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USERS CONFERENCE 2016

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TRANSFORM YOUR WORLD

Advanced Performance Analytics in Solar Power Systems

Presented by **Steve Hanawalt - Power Factors**
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Outline

- Company Overview
- The Problem
- New Approach
- Solution
- Evaluation Results
- Customer Benefits

Power Factors

- Founded in 2013
- Independent Operations Center service for solar power owners and operators
- Real-time monitoring, reporting and performance optimization service
- 2nd largest independent solar monitoring service in the world
- OSIsoft partner using a hosted PI System infrastructure to deliver value-added services to the solar power segment

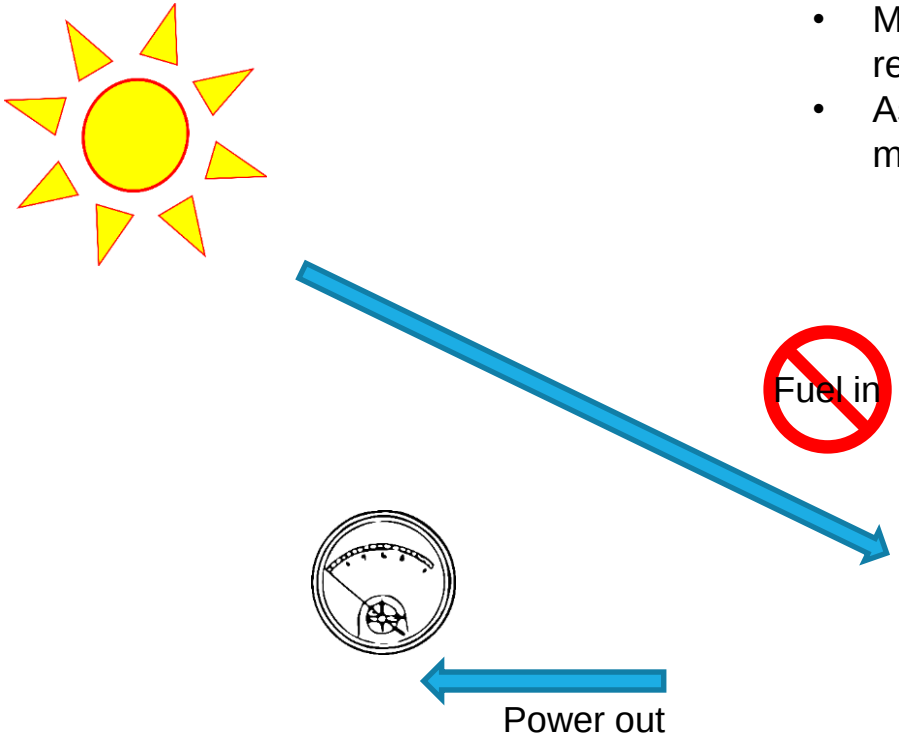
ECG

- Privately held company founded in 1992
- Progressive engineering / IT firm that has been developing Power Generation related solutions since the early1990s

The Problem

- Labor costs are the major driver in solar O&M
- Solar power can’t afford traditional plant sensor and data monitoring cost structures
- Solar plant data volumes have grown geometrically in the last 5 years
- Immature market is provisioning plants with data monitoring systems that are not scalable or robust

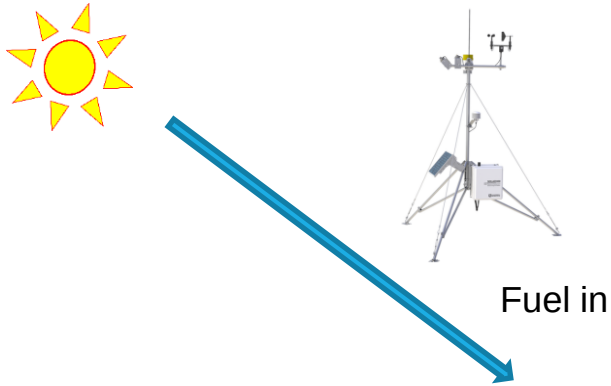
Residential Market



Problem

- Met stations are not included in residential systems installations
- As a result, there is no good way of monitoring system performance

Utility Market



Problem

- Adding sensors deep into the array is too costly
- Manual data processing and analysis drives labor costs “through the roof”

A New Approach is Needed

- How do we deploy advanced performance monitoring methods and keep our labor and data costs low?
  - PI System applications delivered as value-added service
  - Leverage IT and automation
  - Use a new approach to detecting performance anomalies
- Combined power of PF Insight Service & Predict-It

PF Insight Service℠

Solution

- Capture historical plant operating data with PI System
- Cleanse to ensure it represents a healthy system
- Run that training data thru the APR engine and develop model
- “Pipe” that model up to the PI System
- Configure event engine to detect performance anomalies, create work orders and alert L1 monitoring techs
- Route escalated work orders to performance engineers
- Schedule targeted conditioned-based maintenance to correct problem and recover performance

What is Predict-It?

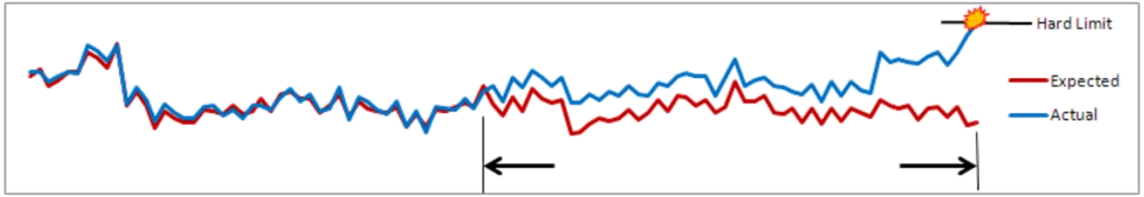
Predict-It is a Pattern Recognition (*predictive analytics*) software solution leveraging existing data from **OSIsoft PI System** to detect process anomalies and performance degradation in *real-time*

PREDICT-IT ALLOWS YOUR WORKFORCE TO FOCUS ON FIXING PROBLEMS, NOT LOOKING FOR THEM

How Does it Work?

- Predict-It uses historical tag values to **create models** based on past performance

- Powerful algorithms detect subtle changes in equipment behavior **days**, **weeks** and **even months** before conventional monitoring techniques

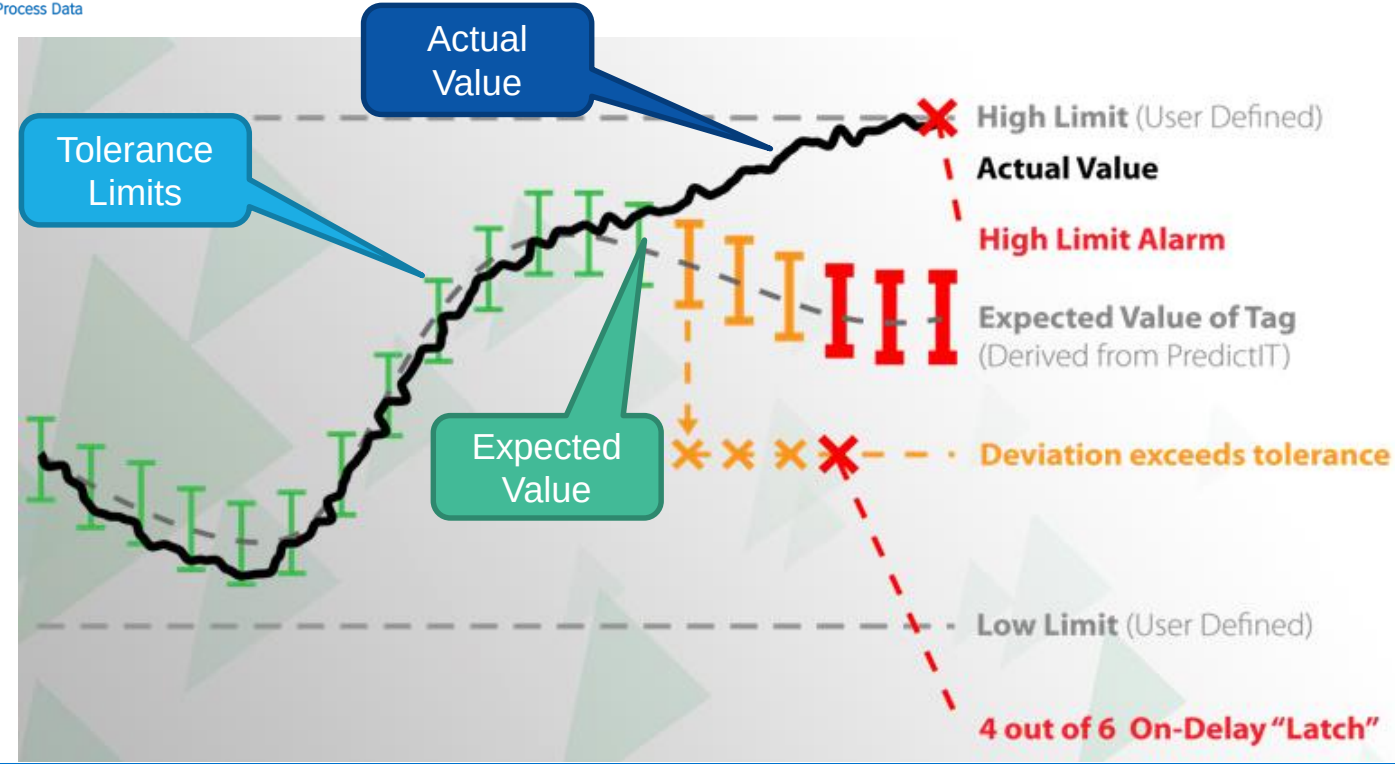


Proactive Advantage

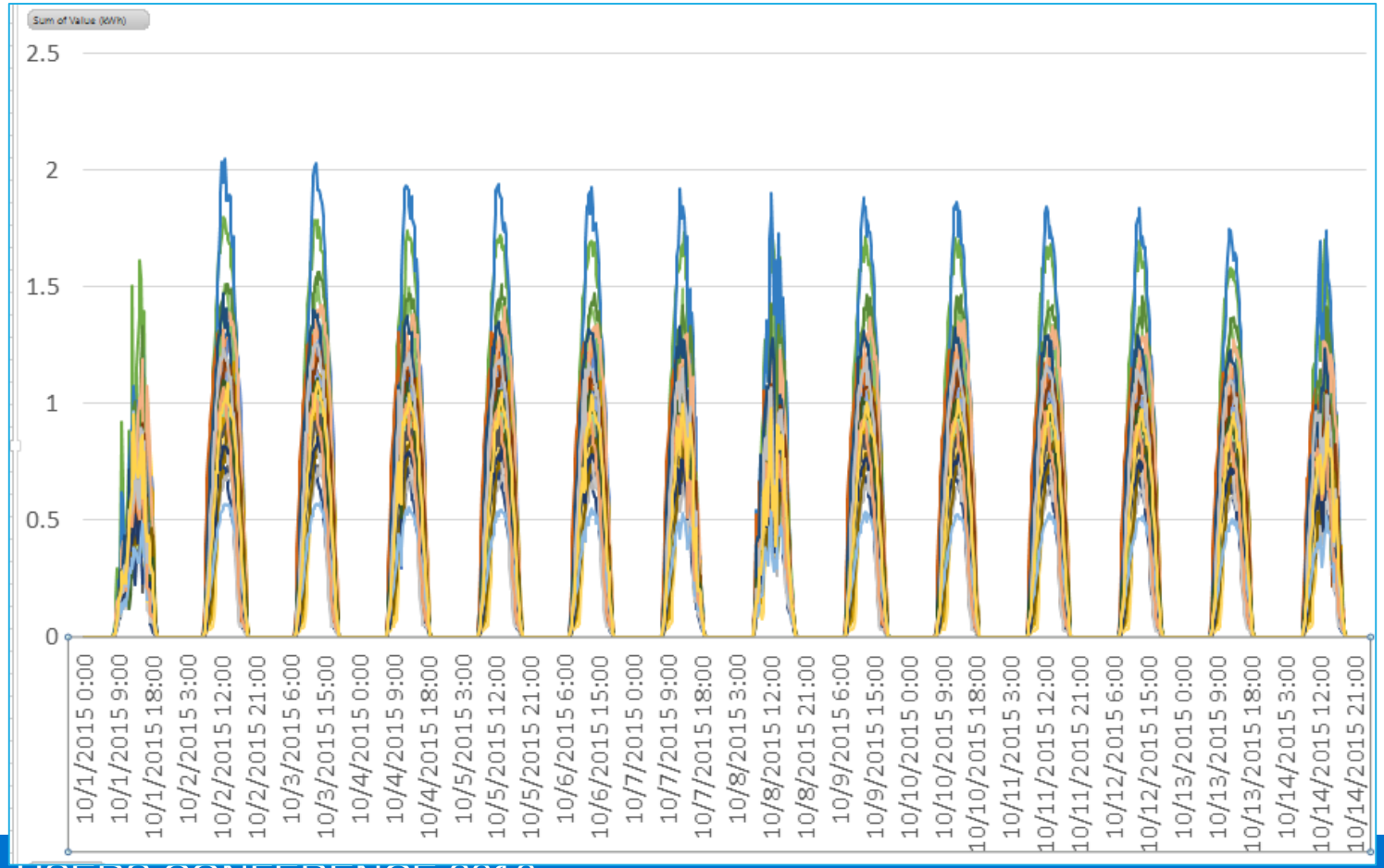
APR Software

PREDICT·it
Predictive Modeling for Process Data

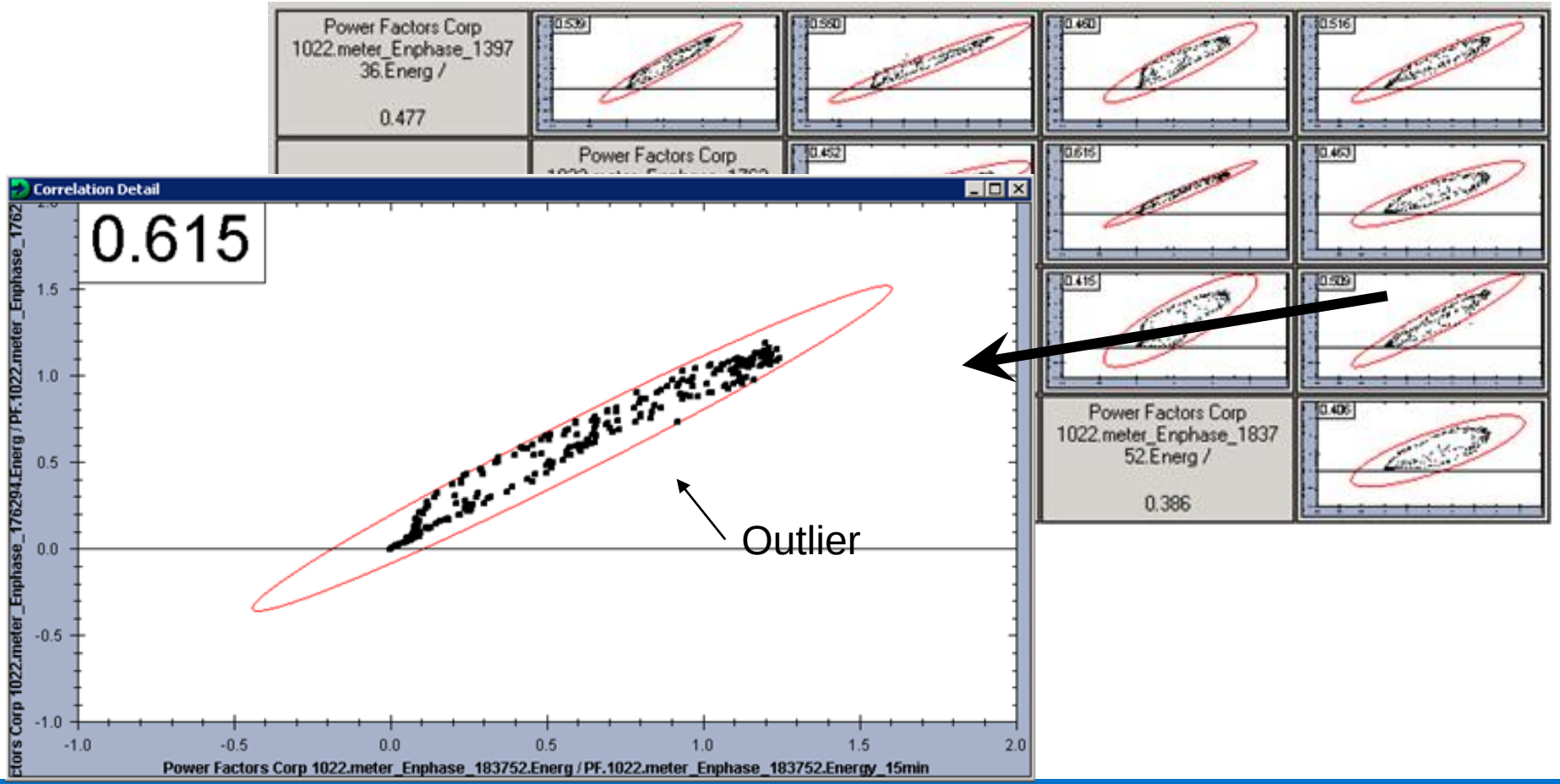
Actual	Real-time value from data archives
Expected	Predicted value from Predict-It estimator
Residual	Difference between Actual and Estimate



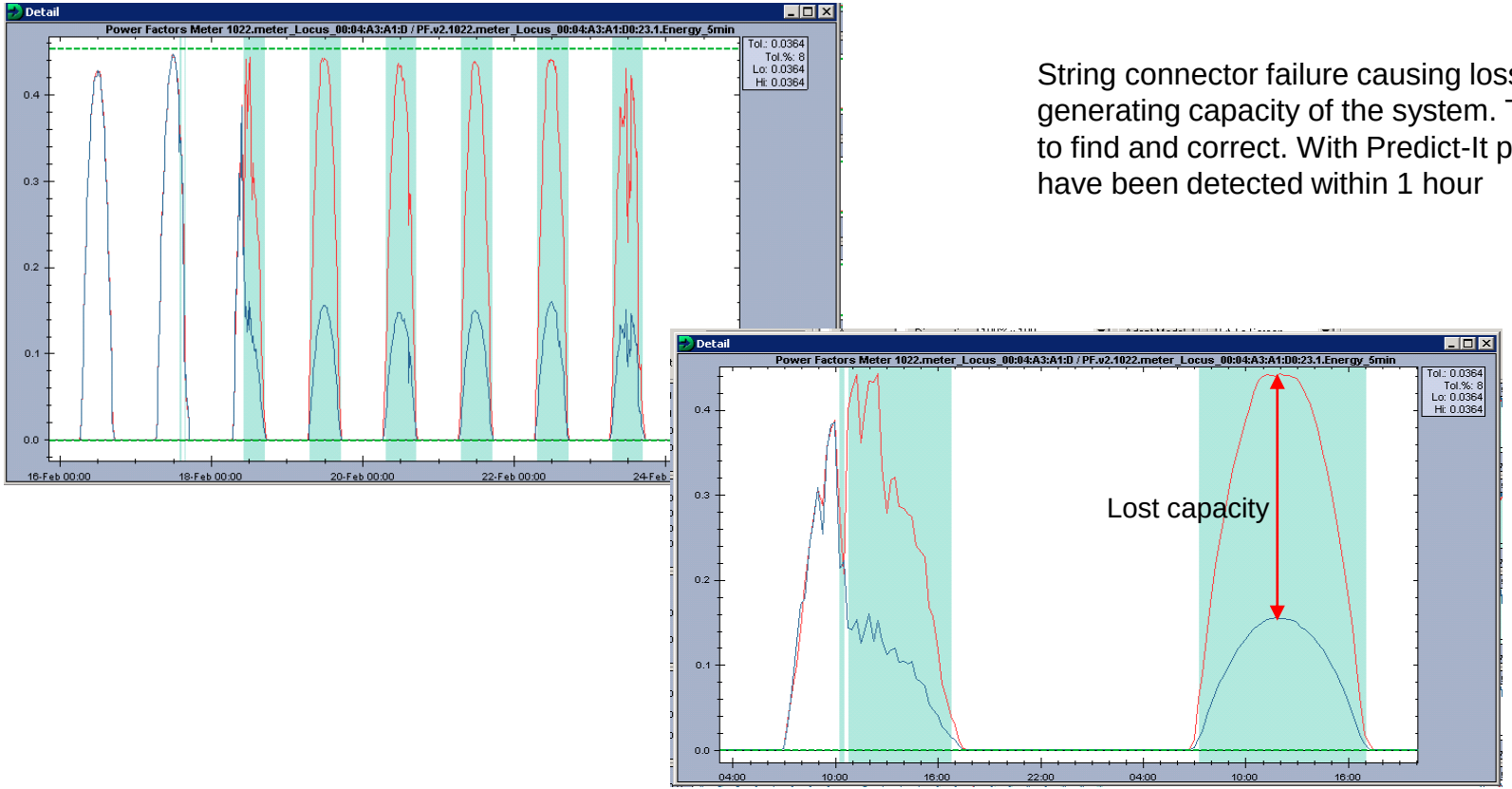
Solar Data – 2 Weeks, 40 Meters



Solar Data – Correlation

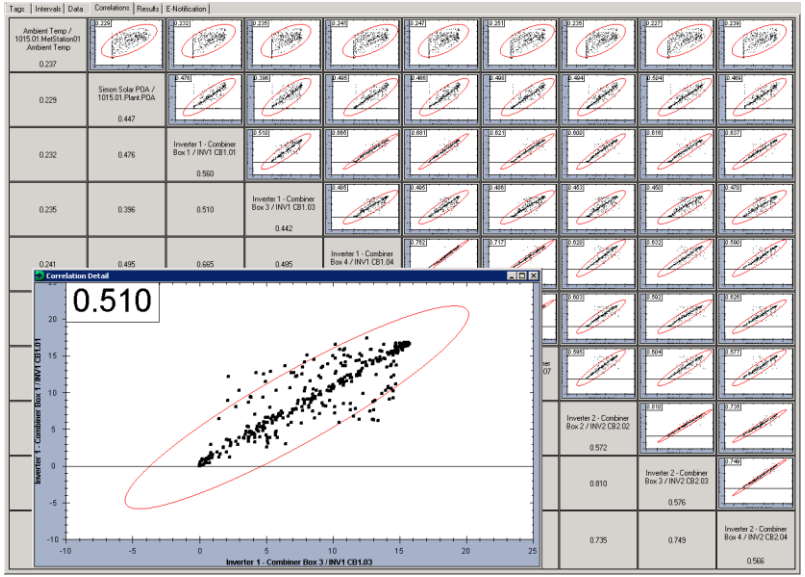


Residential System – Exceptions



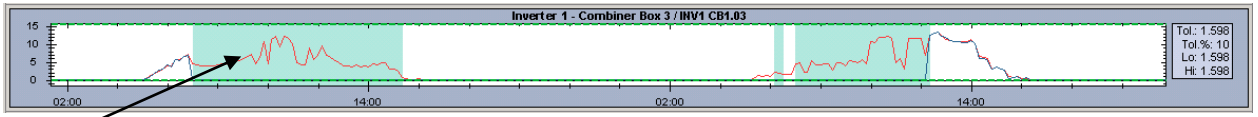
String connector failure causing loss of 60% of the generating capacity of the system. Took 29 days to find and correct. With Predict-It problem would have been detected within 1 hour

Evaluation Results – Utility-Scale Asset



Training data

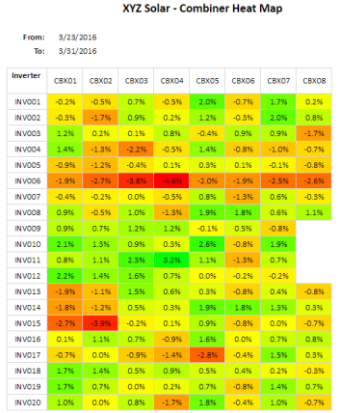
Predict-It found a string failure. These are not detectable without costly monitoring hardware. In many cases, these string failures persist until the first year's maintenance is performed

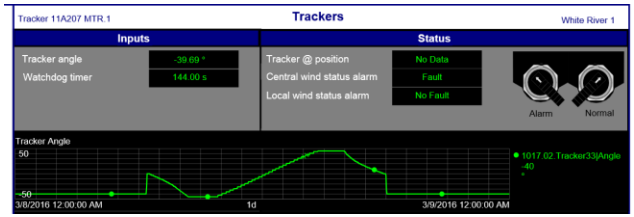


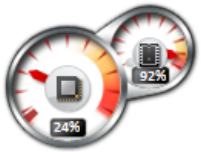
Problem detection

Customer Use Cases - Utility

- Transition from *scavenger hunt* maintenance to *data-driven* maintenance
- Detect *performance anomalies* before they become *performance problems*
- Identify failed instrumentation







Customer Use Cases - Residential

- Offer customers performance guarantees and actually be able to monitor them

- Detect performance anomalies and conduct more efficient truck rolls

Estimated Financial Benefits

- Residential Portfolio (25,000 homes or 75,000 kW)
  - CAPEX: $12.5M
  - Annual savings: $332,000

- Utility Portfolio (1 GW)
  - CAPEX: $10M
  - OPEX: $945,000
  - Annual savings: $3.48M

Benefits

- Significant reduction in capital costs 
- Significant reduction in operating costs
- Ability to find previously undetected performance problems (incremental revenue) 
- Quickly on-board service 
- Exception-based detection and alerting moves from reactive to proactive (condition-based) maintenance program 

Summary

- A new approach is needed for monitoring solar power plants
- PredictIt's advanced pattern recognition engine delivered as a part of an overall performance monitoring service makes this possible
- Preliminary results from both the Residential and Utility solar market segments have been very positive
- PI System platform provides a scalable and robust exception-based monitoring platform with value-added "plug-ins"

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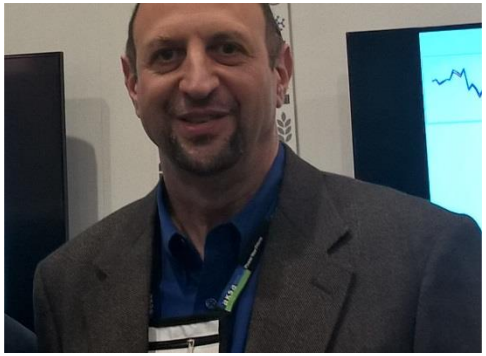

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谢谢

Danke

Gracias

Merci

Thank You

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Спасибо

Obrigado

Predict-It Failure Detection in Solar Power

- Equipment failures for solar equipment that is not monitored (such as modules, string and combiner boxes and residential solar systems)
- Equipment that is operating sub-optimally (trackers not tracking accurately, inverters off MPPT tracking)
- Module degradation
- Detecting failed meters and instrumentation

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