

OpenPWR Visualization & Control An Open Platform for Modern Renewable Operations



Topics

- Panacea Introduction
- OpenPWR Platform Introduction
- OpenPWR Site Visualization



Panacea Technologies Highlights

- Founded in 1996
- Automation Solutions Company
 - Automation and validation services
 - Capabilities ranging from small system upgrades to turnkey solution delivery (\$1K to \$20M) and long-term site support
 - Hardware and Software
 - Successful portfolio of products including, OpenPWR, OpenBIO Product Platform, Panacea Update Manager, FHX File Viewer etc.
- Heavily focus on the importance of standards and project design/execution



Accolades

engineering



- Panacea had two engineers named in the Engineering Leaders Under 40 Program in 2017, 2018, 2019, 2020, and 2021.
- Less than forty engineers are named each year, and Panacea was honored to receive two of the nominations each of the last four years
 - Panacea was named Systems Integrator of the year by Control Engineering and Plant Engineering Magazine
 - Panacea was extremely honored by receiving this prestigious award and the endorsement it carries



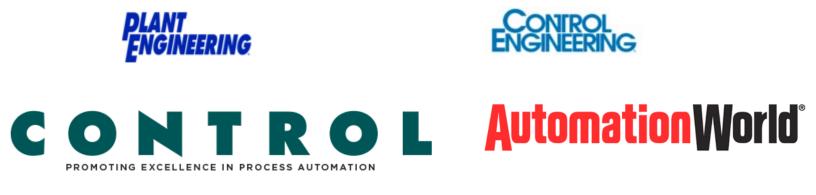


OpenBIO received an Innovator Award from Pharmaceutical Manufacturing Magazine in 2018.



Industry Recognition

• Featured in more than 30 Industry Publications in the past 3 years



InTech



The OpenPWR Platform

OpenPWR is a cross-functional visualization platform that provides uniform control and reporting regardless of resource, hardware manufacturer, or current visualization platform.



OpenPWR is able to consolidate cross-country and transnational renewable energy sites onto a single platform allowing standardized company-wide remote monitoring and control of the entire renewable portfolio.



Why Consolidate Control?

For renewable energy operators, operating multiple sites, with multiple sources and multiple automation

platforms, consolidating data for meaningful analysis can be a time-consuming challenge. Consolidating to a single platform allows users to quickly analyze data for key energy generation forecasts and other economic markers.





Corporate Level View

	APC SP: 4,000 KW AVC SP (Ramping): 3460,0kW 1 POI (Total Power): 4047,5kW			
Estimated Hourly Production Capacity: Estimated Daily Production Capacity: Estimated Weekly Production Capacity: Optimum Turbine Mix:	31.53MWh 733.95MWh 5034.92MWh T12	Availability: Performance:	66.67% 49.18%	
opunian tataite nice				
East Greenbush (EGB)				
Emergency Stopped Running High Wind/ Co Low Prod Fi	APC SP: 13.200 KW APC SP (Ramping): 12200.0KW POI (Total Power): 12919.5KW 31.53MWh	Availability:	66.67%	
Estimated Daily Production Capacity: Estimated Weekly Production Capacity:	890.34MWh 5920.76MWh 0 A11 A02 A03 A06	Performance:	35.52%	
Boston (BOS) Emergency Stopped Running High Wind/ CC Low Prod R	APC SP: 11:00 KW			
Estimated Hourly Production Capacity: Estimated Daily Production Capacity:	POI (Total Power): 102121kW 37.65MWh 912.64MWh	Availability: Performance:	75.00% 27.12%	
Estimated Weekly Production Capacity: Optimum Turbine Mix: B01 C01 C02	6069.06MWh 2 B10 B09 C04 C03			

OpenPWR's corporate view aggregates site data to provide performance to determine key predictive and operational drivers



Site Level View

Panacea Technologies Inc.	Overview	6 Lów Prod 0	raph Topo	mping): 3400.0kW Power): 2719.5kW In		• e	n ntime			
	tot LSAV 25.54V 27075 000 2019 2019 2019 2019 2019 2019 2019	TO5 25.92V 220mls 220mls 41.374kW Running Stopped	T07 ▶	T08 ▶ ■ s 121.22V 7.83m/s ¥84.64kW Running	T09 ► ■ v 114.06V 6.01m/s 237.37kW Running	110 Image: Constraint of the second sec	111 ▶■ ∨ 114.05V 72.0m/s 403.43kW Comm Fault	124.98V 132.88V 0.00kW Stopped		
16 ACTIVE 0 SHELVED	Active, Acknowledged 🗙	Clear, Unacknowledged X	riority: Low ×	Priority: Medium ×	Priority: High	Priority: (Tritical X		Q	Remove All
	Active, Acknowledged			r nonty. weatant 🔨	Thonty. High					Remove All
4 results within filters Active Time $\stackrel{1}{=} 1$	Display Path 🌲	Priority 🌲	2	Chat	e 🔷 3			Name	A	
 Active Time - ' 07/27/2020 10:30:49 			-							
_	T02	Medium			ve, Unacknowl				erheating	
07/27/2020 11:22:31	T07	High			e, Unacknowl				ngerous Weath	
07/27/2020 11:23:02	T11	Low			e, Unacknowl				mmunication Fa	ult
07/27/2020 11:24:30	т03	Critical		Activ	/e, Unacknowl	edged		500 En	nergency	
10 rows 💌		First <	1 2	3 4 5 >	Last				Jur	mp to: 1

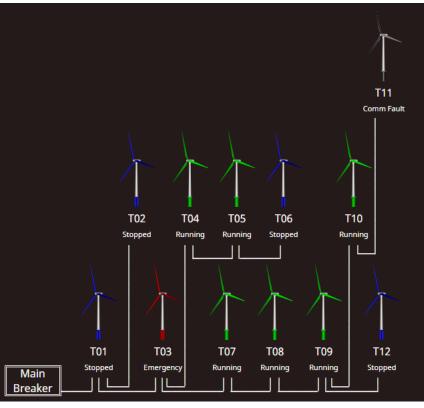
The site view allows for customized and tailored monitoring solutions. This view provides a summary of conditions, output from every turbine or panel, and all active alarms.



Additional Site Level Views

Alarm History Start Iul 24, 2020 11:38 AM Iul 27, 2020 12:38 PM Date Date 22 alarm ev Q = 🌣 2020/07/24 - 2020/07/2 LLTERS (7): Active X Acknowledged X Cleared X Priority: Low X Priority: Medium X Priority: High X Priority: Critical X Remove Al 2 results within filter /ent Time 🌲 Display Path 🌲 Name 🌲 Event State 韋 Priority State 🇘 /27/2020 10:10:49 400 Overheating Active Medium Active, Unacknowledged 7/27/2020 10:26:25 100 Communication Fault Active Low Active, Unacknowledged T08 /27/2020 10:30:49 400 Overheating Active Medium Active, Unacknowledged T02 7/27/2020 11:22:20 500 Emergency Active Critical Active, Unacknowledged T03 /27/2020 11:22:31 300 Dangerous Weather Conditions High Active, Unacknowledged Active /27/2020 11:22:40 100 Communication Fault Active Low Active, Unacknowledged /27/2020 11:23:02 100 Communication Fault Active Low Active, Unacknowledged T11 /27/2020 11:24:30 500 Emergency Active Critical Active, Unacknowledged T03 100 Communication Fault Low /27/2020 11:24:32 Active, Unacknowledged T03 7/27/2020 10:10:12 400 Overheating Ack Medium Active, Acknowledged T02 7/27/2020 10:10:12 100 Communication Fault Ack Low Active, Acknowledged T06 /27/2020 10:28:54 400 Overheating Ack Medium Active, Acknowledged T02 /27/2020 10:28:54 100 Communication Fault Ack LOW Active, Acknowledged T08 /27/2020 11:24:19 500 Emergency Ack Critical Active, Acknowledged T03 /27/2020 11:24:39 100 Communication Fault Ack Low Active, Acknowledged T03 Medium /27/2020 10:10:12 400 Overheating Clear Cleared, Acknowledged T02 7/27/2020 10:10:12 100 Communication Fault Clear Low Cleared, Acknowledged T06 7/27/2020 10:28:54 400 Overheating Clear Mediun Cleared, Acknowledged 0 5 rows 💌

Topography View



All alarms are archived in **Alarm History**. **Topography** view provides a graphical display of the communications fiber to provide insight into substation and fiber related issues.



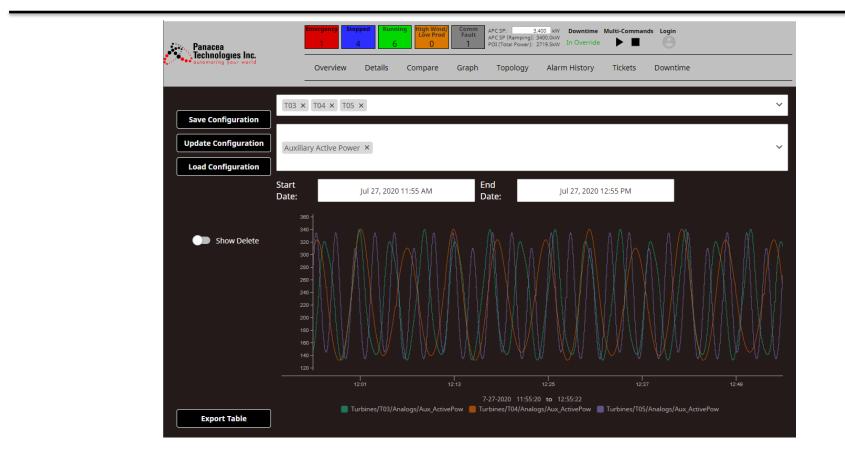
Source Level View

A Panacea Technologies Inc. automoting your world Overview	ed Running High Wind/ Comm 6 0 1 1	APC SP: 3.400 kW Downtime Multi-Commands Login APC SP (Ramping): 3400.0kW In Override To Commands Login POI (Total Power): 1514.5kW In Override To Commands Login	
T04			
General Parameters Auxiliary Active Power: Auxiliary Reactive Power: Pitch Angle: Total Filtered Power: Estimated Energy Produced since Midnight:	135.14kW 108.11kVAr 1.00° 225.24kW 4.26MWh	Outdoor Conditions Ambient Temperature: Sonic Atmospheric Temperature: Estimated Air Density: Wind Direction: Wind Speed:	19.01°C 19.01°C 0.95kg/m3 0.67° 6.06m/s
<u>Grid Parameters</u> Grid Active Power: Grid Frequency: Grid Reactive Power: Grid Voltage:	4487.32kW 60.00Hz 3589.85kVAr 125.32V	Generator Parameters Generator Bearing Temperature (coupling side): Generator Bearing Temperature (non-coupling side): Generator Speed:	35.02°C 45.16°C 758.08rpm
Gearbox Parameters Gearbox Bearing Temperature: Gearbox Oil Particle Flow: Gearbox Oil Temperature:	64.36°C 2.14L/min 65.04°C	Nacelle/Rotor Parameters Nacelle Position: Nacelle Temperature: Rotor Speed: Rotor Temperature:	180.67° 25.36°C 0.70rps 52.51°C

OpenPWR provides real-time monitoring of specific turbines and other sources and their related metrics and environmental data.



Analytics and Data Management



Generating millions of data points annually, OpenPWR is highly adaptable and can provide data averages and continuously generated graphs. Data can be exported in various formats including .pdf reports, tailored for different stakeholders.



Downtime Analysis

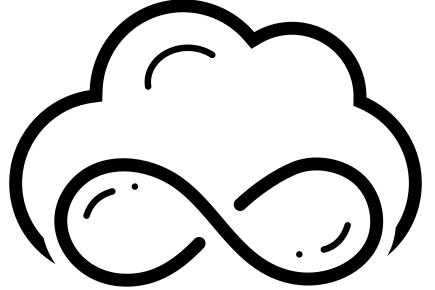
Panacea Technologies Inc.					4 6	Low Prod	Fault 1	APC SP (Ramping): 3400.0kW POI (Total Power): 2719.5kW In C	verride 🕨 🔳	8					
automating your world				Overview	Details	Compare	Graph	Topology Alarm Hi	tory Tickets	Downtime					
					Start:	2020/0	7/27 00:00	0:00			End: 2020	/07/27 2	3:59:59		
Manual Addition	Filter ta	able													
Update Events			rbine 🗘	StartTime 🗘		EndTime 🗘		DowntimeFault 🗘	DowntimeCate	aon: ^	DowntimeCode ≑		Fault 🗘	EnergyLossMWh 🗘	Approval
Merge Events	Wind			07/27/2020 1		07/27/2020 11:2	1.5.1	Weather	Owner	gory ÷	Safety		Manual Stop	0.03	None
Merge Events	▶ Wind		-	07/27/2020 1		07/27/2020 11:1		Weather	Owner		Safety		Manual Stop	0	None
Split Event		dFarm T1		07/27/2020 1		07/27/2020 11.1	5.51	Weather	Owner		Safety		Lockout	3.50	None
Alter Approval		Start Tim			End Time (NU	II)	Do	wntime Fault	Downtime Catego	rv	Downtime Code		Fault		
Alter Approval	07	7/27/2020 11			Select date.		Weathe	_	Owner	~	Safety	~	Lockout	✓ Update	Appr
Show Delete															
	► Wind			07/27/2020 1				Weather	Owner		Safety		Active Power Control	0.54	None
	▶ Wind			07/27/2020 1		07/27/2020 11:2	4:37	Weather	Owner		Safety		Active Power Control	0.20	None
	► Wind			07/27/2020 1				Weather	Owner		Safety		Active Power Control	0.53	None
	► Wind			07/27/2020 1				Weather	Owner		Safety		Unknown	1.12	None
	► Wind			07/27/2020 10	0:28:49	07/27/2020 11:1	2:20	Economic Curtailment	Owner		Information		Active Power Control	0.18	None
onfigure Options	▶ Wind	dFarm T0	1	07/27/2020 10	0:24:44	07/27/2020 11:1	2:20	Turbine	Manufacturer		Notification		Unknown	0.39	None
onfigure Override	► Wind	dFarm T1	2	07/27/2020 10	0:23:01	07/27/2020 11:1	2:20	Turbine	Owner		Safety		Lockout	1.31	None
	► Wind	dFarm T0	1	07/27/2020 10	0:22:08	07/27/2020 10:2	4:42	Turbine	Manufacturer		Information		High Wind/Low Production	0.03	None
	▶ Wind	dFarm T0	2	07/27/2020 10	0:20:53	07/27/2020 11:1	2:20	Economic Curtailment	Owner		Information		Active Power Control	0.19	None
	► Wind	dFarm T0	8	07/27/2020 1	0:15:24	07/27/2020 10:2	6:25	Economic Curtailment	Owner		Information		Active Power Control	0.03	Review
Export Table	▶ Wind	dFarm T0	6	07/27/2020 1	0:14:53	07/27/2020 11:1	2:20	Economic Curtailment	Owner		Information		Active Power Control	0.22	None
	▶ Wind	dFarm T1	3	07/23/2020 14	4:58:16			Economic Curtailment	Owner		Information		Active Power Control	0.01	None

OpenPWR's automated downtime log allows for a more robust analysis of the impact of both internal and external events. Events are assigned to a fault and owner and can be split or merged. A robust log provides insight into the key causes and costs of different downtime events, allowing users to improve availability and determine if incidents are part of a trend and if corrective procedures area followed.



Unlimited Licensing Model

OpenPWR's unlimited licensing model is designed to be a onetime cost, including the deployment and integration of the platform, drastically reducing costs when compared to other packages.



Examples:

	Number of Turbines	Number of Technologies	Est. Deployment & License Cost
Small windfarm	25	1	\$ 90,000
Large windfarm	100	3	\$ 140,000



Capabilities

- Complete suite of project capabilities including:
 - Feasibility Studies
- SOP Creation
- Design Document Authoring
- Programming and Configuration
- Hardware Design and Panel Fabrication (with partner)
- Testing
- Validation
- Startup and Commissioning
- Long Term Support
- Project Management
- Standalone services including the above items as well as:
 - Automation Network Design
 - Serialization
 - Virtualization
 - Legacy install base evaluations and migrations
 - Automation asset and code management
 - On-site support
 - Data Historization and Reporting
 - Integration with Enterprise Systems (ERP, MES, PLM, etc.)



Platforms and Certifications





Panacea Update Manager

Panacea Technologies recently launched the Panacea Update Manager, which automates the process of patching Operating Systems for Automation Platforms.

Panacea Update Manager works by taking vendor recommended patch definitions from GE, Rockwell Automation/Allen Bradley, Siemens, OSI soft, and Wonderware and ensures only vendor approved Microsoft OS patches are deployed on your networks.

The software ensures your Computer Networks receive the latest OS patches keeping your infrastructure secure, but it also ensures potential downtime events are eliminated by only deploying tested patches.

Visit <u>https://www.panaceatech.com</u> for more information.