

Exceed the Expected

Leveraging technology to deliver business value with your data: Real life examples in the renewable sector



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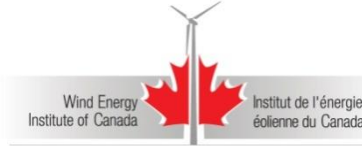
Pre-construction

- ❖ Technical evaluation of planned wind or solar farms
- ❖ Wind resource assessments for onshore & offshore projects (>8,000 MW)
- ❖ Due diligence & peer review
- ❖ Contract negotiation with OEM

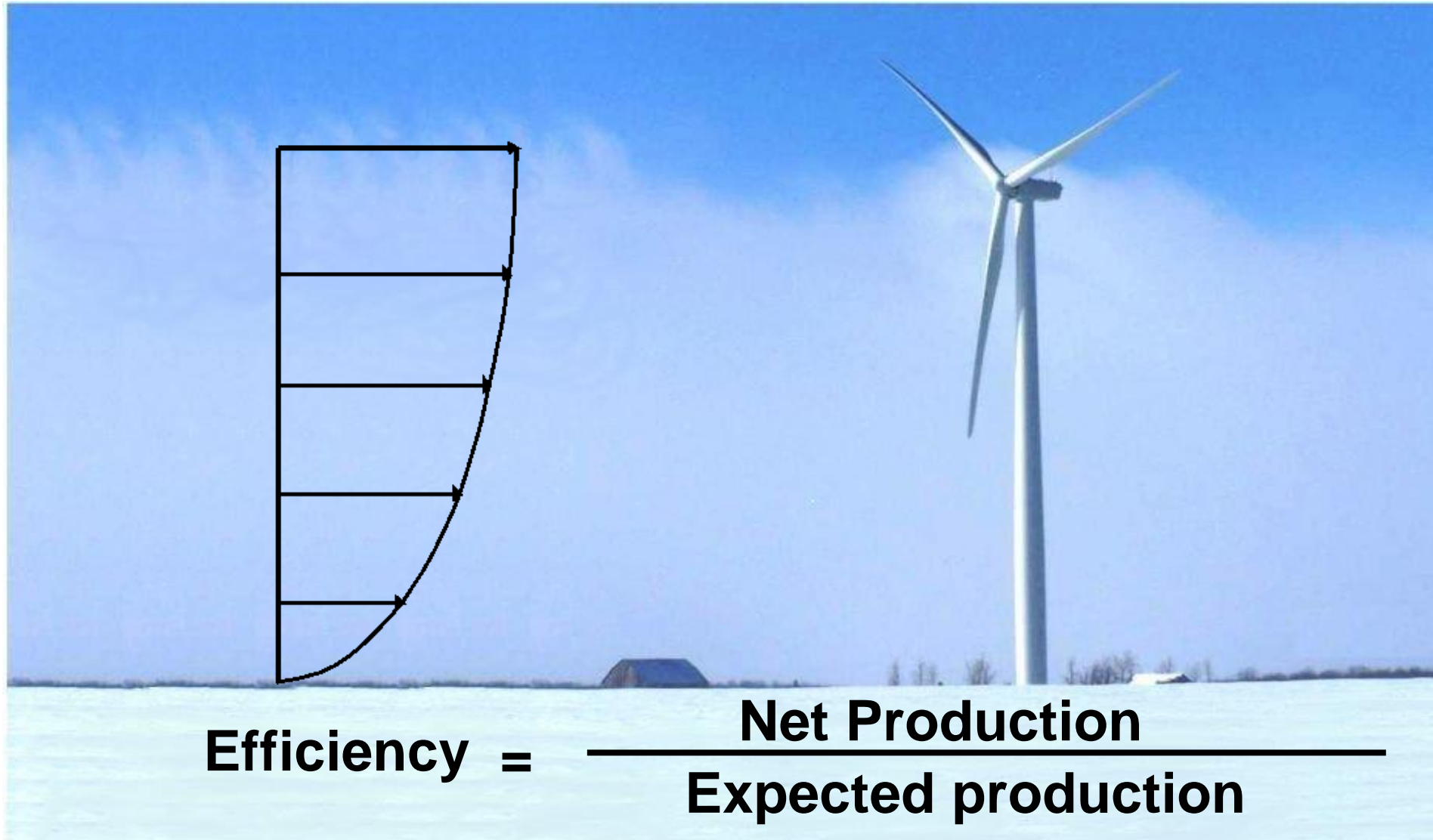
Post-construction

- ❖ Production data analysis
- ❖ Performance monitoring (>4,000 MW)
- ❖ Database & Control room creation and optimisation
- ❖ Upgrade package validation
- ❖ Technical contract management
- ❖ Arista CONNEX

Our Clients (Since 2008)

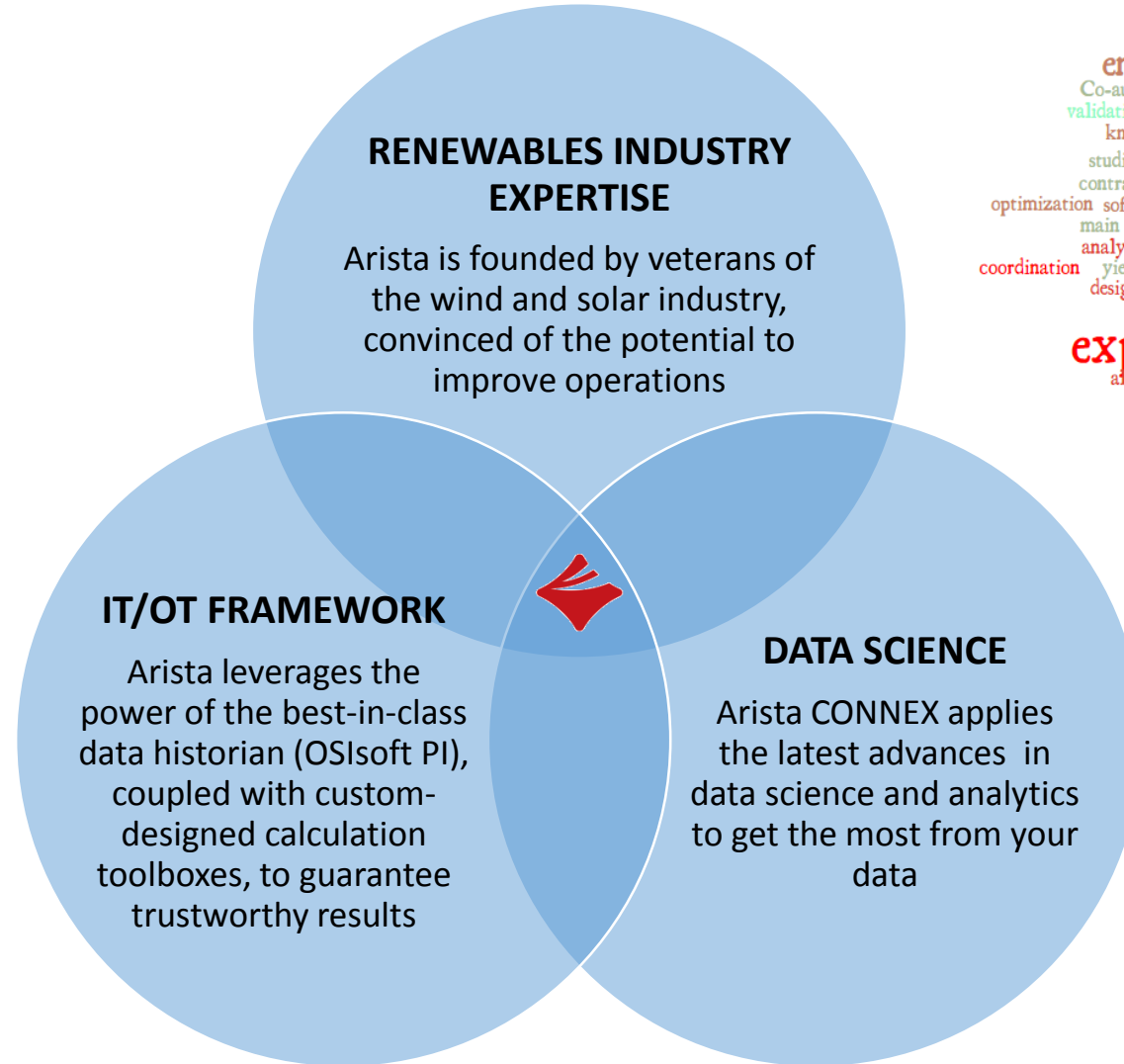


Power Performance of Wind turbines



$$\text{Efficiency} = \frac{\text{Net Production}}{\text{Expected production}}$$

Why Arista ?



energy wind
Co-authored monitoring
validation Extensive comparison
knowledge journal Mechanical
studies project Skilled upgrade Engineering
contractual PhD
optimization software multiple data
main focus solar
analysis
coordination yield calculation turbine
design farm pre-feasibility technical Experienced
including articles
experience
algorithmic resource
development
hydro

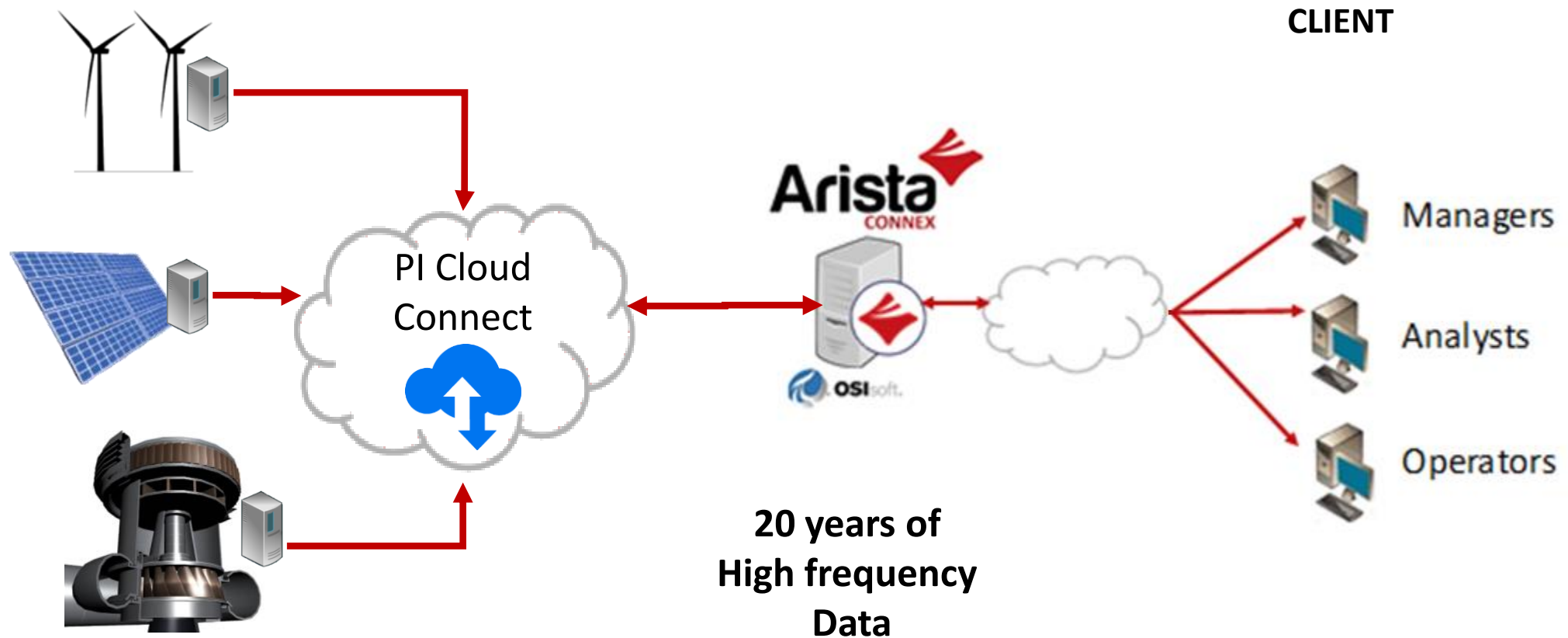
Realtime
FuzzyLogic PhD Python
DataScientist
PatternRecognition
MATLAB^R IoT BigData
Bayes TimeSeries
BusinessIntelligence
HighSpeed



Official partner of OSIsoft

Arista CONNEX is equivalent to a remote centre of excellence

Simplified Arista CONNEX Infrastructure



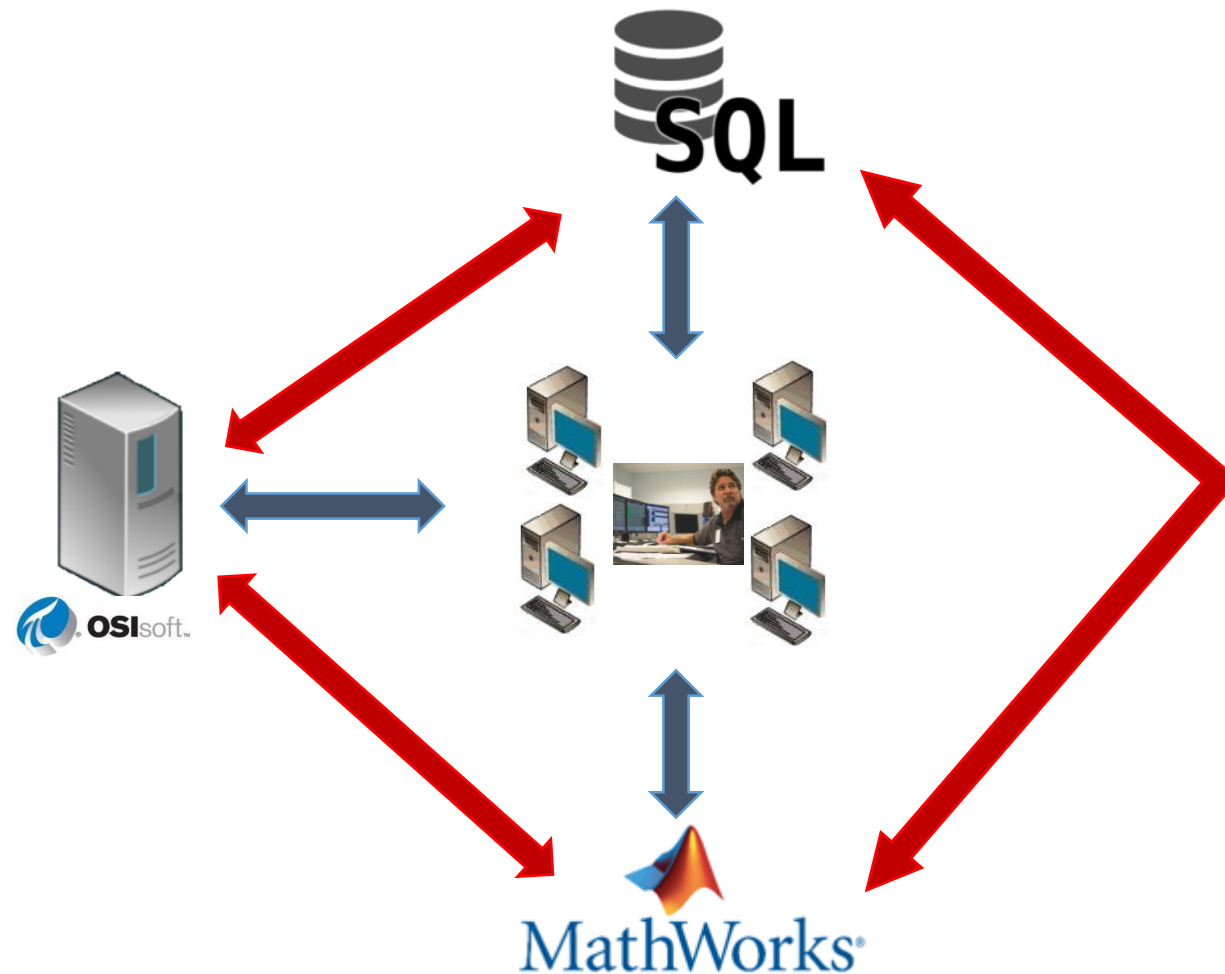
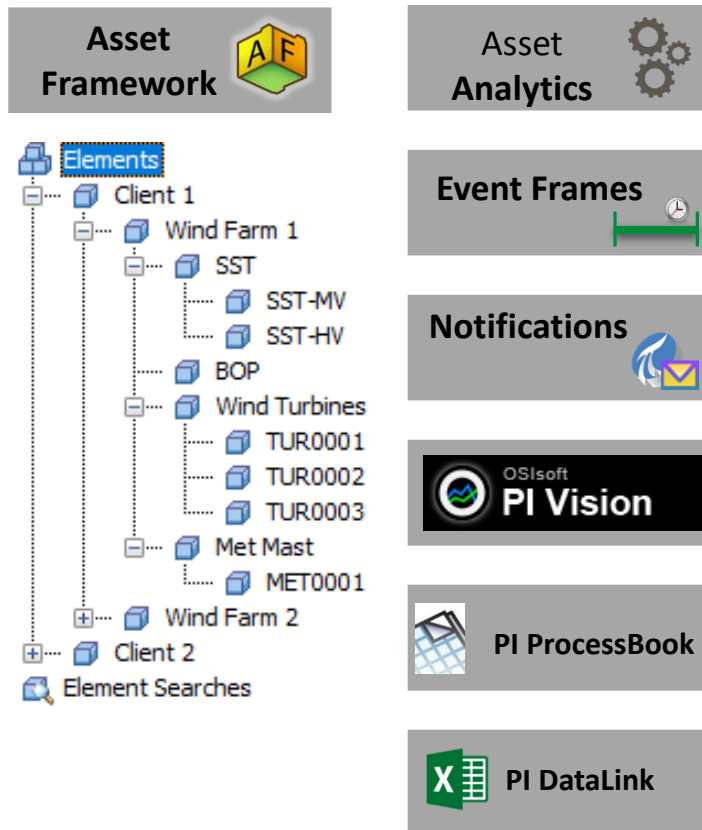
Arista CONNEX – list of actual clients



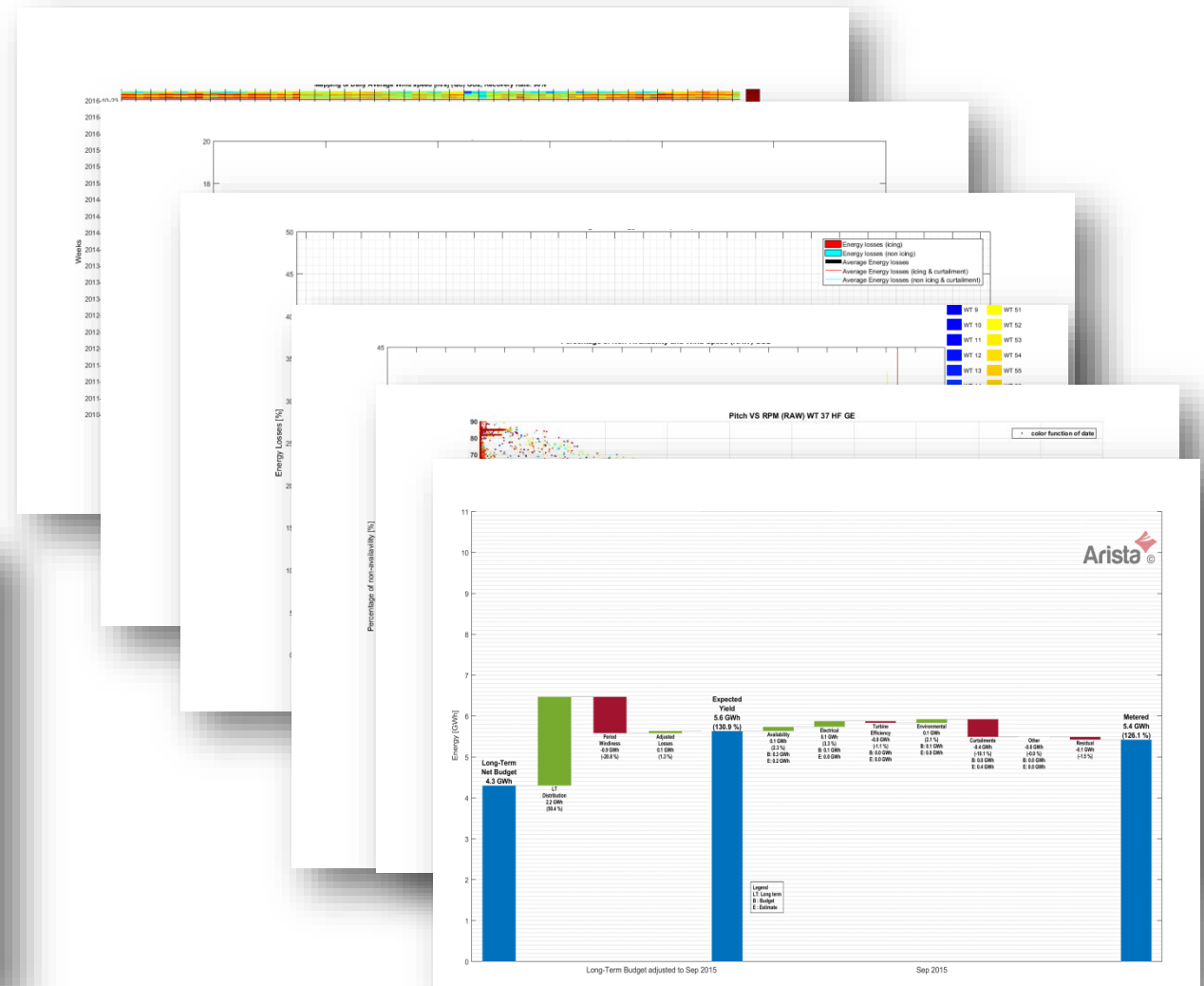
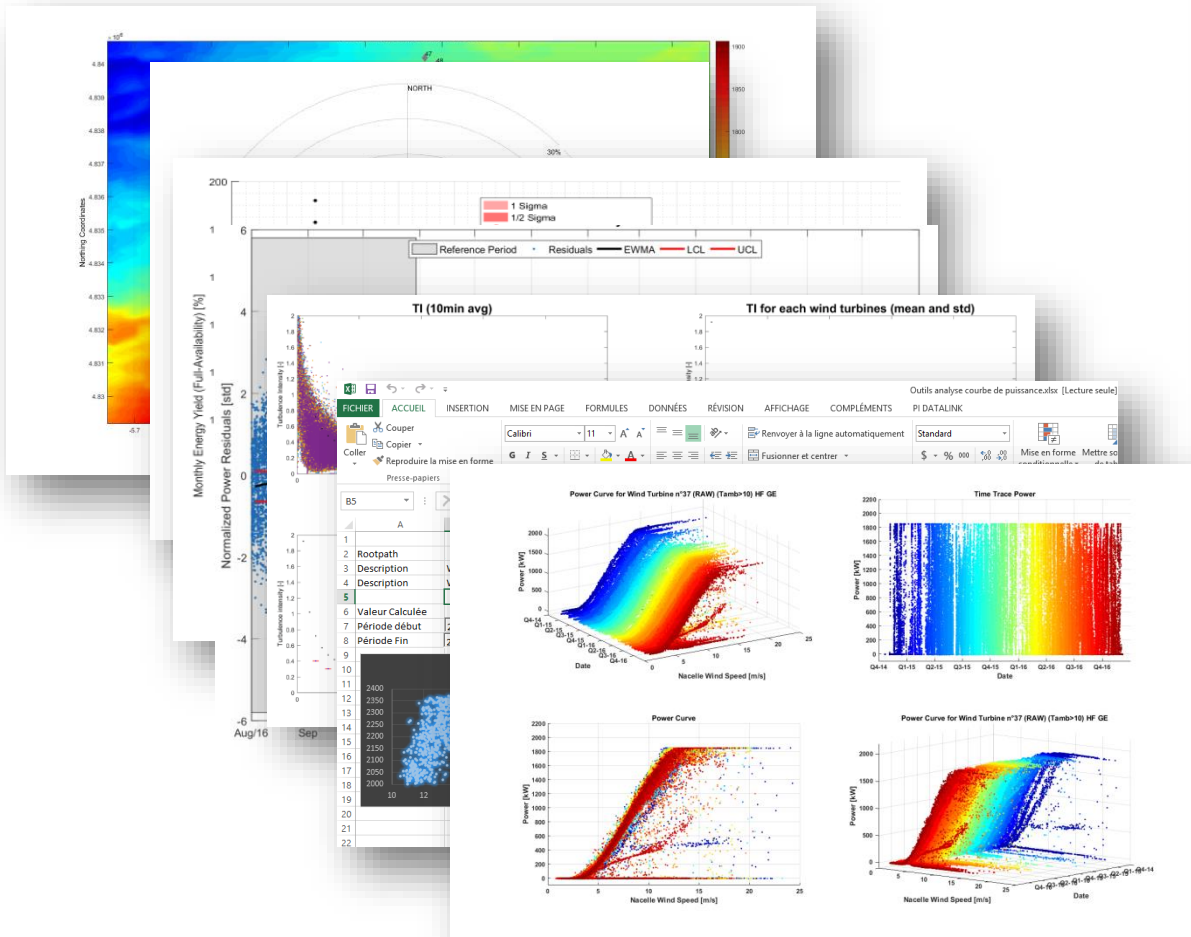
Over the past 10 years, Arista has been involved in various capacities in the monitoring of operational wind farms (> 4,000 MW). Arista has conducted performance monitoring under Arista CONNEX for > 1,200 MW of wind assets.

Client No.	No. of Wind Farms	No. of WTGs	Manufacturer	MW installed
1	6	393	GE	590
2	3	154	Enercon	335
3	1	43	Enercon	101
4	1	11	Siemens	30
5	1	47	Senvion	149
TOTAL	12	648	4	1,205

Arista CONNEX Architecture



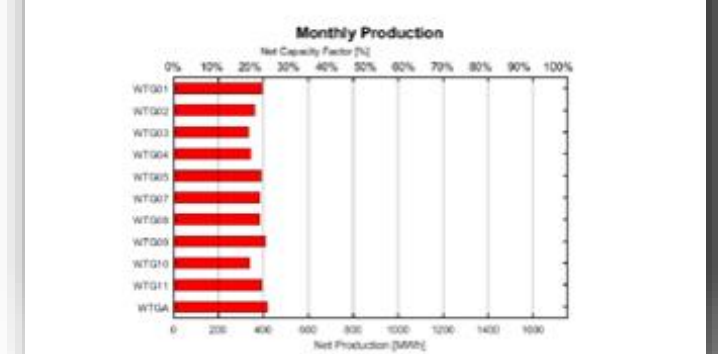
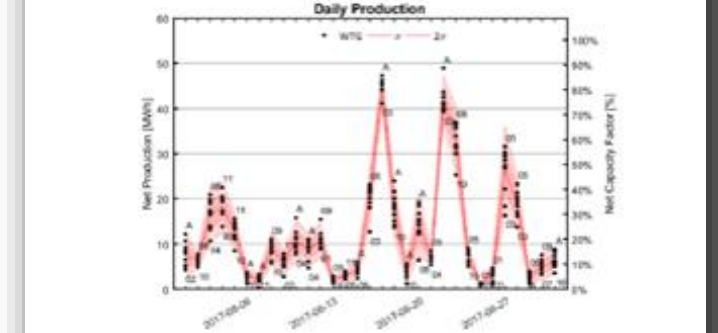
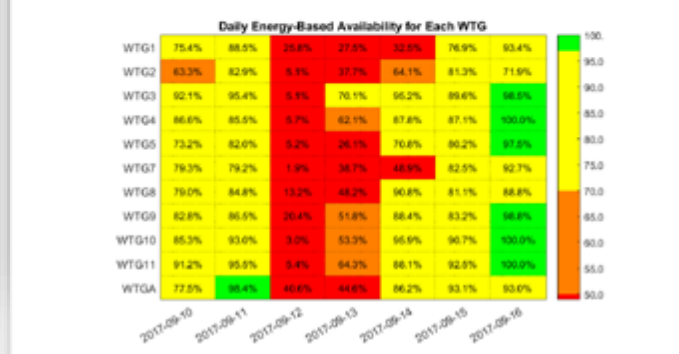
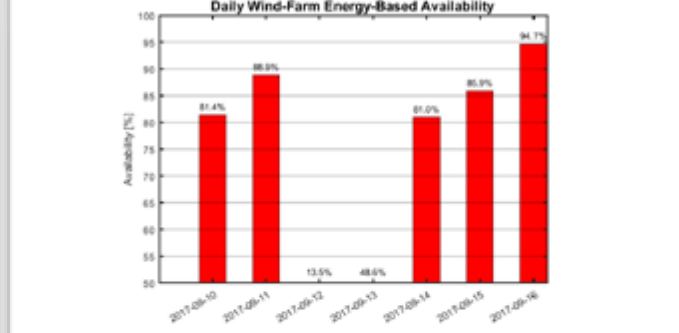
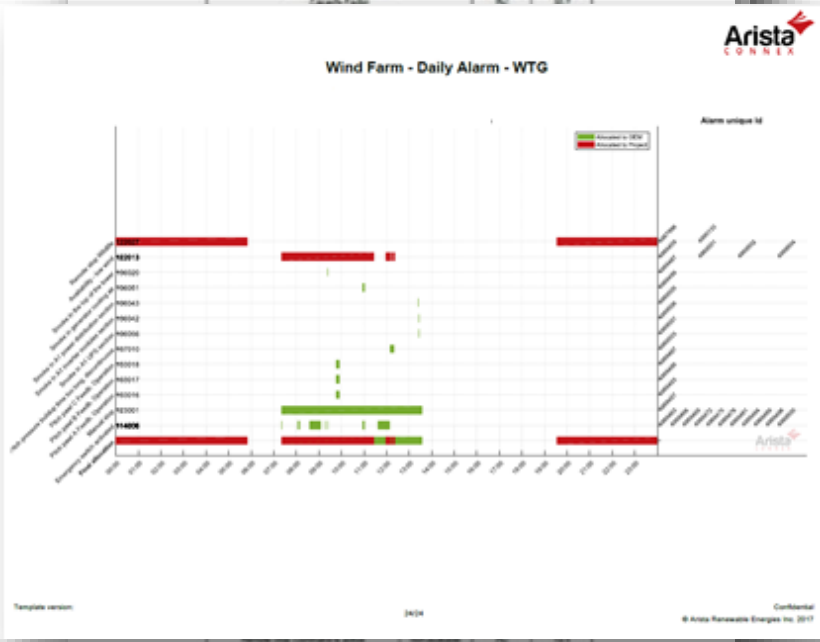
Advanced Analysis



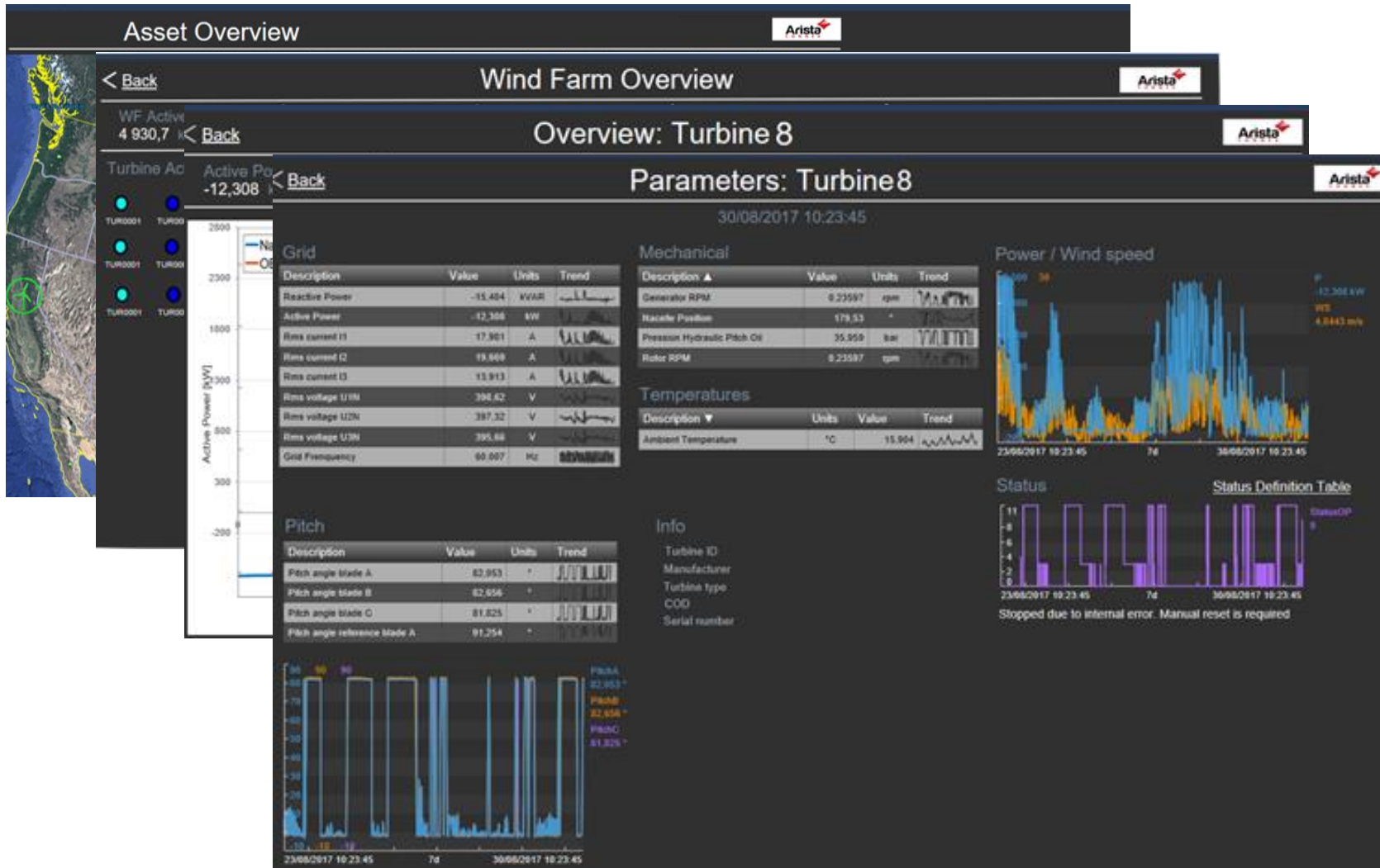
Arista CONNEX



Automated Reporting (Daily, Weekly, Monthly)



Online dashboard



Web Access to
Advanced Analysis
&
High Frequency
Data

Context

- ❖ ~30 MW Wind farm

- ❖ Owner required expert operational performance follow-up to enable :
 - ❖ Performance assessment
 - ❖ Performance improvement
 - ❖ Compensation from other stake-holders
 - ❖ Commercial negotiation, etc.

- ❖ Arista CONNEX was implemented in April 2017, to obtain operational intelligence

Arista CONNEX – Success Story



Concrete examples – ~30 MW wind farm with CONNEX

(1/2)

Arista CONNEX findings	Result	Gain / Savings [\$]
Owner under-compensated during grid curtailment	Grid operator paid the missing compensation.	> \$100,000
Turbines not achieving maximum power	Increase in revenue by 0.1%	> \$10,000
Incorrect calculation of OEM-guaranteed availability	More accurate compensation for availability guarantee	> \$50,000

Arista CONNEX – Success Story



Concrete examples – ~30 MW wind farm with CONNEX

(2/2)

Arista CONNEX findings	Result	Gain / Savings [\$]
Several power-performance improvement proposals	Approximately +3% in AEP	> \$100,000
Un-reported and unnecessary changes made by OEM for icing-management	OEM is evaluating removal of this new algorithm.	> \$100,000
Abnormal wind speed reading, causing excessive bat curtailment .	OEM replaced sensor	> \$5,000

TOTAL SAVINGS (<6 MONTHS): > \$365,000

Arista CONNEX – Other Successes



Examples of savings for other Arista CONNEX clients

(1/2)

Arista Analysis	Result / Savings	Gain / Savings [\$] (for 100 MW wind farm)
High frequency maximum overpower	> 1 gearbox or bearings	> \$200k
Long-term increase in drivetrain vibration	> 1 gearbox or bearings	> \$200k
Fleet temperature analysis of gearboxes or bearings	> 1 gearbox or bearings	> \$200k
Optimization of storm shutdown	> 1 blade	> \$100k
Findings of an increase in yawing occurrences & testing (yaw count)	> 1 yawing system	> \$50k
O&M support: -WTG or component prioritization - Fatigue totalizer	~ 1 tower strike or ~ 1 gearbox or bearing or ~ 1 yawing or pitch system	> \$100k

Arista CONNEX – Other Successes



Examples of savings for other Arista CONNEX clients

(2/2)

Arista Analysis	Result / Savings	Gain / Savings [\$] (for 100 MW wind farm)
Nacelle azimuth continuous validation (if directional curtailment is needed)	~ 1 blade tower strike + proper directional curtailment	> \$200k
Inefficiency analysis	Lost production > 1% AEP	> \$1M
Wind vane alignment tool	> 1% AEP	> \$1M
Detection of slow changes in performance	- Avoidance of lost generation - Avoidance of severe damages	> \$1M

- ❖ OSIsoft PI platform is key to our success and the satisfaction of our clients
- ❖ The PI System and Arista Connex have demonstrated, and continue to demonstrate the business value of operational data for several satisfied clients
- ❖ With the combination of **renewable energy expertise, IT/OT framework and data science**, effective power performance follow-up of renewable energy assets is possible, and enables the detection of critical issues


Exceed the Expected



Thank you!

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