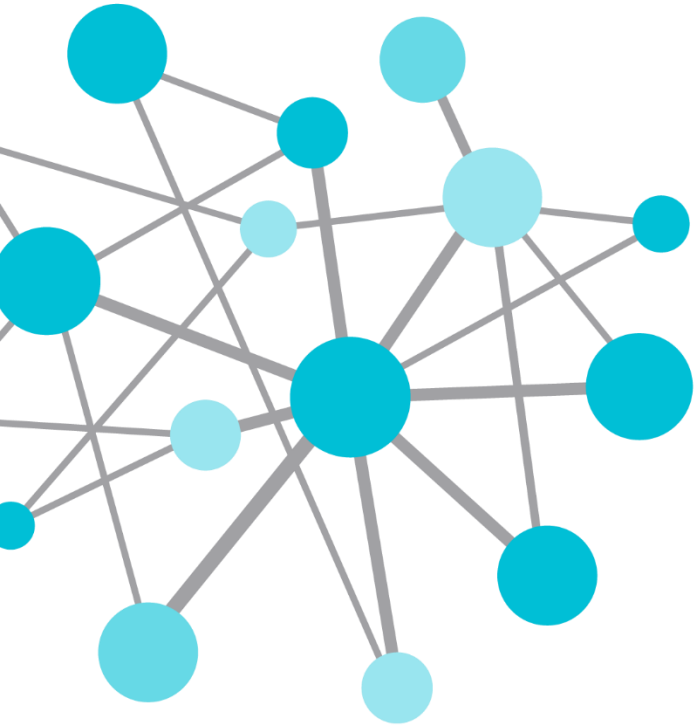


Analyzing Event Impacts using PI Event Frames and Versify

Presented by **Devon Yates**

NaturEner USA

NaturEner Overview

NaturEner

Wind plant operator, owner, and developer

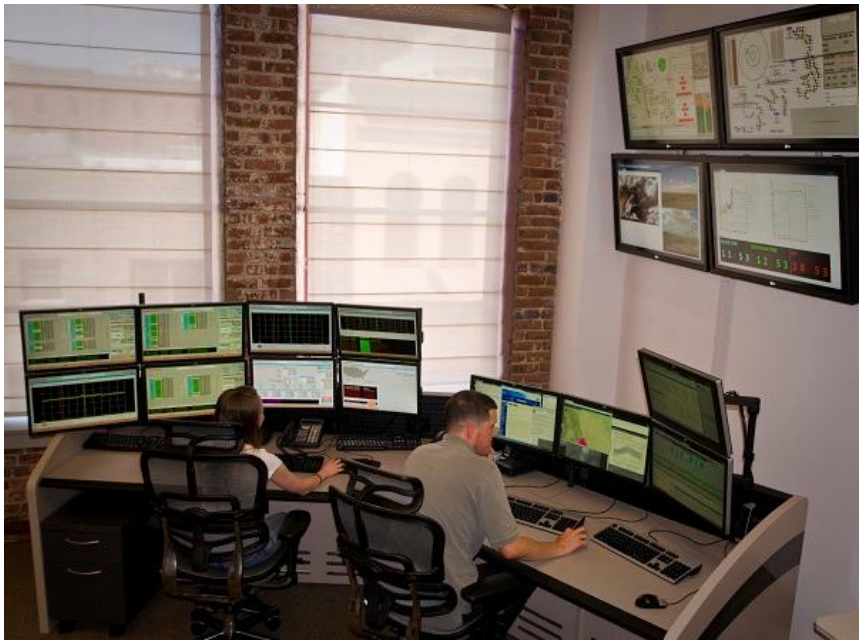
NaturEner North America

- **NaturEner USA** — San Francisco — Wind
- **NaturEner Canada** — Calgary — Wind

	NaturEner USA (San Francisco, Wind)	NaturEner Canada (Calgary, Wind)	Cumulative
Operating	**399 MW**		**399 MW**
Late-stage development		**387 MW**	**786 MW**
Mid-stage development	**360 MW**	**100 MW**	**1,246 MW**

NaturEner Operations Center (NOC)

NaturEner



Expertise in Asset Management and Operations

- Real time interface with all projects
- Full operational control
- Schedule hourly energy and transmission in concert with regulatory and contract compliance considerations
- Staffed 24/7, 365 days a year
- Complete data repository with fully redundant capabilities
- Back-up Center in Calgary (Alberta), for catastrophic events
- Predictive maintenance project support and reporting

Business Challenge

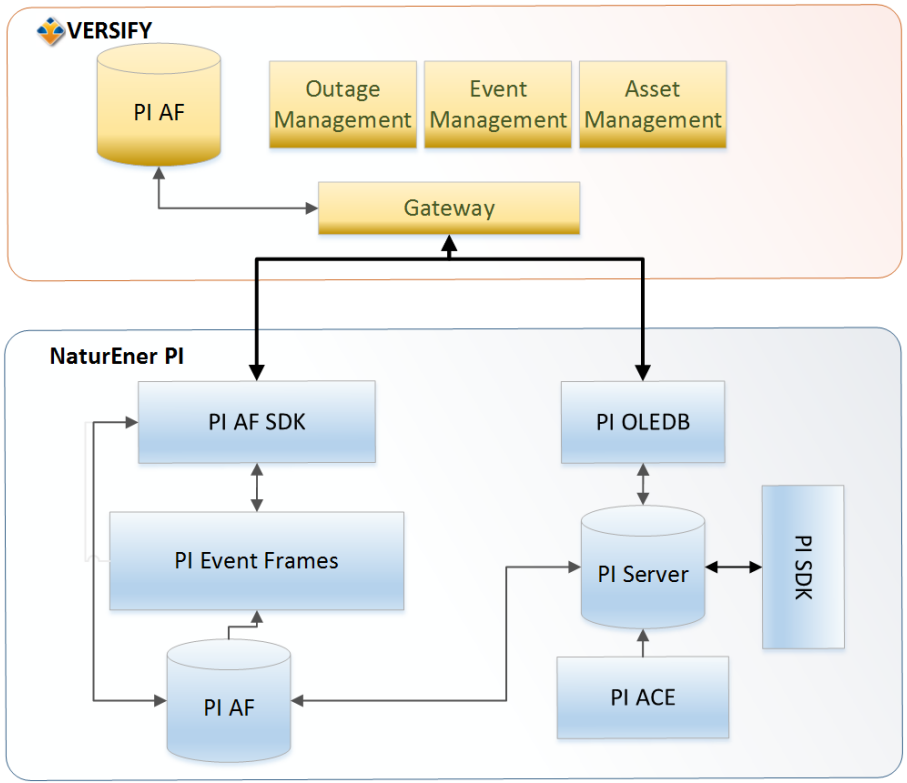
NaturEner

Internal and external events can impact our operations and bottom line.

- Log events in consistent centralized manner
  - Events may be detectable through PI system data
  - May be initiated by an external source
- Trigger Workflows and notifications
- Associate events with data from different sources
  - PI, SQL, User defined categories, Unstructured Text
- Flexible reporting capabilities
  - PI Client tools, Web, ODBC

Solution Architecture

NaturEner



- Log Manual Operator Events
- PI Event Frame Integration for automated event capture
- Operator workflows

↑ Bi-Directional Events ↓

- Common PI AF Model
- Automated Event Capture
- Leverage PI Server for Event analysis
- PI ACE performance metrics

Automated Event Capture

NaturEner

PI Event Frames

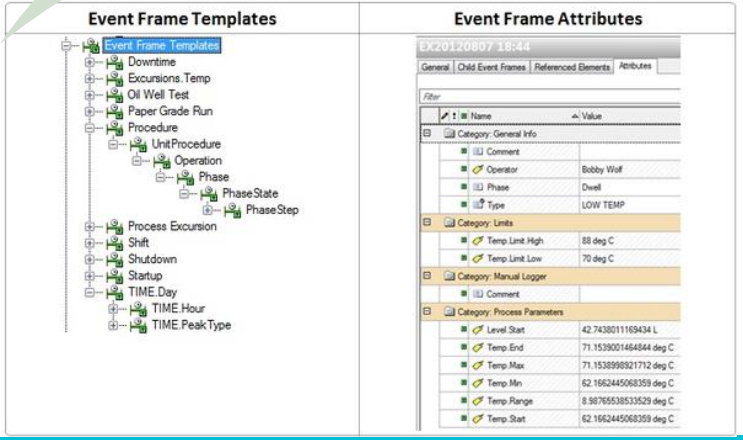
- Event Frame Generator
- Log Event Start/Stops

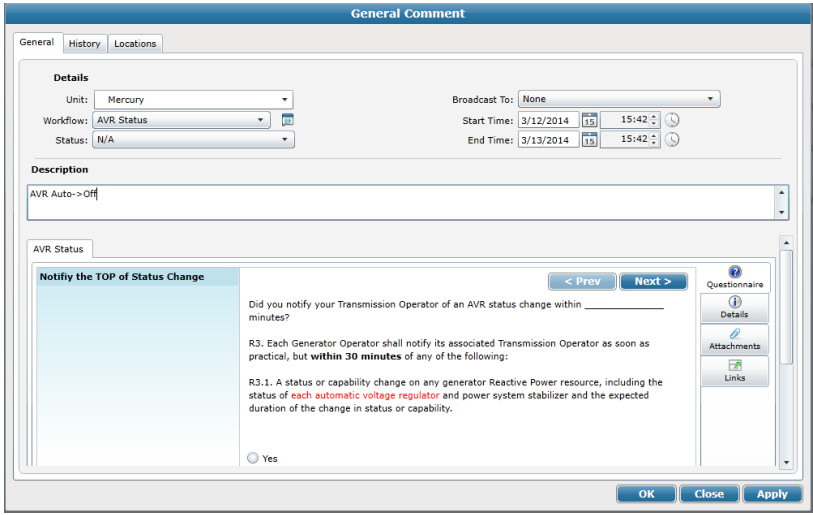
PI AF SDK

- Query Event Frames

Versify Event Log

- Operator Workflows
- NERC Evidence
- Unstructured Details





- Improve Log Accuracy
- Reduce Manual Workload
- Capture data for further analysis

Manual Event Capture

NaturEner

Comment Id	Unit	Workflow	Event Status	Start Time	End Time	Log Entry	Made	Entered	Acknowledged By
0	Andromeda virtG1	CAISO Outage	N/A	03/11/2014 11:00	03/12/2014 11:00	Maintenance Outage Derating: A Other (derateId: 14111) Status:In Review	versify	03/11/2014 09:42	
82816	Corona	CAISO Outage	N/A	03/11/2014 17:00	03/15/2014 17:00	Planned Outage Derating: Coron Other (derateId: 14105) Status:In Review	versify	02/24/2014 15:01	
70301	Andromeda	CPS 1 Failing [12 Month A	Active	08/12/2013 10:46	06/28/2014 12:30	Note Change: Fuel : This is a sample Event Log This can be a full sized event description. Show a history change	versify	12/12/2013 14:48	
71745	ERCOT	Communication	Active	09/05/2013 13:36	09/20/2014 13:36	Communication: This is a sample event from ERCOT	versify	09/05/2013 13:37	versify on 09/05/2013 13:38
70301	Andromeda	CPS 1 Failing [12 Month A	Active	08/12/2013 10:46	06/28/2014 12:30	Note Change: Fuel : This is a sample Event Log This can be a full sized event description. Show a history change	versify	08/12/2013 10:48	versify on 08/12/2013 10:48
70301	Andromeda	CPS 1 Failing [12 Month A	Active	08/12/2013 10:46	06/28/2014 12:30	Fuel: This is a sample Event Log This can be a full sized event description.	versify	08/12/2013 10:48	versify on 08/12/2013 10:48

- Improve Quality Control
- Leverage Versify Tools
- Leverage OSI Client Tools

PI Clients

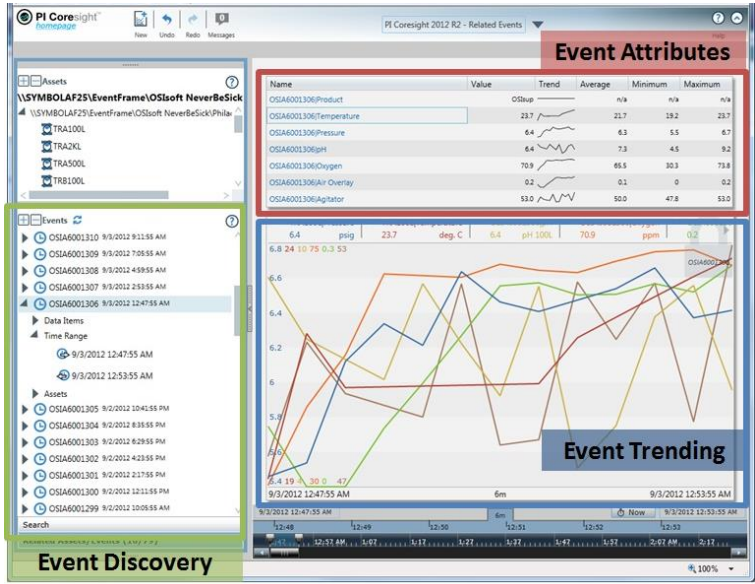
- KPI
- Reporting
- Analysis

Versify Event Log

- Operator Logs event
- Operations Workflow

PI AF SDK

- Send to Event Frames

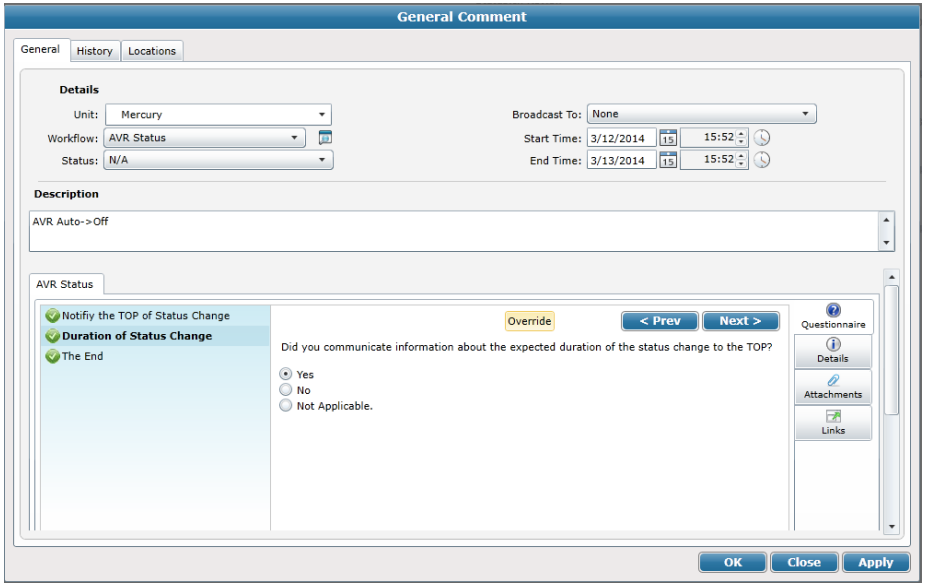


Event Workflows

NaturEner

Versify's Event Workflows are a value-add to PI Event Frames that walk operators through and document defined processes in responding to system events

- ✓ Standardize Operator Response
- ✓ Collects Evidence Required for NERC Audits in real-time
- ✓ Automated event escalation and alerts/reminders
- ✓ Attach additional supporting documentation
- ✓ Training tool for new operators



Use Case: Substation Outage

NaturEner

Initiation

- **Planned Outage**
  - Notify affected entities
  - Modify Resource Plan
  - Future Data / SQL
- **Unplanned Outage**
  - Triggered by PI or Manually

During Event

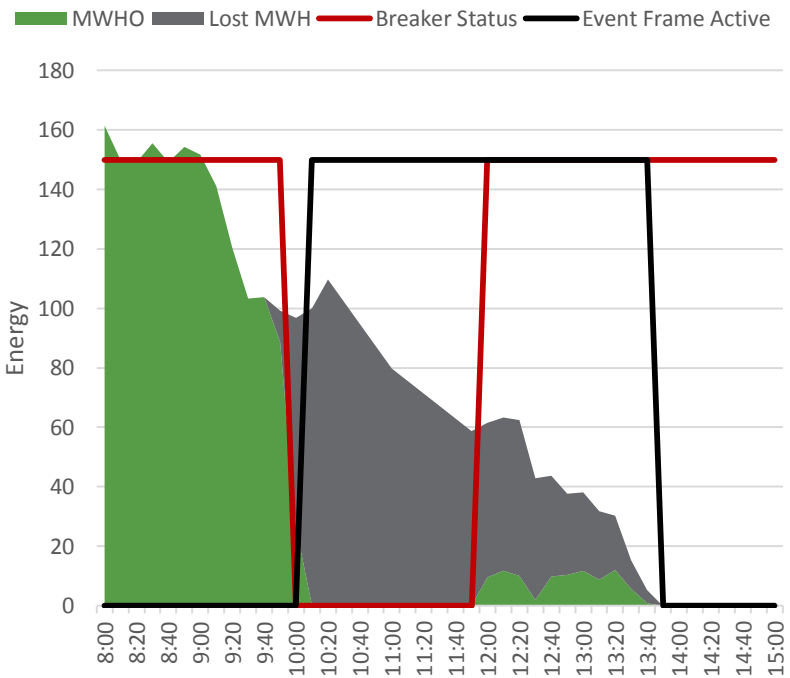
- **Procedures**
  - Guided Response
- **Notifications**
  - Notify Impacted entities if unplanned
  - Notify entities on changed return to service time.

ATF

- **Auditing**
  - Modify Start and End date as necessary
  - Specify cause/resolution
- **Reporting**
  - Review similar events
  - Summarize impact by category.
  - Compliance Reporting

Event Review

NaturEner

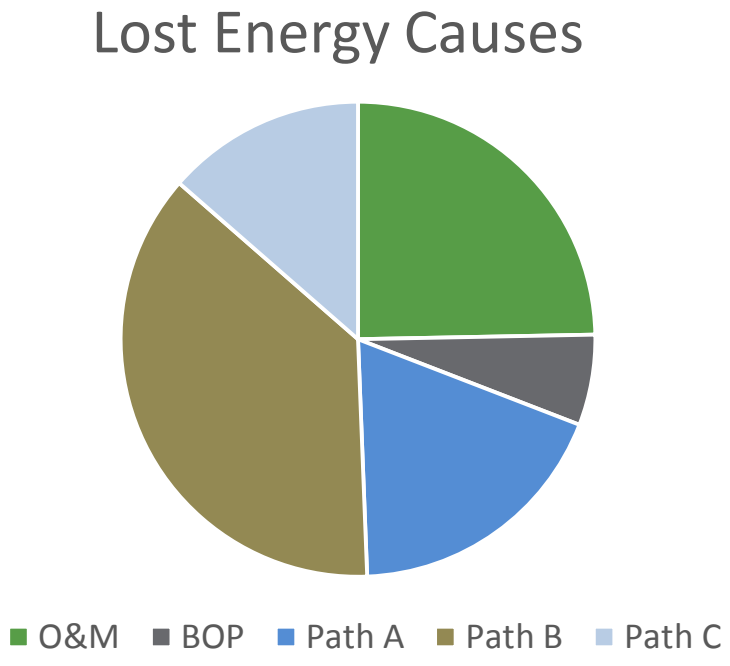


- Automated triggers may not capture full impact of events.
- In this case, a breaker trip occurred, resulting in full loss of generation.
- After the breaker was closed again, many turbines were latched, and needed to be returned to service manually.
- Operator modification of the event end time using the Versify log interface enables capture of this subsequent lost energy.

Reporting

NaturEner

- Summarize impact of events by user defined categories.
  - System Element
  - Responsible Party
  - System conditions
- Time Series data for in-depth analysis
  - Event Review
  - Training Examples



Use Case: Voltage Event

NaturEner

Initiation

- **Automatic Trigger**
  - Reactive Power Saturation
  - Voltage Deviation
  - AVR Disabled
- **User Initiated**
  - Phone call from grid entity
  - Operator Discretion

During Event

- **Procedures**
  - Guided Mitigation Procedure
  - Quick Access to Relevant Plots
- **Notifications**
  - Site O&M
  - Grid Entities for Compliance Requirements

ATF

- **Auditing**
  - Modify Start and End date as necessary
  - Specify cause/resolution
- **Reporting**
  - Review similar events
  - Summarize impact by category.
  - Compliance Reporting

Use Case: Wind Forecast Error

NaturEner

Initiation

- Automatic Trigger
  - Forecast Error Magnitude or Duration
  - SQL Data
- Manual entry by operator

During Event

- Notify Forecast Provider
- Operator comments on situational awareness.

ATF

- Portfolio of Case studies
- Training examples
- Forecast provider analysis

Summary

NaturEner

- Benefits of AF/Event Frames
  - AF
    - User configurable
    - Templates
    - Combine PI and SQL Data
  - Event Frames
    - Event Frame Generator
    - Summary Attributes
  - Reporting
    - PI OLEDB Enterprise
    - Coresight
    - DataLink 2014
- Benefits of Versify
  - Web Data Entry
    - Ability to manually insert events
    - Modify automatically triggered events
    - Add structured and unstructured data.
  - Workflow Engine
    - Embedded procedures
    - Notification/Escalation
    - NERC Compliance
  - Web Reporting
    - Configurable for External users

Analyzing Event Impacts using PI Event Frames and Versify

Understanding the impact of outage events on wind generation is essential for NaturEner to maximize profits from our wind assets. Our partners Versify Solutions Inc. and OSIsoft have helped us better understand and manage unplanned outages, which allows us to optimize our generation and maximize profits.

NaturEner

- Analyze and accurately record information about operational events.
- Improve operational response and notification processes.
- Summarize and analyze event impacts

Use Event Frames with Versify Logging and Workflows

OSIsoft.

VERSIFY® Intelligence. Empowered.

- Structured categorization and logging of events.
- One version of the truth.
- Leverage Versify Tools
- Leverage PI Clients

Contact

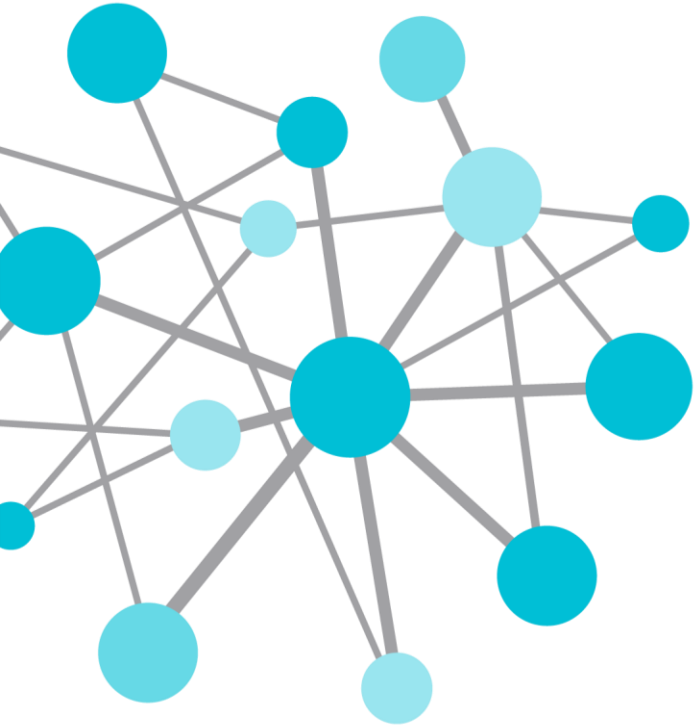
NaturEner

- Devon Yates

  NaturEner USA
  Manager Operational Analytics
  dyates@naturener.net

- Dave Ippolito

  Versify Solutions, Inc.
  VP, Product Development
  dippolito@versify.com



THANK YOU

Brought to you by OSIsoft.