Cloud-based aggregation of high-fidelity, distributed meteorological data from unattended low power field devices

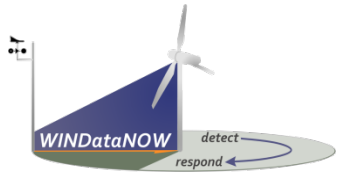
Presented by **Gregg Le Blanc** – WINData, Inc.

We used the cloud.

We got data from far away.

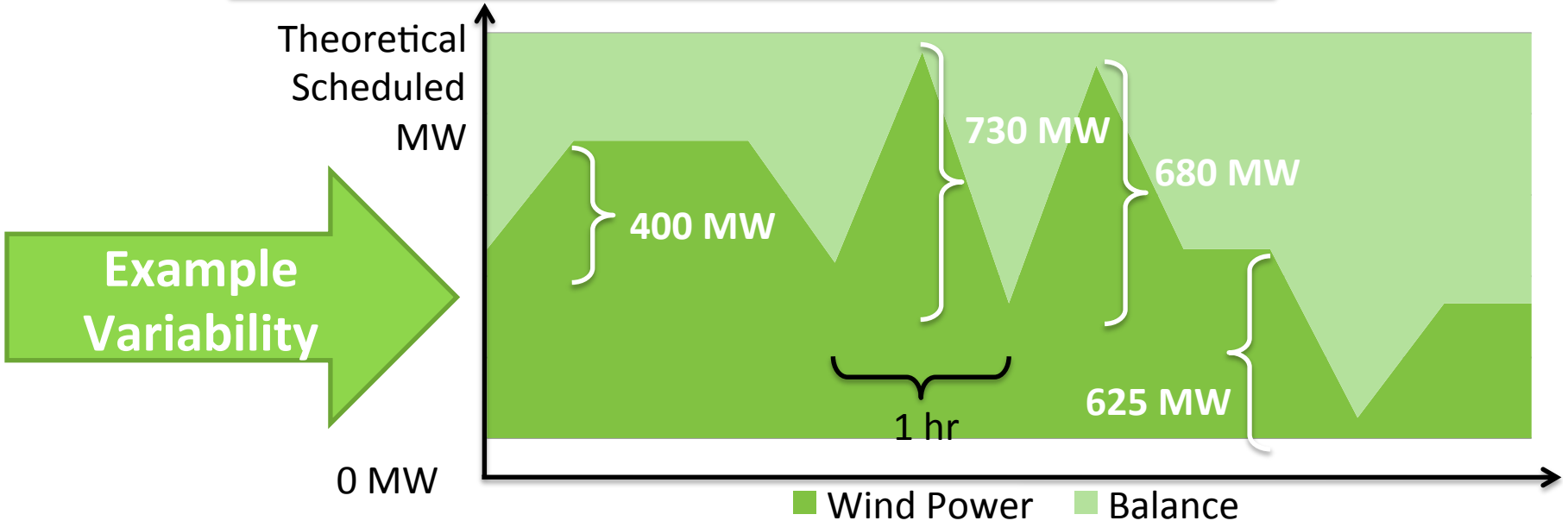
We improved wind forecasts.

Presented by **Gregg Le Blanc** – WINData, Inc.



Use the PI System to transform wind into a “fuel source”

- Spain 21.7% of all power came from wind in Feb 2012
- California: 33% renewable power generation by 2020
  - Currently, 3% in-state wind and 1.7% imported
  - Or, 6 → 13 GWhr



WINData background

- Started by Marty Wilde
  - In wind energy 1991
- Wind energy specialists
  - From raw dirt to developed wind farm
- Over 500 meteorological tower installs
  - Specializing in high-end instrumentation and tall towers
- Goal:
  - Building better “WindTelligence”
  - Field tested

2009:
WINData was awarded a US Department of Energy grant

Partnering with NaturEner and OSIsoft

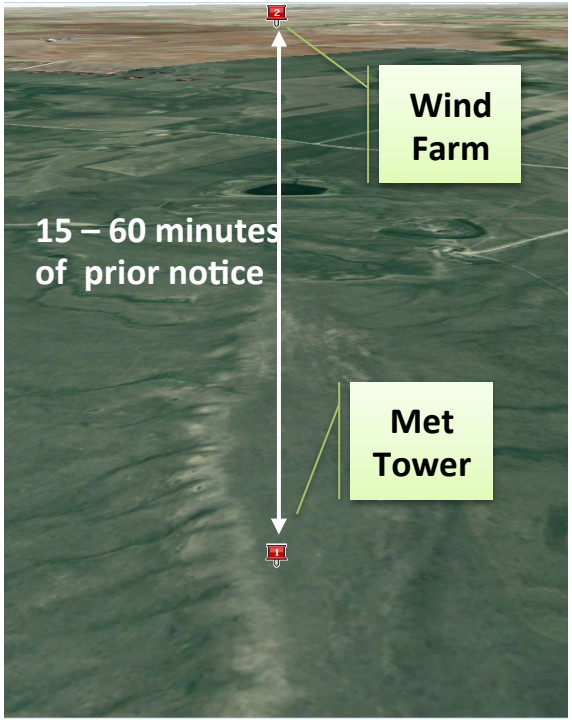
to reduce uncertainty around intra-hour forecasts

RECOVERY.GOV
TRACK THE MONEY

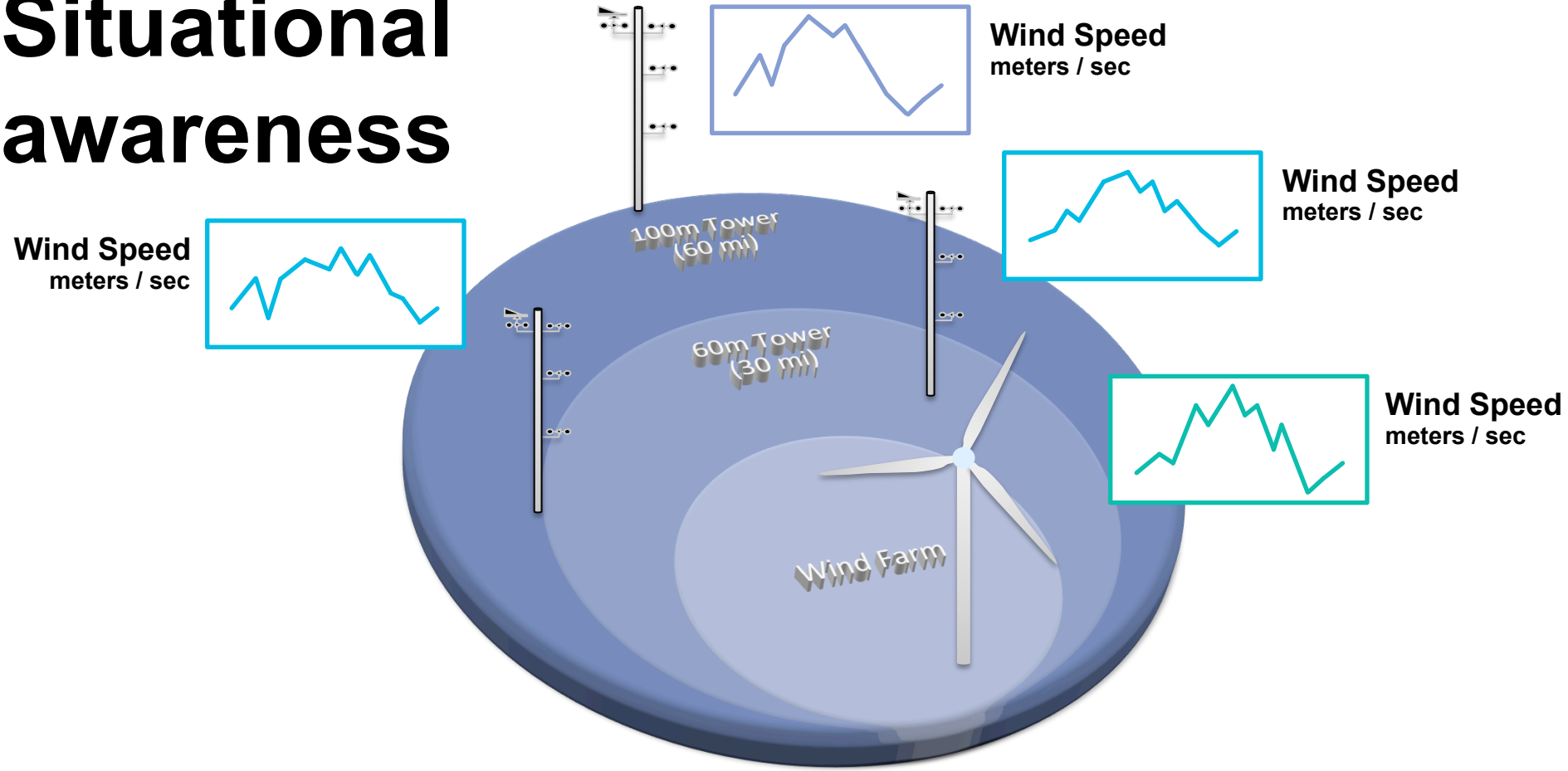
Theory and methodology

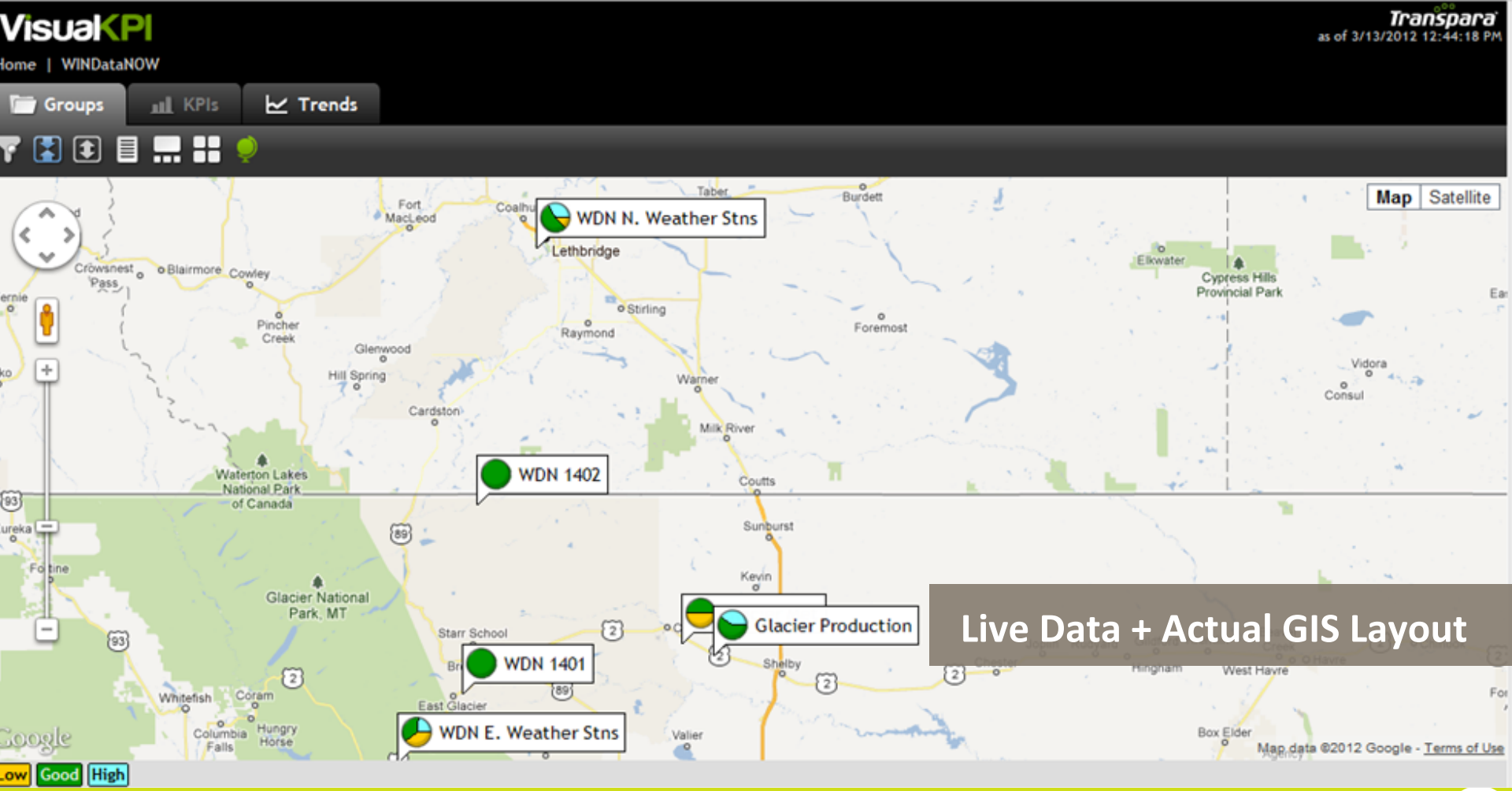
- Towers are located strategically upwind
- Deploy new logger technology
- Use higher fidelity data in near-real time
- Detect “line of site” anomalies for better situational awareness and study

“Line of Site” Locations

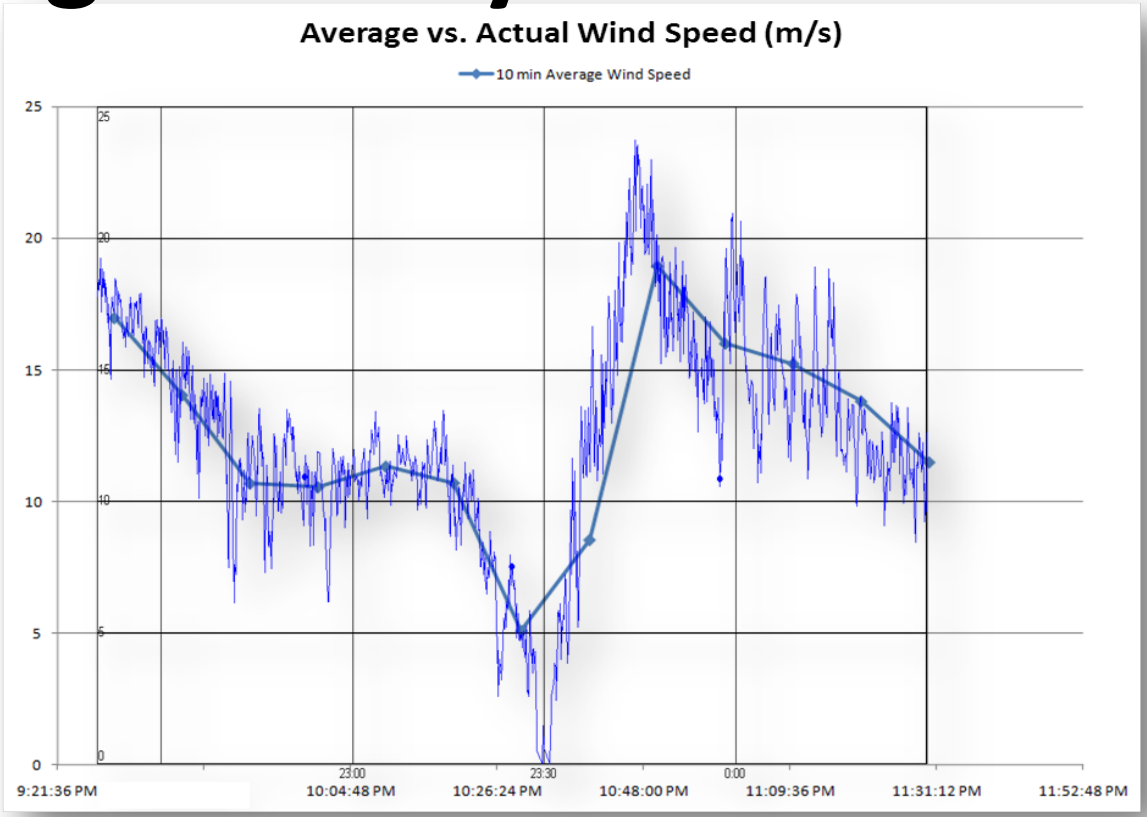


Situational awareness



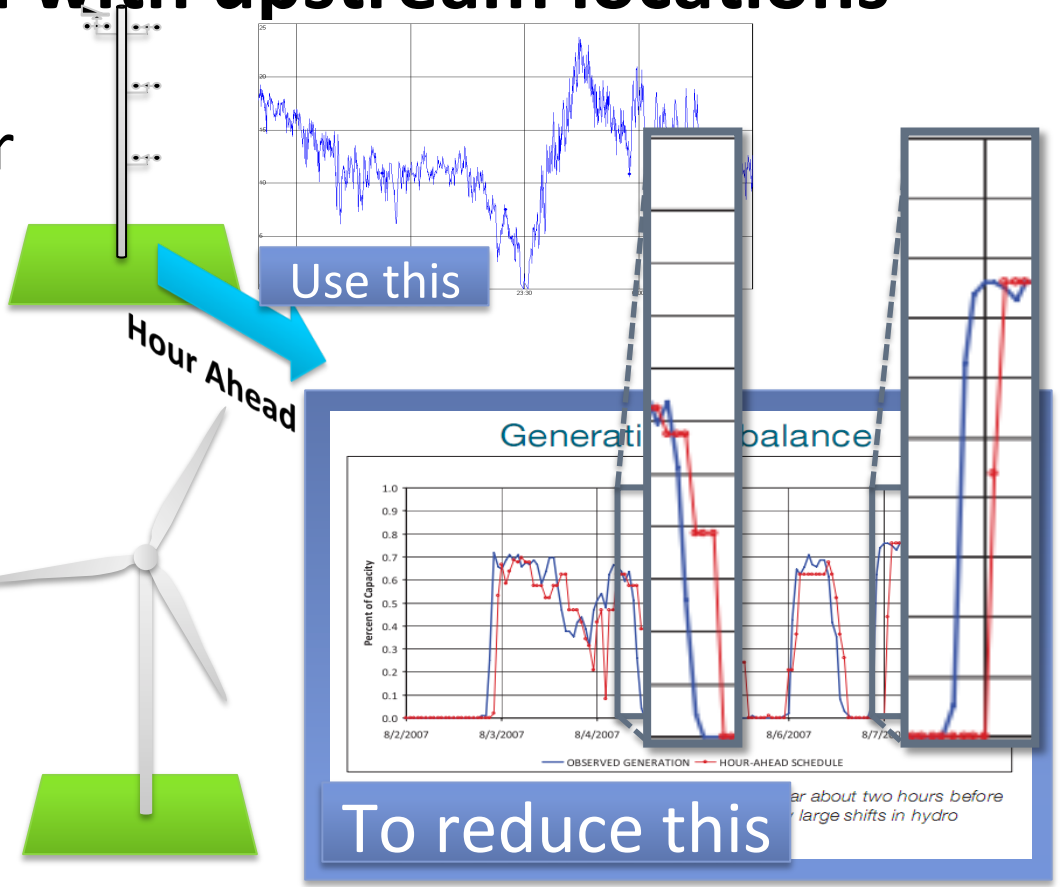

VisualKPI
Home | WINDataNOW
Transpara
as of 3/13/2012 12:44:18 PM
Groups
KPIs
Trends
Map
Satellite
WDN N. Weather Stns
Lethbridge
WDN 1402
Glacier Production
WDN 1401
WDN E. Weather Stns
Live Data + Actual GIS Layout
Map data ©2012 Google - Terms of Use
Low
Good
High

The high fidelity difference



Combine better data with upstream locations

- Decrease forecast error around ramp events
- Operate less conservatively



Logger / infrastructure

Three years of field testing

Technology changes

- 2008 Low Power PC
  - ~40 Watts
- 2011 Low Power PC
  - ~11 Watts

- Broadband / wireless
  - Basically unchanged in regions in question
  - Satellite improvements, but unacceptable prices

Models and requirements

- Maintenance issues
  - Power systems needed attention
  - Instruments vs. weather
- Logger failure modes vs. unattended sites
- Flaky hardware
- Bandwidth vs. data vs. security

Third Generation logger architecture

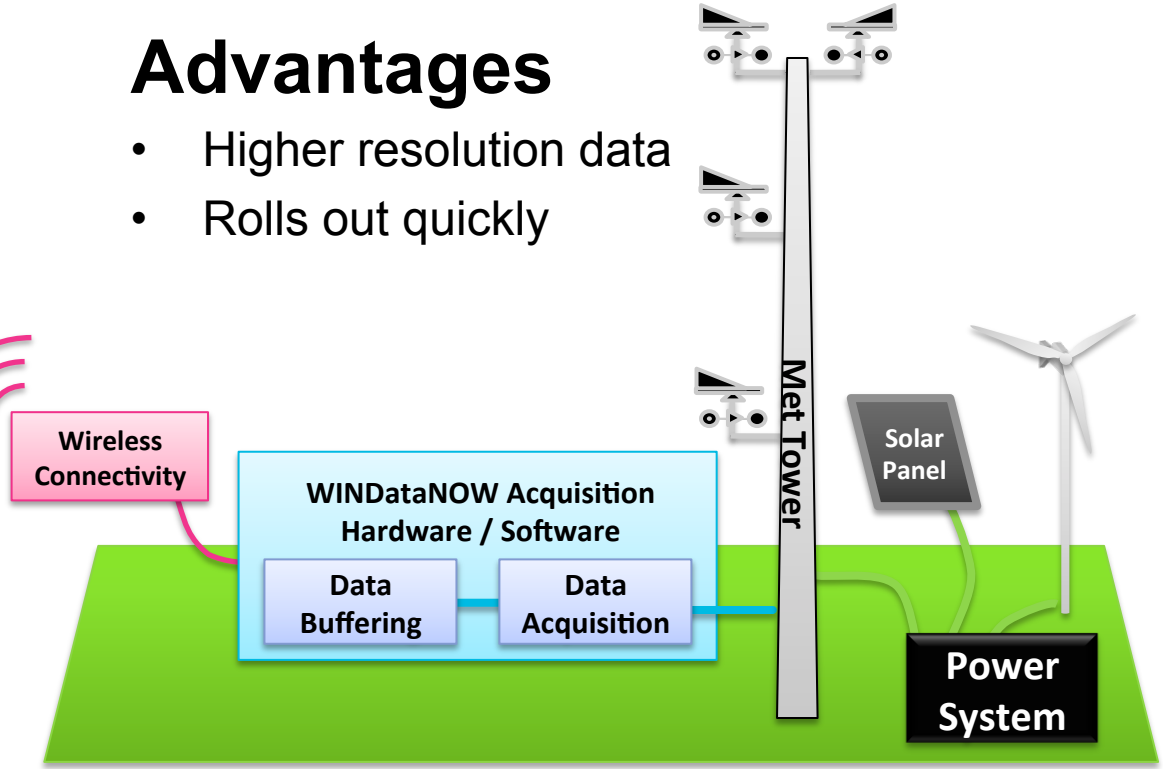
Cloud-based PI System

Advantages

- Higher resolution data
- Rolls out quickly

Architecture

- Fits in place with existing PI Infrastructure
- Fault tolerant
- Low power



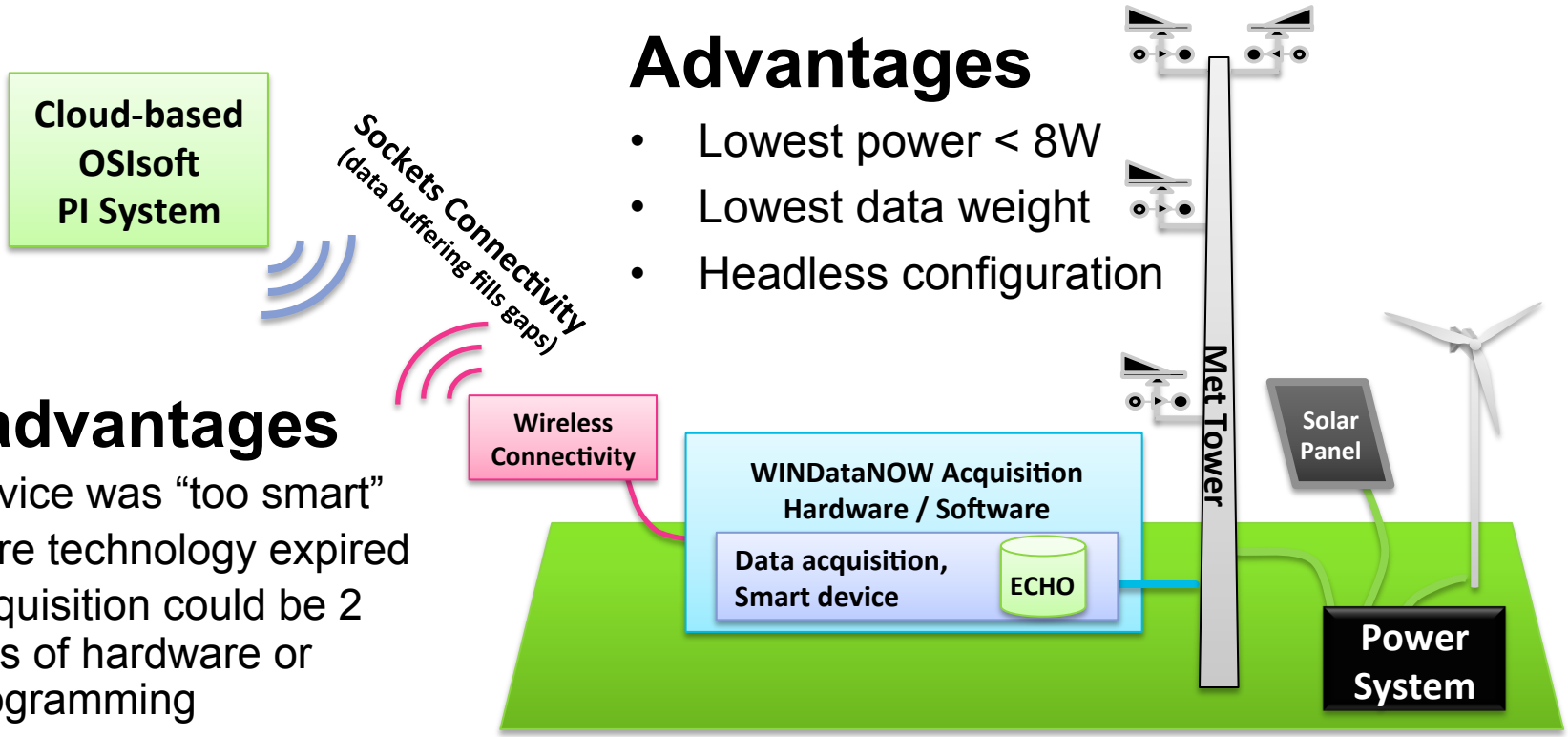
Type 1 Logger Implementation

Advantages

- Lowest power < 8W
- Lowest data weight
- Headless configuration

Disadvantages

- Device was “too smart”
- Core technology expired
- Acquisition could be 2 sets of hardware or programming



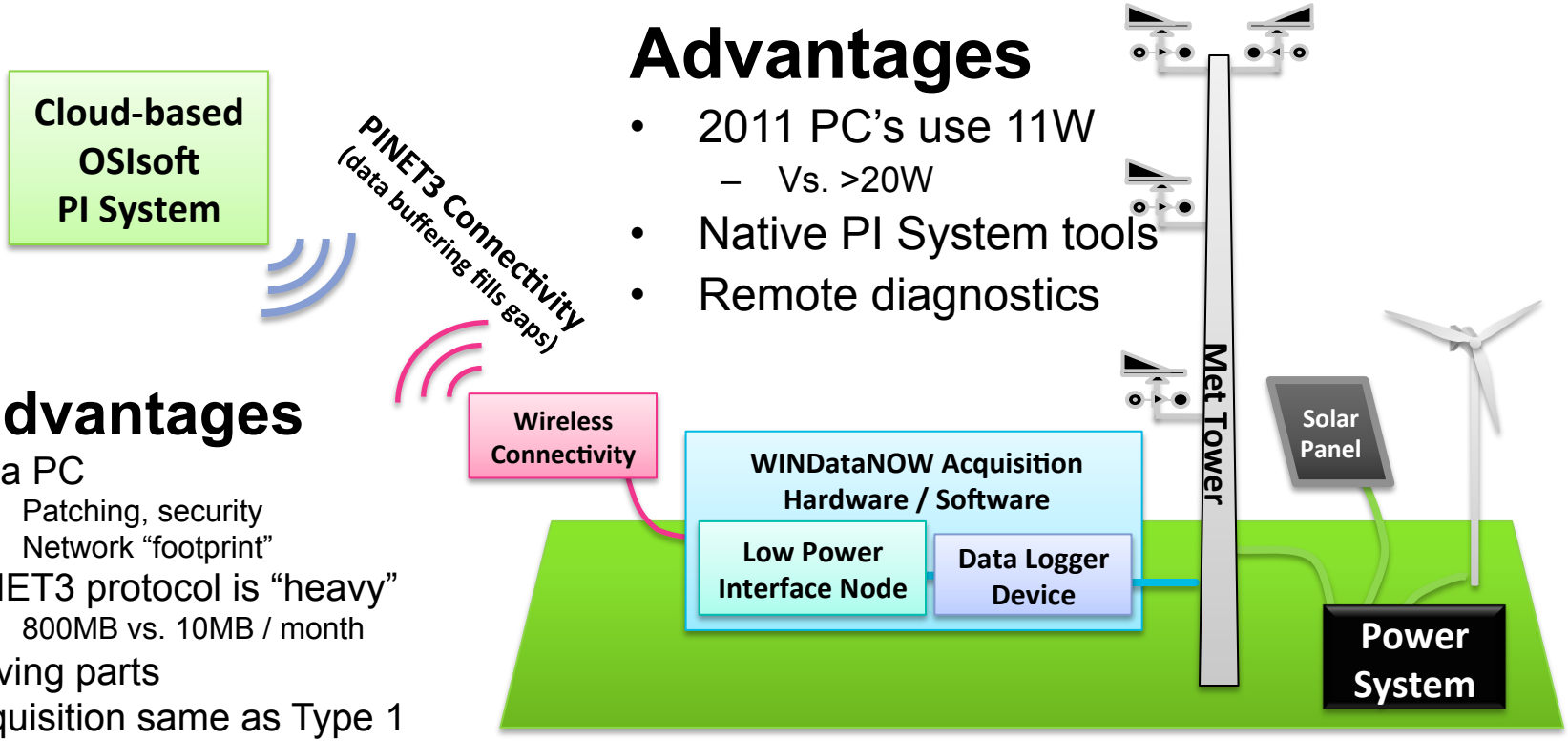
Type 2 Logger Implementation

Advantages

- 2011 PC's use 11W
  - Vs. >20W
- Native PI System tools
- Remote diagnostics

Disadvantages

- It's a PC
  - Patching, security
  - Network "footprint"
- PINET3 protocol is "heavy"
  - 800MB vs. 10MB / month
- Moving parts
- Acquisition same as Type 1



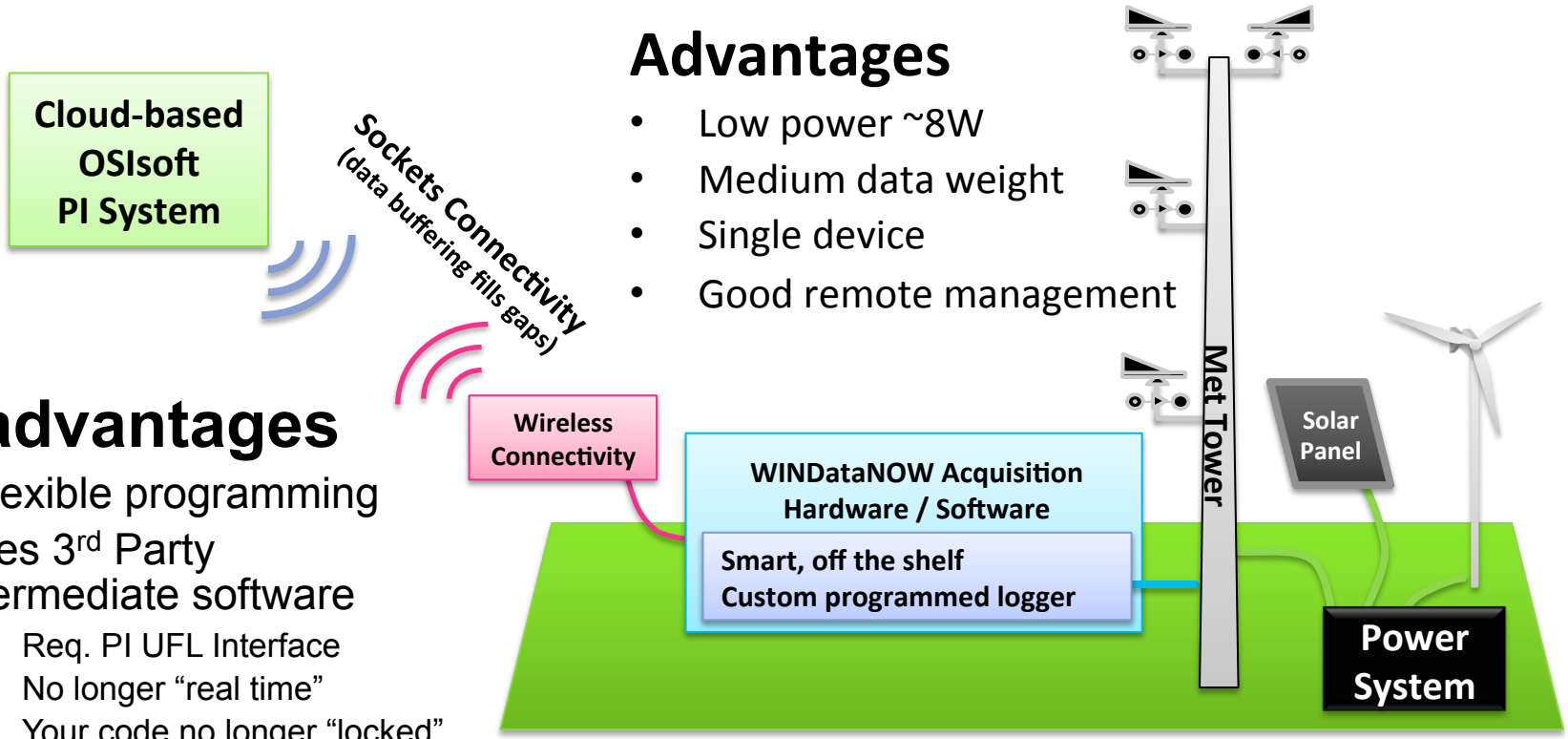
Type 3 Logger Implementation

Advantages

- Low power ~8W
- Medium data weight
- Single device
- Good remote management

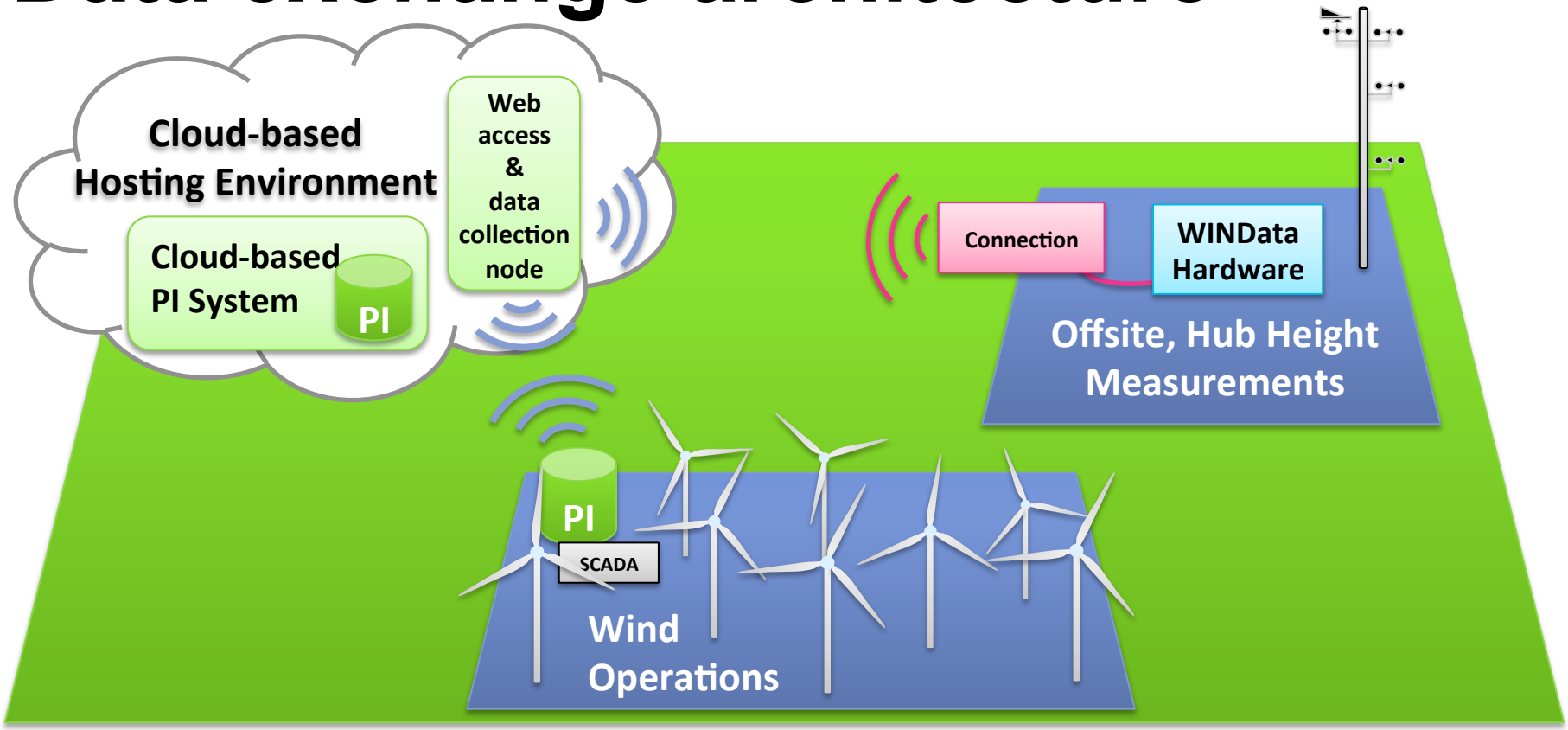
Disadvantages

- Inflexible programming
- Uses 3rd Party intermediate software
  - Req. PI UFL Interface
  - No longer “real time”
  - Your code no longer “locked”

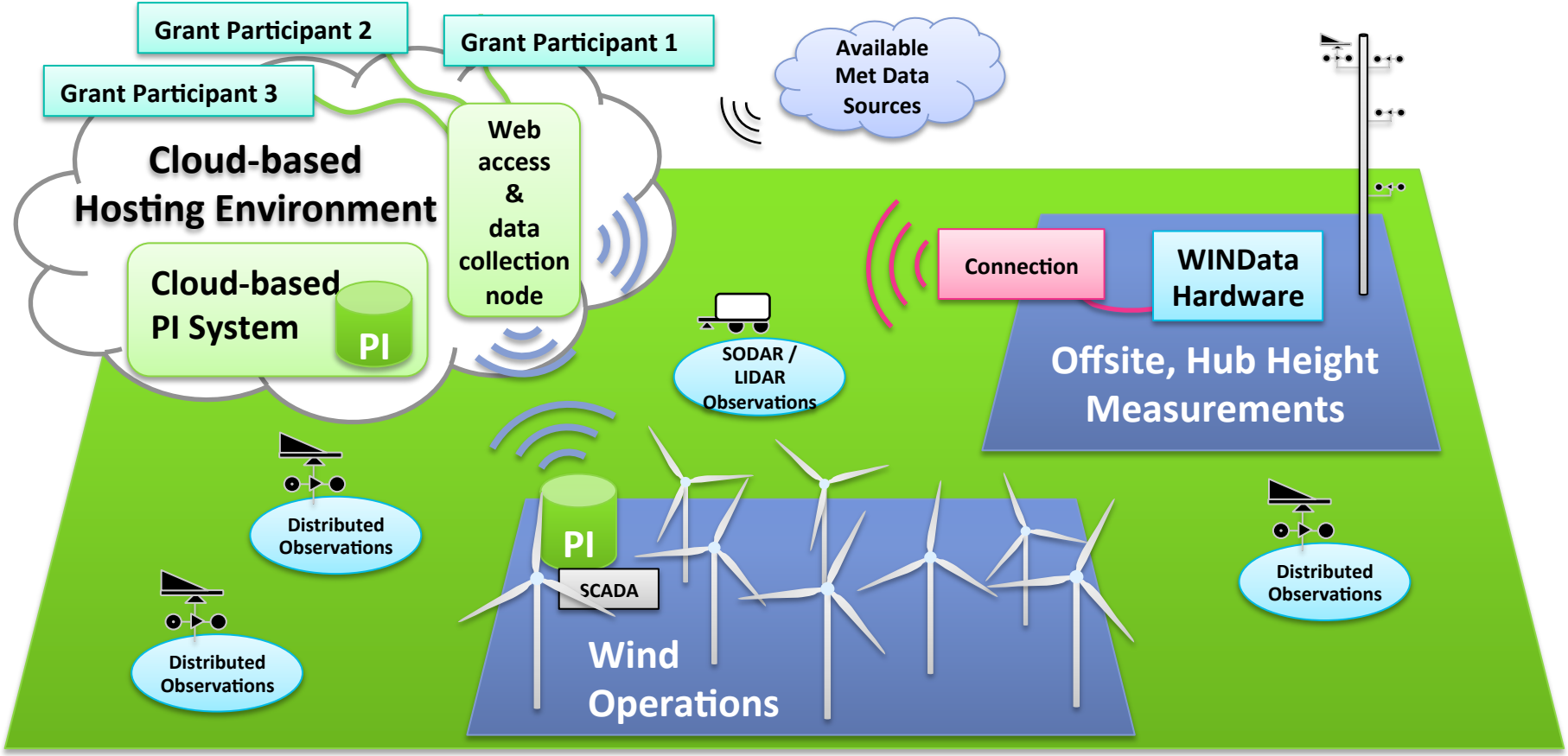


Using “The Cloud”

Data exchange architecture

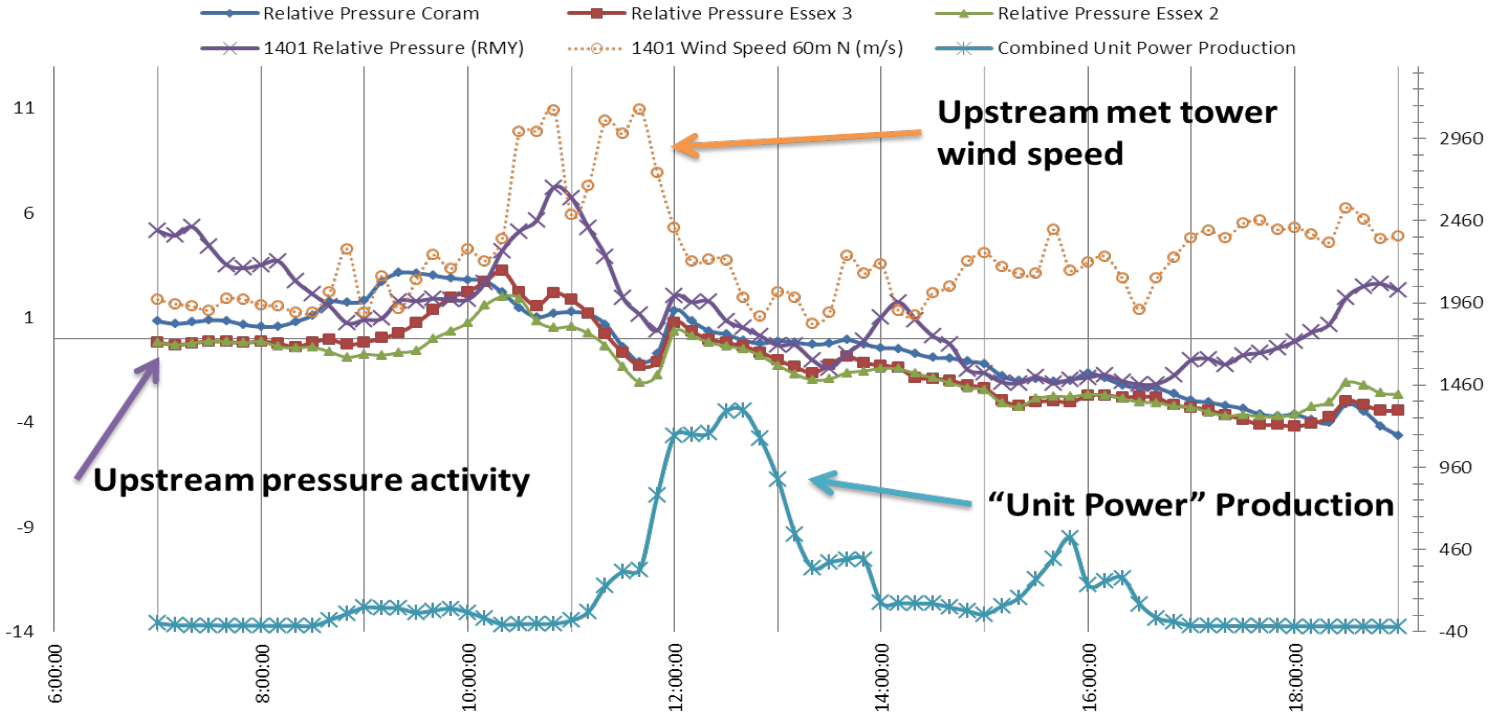


Augmented data exchange architecture



Integration to Advanced forecasting

How pressure (relative to wind plant) can affect power production

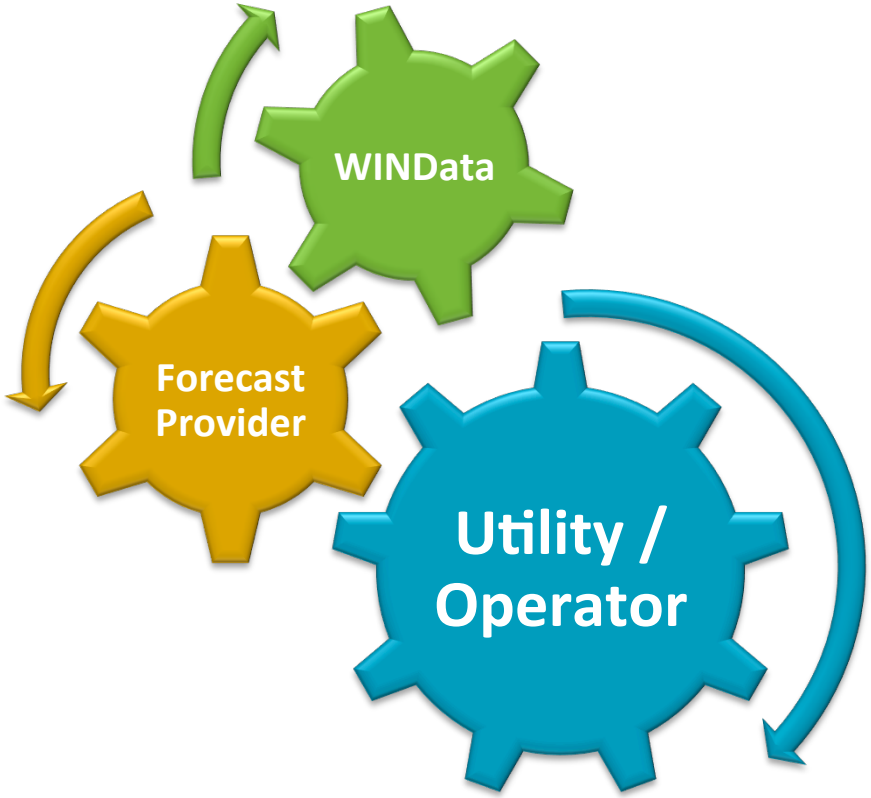


Working together to improve forecasts

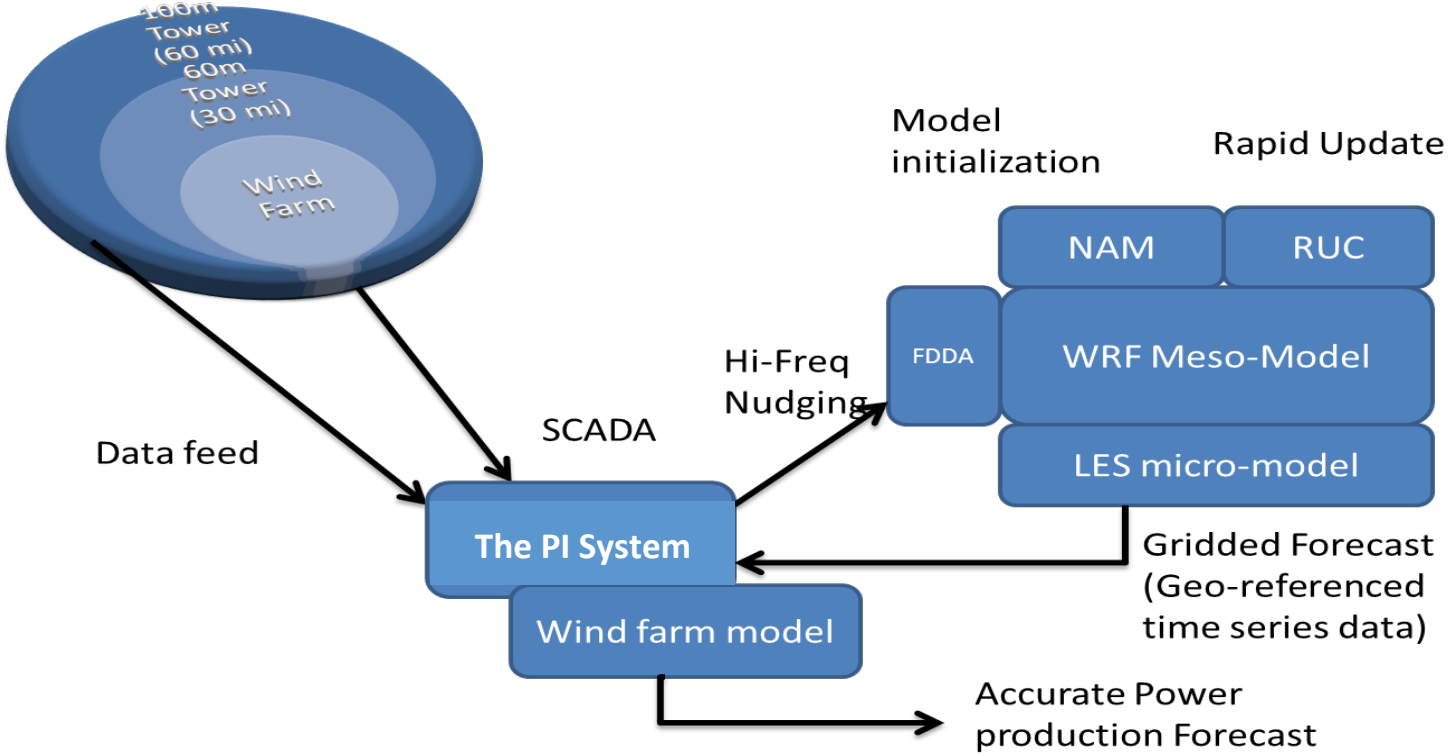
Goal: Designing a program that results in better forecasts

- WINData &
  GL Garrad Hassan

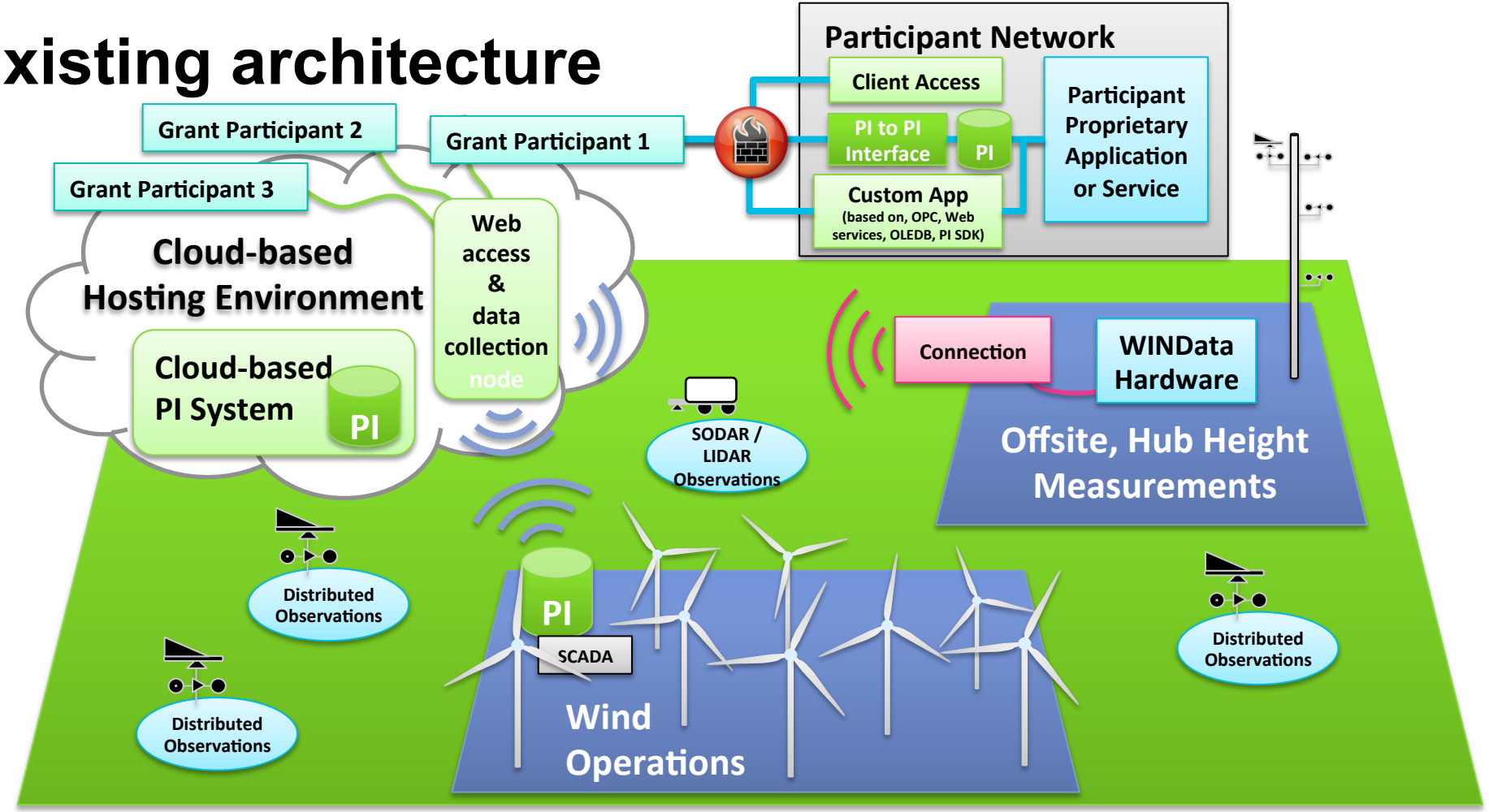
- Teaming up to improve wind energy integration



Integrated Sensor network with Forecasting System

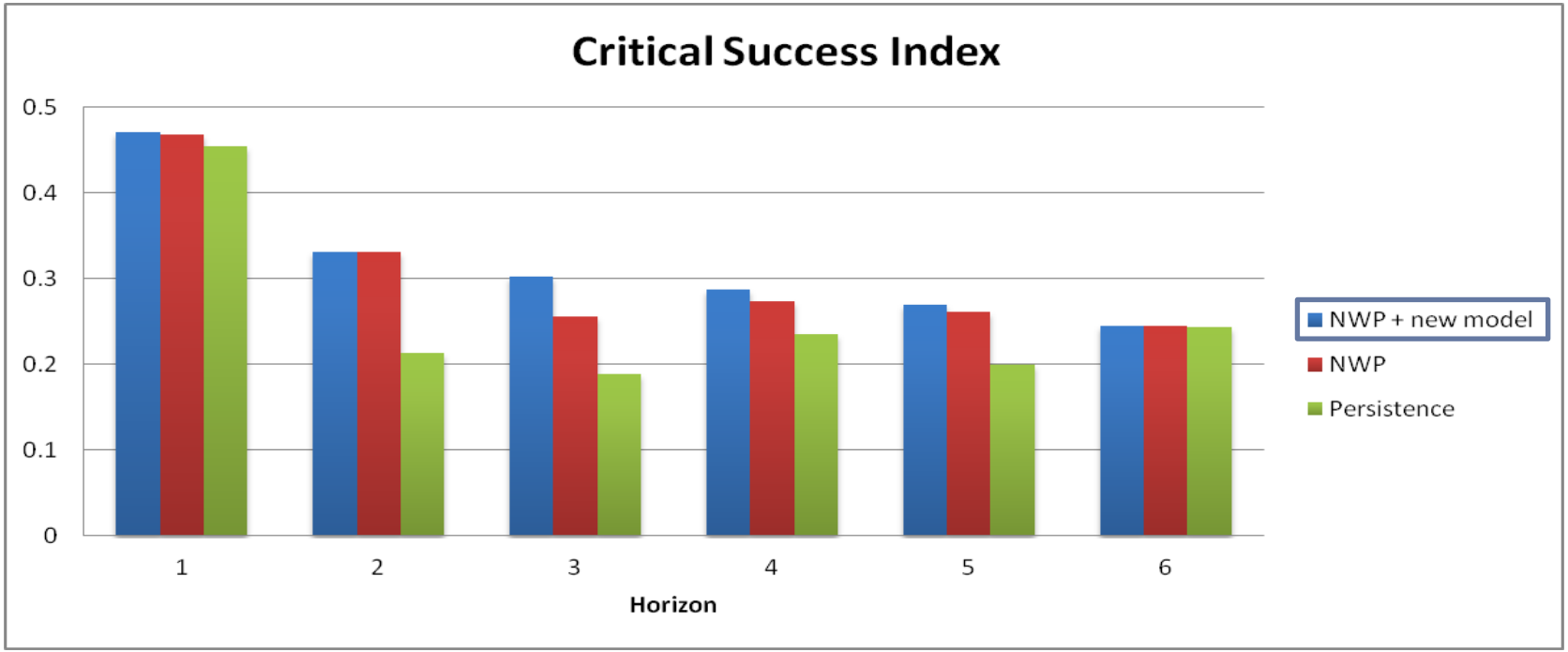


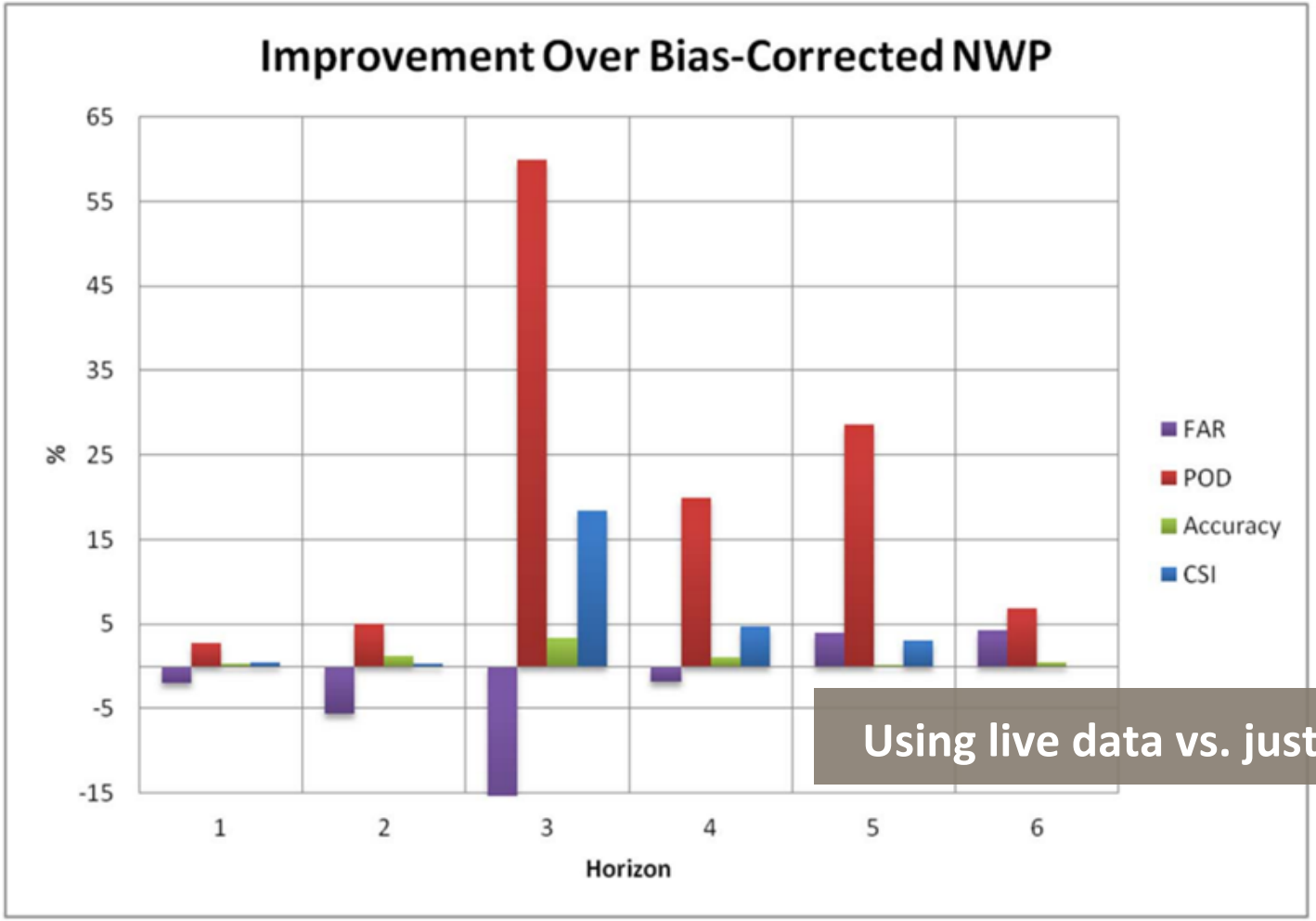
Existing architecture



Demo

Improvement in forecasting when including new offsite measurements





All +

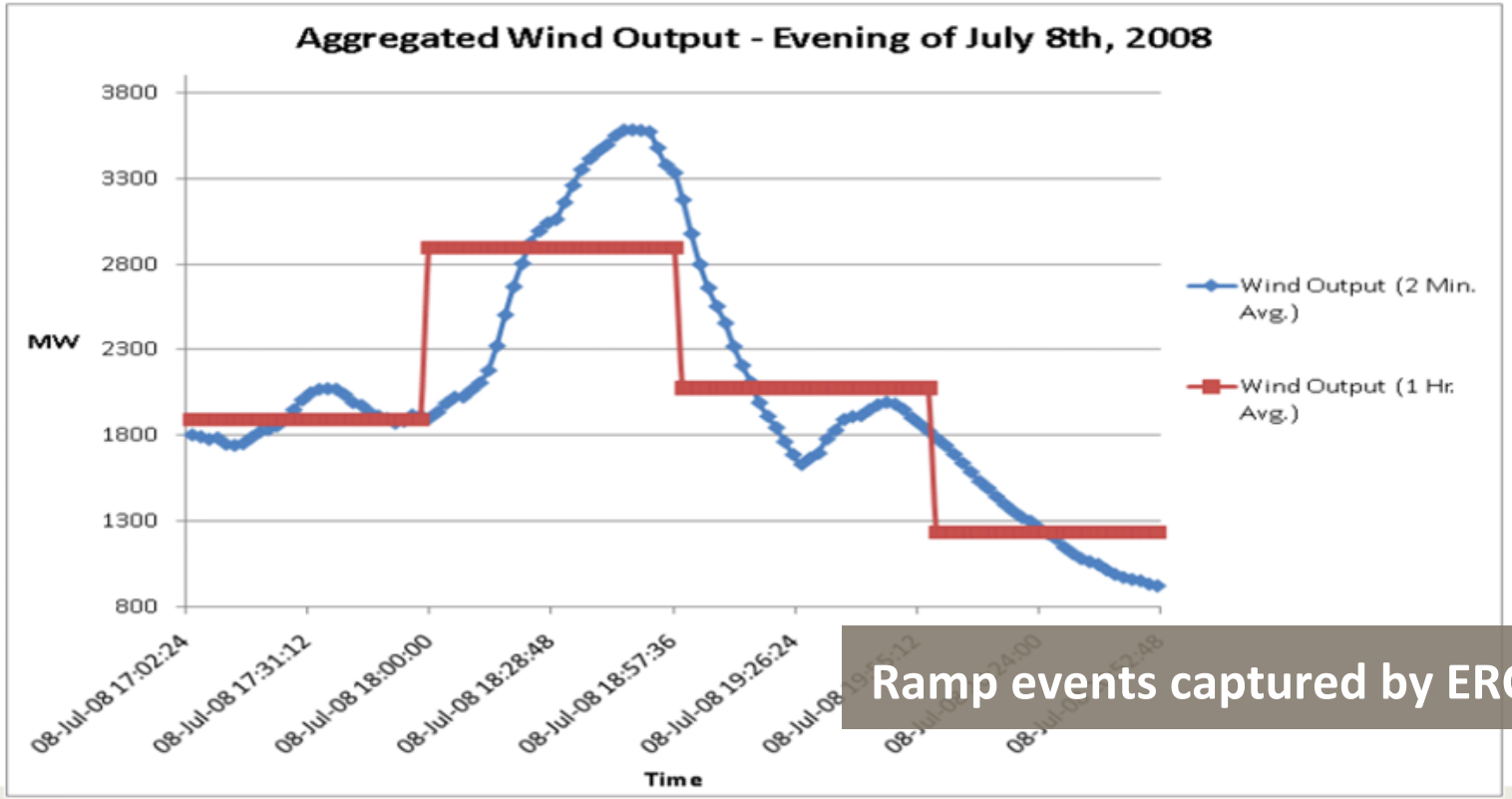
Mostly +

Mostly +

Using live data vs. just correcting a model

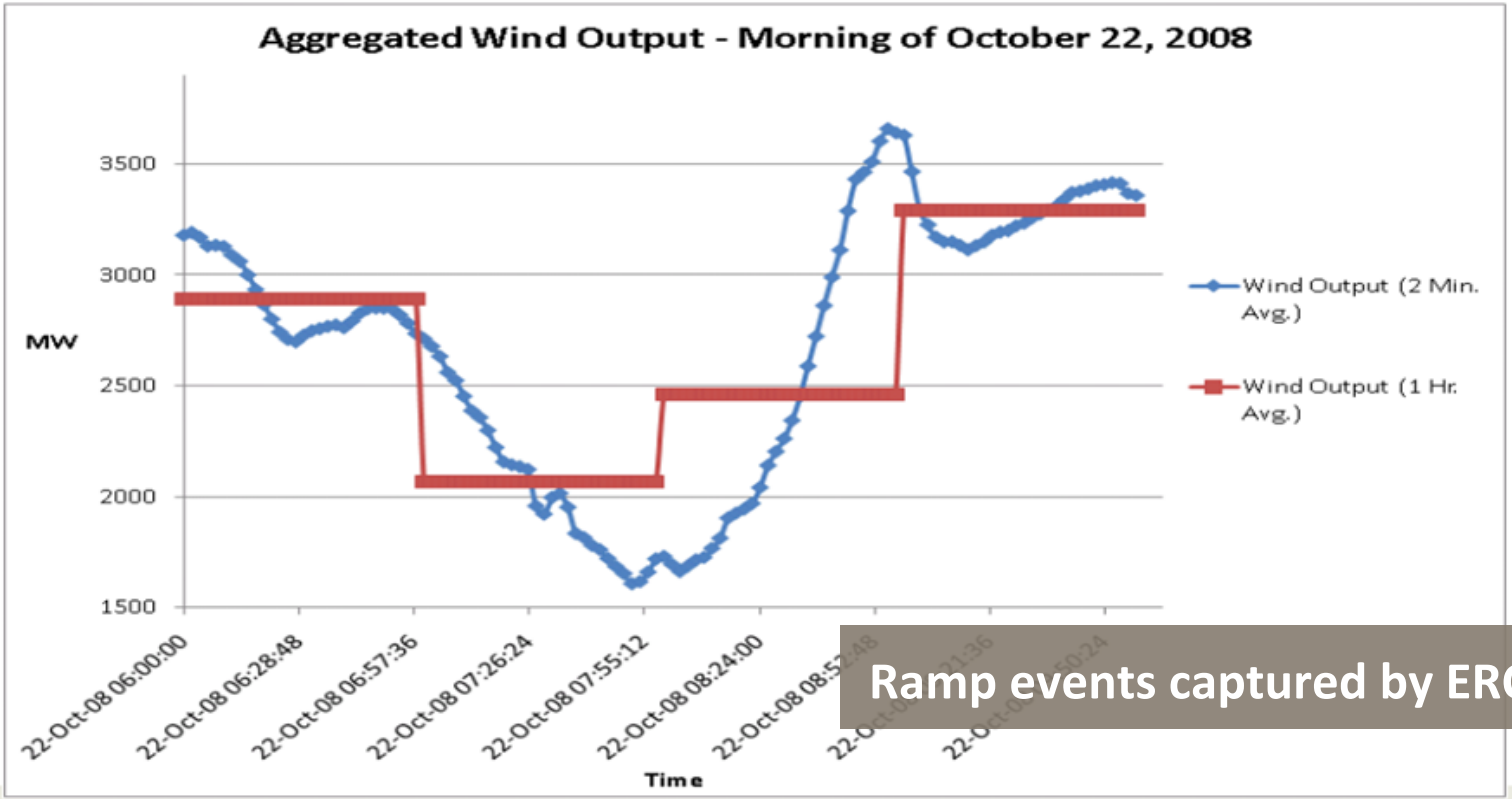
So what?

Ramping Example 1 cont.



Ramp events captured by ERCOT (1)

Ramping Example 2

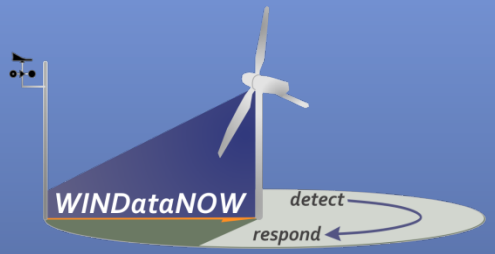


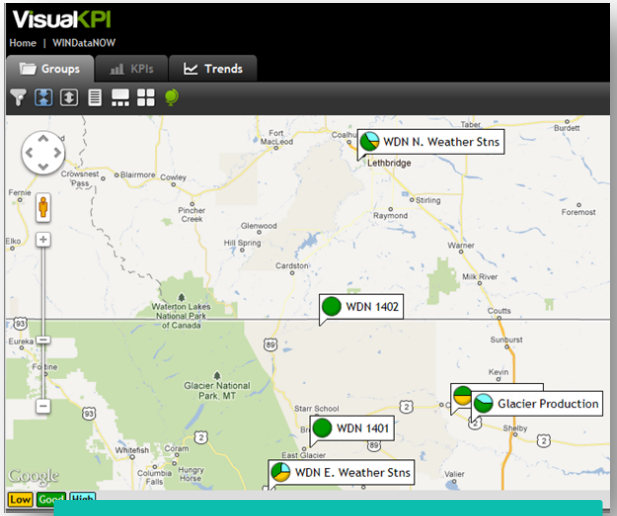
Ramp events captured by ERCOT (2)

What did we learn?

WINData has delivered upon the promise of reducing uncertainty of short term forecasting by using high fidelity upstream meteorological observations thanks to the help of:

- **The US Department of Energy**
- **OSIsoft**
- **Naturener**
- **Transpara Corp**
- **GL Garrad Hassan**





Improve the "state of the art"

- Move from 5 min averages
- Incorporate The PI System into wind forecasting operations
- Improve wind operations at NaturEner

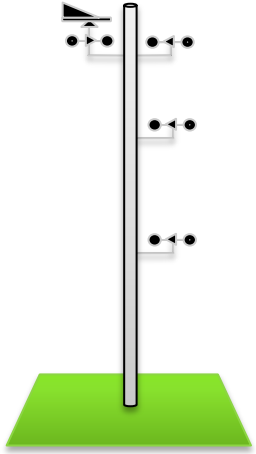
Real-time Wind Sensing

- Using configured, component technologies
- OSIsoft's partner eco-system
- Cloud computing

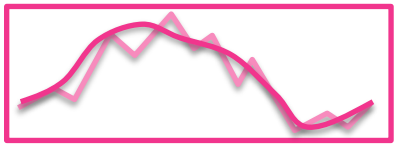
Improved Forecasting

- GL Garrad Hassan has used WINData's data to deliver improved forecasting performance to NaturEner to catch "ramp events

Combining data & intelligence for smoother operations

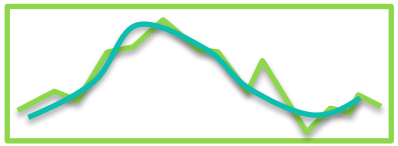


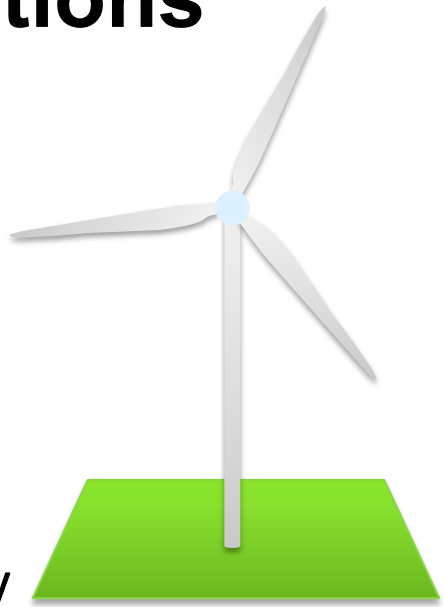
Detect and anticipate changes



Meteorological measurements → Augmented forecast

Power production & Augmented forecast





Improve energy integration to the grid

Thanks & Contact

- Thanks to:
  - The US Department of Energy
  - Naturener USA, LLC
  - OSIsoft, LLC
    - Pat Kennedy
    - Dave Roberts
  - GL Garrad Hassan
  - Transpara Corp.

- Marty Wilde
  - marty.wilde@windata-inc.com

THANK YOU

Brought to you by OSIsoft.