DIGITIZATION OF THE RENEWABLE ENERGY SECTOR

CURRENT TOPICS IN DATA ENGINEERING 2019

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Abstract

The lack of data about energy usage has led to inefficiencies. The scope for efficiently gathering and analyzing the data from various sources of energy has been a challenge. This case study takes a peek towards the importance of Big Data and IoT in the field of energy. Mostly towards how the data is collected and analyzed by the industries.

Introduction

Evolving technologies in the energy sector can provide unprecedented capabilities for forecasting energy demand, shaping usage patterns, preventing outages and more. At the same time, these advancements generate overwhelming amount of data volume with complexity. To utilize this information to gain insights, energy and utility companies are seeking to big data technologies capable of high-volume data management and advanced analytics.

From IoT devices / other sources

Unstructed / Semistructured data

Using Big Data concepts

Structured data

Predictive Analytics

Visualization

Why IoT?

Concept :

- connecting everyday objects to networks
- Encompasses Machine-to-machine communication(without manual involvement)
- Connecting “things” to networks(real-time data transmission)

Why Big Data?

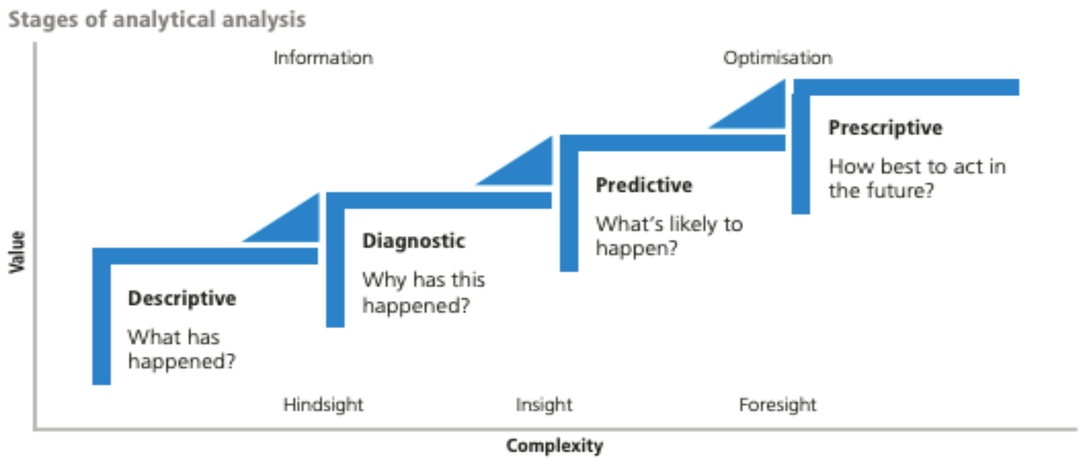
Concept:

- Volume - the size of data transferred
- Variety – Unstructured/semi-structured/structured
- Velocity – real time/batch
- Veracity – accuracy and reliability
- Value – data processing makes sense/ has a meaning

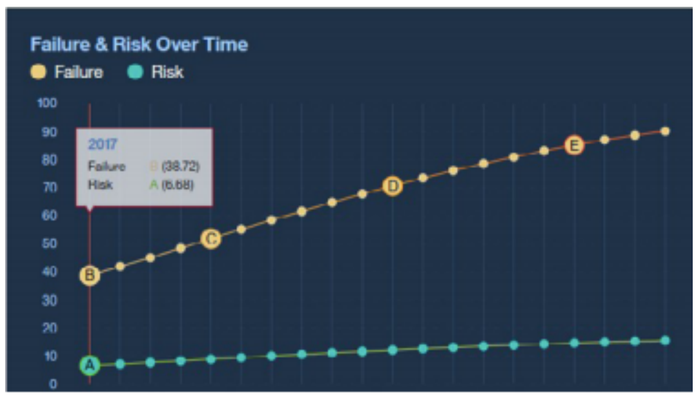
Extraction and transmission of data from IoT devices

- Extract IoT data from devices, at the right time to the right systems
- Infrastructure required for IoT applications – edge devices, wireless network connectivity and cloud APIs
- Most IoT data is gathered by Radio Frequency Identification(RFID)
- Inexpensive wireless, battery powered, IoT node for remote data collection in preference to a wired solution using a data-logger that has limited storage that cannot be remotely accessed.
- IoT embedded system - feature extractor and classifiers

Predictive Analytics

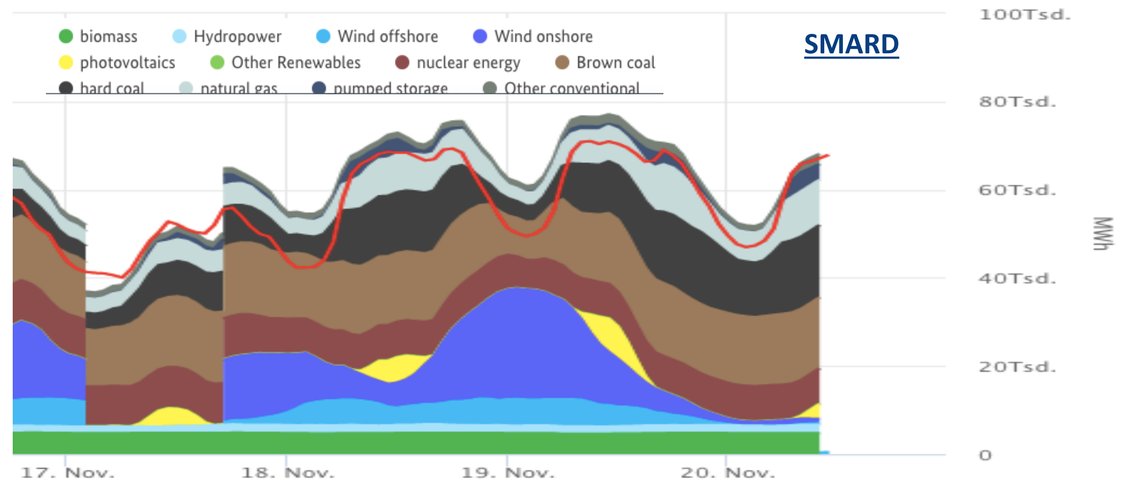


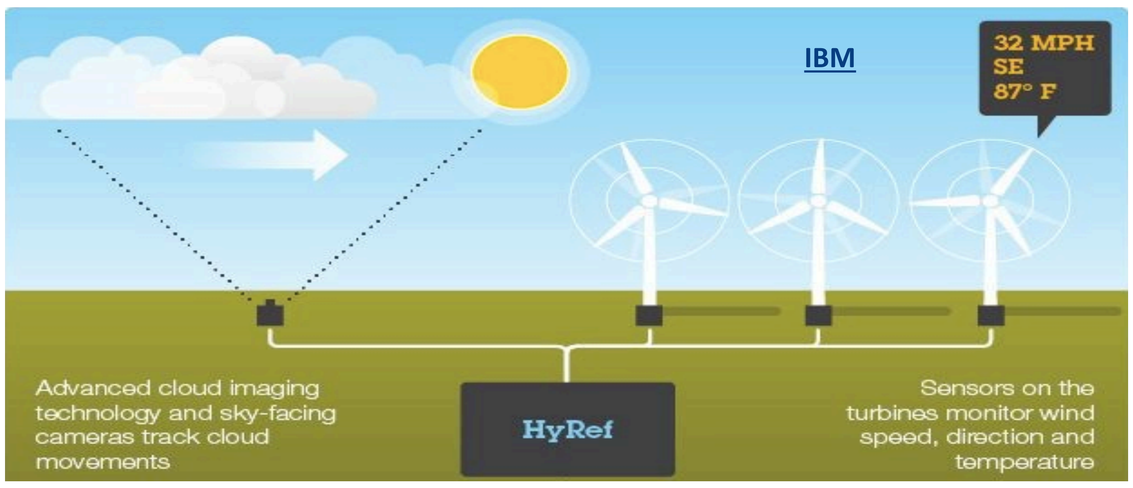
- Predictions help determine the maintenance schedules and procedures that have the least impact on production. Based upon these recommendations maintenance personnel can then generate work orders.
- Predict potential asset degradation or failure.
- Predicitve model generator generates predictive models for each wind turbine/ solar panel /heliostat and other components.
- Monitoring agent for making predictions using the generated models at fixed time intervals.



Initiatives

- Decisyon provides a smart wind farm solution
- SeeMyMachines provides a real-time insight of wind farms anywhere on a single screen
- Octave provides All-in-One cloud asset management for asset management and monitoring
- Crescent Dunes Solar Thermal Facility where Over 10,000 tracking heliostats focus solar energy at the receiver on the 640-foot power tower
- Scaling Solar program, by the World Bank Group, to supply affordable, reliable energy
- IBM HyRef and Wind360 provides weather forecast for a wind farm as far as one month in advance and provides role based access to historical, current and predictive insights for wind turbines and wind farms - power production, turbine availability, wind power conversion rate and turbine health.
- SMARD – real time electricity generation and consumption in Germany





Challenges

- Predicting Life Cycle of a device or component
- Forecasting power output and maintainance
- Weather prediction – renewable energy sources can be unavailable sometimes
- Asset management – Installation complexity that has often slowed the development and deployment of IoT applications
- Producing energy in the most efficient way possible
- Security of data
- Inefficiency in electricity consumption due to deficiencies in grids.

Conclusion

- Smart digital solutions can monitor component/device parameters, track power productions, generate visual alerts, detect underperformance and monitor maintainance.
- Installing additional OEM(Original Equipment Manufacturere) equipment to the solar panels, such as battery Energy Storage Systems, to adapt to solar production so that stored energy can be delivered at peak times.
- Data extraction from equipments can be simplified
- Digitalized energy systems in the future may be able to identify who needs energy and deliver it at the right time, in the right place and at the lowest cost.
- Using Regressions, Machine Learning and Artificial Intelligence to determine relationship between event/outcome, uncovering patterns in data and learn independently responding to environmental stimuli respectively.

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