BALANCING ACT: POWER TRADING IN HIGH-RENEWABLE MARKETS

HANSEN

Balancing Act: Power Trading In High-Renewable Markets

In our increasingly dynamic energy ecosystem, every megawatt matters, and the intermittency of wind and solar has substantial implications for power grids and energy traders.

The need to mitigate climate change by reducing greenhouse gas emissions is one of the most pressing reasons for transitioning to renewable energy. Burning fossil fuels is a proven contributor to global warming, and renewable energy sources can significantly decrease these emissions.

Additionally, energy security is a vital policy goal for governments worldwide, and dependence on imported fossil fuels can pose significant national security risks. Renewable energy sources, such as solar, wind, and hydroelectric power, can be domestically sourced, reducing reliance on foreign energy imports and enhancing energy independence. Regional and international interconnections that share capacity between national grids go some way to strengthening energy security; however, governments across Europe have placed a significant emphasis on the question of energy security.

While challenges remain in fully transitioning to renewable energy, such as intermittency, grid integration, and energy storage, the momentum toward renewable energy adoption is strong, driven, as it is, by environmental, economic, and technological factors. As these factors evolve and solutions to the challenges are found and implemented, the inevitable transition to renewable energy will gain pace.

The Inevitability of Change

The integration of renewables is inevitable and, taken as a whole, beneficial. Grid operators need to innovate and find ways to accommodate intermittent renewables effectively. In the long term, as renewables make up an increasingly high proportion of the production output, this may include implementing demand response programs, flexible generation sources, and grid interconnections to balance supply and demand fluctuations.

The intermittency of renewables, especially solar and wind power, has substantial implications for power grids. Solar and wind power generation fluctuates based on weather conditions and time of day, posing a constant challenge for grid operators as they seek to balance supply and demand in real time. Additionally, the intermittent nature of renewables and the unpredictable nature of production output can introduce instability into the grid; sudden changes in generation can lead to voltage and frequency fluctuations, affecting the grid's stability.

Renewables also influence energy market dynamics by affecting electricity prices and market mechanisms: electricity spot prices typically decrease when renewable generation is high but can spike, sometimes alarmingly, when events disrupt production. While generally delivering positive outcomes, the transition to renewables has implications for traditional power plants' economics and viability. These remain a source for a significant portion of the base load and are often the only option for delivering flexibility services – the mechanisms used to maintain grid stability – during disturbances.

Renewables offer significant environmental benefits: reducing climate-impacting emissions and dependence on finite fossil fuels. However, overcoming the challenges associated with integrating renewables into the grid is essential for realising these environmental benefits and transitioning to a sustainable energy future.

Balancing Act: Power Trading In High-Renewable Markets

The Emergence of Real-Time

Real-time energy data has emerged as a cornerstone of modern grid management and sustainability efforts in today's rapidly evolving energy landscape. From optimising grid operations to empowering consumers, it's impossible to overstate the importance of real-time energy data.

At the heart of the matter lies the need for efficient and resilient energy systems, and with the rise of renewable energy sources, transmission system operators face the challenge of dynamically balancing supply and demand. Real-time energy data provides invaluable insights into fluctuations in generation and consumption, enabling operators to anticipate and respond to changes swiftly, and it plays a vital role in integrating renewable energy into the grid.

Real-time energy data plays a pivotal role in shaping energy trading strategies, offering traders unprecedented insights into market dynamics and price fluctuations. By providing instantaneous information on supply and demand conditions, grid congestion, and renewable energy generation, real-time data enables traders to make informed decisions in a fast-paced and volatile market environment. Traders can leverage this data to identify arbitrage opportunities, optimise trading positions, and mitigate risks associated with price volatility.

Additionally, real-time energy data facilitates the integration of renewable energy into trading strategies, allowing traders to capitalise on fluctuations in renewable generation and navigate the transition to a more sustainable energy market. In essence, real-time energy data is not just a tool for monitoring market trends—it is a strategic asset that empowers traders to stay ahead of the curve and drive innovation in energy trading.

However, the rise of real-time data has led to a corresponding surge in the quantity and complexity of the information energy traders face while operating, as they do, contending within the notoriously short evaluation, strategy creation, and trading execution windows.

The Law of Unintended Consequences

The geographic placement of wind and solar farms is no accident; careful planning went into initial deployments to ensure optimum exposure to the necessary weather elements to maximise the potential production output and returns on investment.

In terms of prevailing weather patterns, this vital data point has resulted in concentrations of renewable energy assets of the same type – wind or solar – being grouped in relatively compact areas. The northern and central European landmass is reasonably modest in the context of large-scale weather systems, which often span hundreds of square kilometres and can easily encompass an entire region's deployment of renewable assets. Therefore, when the wind blows or the sun shines, it blows or shines for – respectively – all wind turbine and solar PV asset operators. And, of course, the reverse is also true. In the context of grid-scale production output, this situation means that the most common and easily deployable renewable energy sources are incredibly weather-dependent.

As an aside, the linkage between the (relative) colocation of same-type renewables and weather effects impacts energy spot prices and future investment potential. When the weather conditions are favourable and all wind farms, or all solar farms, produce, they do so simultaneously, which drives down spot prices. When weather conditions change for the worse (or the sun sets), it affects all assets equally; production falls, and the spot price rises, but no one can take advantage. This interdependency is sub-optimal from a long-term return of investment perspective, and the phenomenon is known as "cannibalisation"; it is also covered in the Hansen point-of-view document – "Navigating the Evolving European Power Trading Market".

Crucially, it immediately impacts the output available to the grid.
As the number of renewable energy assets – as a proportion of baseload – increases, their non-deterministic nature is a concern. When power trading markets operate with less-than-accurate weather forecasting, it has grid-scale consequences.

Balancing Act: Power Trading In High-Renewable Markets

The Role of AI

The influx of weather-dependent renewables adds an entirely new level of complexity to the challenge of accurately predicting energy generation and the impact of this on near-term trades. It's no longer a situation where one trading move triggers a logical and somewhat predictable countermove. Whether we want to or not, we're now in a game akin to three-dimensional chess, and one where the rules don't seem to follow an utterly deterministic logic. With so many pieces of information in constant motion, the role of the energy trader has become much more difficult.

So, what if we had tools that continuously evaluated the past generation performance of renewables relative to the prevailing weather conditions to understand better and correlate the two? And what if we could apply this understanding to develop increasingly accurate future production forecasts and trading strategies?

This capability is what Hansen has created with AI-Optimised Power Trading, a solution that combines two best-of-breed energy products – Hansen EDM and Hansen Trade – to maximise business performance, increase revenues and margins and give you the agility to adapt to market evolutions quickly.

Hansen EDM improves business process efficiency by combining metered asset, contract and market communication data into a single platform that seamlessly automates all trading, balance, settlement, and billing operations. Automating all metered and contract data enables effective trading and position management, delivering imbalance and settlement calculations across the asset portfolio.

Hansen Trade is a modular, Cloud-native SaaS solution delivering a comprehensive physical power trading capability that optimises flexible assets and the balancing of renewables. It provides analytics-driven optimisation of short-term trading in all markets, and its unique market insights help maximise the trading of all asset classes. Hansen Trade mitigates the time and costs associated with adapting to market evolutions.

Crucially, it is not some black-box implementation that obscures the analytical logic, delivering a play-and-pray solution that ignores the value of the trader. No, the Hansen solution leverages clear, understandable, and verifiable logic and presents comprehensive trading strategies or, alternatively, to inform a user-defined strategy.

Here's a look at how the logic works: We apply a complex series of correlations and regressions involving randomisation and other statistical analysis techniques to the entire previous year's short-interval weather forecast and energy production time-series data.

The analytical process includes self-correcting logic that invokes continuous refinement and sequential error reduction, ensuring the AI engine unceasingly explores and exposes the most accurate correlation between an instantaneous weather forecast and actual energy production. This process generates a highly accurate, regionally relevant model of near-term renewables output: a model that is always learning, always using the most topical sample data, and continuously reducing the margin of error.

This correlation – in the form of a deterministic production plan – is then applied to other data sets, such as conventional production and consumption forecasts and other variables – to illustrate potential shortfall or over-production. With this superior knowledge of the real-time market situation, traders can exploit market opportunities and avoid imbalance.

The growing prominence of distributed energy resources – particularly weather-dependent renewables – provides energy retailers with unprecedented challenges. Increasing speed and volume in the market brings a new level of complexity to energy trading, forcing decision-making closer to real-time.

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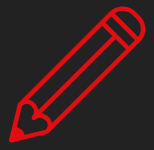
Delivering a Scalable, Flexible, and Agile Trading Solution

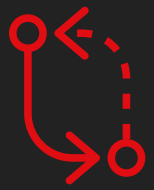
Hansen's AI-Optimised Power Trading solution seamlessly automates all your trading, balance, settlement, and billing operations by leveraging our proven capabilities in managing time-series, contract, and market communication data at scale.

Consolidate to a single energy-related data repository that converges all energy assets and manages multiple contractual positions. Combine your data to improve your business process efficiency and seamlessly automate all trading, balance, settlement, calculations, and billing operations.

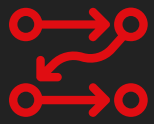
Visualise the market with real-time market awareness that empowers enhanced trading strategies and enables informed decision-making and corrective action, improving your trade-balance position management.



Create unique strategies specifically tuned for individual assets or asset groups. Leverage a user-friendly business-centric interface with no software coding or customisation requirements. Strategy within the trading platform is open, transparent, and configurable.



Automate the operations of distributed asset portfolios and short-term trading across all asset classes. An analytics-driven logic engine seamlessly automates operations across continuous trading, auctions, and ancillary services. Its efficiency enables a quick and seamless transition between continuous trading and auctions.



Optimise short-term trading performance in all markets and deliver unique market insights that maximise the trading of all asset classes. The solution mitigates the time and costs associated with adapting to market evolutions and reduces the barrier to entry to new markets and services.

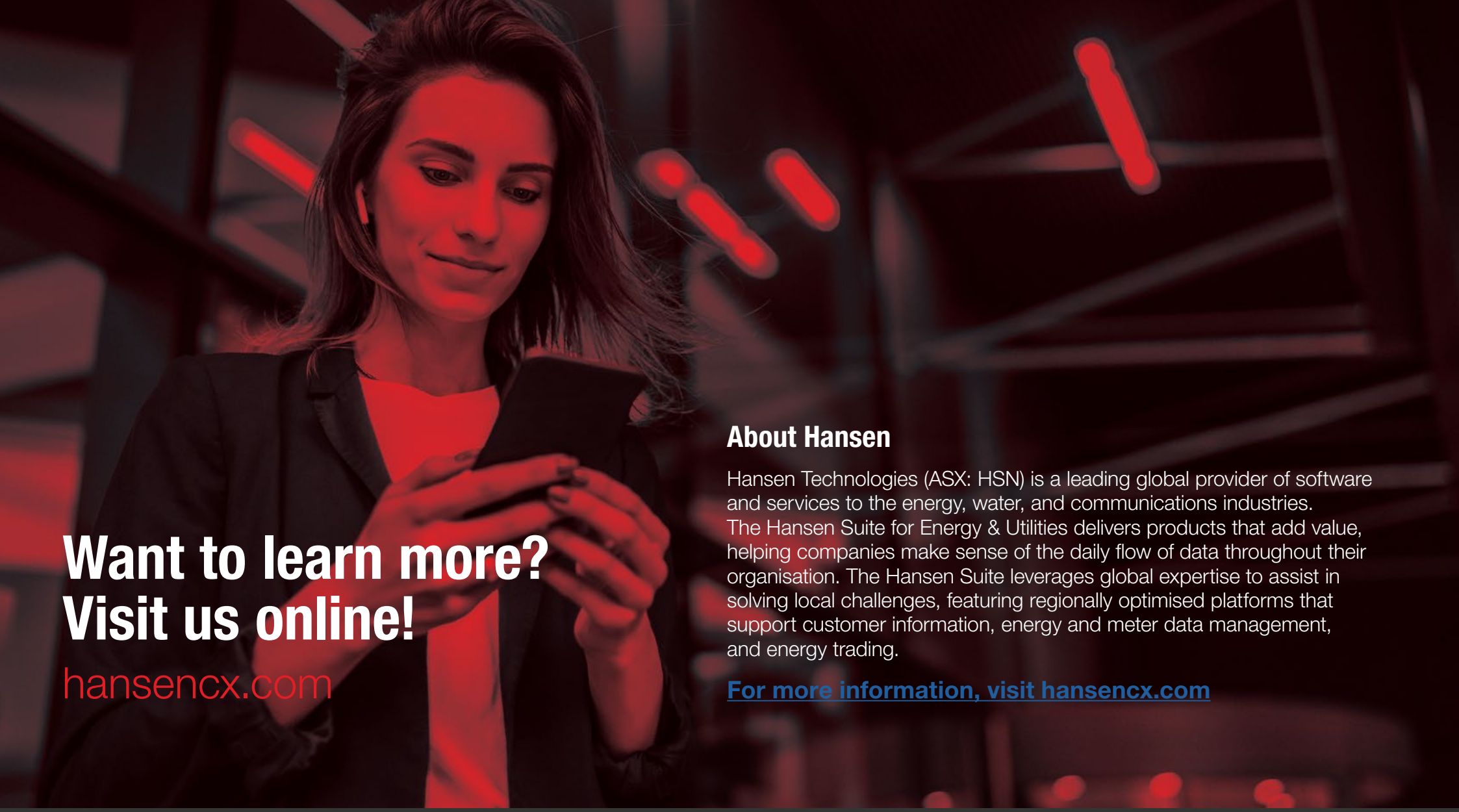
In Conclusion

In our increasingly dynamic energy ecosystem, every megawatt matters. Every power trade becomes a vital part of a complex strategy to keep the power network resilient despite uncertainties, keeping our lights on and the machines running.

As the power system becomes more complex, with the inevitable transition to a diverse range of renewables, many of which are weather-dependent, flexibility, automation, and optimisation of short-term power trading becomes ever more critical.

Energy traders must process vast amounts of data quickly and accurately and gain insights to make informed trading decisions in dynamic energy markets. Correctly implemented, AI algorithms can analyse market trends, historical data, and real-time information to identify patterns, forecast price movements, and optimise trading strategies more precisely than traditional methods. By harnessing the potential of AI, energy traders can gain a competitive edge, mitigate risks, and capitalise on opportunities in a rapidly evolving energy landscape, ultimately driving profitability and success in their trading activities.

Hansen's AI-Optimised Power Trading solution enables you to automate end-to-end dynamic trading using a next-generation logic engine, leveraging inputs like price, weather, and consumption to optimise business performance. Hansen gives you the power to transform in a market where the only constant is change.
Reach out to our team today to learn more and get started.



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About Hansen

Hansen Technologies (ASX: HSN) is a leading global provider of software and services to the energy, water, and communications industries. The Hansen Suite for Energy & Utilities delivers products that add value, helping companies make sense of the daily flow of data throughout their organisation. The Hansen Suite leverages global expertise to assist in solving local challenges, featuring regionally optimised platforms that support customer information, energy and meter data management, and energy trading.

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