&M in the event of CAPEX reduction based on lower-quality components.
- **Defining the right scope of activities to be outsourced to the O&M provider** to fit to the specific needs of the asset managers. For example, according to DNV GL, the solar panel cleaning method and frequency are to be adapted to the specific requirements of a plant in terms of size, geography, and weather. If the site is located in the desert, panels can be wiped clean, while in humid locations they must be cleaned with water.
- **Setting the right KPIs and the right service-level agreements (SLAs)**, benchmarked with comparable sites and with best-in-class international O&M providers, to ensure sufficient performance guarantees, especially in terms of asset availability. Asset availability KPIs are considered more accurate than production level KPIs when it comes to evaluating O&M services. However, “availability” can be please clarify, which can be equipment-based (e.g., percentage of inverters available at peak time), timebased (e.g., percentage of time the plant feeds the grid above a minimum level), or energybased (e.g., energy production compared with what could have been produced). These KPIs need to be defined according to the specificities of the plant. On the other hand, the SLA defined for the O&M provider needs to be aligned with the one that binds the asset manager to its electricity’s off-taker.

Refinement of availability KPIs



- **Including a bonus/penalties mechanism** in the contract to incentivize and encourage the partner to reach – or even exceed – the initial performance objectives in terms of downtime avoidance – is also a best practice observed by Capgemini. To protect the O&M provider, the maximum penalty is, on the one hand, generally equal to the annual value of the contract if the partner does not meet its guarantees. On the other hand, the bonus can reach up to 50% of the initial contract value when the asset's availability (or reaction time) exceeds the contractual SLA.
- **Performing regular audits** of the assets and of the selected O&M provider, as well as regular benchmarks of the different providers and their services catalogue, references, SLA levels, innovation level, technologies used, or technological partnerships, competencies (especially in this sector where human resource turnover is high), etc. DNV GL observed that these audits are to be generalized into equipment and spare parts providers, as the quality of equipment has a strong impact on the efforts to operate and maintain the assets.

O&M critical activities can be partly or fully robotized/automated to reduce costs and increase assets' availability time:

- Capgemini Invent notes that some O&M providers have already started performing inspection rounds and thermographic imaging with drones or aircraft equipped with sensors to drastically decrease inspection time. They may call services from third parties specialized in drone use, such as Hawk, a French start-up.

- Indeed, drones and aircraft are used to identify cracks in panels or any other physical damages. A drone inspection can cover more in 10 minutes than a human can in one hour. According to Singulair's (Formerly Hawk) experience, drone use can reduce the inspection cost by more than 50% and shorten inspection time by more than 90%.
- Digital mobility solutions are also used to help field operators focus on their core activities. For example, Capgemini Invent has discovered that providing a smartphone with digital applications helps field operators perform some activities, such as: access to an asset's historical data (e.g., the last time the asset was maintained), access to the checklist of activities to perform, chat with colleagues to ask questions and get answers instantly, etc., remotely. In addition to these advantages, these "zero-paper" activities also allow updates and data storage in a secured cloud solution, as well as the ability to share data in real time with management and colleagues (especially useful if there is a shift-organization).

O&M providers can leverage collected data to decrease downtime frequency and duration, and thus increase asset availability:

- The huge amount of data collected with sensors must be analyzed with specific solutions to produce insights and/or recommendations. However, DNV GL notes that appropriate sensors shall be purchased at the construction, otherwise they would not bring the expected value. On the one hand, these data allow for monitoring the assets' performance to compare them to the initial forecasts, as well as to benchmark them with other PV fields, including competitors, and make decisions about improvement. On the other hand, maintenance activities have moved from reactive to preventative, and are now increasingly predictive. Indeed, predictive maintenance solutions enable analysis of the small signals received from sensors to identify the need for maintenance intervention before downtimes occur. In the field, it transpires that, in order to keep profitability, O&M contractors cut costs by minimizing staff: few people are dedicated to data analysis and efforts are focused on breakdown maintenance.
- Capgemini Invent observed that, to be efficient, data valorization needs to rely on an end-to-end system, including: data collection technology that fits with the plant's needs (sensors, drones, etc.), onsite reliable telecom infrastructure to ensure data transmission with the right quality, a secured "data lake" or database to store data, and a specific solution which responds to the business needs of the plant.



- According to DNV GL, asset managers must secure full ownership of and access to data collected and processed by the O&M provider to:
 - Feed the contractual performance KPIs dashboard in order to allow the correct functioning of the contractual bonus/penalties mechanism
 - Feed the digital solutions processing for the collected data (e.g., predictive maintenance models)
 - Secure the handover between two O&M providers or between the O&M provider and the asset manager at the end of the contractual period
 - This need results in a high appetite of asset managers for acquiring high-potential companies specializing in data management and processing
 - In addition, operations performance data can be leveraged and analyzed to identify the best designs of power plants. That assessment will feed the engineering phase of new projects and have a significant impact on the performance of the new asset.

2. FINANCIAL AND ECONOMIC RECOMMENDATIONS

Digitalizing the data collection and management process across all assets

- Energy asset owners and O&M providers alike have realized that a “two-to-threefold growth in assets under management per year” can no longer be enabled by proportional headcount growth alone. Infrastructure changes are needed to drive higher operational efficiencies that enable faster-scale and more effective use of valued resources.
- Asset owners working with their O&M providers and origination and execution teams and partners should create an end-to-end approach to data management. Most organizations have grown up in a world of departmental data silos. This is especially prominent within investment, budgeting, and performance management processes that require large amounts of data inputs across both technical and economic vectors. As a company grows, those silos become increasingly disconnected until they create a “plumber’s problem” – pipes of data that are blocked from flowing freely between departments and partners (for example, in an energy company across its origination and development, engineering and construction, finance and risk, and operations and maintenance departments). The key to strategic, real-time (and predictive) decision making is having a centralized data repository where insights can be easily extracted because data, workflows, and financial models are connected across departments and data silos. Such a new-age infrastructure would have significant impact to reducing the IRR deal leakage discussed earlier.

Leverage advanced data analytics for predictive insights and better decisions

- Organizations in every sector are realizing the importance of having a single modern architecture, database, and advanced analysis system that drives the next wave of intelligence. The best-run asset and investment managers combine technical, economic, and risk datasets to power critical dashboards for CEOs and CFOs whose biggest responsibility is to make sound, real-time resource and investment decisions that drive profitable growth. Armed with big data, organizations can not only optimize the performance of assets, but do it with economics in mind to maximize returns, profits, and/or cash. Being able to run sensitivities on economics and risk to drive better performance of CAPEX budgets during execution, and OPEX budgets during operation with constant learnings applied across each stage, is critical to building toward automation and machine learning. This could present the biggest opportunity yet for energy companies to improve the profit margins of energy project portfolio assets.

3. BROADER ORGANIZATIONAL LEVERS AND RECOMMENDED ACTIONS:

Promote a culture of continuous improvement to sustain the operational performance achieved through contracts optimization, automation, and digitalization in the long term.

Indeed, according to Capgemini Invent, a change management program can be launched to:

1. Secure the awareness of people about the challenges and the potential gains of the new working methods.
2. Define a new organization in coherence with the company’s objectives, processes, tools, and skills; and more importantly: communicate this new organization to clarify roles and responsibilities.
3. Launch a training program to allow people to properly use the new tools.
Define and implement the right KPI to measure and track the change progress, and ensure that incentives reflect it properly.
4. Connect ERP, CRM, ILM (investment lifecycle management) systems to create a modernized, fully-connected asset solution for managing and analyzing interactions with hard asset investments and data associated throughout the entire investment lifecycle. All three systems are essential to the success of maximizing renewable energy assets and need to be integrated in a way that leverages data flows across systems for full-impact insights.

OUR VALUE PROPOSITION

Our consortium Caggemini/DNV GL/Mercatus can support you to increase the performance of your O&M and asset management activities, in an end-to-end approach by providing the:

- Planning and Design for Digital Transformation initiatives
- Strategic, financial, and technical due diligence for acquisitions or divestments
- Assessment of organizational systems, processes and data management strategies across your investment, operations and asset management phases
- Assessment of technical and financial operational performance of your assets compared to peer benchmarks, identifying and qualifying improvement levers
- Design of the business-case that will increase your performance based on a selection of technological solutions chosen with your teams to fit their needs
- Deployment of these technological and data management solutions
- Audit to review and select your partners (O&M provider, technology solutions providers, etc.)
- Review of your O&M contracts based on a benchmark of best-in-class contracts and recommendations of an action plan to renegotiate them.





Authors:

Florent Andrillon

florent.andrillon@capgemini.com

Arthur Arrighi de Casanova

arthur.arrighi-de-casanova@capgemini.com

Ali Habi

ali.habi@capgemini.com

Tim Buchner

tim@gomercatus.com

Melanie Flanigan

mflanigan@gomercatus.com

Stéphane Lebeau

stephane.lebeau@dnvgl.com

Neven Bernard

neven.bernard@dnvgl.com

About Capgemini Invent

As the digital innovation, consulting, and transformation brand of the Capgemini Group, Capgemini Invent helps CxOs envision and build what's next for their organizations. Located in more than 30 offices and 10 creative studios around the world, its 6,000+ strong team combines strategy, technology, data science, and creative design with deep industry expertise and insights, to develop new digital solutions and business models of the future.

Capgemini Invent is an integral part of Capgemini, a global leader in consulting, technology services, and digital transformation. The Group is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital, and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of 200,000 team members in over 40 countries. The Group reported 2017 global revenues of EUR 12.8 billion.

Visit us at

www.capgemini.com/invent

Mercatus

Mercatus is the leading provider of alternative asset investment management solutions, helping investors maximize returns, accelerate growth, and mitigate risk. Mercatus is the only platform to systematically consolidate asset and portfolio data, automate and control financial analysis, and streamline decisions and collaboration across the entire investment lifecycle. Many of the largest alternative investors and asset owners leverage Mercatus to manage over \$450B of assets and investments across 113 countries and 11 asset classes. Mercatus is headquartered in Silicon Valley with offices in Europe and India.

For more information: www.gomercatus.com

DNV GL

is driven by its purpose of safeguarding life, property, and the environment. DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries.

Combining leading technical and operational expertise, risk methodology, and in-depth industry knowledge, we empower our customers' decisions and actions with trust and confidence. We continuously invest in research and collaborative innovation to provide customers and society with operational and technological foresight. With our origins stretching back to 1864, our reach today is global.

Operating in more than 100 countries, our professionals are dedicated to helping customers make the world safer, smarter and greener.

For more information: www.dnvgl.com