

## Benefits of Real Time Power's Flowtim System

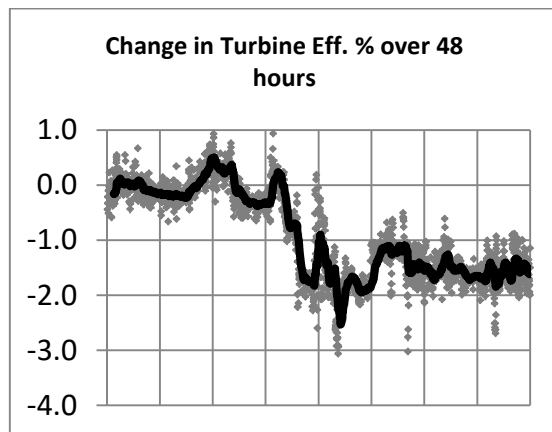
Provides users and OEMs with extremely accurate air mass flow measurements that are critical for protecting the long term health and performance of gas turbines.

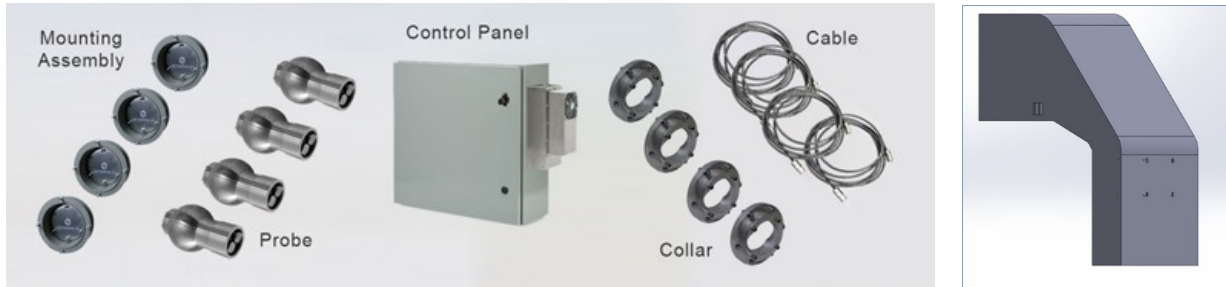
### About RTP's Ultrasonic Technology for Gas Turbines:

- Installed in over 30 units worldwide – GE / Alstom, Mitsubishi, & Siemens units
- Installed in 3 major OEM test facilities for precise measurement of inlet flow
- Accurately measures inlet air density & static temperature
- Delivers consistent and repeatable measurements, never needs re-tuning
- Accuracy to 1% and improves 3<sup>rd</sup> party thermodynamic software packages (i.e., RTP's data can go into Pi for Eta Pro or other systems to utilize).

### \$15 Million in Proven Performance Benefits & Prevented Damage ...actual field experience by real users:

- Early detection of 2<sup>nd</sup> stage turbine breach
- Identified icing build-up inside inlet duct
- Detected surge in upgraded compressors
- Prevented 1<sup>st</sup> stage turbine breach
- Identified compressor bleed valves stuck open after start-up
- Recognized reverse water piping in TAS inlet chiller coils
- Discovered compressor bleed valves seal leaking
- Quantified the best type of inlet filter for specific application

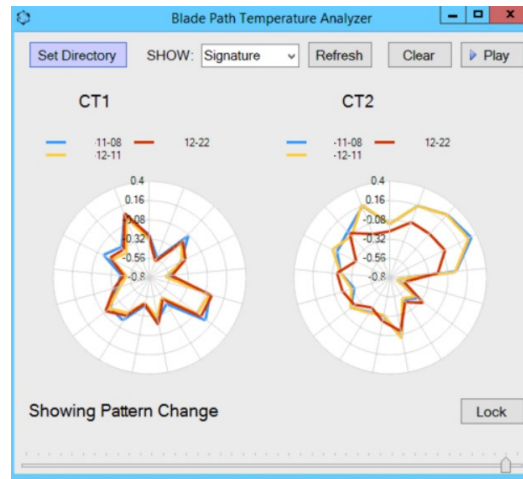




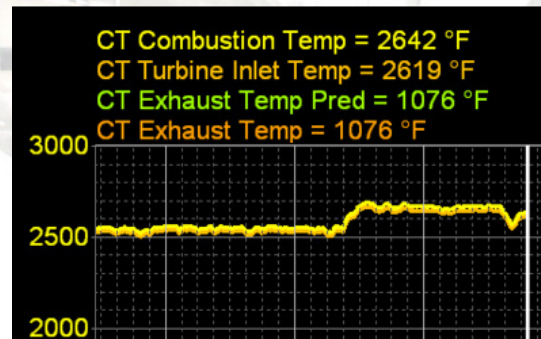
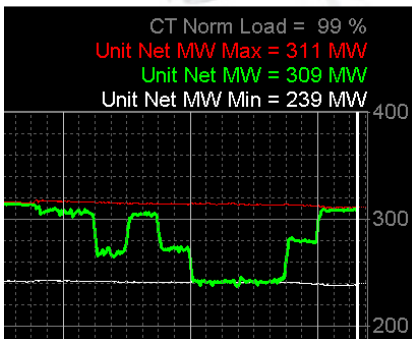
**The correct air mass flow measurement will significantly improve gas turbine health monitoring, load forecasting & optimization**

- RTP's adaptive, real-time modeling can identify performance and health issues on the Gas Turbine prior to damage occurring:
  - Detection of icing issues before they cause damage
  - Pinpoints performance issues between filters, coils, compressor, turbine, & HRSG
  - RTP's Flowtim system will identify differences in baseline and actual compressor efficiencies, indicating the need for a water wash. A 1.4% loss of efficiency equals ~2 MW reduction in output.
    - ROI for RTP's water wash optimization is worth ~ **\$80,000 per year**
  - Accurate mass flow rates for air and fuel allow Turbine Inlet Temp to be estimated to a high degree of certainty, thereby calculating accurate Turbine Efficiency. RTP uses it for detecting issues with turbine blades and isolating performance issues between the compressor and turbine section.
  - Early detection of gas turbine damage occurring. RTP uses separate compressor and turbine efficiencies to pinpoint sources of performance degradation. Any changes to the adaptive model can be indications of damage and a health alert given to the plant operators. For example, Air Filter Health Alert when predicted  $\Delta P$  is greater than actual  $\Delta P$ . Or, a Gas Turbine Backpressure Health Alert is given when a drain valve is accidentally left open and the predicted backpressure drops below achieved backpressure.

Special adaptive models leverage the air mass flow rate & TIT calculation to detect breaches in the hot section blades. The CT2 (below) was flagged with a breach, saving the owner more than **\$1 million in prevented damage.**



- HOL & LOL Predictions are accurate with the RTP system predicting constraints based on Exhaust Gas Temperature, Exhaust Gas CO, and other constraints applicable to LLCO operation. Predictions account for chillers, thermal energy storage, duct burners, etc.
  - ROI for Flowtim on HOL can equal **\$427,050 per year** (1% forecast error on 1,300 MW, \$15 spark spread, & 2190 hours)
  - ROI for Flowtim on LOL can equal **\$191,625 per year** (1% forecast error on 350 MW, -\$25 spark spread, & 2190 hours)



- The Flowtim system will accurately measure impacts of turbine upgrades and other other impacts from outages immediately upon start-up.
- Essential for plant performance and capacity tests. Never have to worry about differences in calculated mass flow rate between GTs & HRSGs.