Pumps Reliability and Efficiency (Energy) Monitoring System
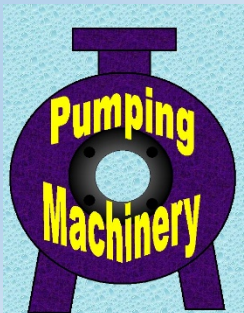## PREMS-2A

INTRODUCTION and TRAINING WEBINAR

by

www.PumpingMachinery.com

DrPump@PumpingMachinery.com

770-310-0866

As any rotating machinery, pumps must be:

a) - Reliable

b) - Efficient

Reliable means – runs a long time and do not fail

Efficient means – does not take excessive energy (cost) to do the job

How do you measure Reliability?

Reliability – vibrations, temperatures, and other parameters versus time, i.e. continual trending – not just an occasional or periodic present value or an alarm.
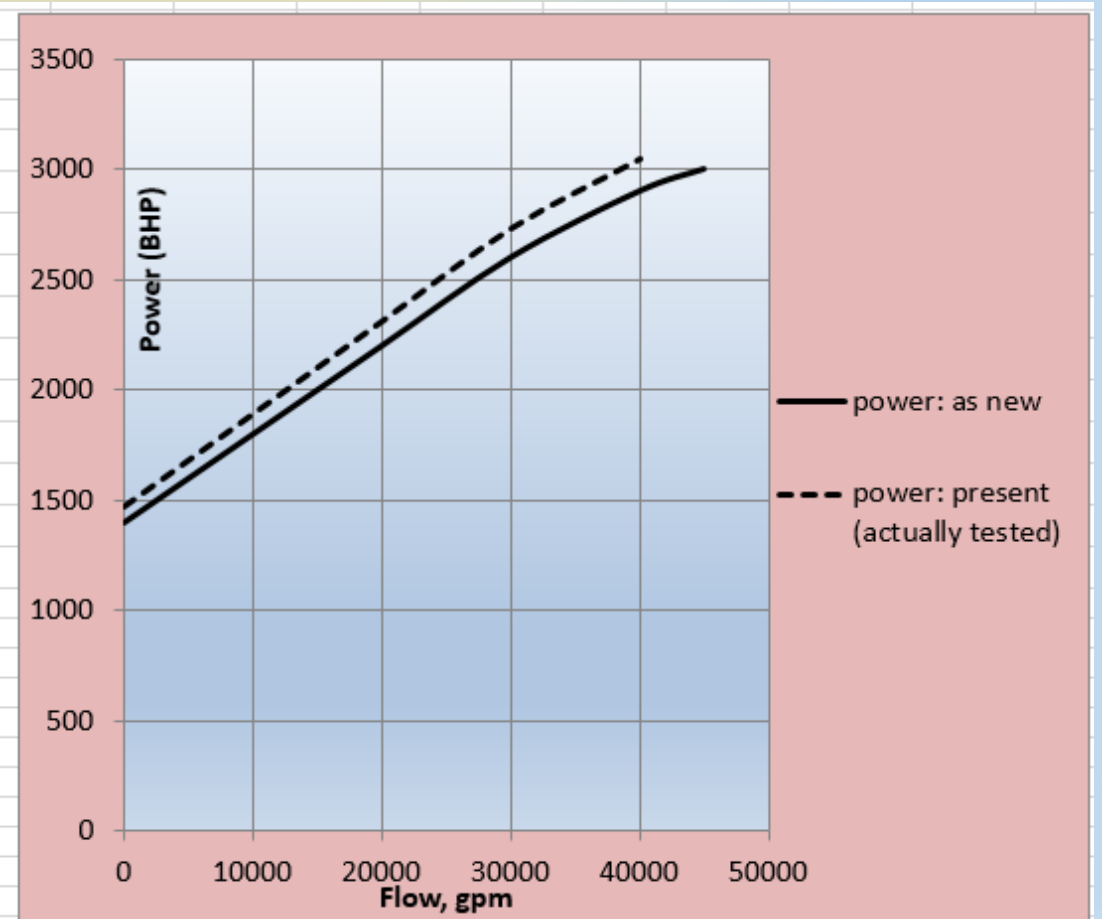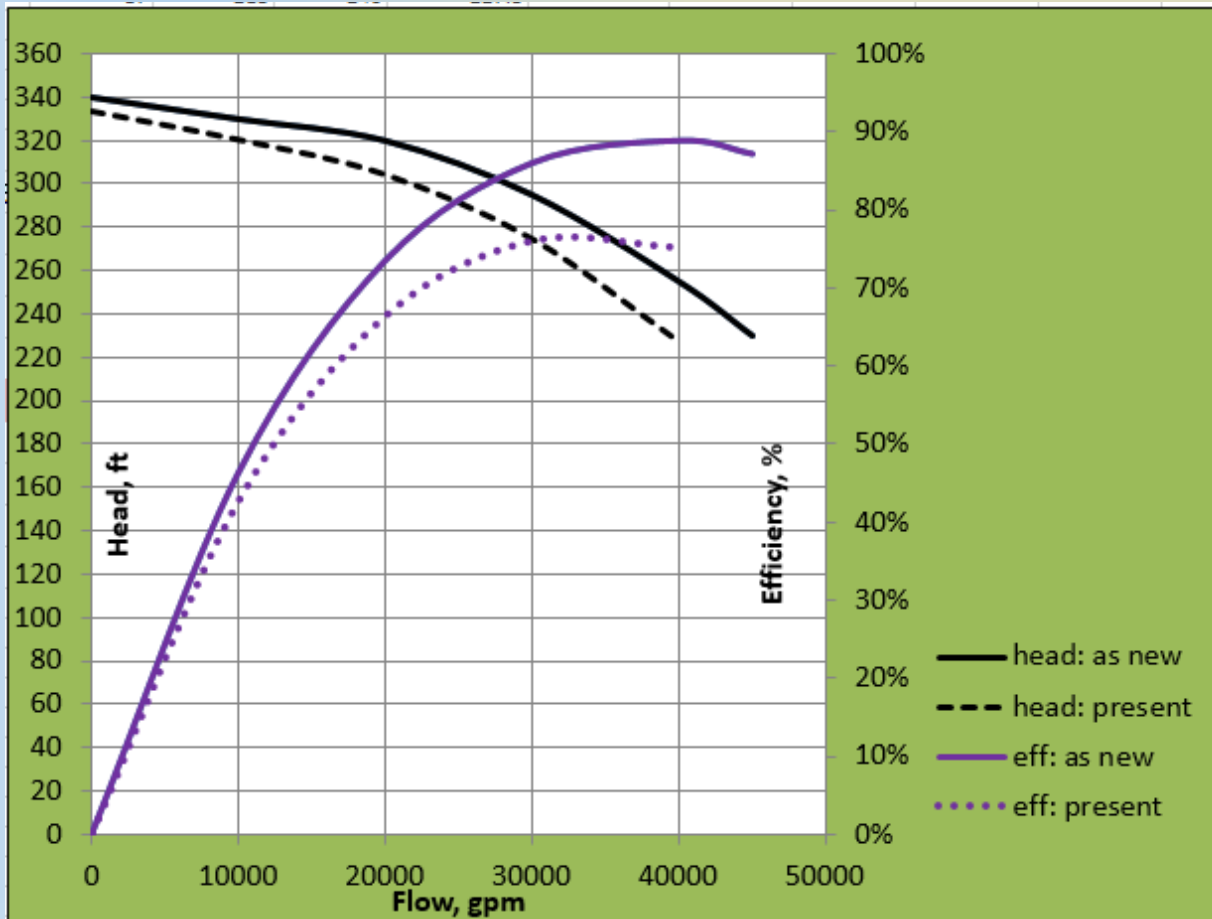
- will your pump or motor crash and stop the plant process?

How do you measure Efficiency?

Efficiency – how does hydraulic performance changes with time: does it take more power, develops less head, pumps less flow, costing more to operate.

How much Energy *does* <u>In</u>-Efficiency cost?

Consider a simple example:

How much energy (money) does a 3000 hp (2250 kW) pump, running non-stop, consume per year, at a typical cost of $0.10 per kW-Hr ?

The answer: 2250 x 24 x 365 x 0.1 = $1,971,000

If the pump efficiency is degraded by, say, 10% - it is approximately $200,000 wasted per year. But how efficient *is* the pump, truly? Can we measure it – simply, quickly, continually, and – inexpensively?

How do plants address this issue today?

Approach 1: know-nothing-do-nothing

Approach 2: do something, but not enough (periodic vibrations and temperature monitoring on critical units)

Approach 3: use expensive systems, such as SCADA, DCS, and similar. Usually monitors a few and most critical pumps, with shut down on vibration alarms. Historic trends may be available but typically too involved and cumbersome to review. Addition to assess health of other pumps (not initially considered when plant came on-line) is usually expensive, time consuming, and typically impractical.

PREMS-2A does the job for you:
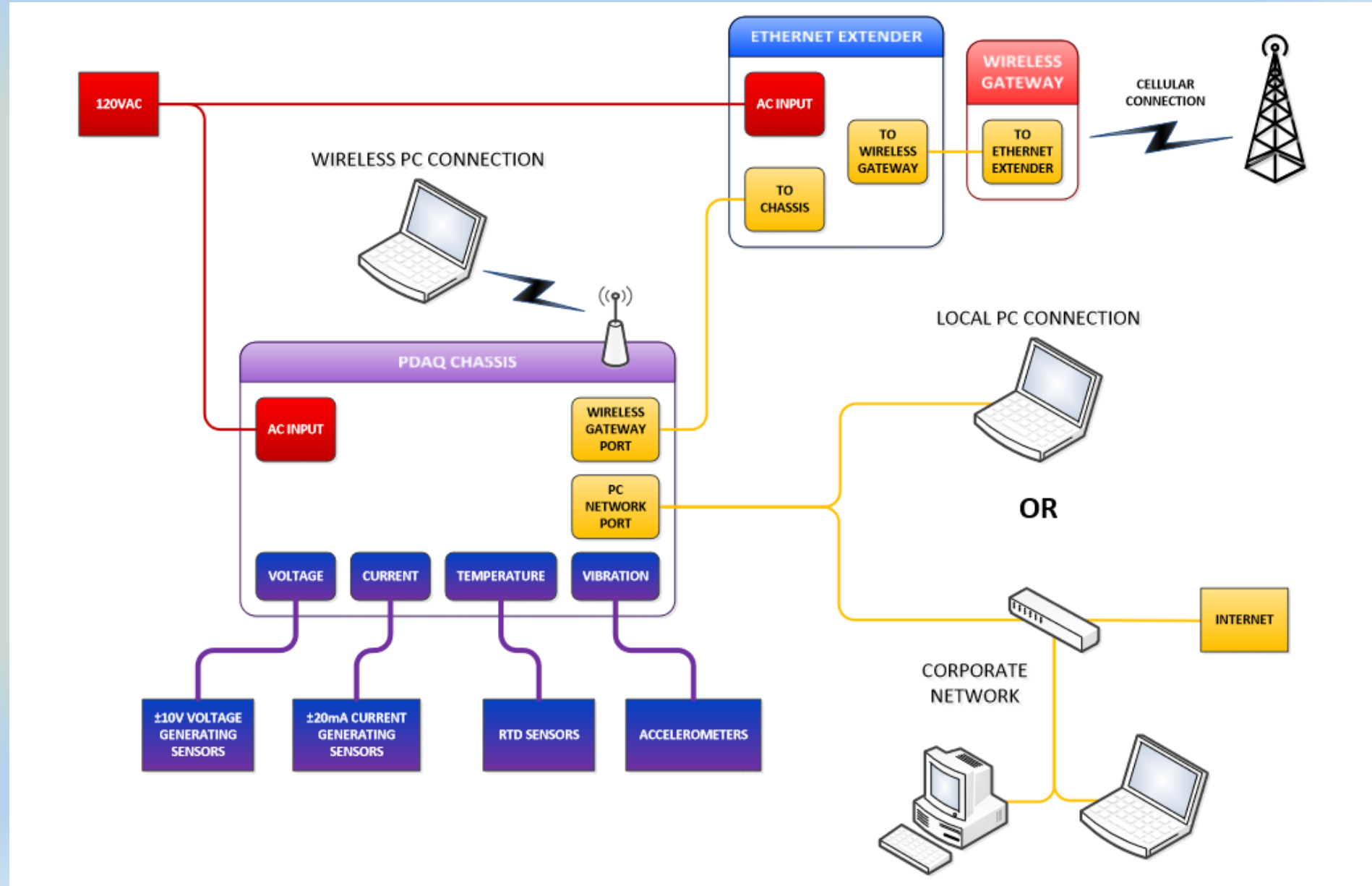
How does it work?

a. You can either buy or rent the system, or contract us to do the pump health audit

b. Each PREMS-2A module is custom built: for a single pump, or many pumps

c. You can use your existing probes or we provide probes:
- Vibration accelerometers: mag-base, installed in minutes on bearing housing and/or other spots
- Temperature probes: also mag-base, essentially attach-and-ready
- Pressure transducers (typically suction and discharge): usually added via Tees near existing gages
- Power (amps) monitors: usually a CT transformer around a motor lead or switchbox
- Flow monitor: from either an internal (such as mag meter, venturi, etc) or external (such as u-sonic, etc)

d. Connect the probes to the PREMS-2A chassis and the chassis to the gateway box.

e. Turn on the power – the system is transmitting, live, continually

f. Install software on your computer and watch data live streaming on the screen

What do you see on the screen?

The Summary Screen shows the main menu entry with a quick summary of the incoming data:

If you click on Time Data tab, you see live data. The frequency of the data, its display times, and warning/alarm values are user-settable. For example, you can choose to take data each 2 seconds, display every 10 seconds, issue warning at, say, 0.30 in/sec vibration (RMS), and alarm at 0.50 in/sec:
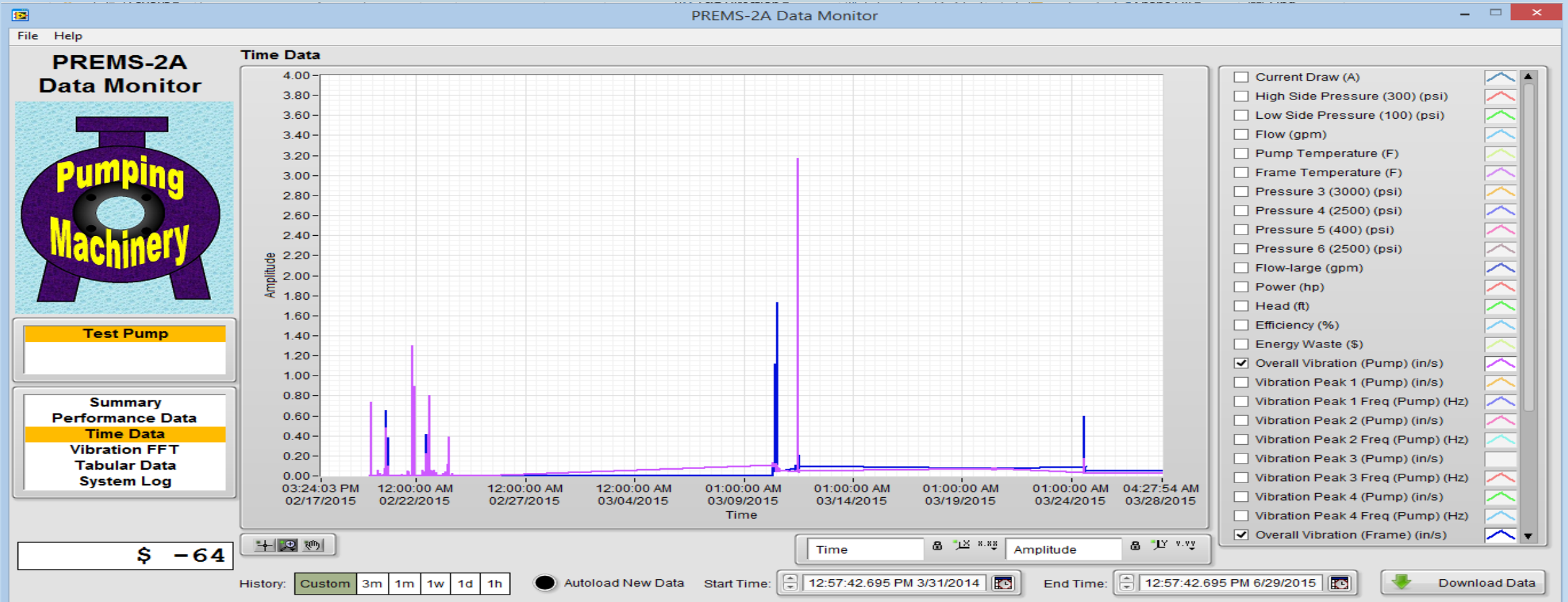
You can select only the latest data (an hour), a day, a few month, or custom range including the entire history. You can zoom and review any parameter by itself, or plot all or a many parameters as you need to review.

You can get the data in <u>Tabular</u> form and download it on your spreadsheet:

For more detailed vibration analysis review, full <u>spectral frequency analysis</u> (FFT) is taken also continually:
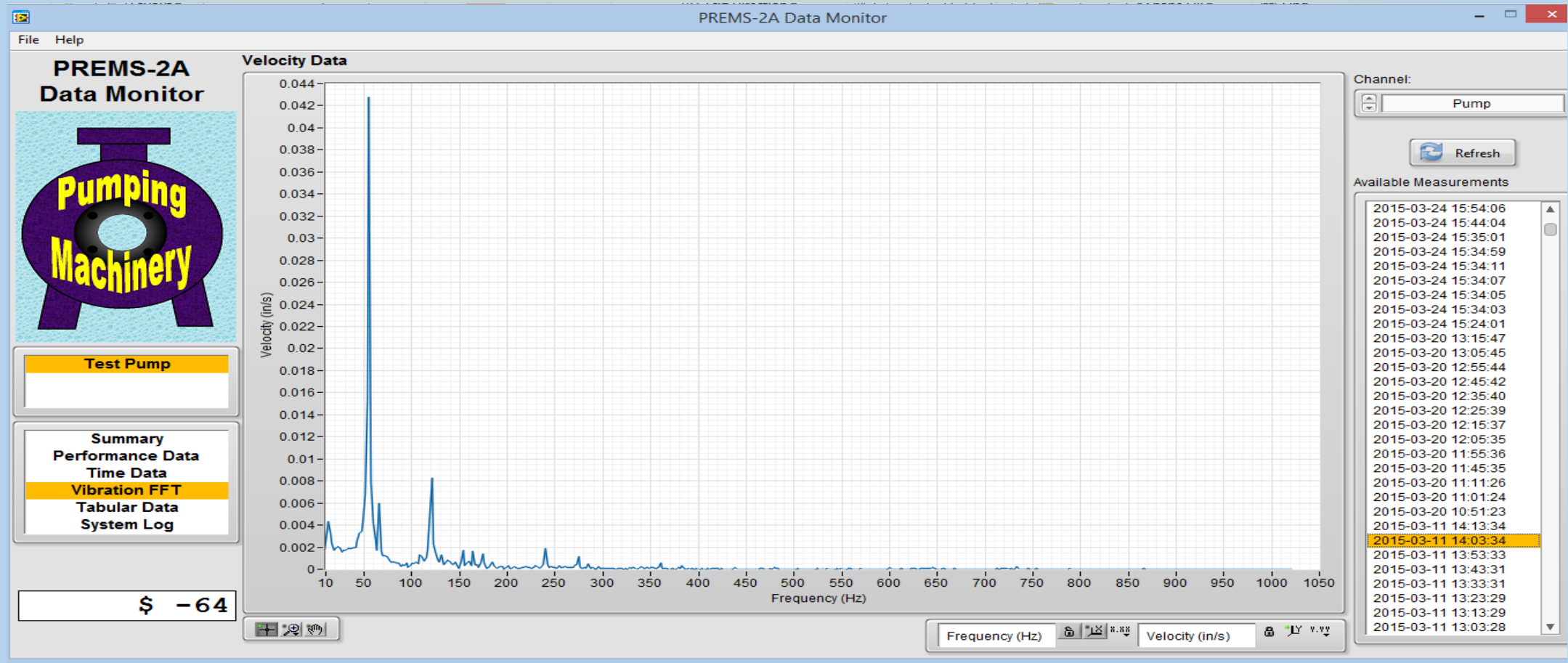
You can see 1X harmonic (running speed), 2X (misalignment?), blade pass, cavitation, and other FFT frequency constituents of vibrations

You can easily enter (or update) your pump OEM <u>performance</u> curve (Head, Power, Efficiency, versus Flow), which is your target performance of the initially installed, or repaired, pump:
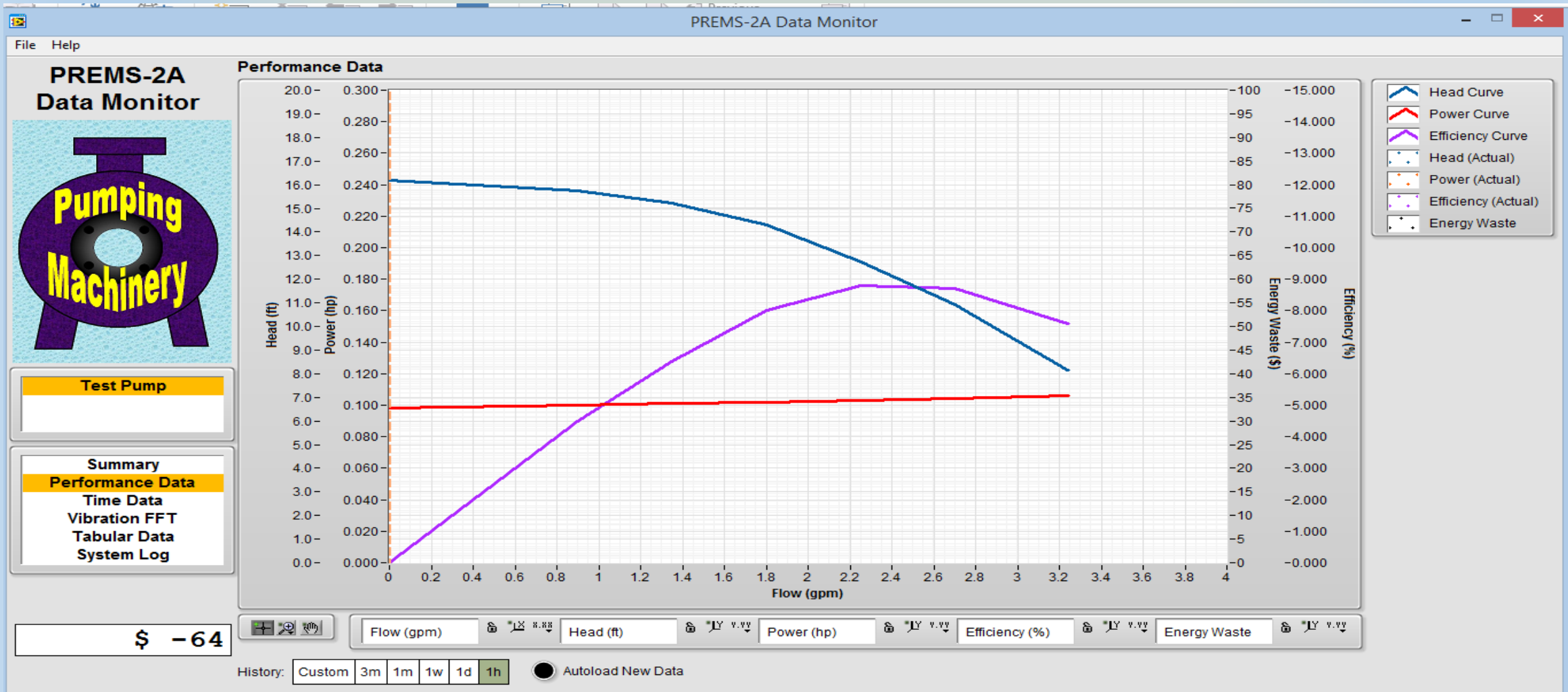
As PREMS-2A takes data, it continually displays it on the <u>performance screen</u>. You do not need to keep opening and closing valves to obtain actual performance - PREMS-2A does the tracking for you: as system goes thru its normal operational changes (i.e. as pump naturally moves on its curve) due to natural system response, the data keeps being updated. It shows to you where the pump runs at different times, how far from the BEP flow it races to the right or left of peak. It therefore constructs, live, the true pump performance curve:
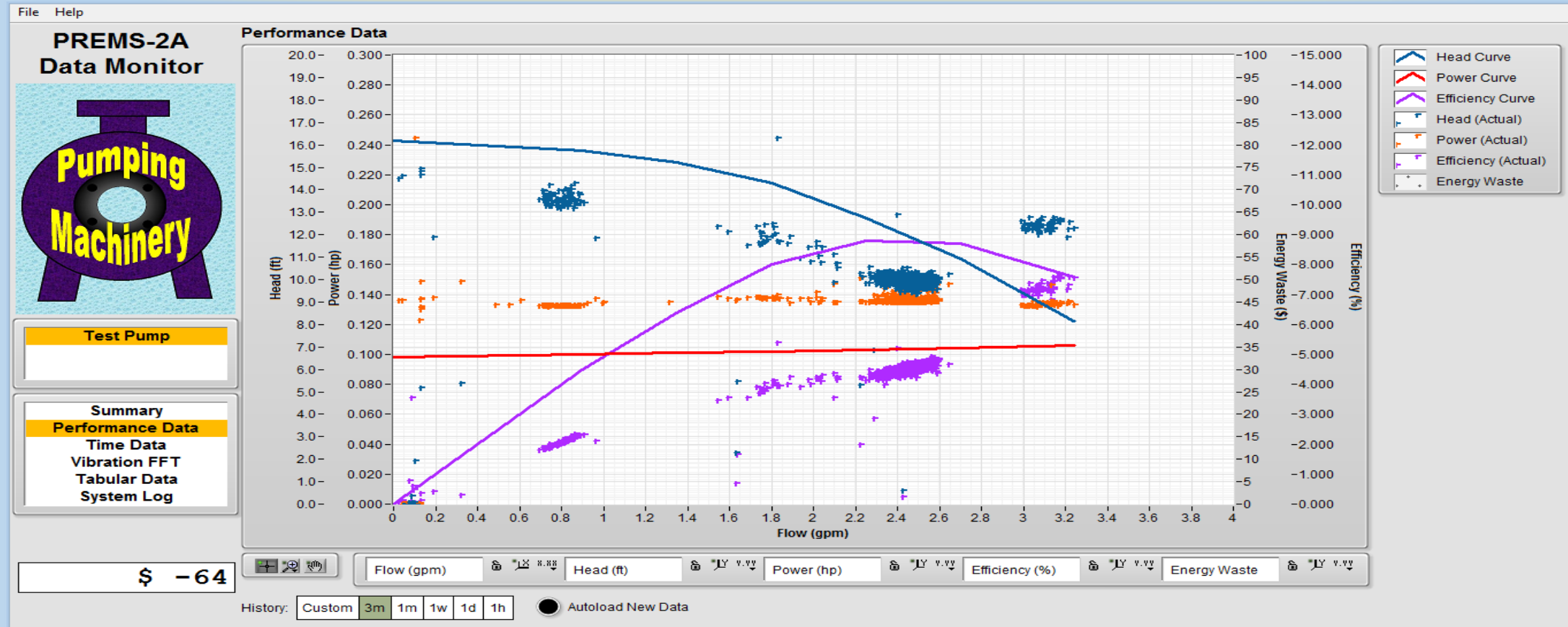
PREMS-2A system essentially constructs real and live H-Q, BHP-Q, and Efficiency-Q curves, and tells you how much power increased, efficiency dropped – for the entire range of the curve.

You can also turn-on the "*Dollars-Wasted" function* – to show the actual cost, in dollars, of your pump operating at reduced efficiency at each flow data. The pro-rated cost of the as-present-flow is also shown at the lower left part of the screen (in this example, for a small pump):
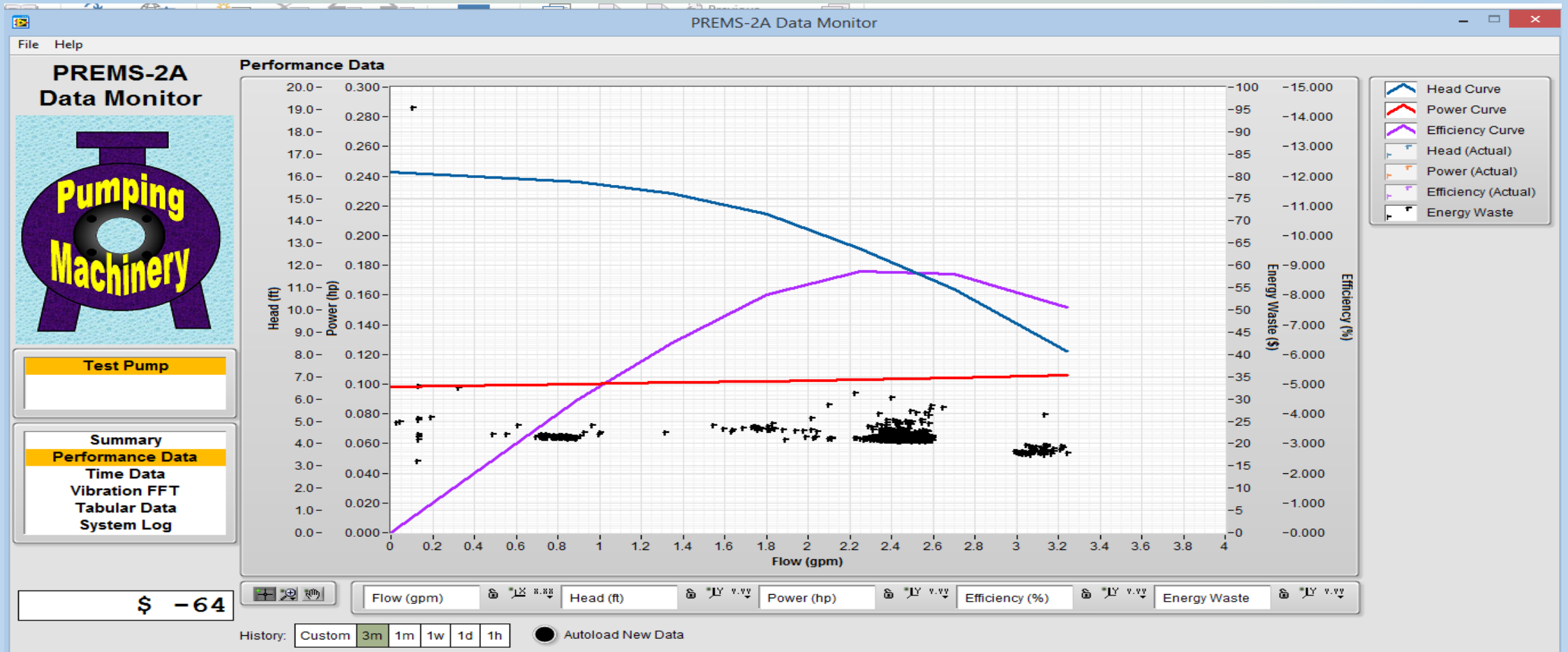
Note: you can specify the percentage of time the pump actually operates during the year, adjust the cost of kW-HR. You can also easily change graphics as you might prefer: lines colors, width, etc.

What do you get with the PREMS-2A system?

- Hardware, instrumentation and software – including a laptop PC computer with software loaded and ready to go
- Installation assistance and training – satisfaction guarantee – (30) days trials available
- Consulting assistance of data interpretation, if so desired, as well as pumps troubleshooting support
- Attendance of the Pump School training session for your lead "PREMS-2A" champion (project contact) and 10% discount for any other maintenance, operating, or engineering personnel from your plant at the Pump School sessions:
    - www.pumpingmachinery.com/pump_school/pump_school.htm
- News updates and general product brochure is at:
    - www.doctorpump.com
- Same pump basic concept video: www.pumpingmachinery.com/pump_school/PVA/pva.htm (module #10 and #11)
- Complete system purchase, lease/rent, or consulting pumps health audit – direct or via rep/distributor if available in your area
- The system can be moved form one pump to another and operational in just a few hours, and start transmitting
- Security: wireless option does not require your IT people to direct connect anything – no interference with your main system
- Can be connected to SCADA or PCS, if desired
- You own the data
- Adaptable to other types of rotating machinery: pumps, motors, compressors, blowers, centrifuges, gear boxes, etc.
- No pump size or type limitations: from small to thousands of horsepower: water and wastewater plants, power plants, paper mills, and more

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