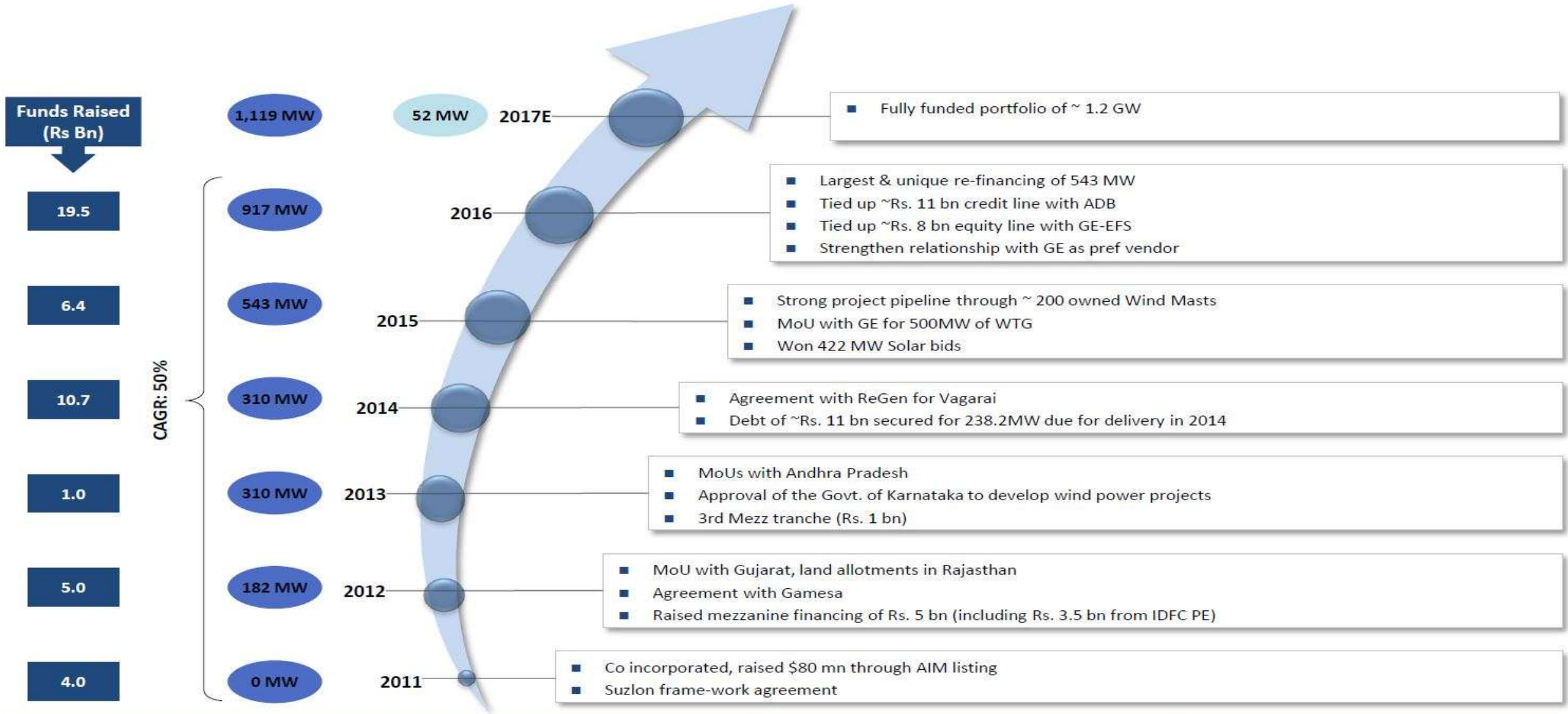




**A smarter way to manage your fleet;  
Big Data, Artificial Intelligence &  
Cloud Computing**

# Mytrah – The Most Premier Renewable Platform in India

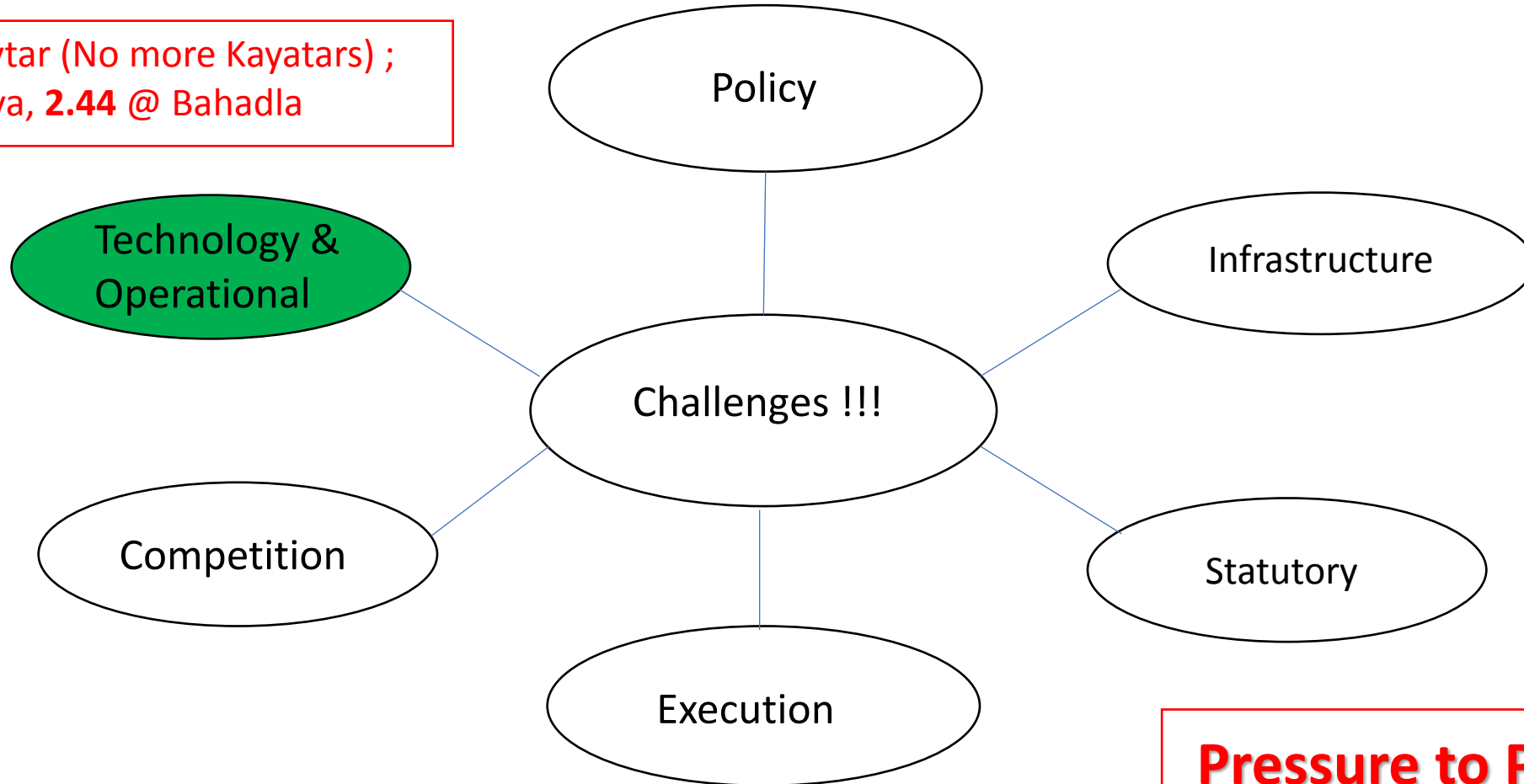


**Fully Operational Capacity of ~1 GW Built Up in 5 Years – One of the Fastest Rollouts With the Support of Marquee Financial Sponsors**



# Challenges for Sustainable Business Development

**3.46 @ Kaytar (No more Kayatars) ;  
2.97 @ Reva, 2.44 @ Bahadla**



**Pressure to Perform**

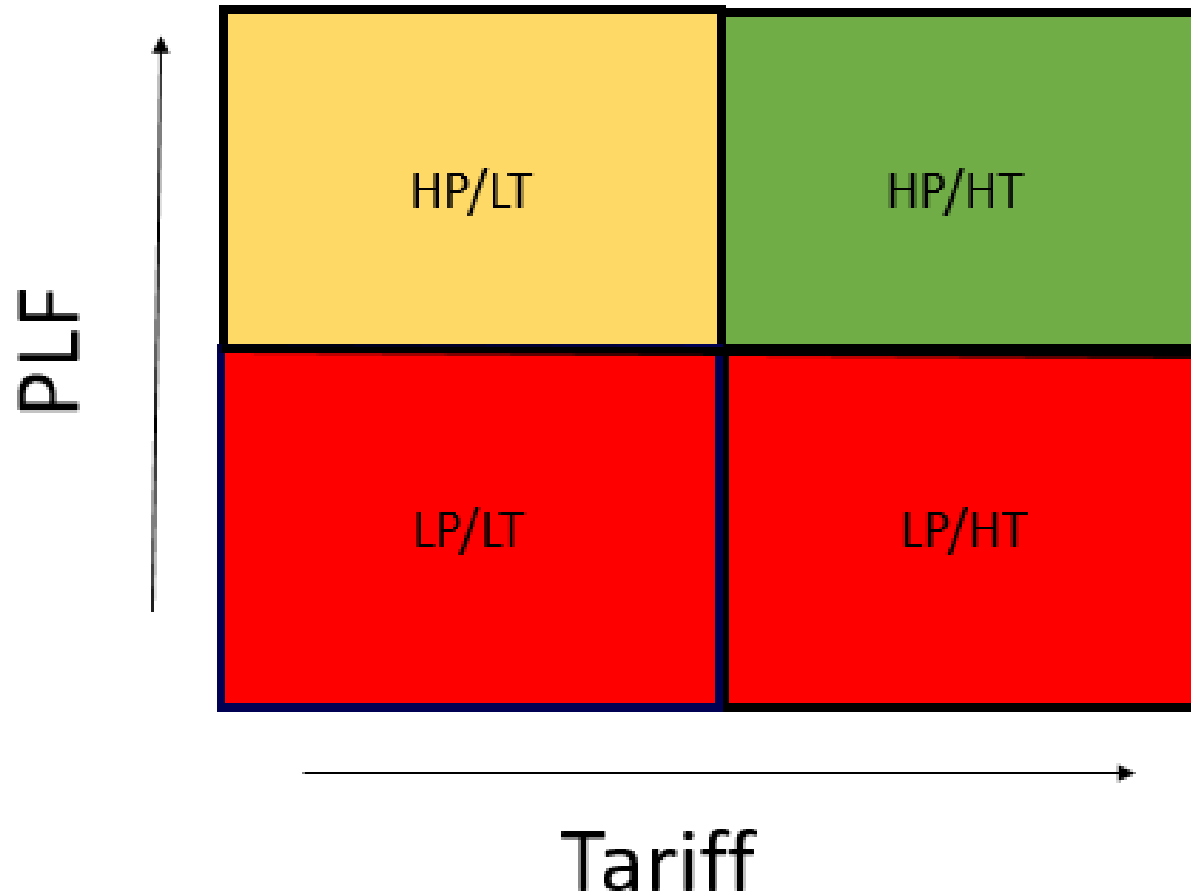
# Technology & Operational Challenges

- Industry moving from MW to KWhr
- Forecasting and Scheduling ( and impact on revenue)
- Skilled work force
- Inertia towards change ; what is for me ? (time Vs energy availability, contracts)
- Standards and Regulations
- Infrastructure, Connectivity & RoW
- IP Vs Open source (need of industry maturity)
- Lead time from identification to fixing
- And the list goes on !!

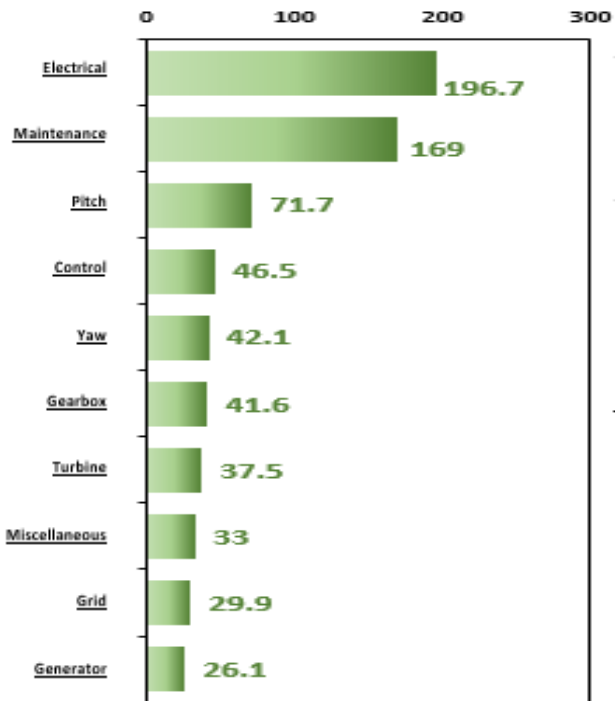
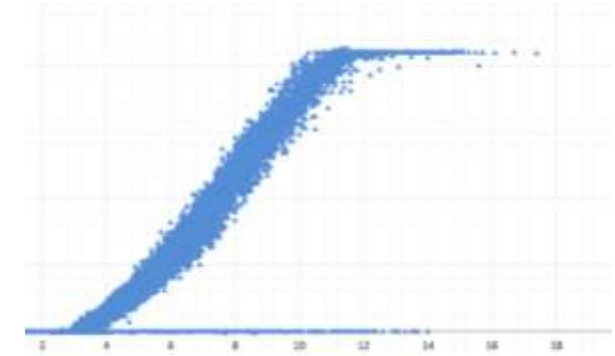
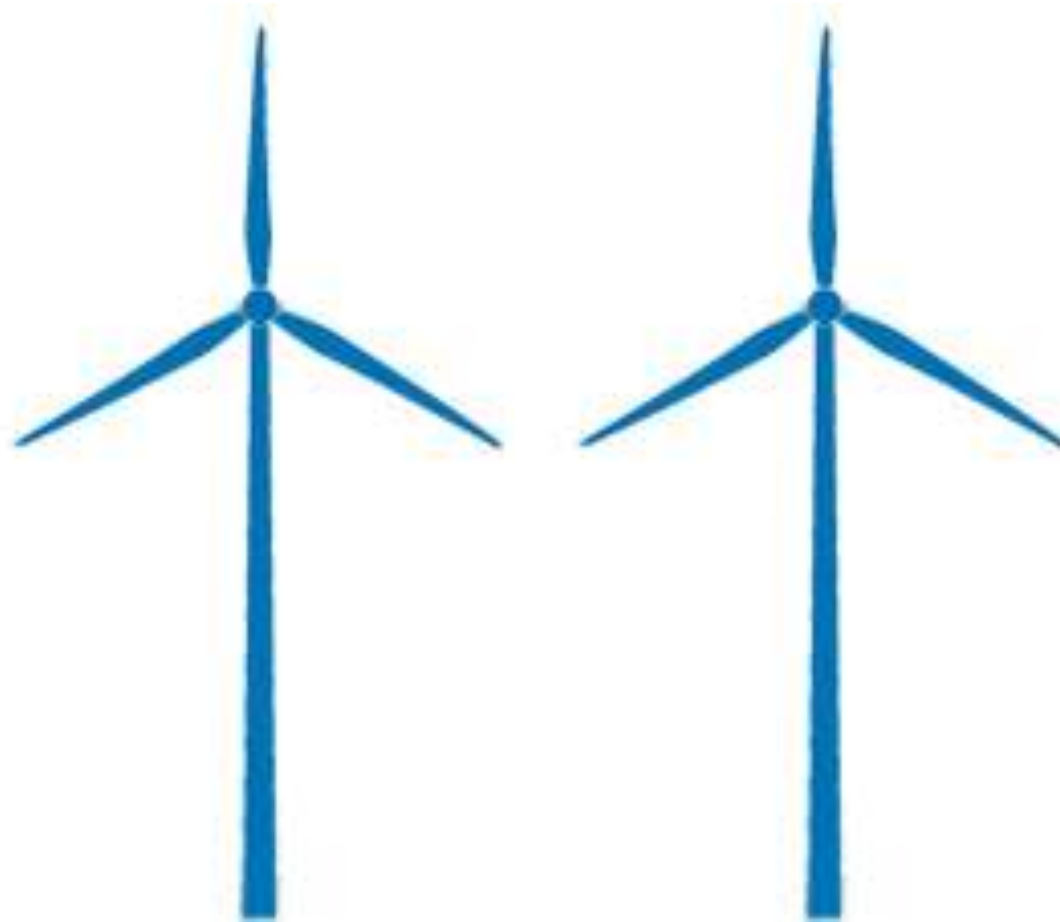
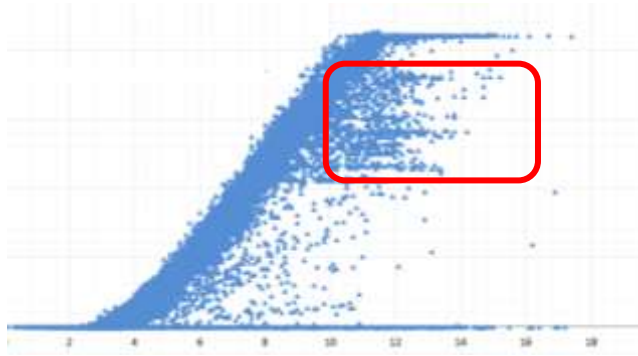
# PT Matrix – Sustainable generation matters



(Difference between a non performing asset and a performing asset is few hundred units !!!)



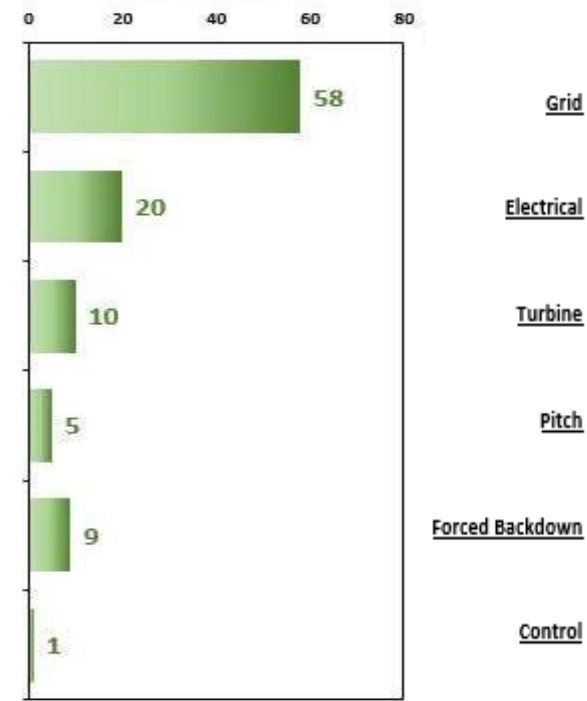
# Generation v/s Performance



Breakdown (hrs)

**5304535 kWh**

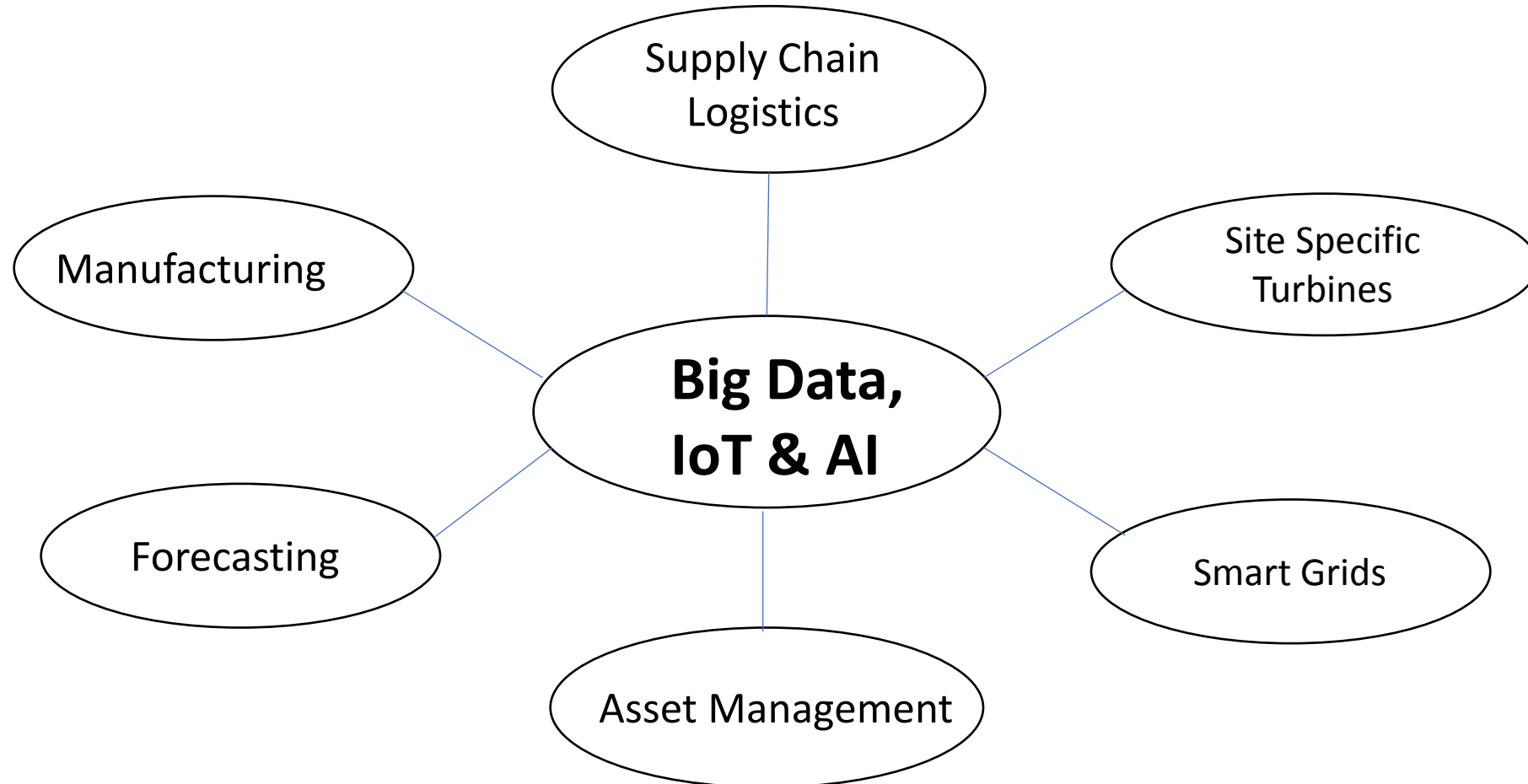
**4804642 kWh**



Breakdown (hrs)

\* 2 nearby turbines of same site

# Way Forward: Digital Solutions



# Did you know it?



- 90% of the data today in the world has been created in the last 2 yrs alone. Digital universe is doubling in size every 2 yrs.
- The data we create and copy annually will reach 44 Zettabyte by 2020 (1 ZB= 1 trillion Gigabyte)
- Boeing 787 planes collect over a half terabyte of data (like engine health, air traffic control, route restrictions, fuel use etc.) per flight
- Google Deep Mind beat Alphago Champion Lee Sedol 4-1, March 2016.
- Every Minute we send 204 million emails, Generate 1.4 million Facebook Likes, Send 278K tweets and Upload 200K Photos to FB.
- Google alone processes on an average over 40K search queries per second, Making it over 3.5 Billion in a single day.
- **'Special'** people are willing to pay extra to feel like this ( Delta Airlines Big data studies....)
- The Majority of people ( 87%) have not heard of the term **'Internet Of Things'**.



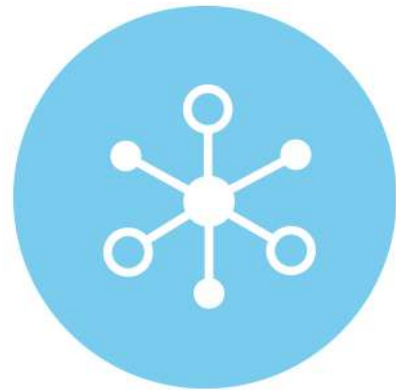
# Data is Everywhere



“Turning Data into actionable insights”

**VOLUME**  
**VELOCITY**  
**VARIETY**  
+  
**COMPLEXITY**

**SCALABILITY**  
**MODULARITY**  
**PERFORMANCE**



**INTEGRATE**



**ANALYZE**

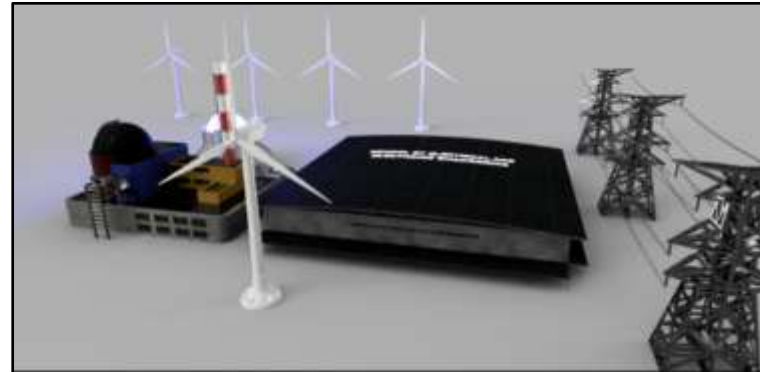


**VISUALIZE**

# Big Data , IoT & AI

## ✓ Manufacturing:

- Frugal Innovation
- 3D printing
- Smart Alloys
- Brilliant Factory



3D printing

## ✓ Site Specific Turbines

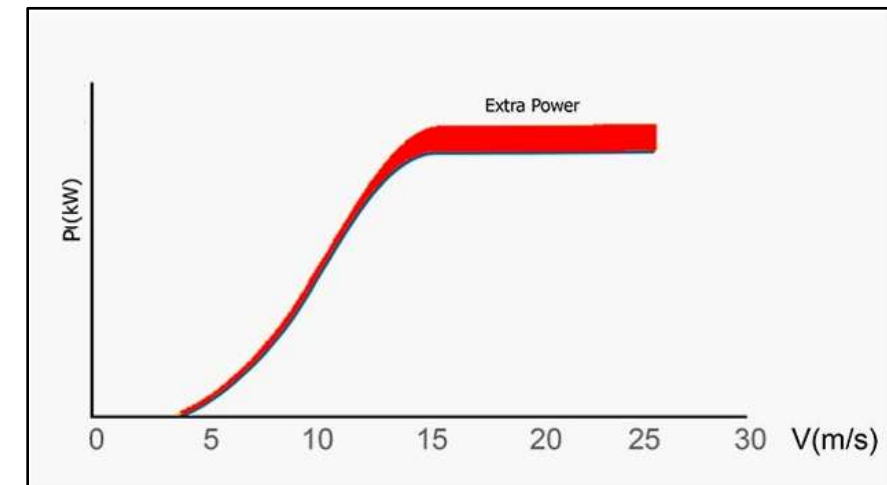
- Power UPs
- Customized Hub Heights, Rotor Dia & Generator capacities.
- Re-Calibration of Cost & Technology.
- [Buddy Turbines](#).
- [Digital Clone](#)
- Wind Turbines are becoming more likely of software commodity.

## ✓ Smart Grids:

- Smart Forecast
- Intelligent Communications between Grid & Wind Farms ( Siri !)



Brilliant Factory



Power UPs

# Digital Asset Management

- A Modern WTG produces 700-1000 various signals !!
- Assessing Right data at Right time.
- Diversity in Technology, Geographical Spread, Heterogeneous SCADA.
- Visualize-Analyze-Act ( Monitoring, workflows, Prognosis/Diagnosis)
- Institutionalizing the Knowledge (Intelligent Systems & Processes)
- Integrating complete **supply chain management**- Predictive Analytics, Digital Inventory etc.
- Platform Independent Solution (OPC)

# Automated Intelligent Analysis Tool (AIA),

- Machine learning and pattern recognition - Advanced analytics algorithms
- Big data databases (clustered and distributed)
- Mature machine learning technique - enhancing life of turbine components
  - thereby increasing the effective productive life of turbine.

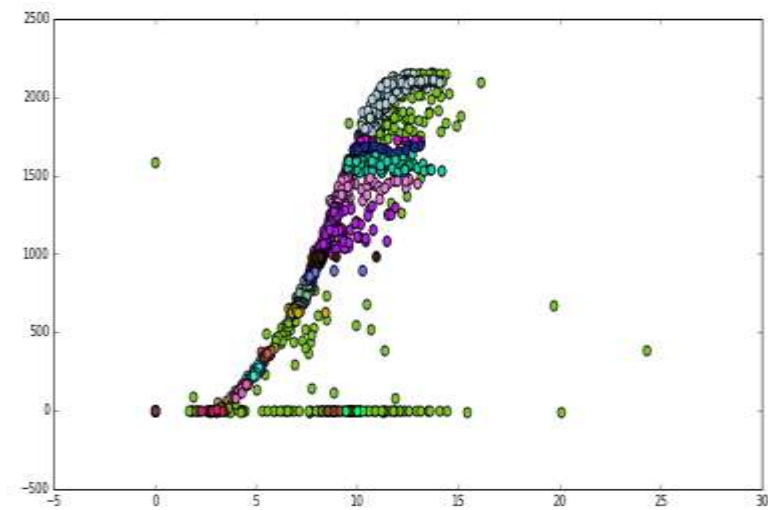


Fig1. Automated Clustering

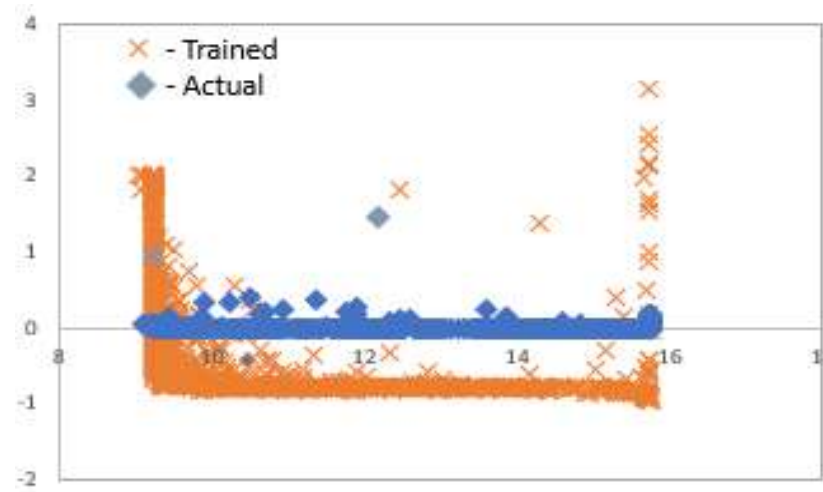


Fig2. Machine learning Technic

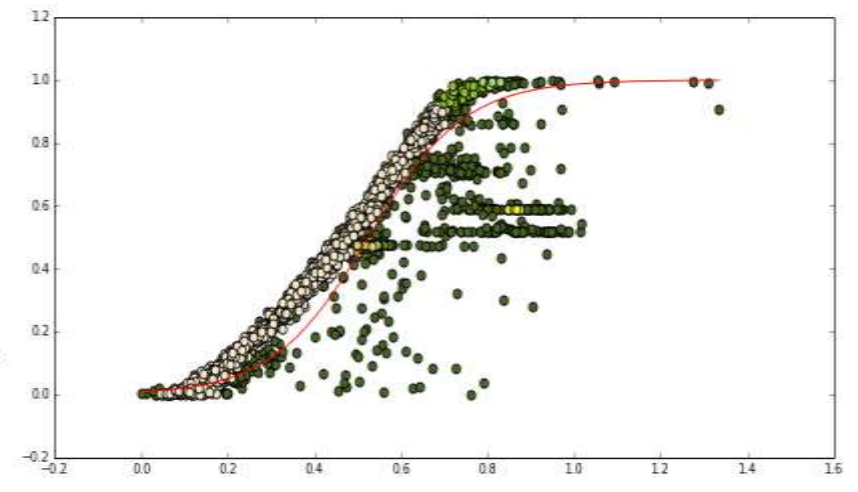
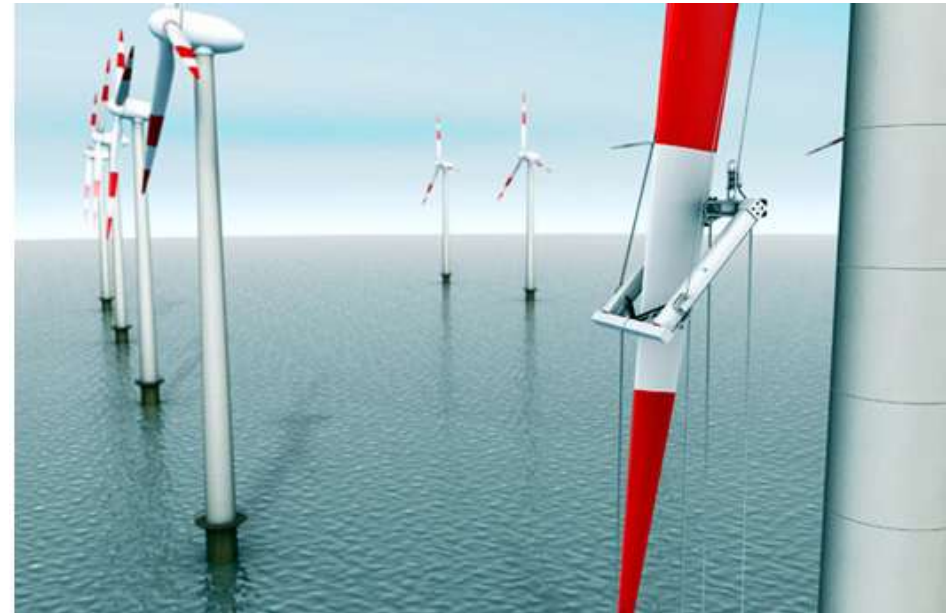


Fig3. Curve fitting and Pattern Recognition.

# Beyond the software

- Drones used for Blade & Tower Inspections, Aerial Survey.
- Robots for Surveillance & Cleaning.
- Thermal cameras.





# Hybrid/Carbon fibre and Nano powder reinforced composites for wind turbine blades

- Due to the increase in blade size, the choice of material has become the critical issue.
- Aspects should be taken into consideration for design of Turbine blades, among them – high fatigue strength, less weight, less cost and potential of recycling.
- Joinable / Attachable Blades



In God we Trust; All Others must bring Data...