

# WORLDMETER.IO AS INTERNET OF THINGS CONCEPT FOR ENERGY DATA INTEROPERABILITY

Ewald HESSE<sup>1</sup>

## Abstract

Grid Singularity is a new venture creating an Internet-based decentralised energy data exchange platform built on the most advanced blockchain technology. This newly structured ecosystem provides a data transparency and integrity solution in a major shift away from a traditional, centralised model of the energy market. The Grid Singularity platform will support a range of valuable applications to be designed and used by diverse energy market participants, from regulators to operators, investors, traders and consumers. These applications will enable forecasting for grid balancing (smart grid management), facilitate investment, trade of green certificates/certificates of origin and eventually energy trade validation.

Grid Singularity has been created by a team of experienced energy market professionals, in partnership with leading blockchain technology developers at Ethcore, who are principal founders of the open source not-for-profit organisation Ethereum. By recording the relevant data in real time at the source (power plant) on the blockchain, the proposed system diminishes the counterparty risk since data can no longer be modified, while decentralised storage ensures that the data generator has exclusive access to own data. The data recording process is to be certified by the respective energy regulators to validate arbitration and/or clear obligations. The main advantage of the platform lies in its interoperability, leading to immense infrastructure cost savings compared to standard technical solutions that require a fully independent vertical integration for each energy market operation. The platform also renders some of the current key entry barriers to energy trade obsolete such as a need to have special accounts/deposits/certification with an intermediary financial institution. The reduced cost and complexity of the system will attract more market players and transform the energy market into a more competitive, and a generally more open and fair market.

## The Grid Singularity platform is structured as follows

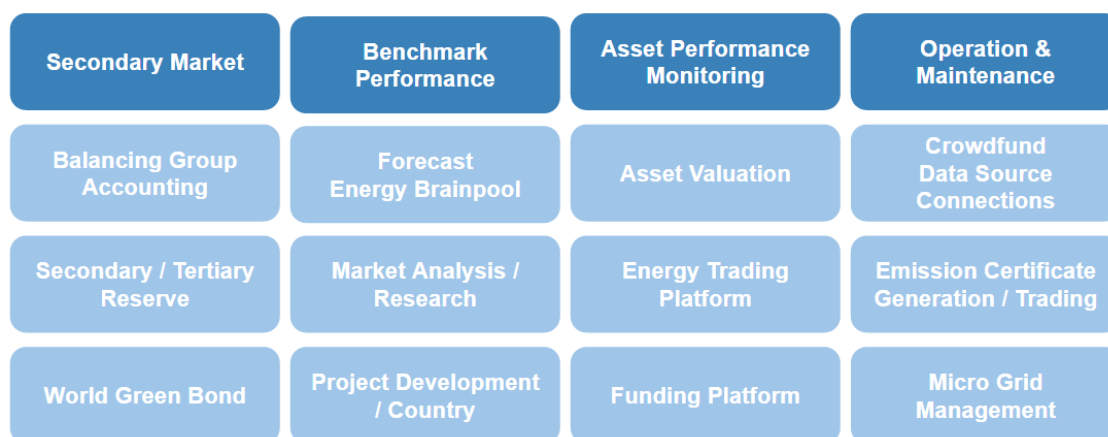
- **Data capturing**  
Realtime kWh traffic is measured by installing a proof of delivery (POD) meter at the site (e.g. power plant). Middleware integrates into the meter and captures the production data. Communication between POD meter and middleware can be realised via Ethernet Lan, WiFi, LoRa, GPRS/3G/LTE, Satellite or Power Line Communication (PLC). Besides the open data, private data will also be captured by the blockchain but not distributed. A private data management system (zero knowledge proof) will enable the data owner to trade data peer-2-peer at will. Decentralised data storage will guarantee exclusivity of data access to the generator of that data (including an option to share data). The Grid Singularity company will have no possibility to access private data of any participant on the platform, and this will be clearly stated.
- **Data processing and distribution**  
The captured data is parsed, formatted and distributed securely, via the blockchain, where it can be used by third parties, including automated services based on smart contracts. This record is to be certified by the respective energy regulators to validate arbitration. This mechanism maximises efficiency, provides full transparency, while at the same time fulfilling any privacy needs required for particular entities in the system. The system is scalable, and additional participating power plants or other interested energy market participants can be added at any time.

Grid Singularity will provide several free applications as a starting point to foster knowledge and data sharing (shown in darker blue colour below) and design the system openly to enable third parties to design their own apps, providing them with a database and interoperability structure.

The application fee revenue will be shared by the Grid Singularity and the application designers. Some examples of future applications include the following:

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<sup>1</sup> Grid Singularity GmbH, Stumpergasse 64, Tel.: +43 664 2822791, [ewald@gridsingularity.com](mailto:ewald@gridsingularity.com), [www.gridsingularity.com](http://www.gridsingularity.com)



**Figure 1: Some examples of future applications.**

- *Benchmark Performance App* will enable the power plant owners/managers to source the performance of similar / local power plants. This information could lead to performance optimisation and other insights as for example: (i) solar power plant may perform less than the neighbouring solar power plants, indicating that there is snow or sand on the panels; (ii) a hydro power plant increased performance up the river serves to warn the power plant downstream to prepare for the production increase.
- *Secondary Market App* could facilitate assets trading.
- *Asset Performance Monitoring App* would enable financial institutions to monitor performance of their assets and disclose that information on their own domains. Additional information that can be rendered is the quantity of CO<sub>2</sub> emissions that are generated - or saved by use of renewable energy.
- *Operation & Maintenance App* will be designed in cooperation with OEM's. With the availability of technical data OEM's can predict the lifetime expectation of power plants equipment and provide recommendations for efficient operation of power plants.
- *Balancing Groups Accounting App* would enable distributed producers to perform automated grid balancing services. Grid operators need to maintain a stable provision of grid frequency (i.e. 50 Hz) across the distribution lines. In decentralised energy markets, further costs for grid operators arise due to the complexity of balance cost accounting. With this application, energy generation connected onto the blockchain will deliver electricity on demand within seconds, according to the associated smart contract.