A balance of power

PES was delighted to have the chance to speak with Mahmoud Hamada, PhD, MBA, Managing Director of SAMAWATT, to find out how machine learning algorithms can help reduce grid imbalance penalties. With government subsidies covering these penalties no longer an option, how can small and medium-sized renewable energy farms without the necessary market trading expertise, have other options than PPA to reduce the imbalance risk? Read on to find out more...

PES: Firstly, welcome to PES Wind Mahmoud, I'm looking forward to our conversation. As a business that aims to help wind and solar power producers reduce electric grid imbalance penalties, perhaps we can begin by looking at how the imbalance occurs and just how big a problem it causes?

Mahmoud Hamada: Thank you for the warm welcome. Yes, wind and solar farms have a fundamental problem: their power production is intermittent because it depends on unpredictable weather conditions.

This intermittent production causes instability in the electric grid system, so to incentivise greater accuracy in electricity production forecasts, the grid operator levies grid imbalance penalties on the producers whenever there is a deviation between forecast and actual electricity injection into the grid.

PES: Presumably the levies are quite substantial with not much help available to cover their cost?

MH: Over the past 20 years, generous government subsidies have covered these penalties. However, these subsidies have declined significantly over the past five years, negatively impacting park profitability. Small and medium-sized renewable energy farms, which do not have market trading expertise, are therefore forced to undertake expensive power purchase agreements with big energy utilities to eliminate or reduce the imbalance risk, at the cost of reducing their margins.

PES: This does sound like a precarious balancing act. Is there a way that grid imbalance can be better monitored and managed to negate these penalties?

MH: Yes there is, as SAMAWATT has developed OptimalAsset™, a plug-and-play

automated trading software-as-a-service solution that monitors simultaneously the fluctuation in the renewable farm production and the dynamics of the wholesale market supply and demand and prices.

PES: Can you explain a little more about how that works?

MH: OptimalAsset™ uses highly sophisticated machine learning models to optimise the electricity forward sales commitments to minimise unexpected supply deviation to the grid.

It enables renewable power producers to increase profitability by reducing grid imbalance penalties due to intermittent production by an order of magnitude. Furthermore, it also enables even small players to access the wholesale electricity markets directly, without passing through expensive intermediaries. This is particularly important in the context of the phasing-out of government subsidies and feed-in tariffs.

It also enhances the stability of the energy grid, thus reducing the need to use carbon-intensive gas fired power plants to provide emergency electricity supply.

PES: Why is it new compared to existing solutions?

MH: Our innovation is game-changing because it enables small and medium-sized wind and solar energy producers, who currently sell their power via energy utilities or power aggregators, to access the wholesale power market in a profitable way, while ensuring higher grid stability.

It is similar to encapsulating a large capacity big frame server into a handheld device, with similar performance and putting it in the hands of mainstream users. Normally, a large team working 24/7 shifts and market

Mahmoud Hamada

experience in trading is required to perform such selling of renewable energy.

PES: It sounds like a novel approach for managing the imbalance risk. Has it been tested in real world terms to see if it does make a difference?

MH: Our software is used by small and large renewable farm operators and has proved its superiority over other methods. This is due to a well-researched set of algorithms over the past five years, thorough understanding of the mechanics of power trading by our team of ex-power traders and data scientists and the assembly of all the products needed for trading renewable energy (i.e, forecast, optimization, and market execution) in a plug-and-play integrated platform.

PES: What makes this particular technology so important right now?

MH: Government subsidies to renewable energy producers will eventually be phased-out.

Newer governmental policies motivate operators to sell directly into the power exchange market. Solar and wind farm operators will then have to manage their assets more efficiently due to new exposure to power price volatility instead of guaranteed feed-in tariffs and high grid imbalance penalties.

The transition from guaranteed tariffs to floating market prices creates the need to find more cost-effective ways to access the energy market.

An end-to-end solution is a catalyst for new renewable energy operators to enter the market and a compelling reason for existing operators to switch to a simple to use and cost-effective solution. Large operators have lower imbalance penalties with OptimalAsset™ and small medium-sized operators are able to access the power market directly, at a fraction of the cost.

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PES: Very timely then and potentially even more important going forward. What value does such a solution offer wind farms?

MH: Given the continuing decline in subsidies, and newer policies motivating the sales of the produced electricity directly into the power exchange market (e.g. EPEX-SPOT), solar and wind farm operators will need to manage their assets more efficiently. This is because of their new exposure to power price volatility instead of guaranteed feed-in tariffs and the high grid imbalance penalties caused by their production intermittence.

Small and medium-sized renewable energy farms now face decreasing profit margins so they have two choices. They can either outsource this operation through a Power Purchase Agreement (PPA) to a large utility, or a power aggregator, thereby forgoing full revenue potential, or develop the expertise in-house to trade directly in the market.

The second option is not an easy task for most small and medium sized renewable energy farms, as it requires a significant investment and a change in the core strategy and skill of the company.

PES: Lacking the trading know-how is significant isn't it?

MH: Yes, and this is why we offer direct access to the power market exchange. In addition, OptimalAsset™ enables us to monitor fluctuations in renewable farm production and the dynamics of the wholesale market supply, demand and prices.

For the small and medium-sized renewable energy farms with no market trading

experience, this is a plug-and-play turnkey solution that encapsulates an enormous trading know-how and offers a viable alternative to expensive Power Purchase Agreements in order to retain the full profit margin.

PES: Is there a reason why you don't just focus on reducing errors in the production forecast?

MH: Although this is an important aspect of the solution, our algorithm goes one step further and finds a novel way to use market signals as a feedback mechanism to optimize the dispatch of future production volumes of the renewable energy farm.

This continuous optimisation has a double effect. It helps with better planning of grid supply coming from the renewable energy farm, and thus, minimizes grid instability and maximises the financial value of the farm by reducing grid imbalance penalties.

This innovation is challenging to achieve because it requires a thorough understanding of the electricity market trading and superior mathematical and meteorological skills.

PES: Is your approach unique to the market?

MH: Democratising access to the wholesale electricity market for small and medium-sized farms, SAMAWATT is uniquely placed as the first fully-fledged, end-to-end integrated platform that meets all the requirements for renewable energy trading: production forecasts, portfolio optimisation, price risk management and automated algorithmic market execution.

OptimalAsset™ is a quality product founded on long research in artificial intelligence and thorough understanding of the energy trading mechanics. It is driven by innovation based on sophisticated machine learning models and optimal control.

PES: Is there potential for this to have broader societal, economic, environmental or climate impacts in the future?

MH: We are contributing towards supplying clean, affordable and secure energy. We can improve the net profit of wind or solar power plants by up to 30% and at the same time empower small operators to directly access wholesale energy markets without intermediaries. This will lower the hurdles for investments in new plants and help small players like municipalities or interest groups to engage in local projects.

The first application is for wind and solar power parks. Next, the application can be transported to energy trading for microgrids, individual or aggregate producers/ consumers, together with additional modules for smart-building-applications and demand-side energy management.

As more and more small, decentral generation units (photovoltaic) in combination with battery storage and electric vehicles are installed, the management of imbalances on local grids will be increasingly challenging and call for similar solutions.

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