



# Direct to Controller Integration Using OPC

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**Senior SCADA Engineer**

**SUZLON**  
POWERING A GREENER TOMORROW

# Agenda

- Who is Suzlon? Who is SWECO? What is the SMC?
- The Suzlon PI System
- “Direct-to-controller”
  - The need
  - Approaches and attempts
  - Roll-out to the fleet
  - Benefits and Challenges
- The future...



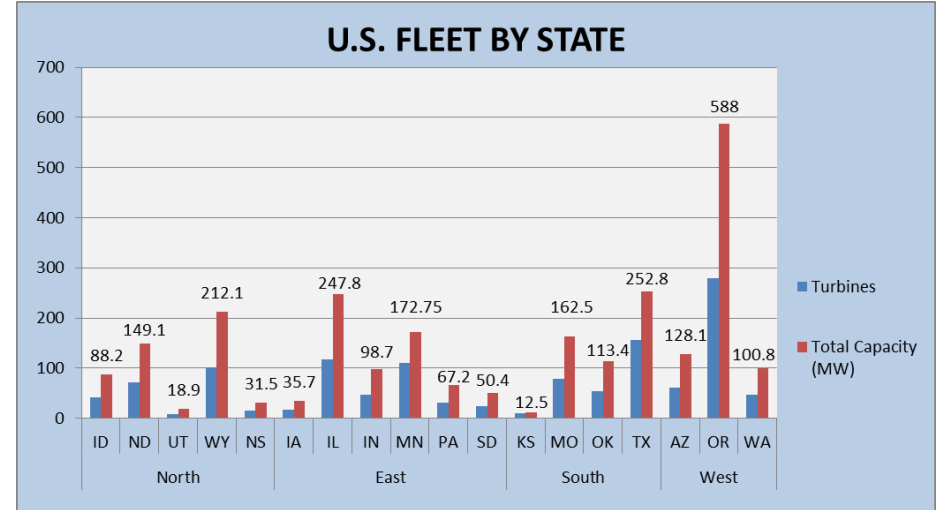
# About Suzlon Group

- Global Wind Turbine Manufacturer
  - Est. 1995 in Pune, India
  - Acquired REpower Systems in 2011
- 5th Largest Wind Turbine OEM
  - Suzlon and REpower combine for 18+ GW installed capacity
  - Current Annual Manufacturing Capacity of 5,900 MW



# Suzlon Wind Energy Corporation

- SWECO – North American SBU
- SWECO HQ - Chicago, IL
- 1274 WTG's Installed
- 2530 MW Total Capacity



# Suzlon Monitoring Center (SMC)

- Staffed 24/7/365
- Since April 2009
- Monitor and reset WTG's
- Troubleshooting
- Root-cause analysis
- O&M Assistance
- Weather alerts
- Report generation



# SMC Monitored Fleet

**1,863 turbines → 3,721 MW**



**USA (1,259)**



**Portugal (49)**



**Bulgaria (6)**



**China (236)**



**Nicaragua (30)**



**Romania (4)**



**Brazil (185)**



**Turkey (15)**



**Sweden (2)**



**Spain (111)**



**Canada (15)**



**Germany (1)**

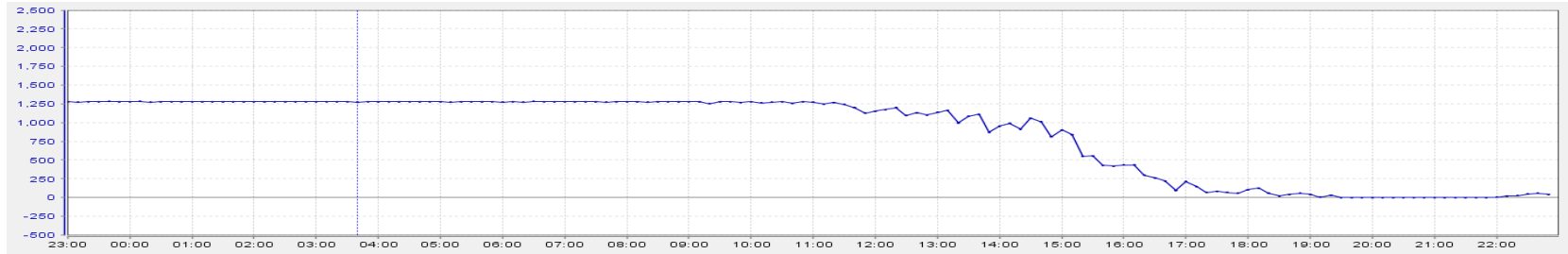
# The Need for a PI System

- Without a PI System:
  - One application for control
    - Limited park overview
    - Event and statistical logs available, but difficult to work with
  - Separate web interface to reporting
    - 10-minute average data
    - “Canned” reports only
  - Faults and warnings
    - Restricted to those on controller
    - Manually created notifications
- With a PI System:
  - Custom dashboards and reports
    - No restrictions
    - Share via SharePoint, client tools
  - High-resolution data
  - Automatic fault notifications
    - Frees up manpower
    - Add custom content
  - Proactive alerting
    - New KPI’s via ACE scripts
    - New alerts save time and labor

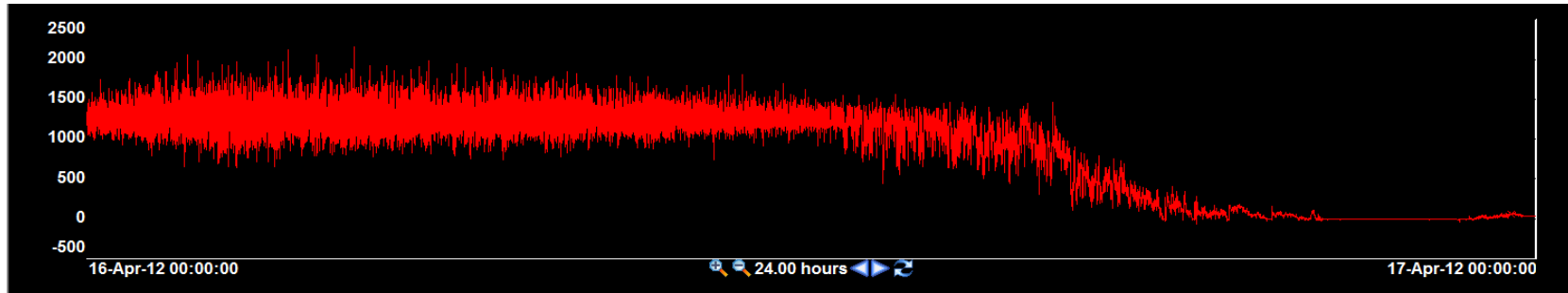
# The Need for a PI System

10 minute active power data vs. 1 second data...

SCADA:



PI:

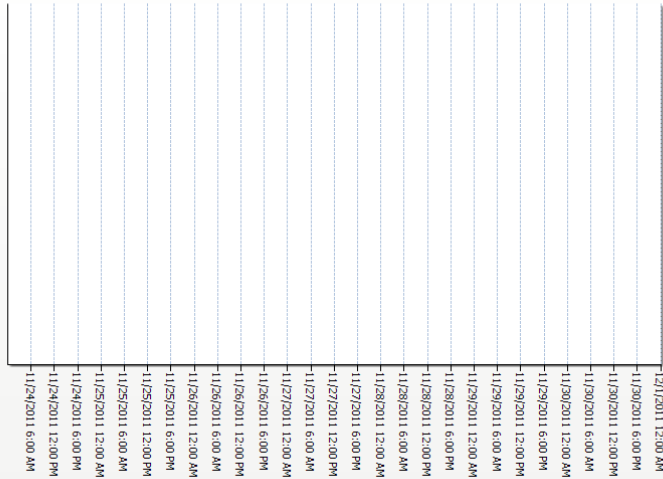




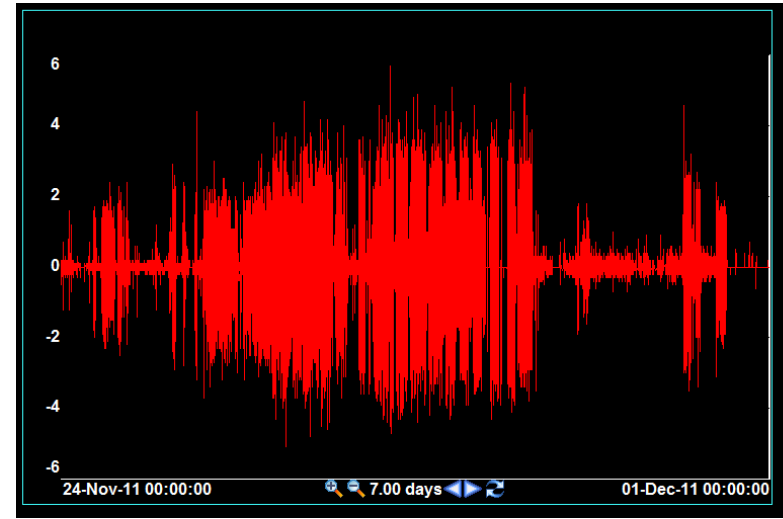
# The Need for a PI System

10 minute drive train vibration data vs. 1 second data...

SCADA:



PI System:



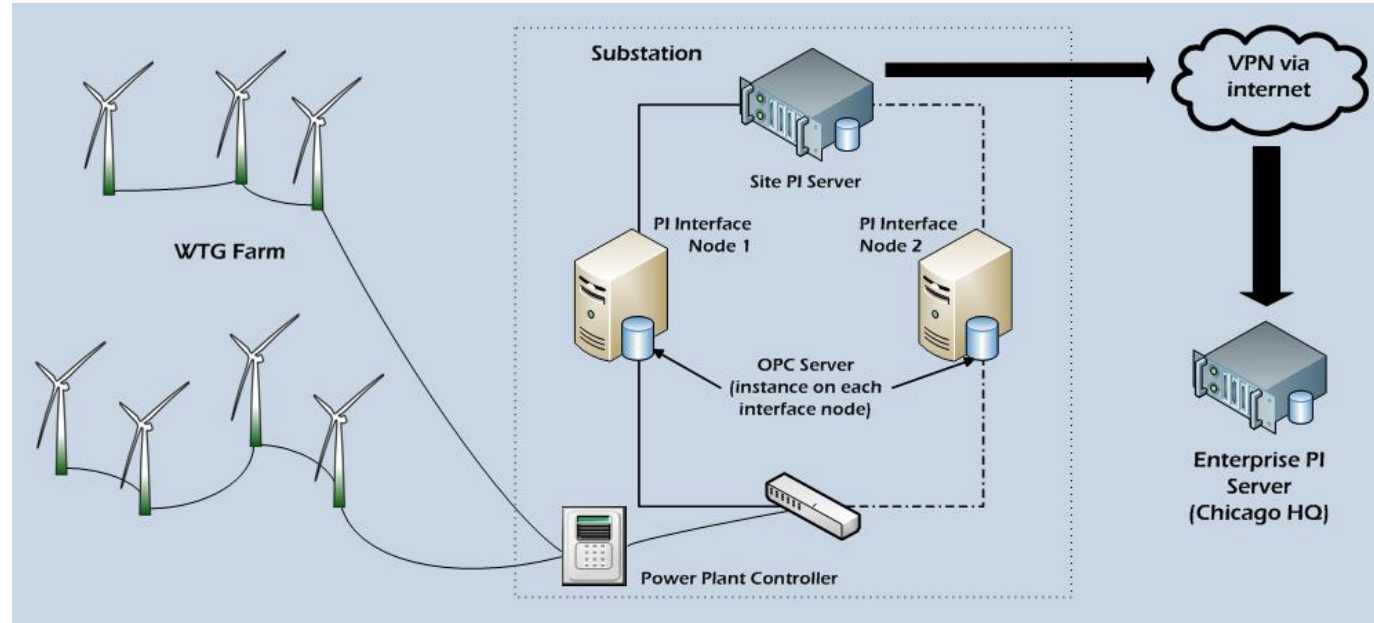
# Suzlon PI System Pilot Program

- Entered into Enterprise Agreement (EA) with OSIsoft
- Chose three sites to start:
  - Site A – 67 2.1 MW WTG's
  - Site B – 20 2.1 MW WTG's
  - Site C – 12 1.25 MW WTG's
- Creating dashboards, reports, models, and templates
  - Demonstrate value of PI System
  - Prepare for future roll-out



# PI OPC: The Initial Approach

- Power Plant Controller acts as “data concentrator”
- PI OPC server exposes less than 100 points per WTG
- No alarm states, digital states, etc.

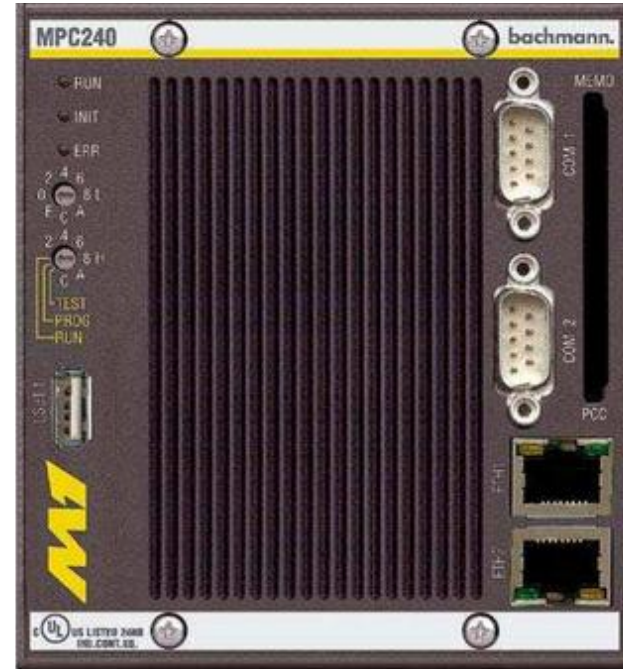


# The Need for “Direct to Controller”

- Having *some* analog values, status tags, and counters is a good start, but...
- Having all analog values, digital states, fault states, user info, controller KPIs, and parameter settings adds a significant amount of value to a PI System.
  - Additional insight into plant and turbine behavior
  - Increases availability and production
  - Saves parts, time, and labor
  - Promotes proactive maintenance and troubleshooting

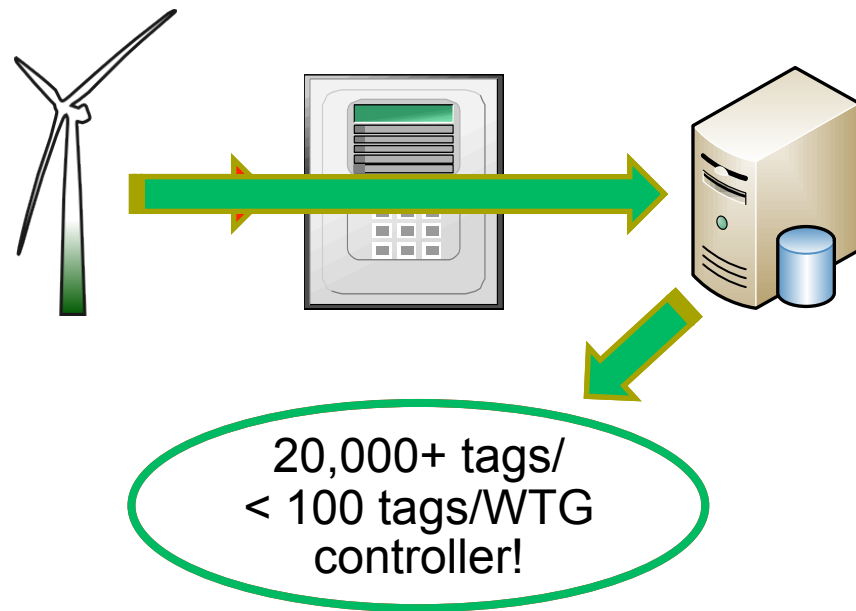
# 61850: The Next Attempt

- IEC 61850 – standard for design of electrical substation automation
- Third-party interfaces available, require MMS
- Bachmann MMS-Client
  - Software-based solution
  - Not compatible with MPC 240 used in Suzlon WTGs

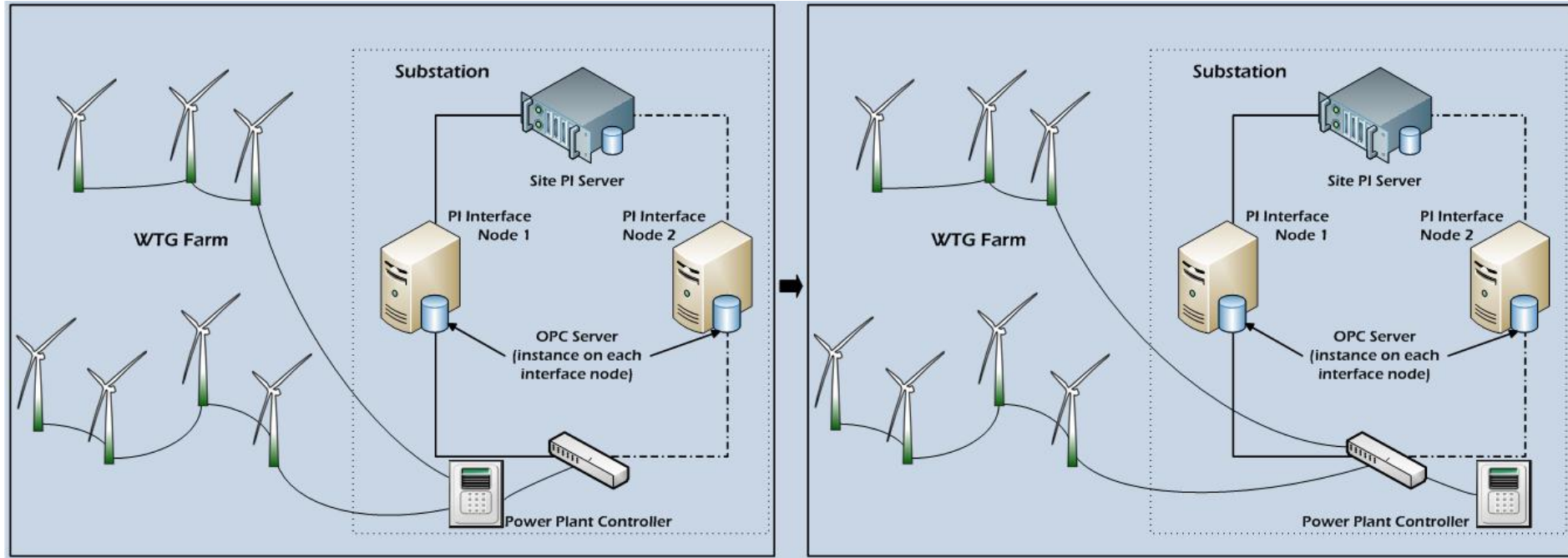


# PI OPC: The Final Approach

- Cut out the “middle-man”-- eliminate the use of the PPC as a data concentrator
- Connect directly to WTG controller with PI OPC server
- Explore points available from WTG controller
- Choose desired points and add to new PI OPC template

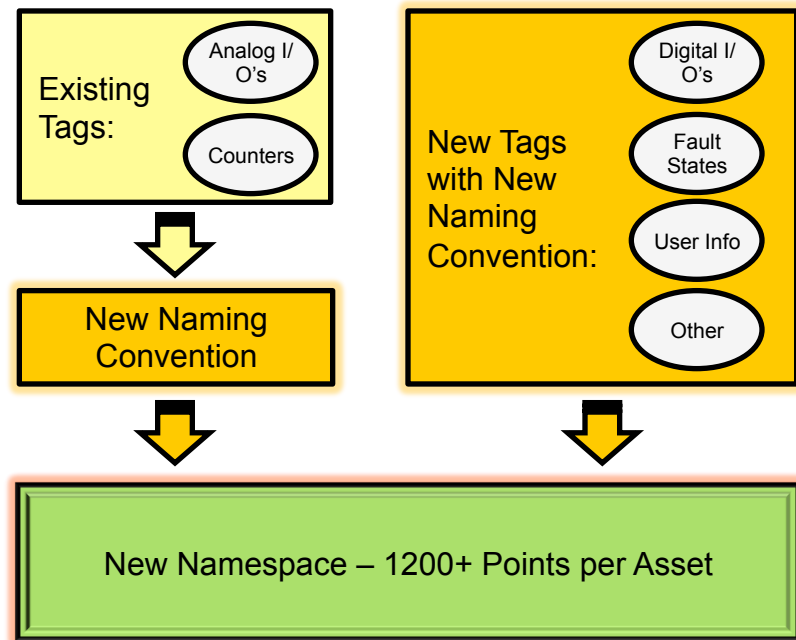


# PI OPC: The Final Approach



# PI OPC: The Final Approach

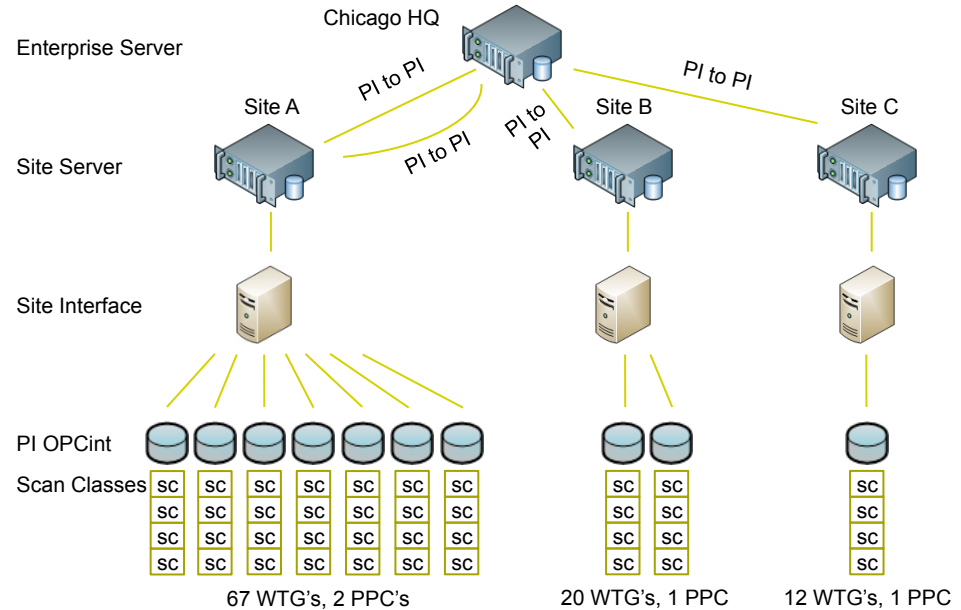
- Selected 1200+ points per WTG
  - New naming convention based on controller references
    - Mapped existing tags into new convention
    - Created new tags, chose exc/comp settings
  - All analog values, digital states, alarm states, alarm thresholds, parameters, user info, counters, and more!
  - Also 1200+ points per Power Plant
- Tested with 4 WTG's and 1 PPC





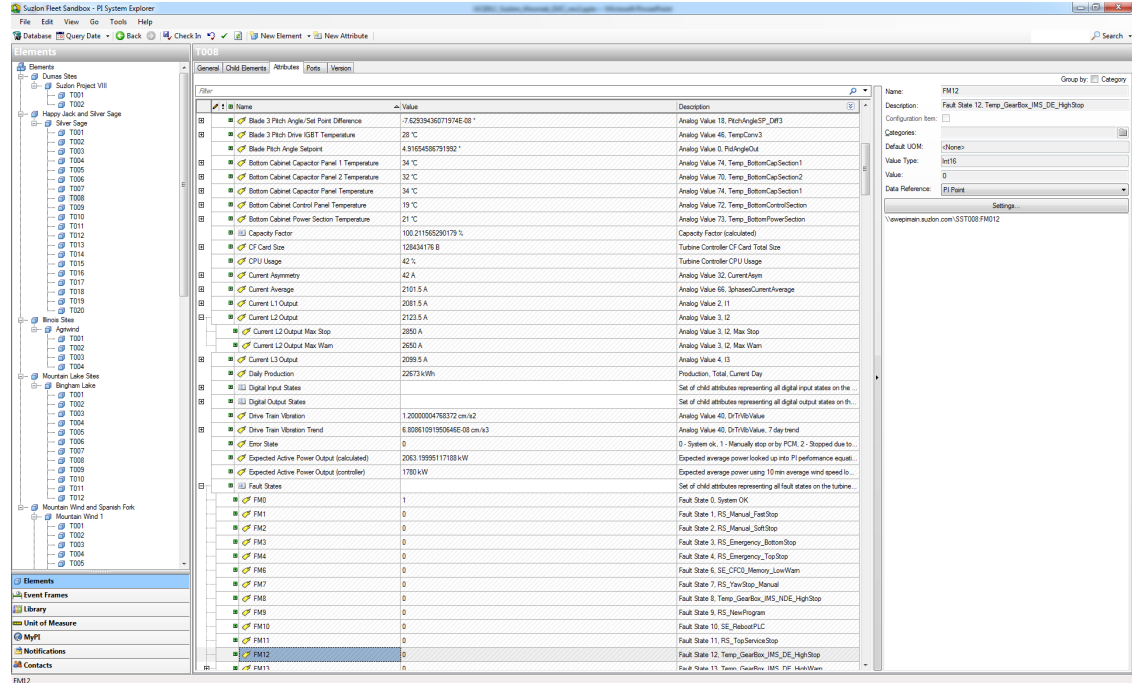
# PI OPC: The Final Approach

- Deployed new PI OPC template at all “pilot” sites
- Added PI to PI instance for larger site
- Created multiple PI OPC interface instances at each site
- Introduced new scan classes on each PI OPC interface



# PI OPC: The Final Approach

- In addition to creating tags, also created PI AF structure to match
- Allows PI ProcessBook users to easily take advantage of additional points via Element Relative displays
- Also facilitates the creation of PI Notifications via templates



# Benefits of PI OPC Expansion

- Access to digital states
  - Better, more detailed displays
  - State counters
  - More triggers for notifications
- Visibility of parameters and thresholds
  - Monitor for out-of-config items
  - New criteria for alerts
- User info: who's logged in?

Silver Sage						
Turbine	Yaw CW		Yaw CCW		Yaw brake feedback	Yaw sensor error
	D.O.	D.I.	D.O.	D.I.		
SS-01	○	○	○	○	○	○
SS-02	○	○	○	○	○	○
SS-03	○	○	●	●	●	○
SS-04	●	●	○	○	●	○
SS-05	○	○	○	○	○	○
SS-06	○	○	●	●	●	○
SS-07	○	○	●	●	●	○
SS-08	○	○	●	●	●	○
SS-09	○	○	○	○	○	○
SS-10	○	○	○	○	○	○

# Benefits of PI OPC Expansion

- Alarm visualization
  - Previously, only “primary” alarm was visible
  - Expansion allows visibility of all active alarm states
- Controller performance
  - CPU usage and Memory
  - Great for SCADA engineers
- Generally speaking, **more to play with !**

Pre-expansion active events listing:

<a href="#">437</a>	MANUAL	2 - RS Manual SoftStop	2012-04-08-21:55:4 -06:00	0m
<a href="#">436</a>	EVENT	224 - Elec FB PowerSupplyPitch	2012-04-08-16:46:0 -06:00	5h 8m

Same WTG & time frame, after expansion:

Event Description	Start Time	Duration
RS_Manual_SoftStop	Apr-08-2012 21:54:16	0d : 00h : 00m : 30s
Pitch_FreqConvPitch1_ErrStop	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Temp_BatteryBox1_LowWarn	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Pitch_FreqConvPitch3_ErrStop	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Pitch_FreqConvPitch2_ErrStop	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Pitch_BatterySurveillance3	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Pitch_BatterySurveillance2	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
Pitch_BatterySurveillance1	Apr-08-2012 21:32:16	0d : 00h : 00m : 30s
RS_StopBrakeButtonTop	Apr-08-2012 20:30:45	0d : 00h : 49m : 01s
Elec_FB_PowerSupplyPitch	Apr-08-2012 16:44:46	0d : 05h : 06m : 00s

		Park Avg.	T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29		
<div>KEY</div> <div>Turbine State</div> <div><div></div> System OK</div> <div><div></div> Manual Control</div> <div><div></div> Stopped/Failed</div>	Wind speed(m/s)	10	<div><div></div>13</div>	<div><div></div>10</div>	<div><div></div>10</div>	<div><div></div>13</div>	<div><div></div>11</div>	<div><div></div>11</div>	<div><div></div>13</div>	<div><div></div>14</div>	<div><div></div>9</div>	<div><div></div>7</div>	<div><div></div>8</div>	<div><div></div>10</div>	<div><div></div>9</div>	<div><div></div>11</div>	<div><div></div>12</div>	<div><div></div>13</div>	<div><div></div>11</div>	<div><div></div>10</div>	<div><div></div>9</div>	<div><div></div>5</div>	<div><div></div>9</div>	<div><div></div>11</div>	<div><div></div>9</div>	<div><div></div>10</div>	<div><div></div>7</div>	<div><div></div>9</div>	<div><div></div>9</div>	<div><div></div>11</div>	<div><div></div>10</div>		
	Gen Speed(rpm)	<div><div></div></div>	<div><div></div>1843</div>	<div><div></div>1835</div>	<div><div></div>1829</div>	<div><div></div>1843</div>	<div><div></div>1840</div>	<div><div></div>1831</div>	<div><div></div>1836</div>	<div><div></div>1843</div>	<div><div></div>1825</div>	<div><div></div>1810</div>	<div><div></div>1813</div>	<div><div></div>1824</div>	<div><div></div>1818</div>	<div><div></div>1828</div>	<div><div></div>1867</div>	<div><div></div>1849</div>	<div><div></div>1824</div>	<div><div></div>1830</div>	<div><div></div>1824</div>	<div><div></div>32</div>	<div><div></div>1819</div>	<div><div></div>1826</div>	<div><div></div>1819</div>	<div><div></div>1819</div>	<div><div></div>1810</div>	<div><div></div>1821</div>	<div><div></div>1818</div>	<div><div></div>0</div>	<div><div></div>1825</div>		
	Active Power(kW)	<div><div></div></div>	<div><div></div>1816</div>	<div><div></div>1480</div>	<div><div></div>1252</div>	<div><div></div>1841</div>	<div><div></div>1665</div>	<div><div></div>1361</div>	<div><div></div>1536</div>	<div><div></div>1808</div>	<div><div></div>1099</div>	<div><div></div>512</div>	<div><div></div>579</div>	<div><div></div>1051</div>	<div><div></div>821</div>	<div><div></div>1236</div>	<div><div></div>2105</div>	<div><div></div>2000</div>	<div><div></div>1042</div>	<div><div></div>1280</div>	<div><div></div>1077</div>	<div><div></div>-3</div>	<div><div></div>831</div>	<div><div></div>1136</div>	<div><div></div>873</div>	<div><div></div>871</div>	<div><div></div>473</div>	<div><div></div>932</div>	<div><div></div>806</div>	<div><div></div>0</div>	<div><div></div>1118</div>		
	GB HSS DE(C)	79	<div><div></div>87</div>	<div><div></div>76</div>	<div><div></div>73</div>	<div><div></div>75</div>	<div><div></div>79</div>	<div><div></div>68</div>	<div><div></div>78</div>	<div><div></div>75</div>	<div><div></div>76</div>	<div><div></div>74</div>	<div><div></div>75</div>	<div><div></div>75</div>	<div><div></div>77</div>	<div><div></div>75</div>	<div><div></div>85</div>	<div><div></div>82</div>	<div><div></div>80</div>	<div><div></div>84</div>	<div><div></div>79</div>	<div><div></div>42</div>	<div><div></div>84</div>	<div><div></div>79</div>	<div><div></div>82</div>	<div><div></div>76</div>	<div><div></div>79</div>	<div><div></div>73</div>	<div><div></div>76</div>	<div><div></div>10</div>	<div><div></div>81</div>		
<div>Temperature</div> <div><div></div> Normal Oper. Temp</div> <div><div></div> Low Temp</div> <div><div></div> Pre-Alarm High Temp</div> <div><div></div> High Temp</div>	GB HSS NDE(C)	80	<div><div></div>79</div>	<div><div></div>82</div>	<div><div></div>81</div>	<div><div></div>78</div>	<div><div></div>86</div>	<div><div></div>83</div>	<div><div></div>83</div>	<div><div></div>77</div>	<div><div></div>78</div>	<div><div></div>78</div>	<div><div></div>69</div>	<div><div></div>80</div>	<div><div></div>82</div>	<div><div></div>82</div>	<div><div></div>81</div>	<div><div></div>77</div>	<div><div></div>73</div>	<div><div></div>80</div>	<div><div></div>73</div>	<div><div></div>37</div>	<div><div></div>78</div>	<div><div></div>72</div>	<div><div></div>88</div>	<div><div></div>81</div>	<div><div></div>74</div>	<div><div></div>81</div>	<div><div></div>82</div>	<div><div></div>10</div>	<div><div></div>87</div>		
	GB IMS DE(C)	64	<div><div></div>69</div>	<div><div></div>59</div>	<div><div></div>60</div>	<div><div></div>57</div>	<div><div></div>65</div>	<div><div></div>76</div>	<div><div></div>59</div>	<div><div></div>58</div>	<div><div></div>58</div>	<div><div></div>60</div>	<div><div></div>67</div>	<div><div></div>58</div>	<div><div></div>60</div>	<div><div></div>59</div>	<div><div></div>71</div>	<div><div></div>69</div>	<div><div></div>67</div>	<div><div></div>71</div>	<div><div></div>67</div>	<div><div></div>45</div>	<div><div></div>68</div>	<div><div></div>66</div>	<div><div></div>65</div>	<div><div></div>57</div>	<div><div></div>68</div>	<div><div></div>59</div>	<div><div></div>59</div>	<div><div></div>11</div>	<div><div></div>67</div>		
	GB IMS NDE(C)	<div><div></div></div>	<div><div></div>65</div>	<div><div></div>67</div>	<div><div></div>67</div>	<div><div></div>67</div>	<div><div></div>70</div>	<div><div></div>59</div>	<div><div></div>66</div>	<div><div></div>62</div>	<div><div></div>68</div>	<div><div></div>70</div>	<div><div></div>58</div>	<div><div></div>68</div>	<div><div></div>67</div>	<div><div></div>70</div>	<div><div></div>65</div>	<div><div></div>59</div>	<div><div></div>56</div>	<div><div></div>64</div>	<div><div></div>55</div>	<div><div></div>39</div>	<div><div></div>63</div>	<div><div></div>57</div>	<div><div></div>70</div>	<div><div></div>64</div>	<div><div></div>60</div>	<div><div></div>70</div>	<div><div></div>70</div>	<div><div></div>11</div>	<div><div></div>67</div>		
	Communication	Gear Oil(C)	61	<div><div></div>64</div>	<div><div></div>60</div>	<div><div></div>62</div>	<div><div></div>58</div>	<div><div></div>64</div>	<div><div></div>60</div>	<div><div></div>60</div>	<div><div></div>59</div>	<div><div></div>60</div>	<div><div></div>61</div>	<div><div></div>59</div>	<div><div></div>58</div>	<div><div></div>60</div>	<div><div></div>60</div>	<div><div></div>65</div>	<div><div></div>60</div>	<div><div></div>58</div>	<div><div></div>65</div>	<div><div></div>58</div>	<div><div></div>60</div>	<div><div></div>63</div>	<div><div></div>58</div>	<div><div></div>65</div>	<div><div></div>58</div>	<div><div></div>60</div>	<div><div></div>61</div>	<div><div></div>62</div>	<div><div></div>11</div>	<div><div></div>65</div>	
<div>Bad Data</div> <div>No Comm</div>	Drive Train Vibration	<div><div></div></div>	0.00	0.00	0.00	0.10	0.00	0.00	-0.10	0.00	0.00	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.00	-0.10	0.00	0.00	0.00	-0.10	0.00	-0.10	0.00	0.00	0.00	0.00	-12.00		
	G1L1 Temp(C)	71	<div><div></div>68</div>	<div><div></div>82</div>	<div><div></div>65</div>	<div><div></div>58</div>	<div><div></div>65</div>	<div><div></div>65</div>	<div><div></div>64</div>	<div><div></div>65</div>	<div><div></div>70</div>	<div><div></div>65</div>	<div><div></div>58</div>	<div><div></div>64</div>	<div><div></div>58</div>	<div><div></div>65</div>	<div><div></div>73</div>	<div><div></div>73</div>	<div><div></div>82</div>	<div><div></div>79</div>	<div><div></div>79</div>	<div><div></div>30</div>	<div><div></div>69</div>	<div><div></div>78</div>	<div><div></div>77</div>	<div><div></div>73</div>	<div><div></div>69</div>	<div><div></div>64</div>	<div><div></div>79</div>	<div><div></div>8</div>	<div><div></div>70</div>		
	G1L2 Temp(C)	70	<div><div></div>68</div>	<div><div></div>81</div>	<div><div></div>64</div>	<div><div></div>59</div>	<div><div></div>64</div>	<div><div></div>63</div>	<div><div></div>64</div>	<div><div></div>64</div>	<div><div></div>69</div>	<div><div></div>65</div>	<div><div></div>58</div>	<div><div></div>63</div>	<div><div></div>58</div>	<div><div></div>64</div>	<div><div></div>73</div>	<div><div></div>72</div>	<div><div></div>81</div>	<div><div></div>79</div>	<div><div></div>78</div>	<div><div></div>30</div>	<div><div></div>69</div>	<div><div></div>77</div>	<div><div></div>77</div>	<div><div></div>71</div>	<div><div></div>68</div>	<div><div></div>62</div>	<div><div></div>77</div>	<div><div></div>9</div>	<div><div></div>67</div>		
	G1L3 Temp(C)	70	<div><div></div>67</div>	<div><div></div>79</div>	<div><div></div>63</div>	<div><div></div>59</div>	<div><div></div>64</div>	<div><div></div>64</div>	<div><div></div>64</div>	<div><div></div>65</div>	<div><div></div>68</div>	<div><div></div>66</div>	<div><div></div>58</div>	<div><div></div>63</div>	<div><div></div>57</div>	<div><div></div>65</div>	<div><div></div>74</div>	<div><div></div>71</div>	<div><div></div>82</div>	<div><div></div>78</div>	<div><div></div>78</div>	<div><div></div>30</div>	<div><div></div>68</div>	<div><div></div>76</div>	<div><div></div>77</div>	<div><div></div>69</div>	<div><div></div>69</div>	<div><div></div>64</div>	<div><div></div>77</div>	<div><div></div>8</div>	<div><div></div>68</div>		
	GEN DE(C)	33	<div><div></div>30</div>	<div><div></div>36</div>	<div><div></div>34</div>	<div><div></div>28</div>	<div><div></div>33</div>	<div><div></div>29</div>	<div><div></div>32</div>	<div><div></div>31</div>	<div><div></div>34</div>	<div><div></div>35</div>	<div><div></div>29</div>	<div><div></div>33</div>	<div><div></div>28</div>	<div><div></div>30</div>	<div><div></div>34</div>	<div><div></div>33</div>	<div><div></div>41</div>	<div><div></div>42</div>	<div><div></div>36</div>	<div><div></div>21</div>	<div><div></div>31</div>	<div><div></div>35</div>	<div><div></div>33</div>	<div><div></div>34</div>	<div><div></div>34</div>	<div><div></div>29</div>	<div><div></div>33</div>	<div><div></div>9</div>	<div><div></div>29</div>		
	GEN NDE(C)	41	<div><div></div>40</div>	<div><div></div>35</div>	<div><div></div>39</div>	<div><div></div>36</div>	<div><div></div>42</div>	<div><div></div>39</div>	<div><div></div>39</div>	<div><div></div>39</div>	<div><div></div>42</div>	<div><div></div>47</div>	<div><div></div>38</div>	<div><div></div>40</div>	<div><div></div>36</div>	<div><div></div>39</div>	<div><div></div>44</div>	<div><div></div>39</div>	<div><div></div>48</div>	<div><div></div>48</div>	<div><div></div>43</div>	<div><div></div>16</div>	<div><div></div>39</div>	<div><div></div>44</div>	<div><div></div>42</div>	<div><div></div>38</div>	<div><div></div>40</div>	<div><div></div>40</div>	<div><div></div>43</div>	<div><div></div>8</div>	<div><div></div>41</div>		
	Nacelle Temp(C)	16	<div><div></div>12</div>	<div><div></div>7</div>	<div><div></div>7</div>	<div><div></div>7</div>	<div><div></div>14</div>	<div><div></div>7</div>	<div><div></div>10</div>	<div><div></div>9</div>	<div><div></div>7</div>	<div><div></div>10</div>	<div><div></div>7</div>	<div><div></div>13</div>	<div><div></div>7</div>	<div><div></div>9</div>	<div><div></div>8</div>	<div><div></div>10</div>	<div><div></div>7</div>	<div><div></div>18</div>	<div><div></div>10</div>	<div><div></div>9</div>	<div><div></div>7</div>	<div><div></div>7</div>	<div><div></div>14</div>	<div><div></div>8</div>	<div><div></div>11</div>	<div><div></div>8</div>	<div><div></div>8</div>	<div><div></div>7</div>	<div><div></div>9</div>		
	Outdoor Temp(C)	9	<div><div></div>15</div>	<div><div></div>16</div>	<div><div></div>14</div>	<div><div></div>15</div>	<div><div></div>16</div>	<div><div></div>15</div>	<div><div></div>14</div>	<div><div></div>12</div>	<div><div></div>15</div>	<div><div></div>17</div>	<div><div></div>16</div>	<div><div></div>14</div>	<div><div></div>15</div>	<div><div></div>16</div>	<div><div></div>16</div>	<div><div></div>16</div>	<div><div></div>16</div>	<div><div></div>22</div>	<div><div></div>18</div>	<div><div></div>16</div>	<div><div></div>13</div>	<div><div></div>13</div>	<div><div></div>16</div>	<div><div></div>16</div>	<div><div></div>17</div>	<div><div></div>15</div>	<div><div></div>16</div>	<div><div></div>8</div>	<div><div></div>15</div>		
				T01 System OK					T06 System OK					T11 System OK				T16 System OK				T21 System OK											
				T02 System OK					T07 System OK					T12 System OK				T17 System OK				T22 System OK											
			T03 System OK					T08 System OK					T13 System OK				T18 System OK				T23 System OK												
			T04 System OK					T09 System OK					T14 System OK				T19 System OK				T24 System OK												
			T05 System OK					T10 System OK					T15 System OK				T20 RS Manual SoftStop				T25 System OK												

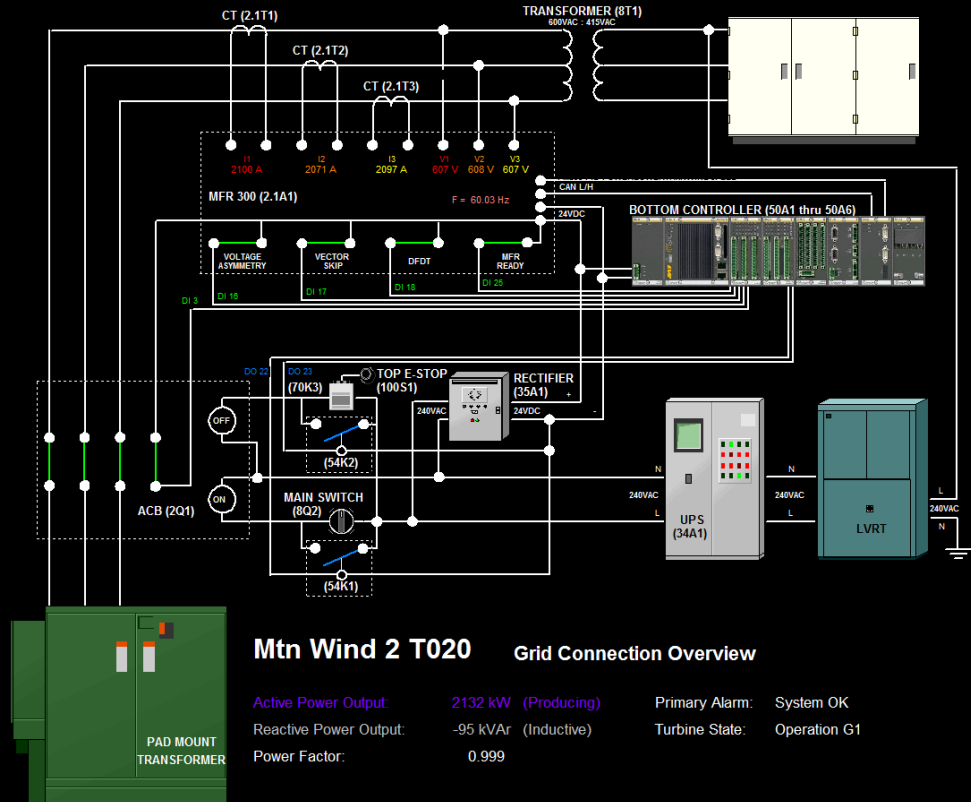
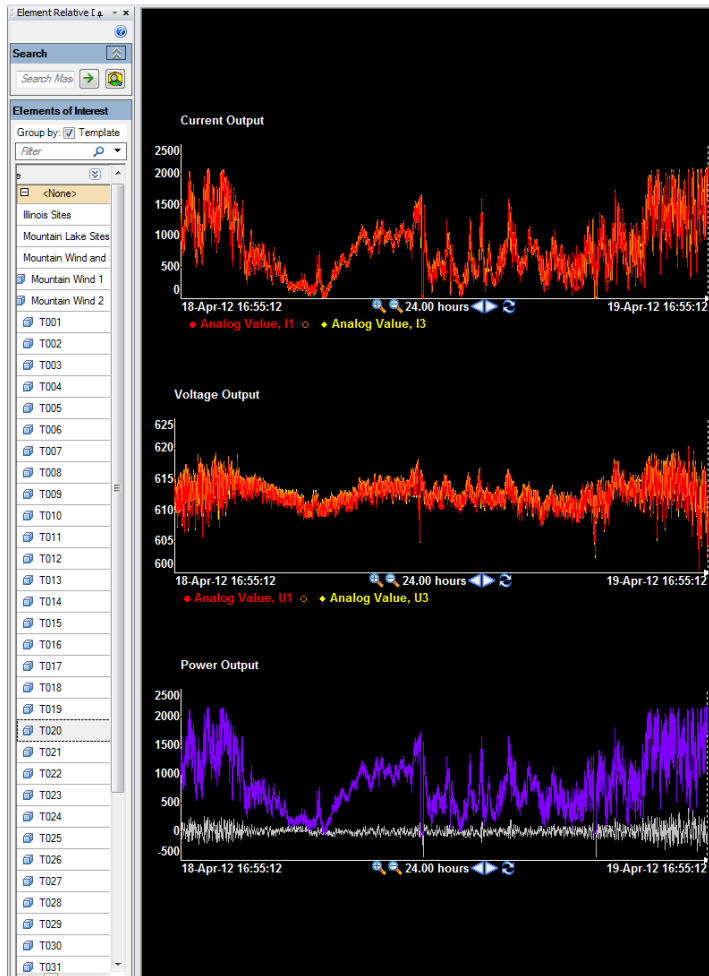
Park Overview

Individual Turbine

Gen Bearing Trend

Park Tree

Park Tree



# Challenges with PI OPC Expansion

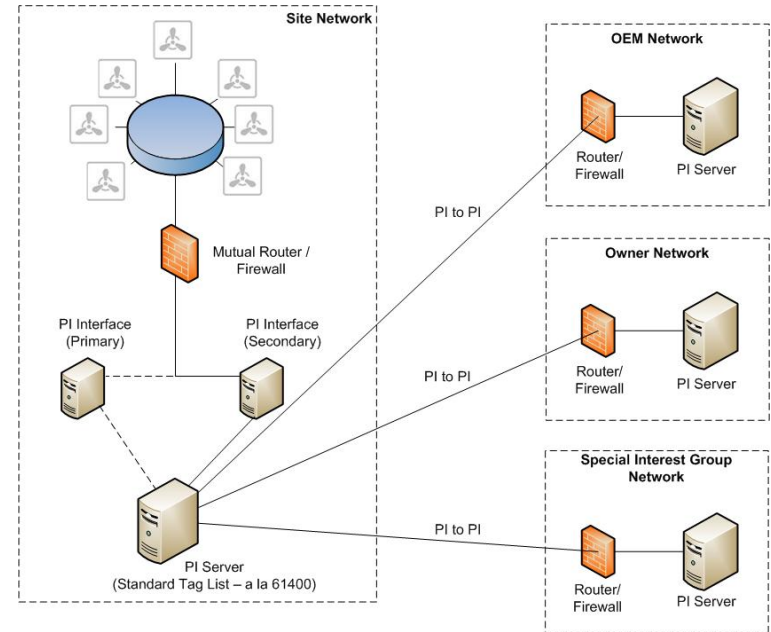
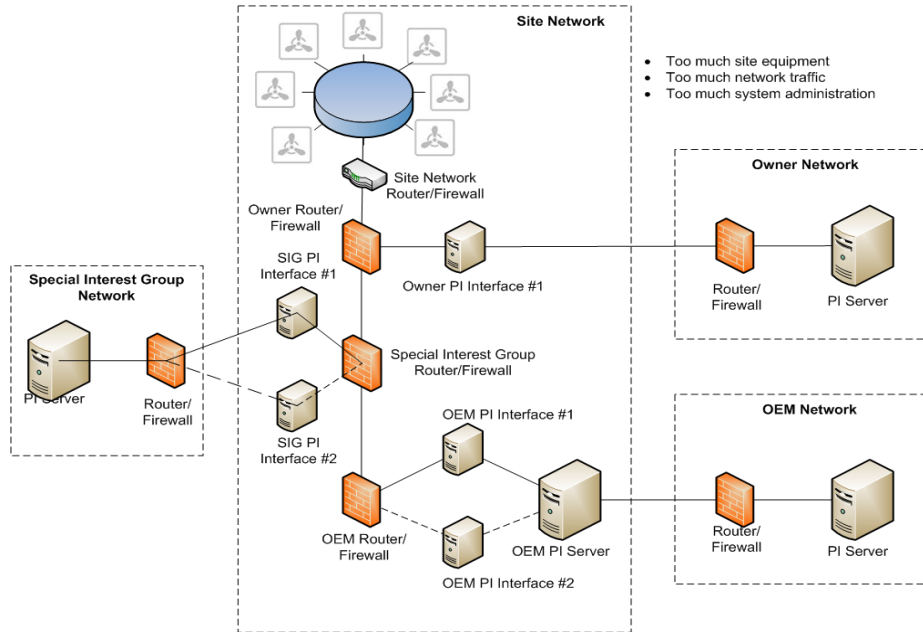
- Not true “Direct to Controller”
  - PI OPC is still the “middle man”
  - Would a native interface be faster? More reliable? Less network demand?
- Local network issues
  - Initially, expansion caused our PI System to be a “bandwidth hog”
  - Stepped down to “warm” failover instead of “hot”
    - One active PI OPC server instead of two
    - “Warm-2” on PI OPC interface – keeps PI OPC server ready, but not active
  - Upgraded PI OPC server
    - Previous release caused memory leak on controller at disconnect



# The Future...

- The Goal = MORE DATA!
  - More data can lead to improved availability and production
  - Also potentially leads to savings on parts, time, and labor
- IEC 61850 and 61400-25 standards
  - More native interfaces becoming available
  - Repower offers 61400-25 server option for their entire product line
  - Retrofit existing WTG's to be 61850 or 61400-25 ready/compatible?
  - Standards currently call for less than 200 points/WTG
- Direct-to-Controller with PI OPC
  - Standardize a namespace
  - Improve security
  - Use as option for older/incompatible WTG controllers
  - Extend access to non-OEM entities...

# The Future...

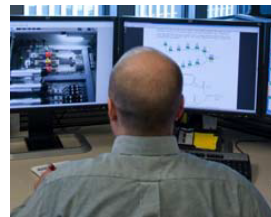


# The Future...

- Share a common PI OPC server
  - Reduce connections to controllers
  - Reduce local network congestion
  - Standardize an PI OPC namespace
  - Still requires each entity to have separate interfaces and servers
- Share a common PI System
  - Reduces number of devices on network
  - Standardize a PI System namespace
  - Considerations: financial, proprietary, maintenance, etc.

# Acknowledgments

We probably could have used an army of people to accomplish this, but it was really just a handful of folks...



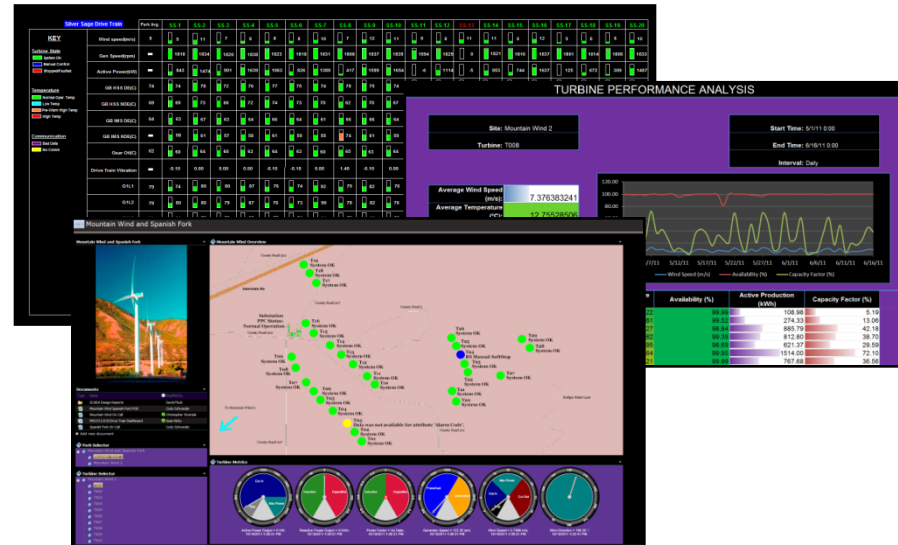
And, of course, this would not have been possible without the support from OSIsoft!

# Suzlon: Direct to Controller Integration Using PI OPC

“Expanding the number of available tags in our PI System has allowed us to boost our troubleshooting capabilities—both visually and operationally. Now we can recognize certain tendencies in parameters that we couldn’t even see before. Using this additional data to trigger warnings and notifications allows us to be more proactive, which is a win-win for us and our customers.”

**Richard Duesing**

Suzlon Monitoring Center Manager



## Challenges

- Lack of tags available in PI System due to limited dataset exposed on PI OPC server
- Difficulty gaining insight on equipment behavior
- Inability to alert on trends characteristic of potential issues

## Solutions

- Connect directly to turbine controllers using PI OPC server
- Expand dataset exposed on PI OPC server
- Modify PI Interface and server settings to minimize impact on controllers and local network

## Results

- Ability to create meaningful and insightful dashboards, reports, and notifications with the PI System
- Major step in moving from reactive to proactive operations and maintenance

# Direct to Controller Integration Using PI OPC

- Expanding the dataset available in a PI System opens up numerous possibilities
- Using PI OPC to get more data directly from a controller is an easily implemented solution
- The next challenge is to make more data available to our customers, utilities, and all other parties interested

# Direct to Controller Integration Using PI OPC

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# THANK YOU

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