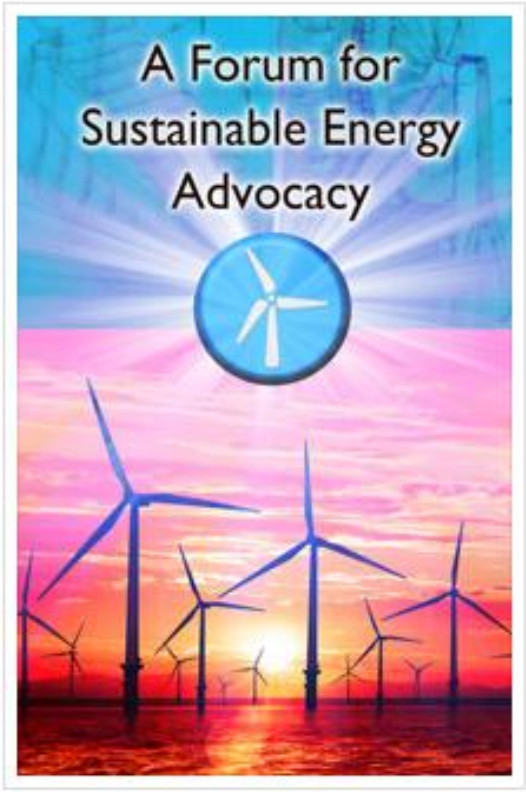
AEE Technical Round Table Conference

Energy Control Sequences
Set Back Strategies
Demand Control Ventilation



Host: Kathleen Stanley

November 5th 2013

Challenge to operate cleanrooms efficiently

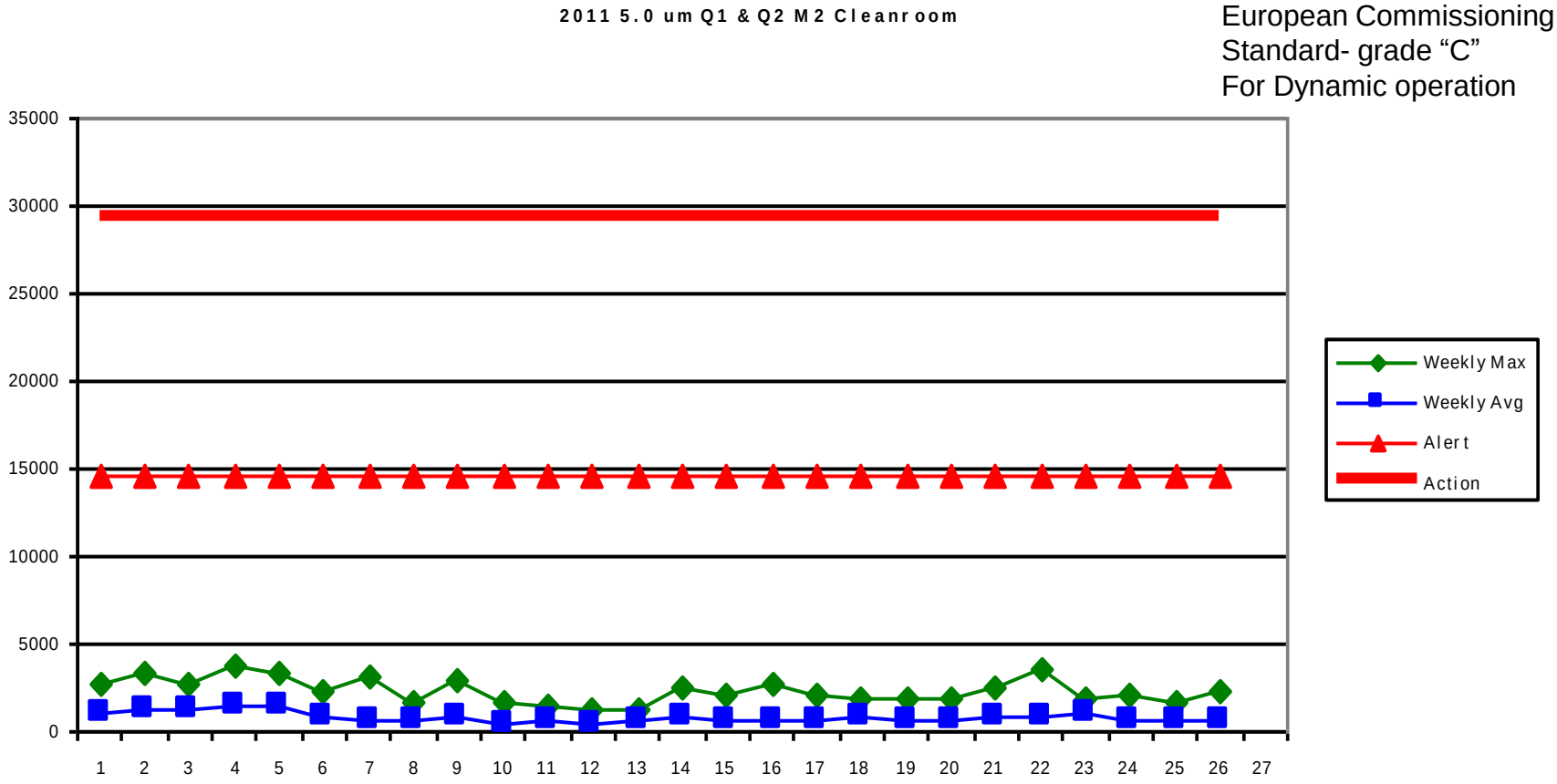
- Cleanrooms are typically “Set it and Forget it”

- This is a waste of energy
……if the filtration and air flow systems are designed correctly they often are cleaner than required.



Results - Particle Counts

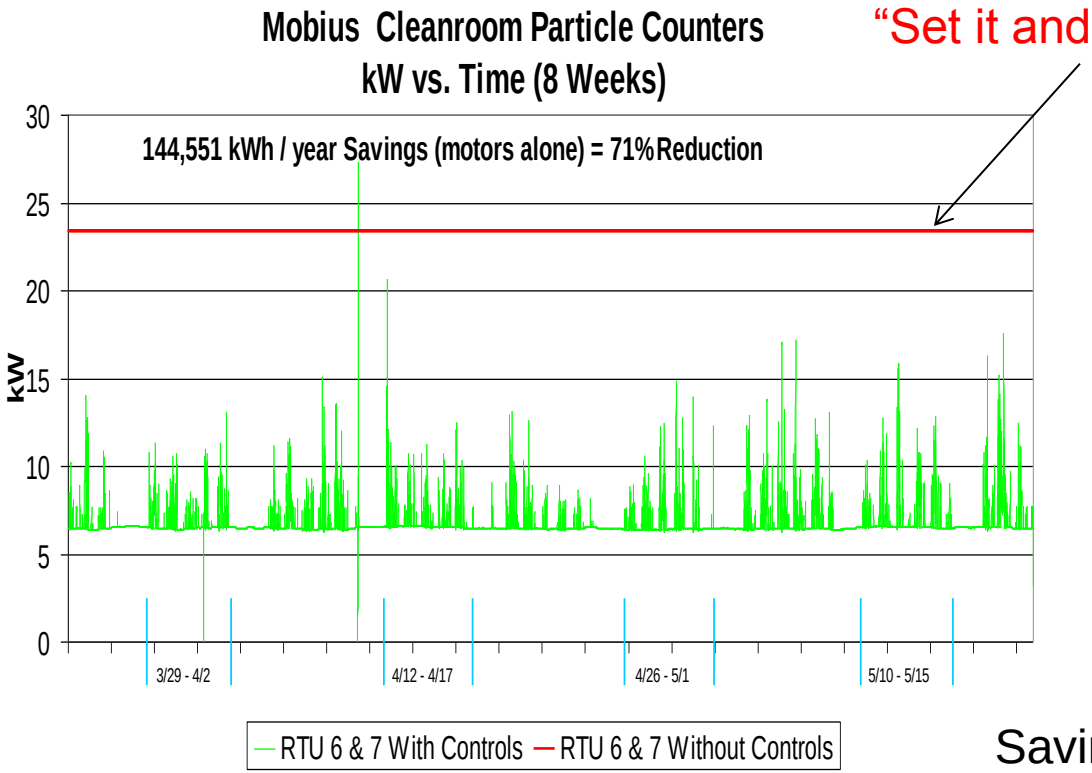
Note: Alert & Action Limits are set upon European Commissioning Standard- grade “C” For Dynamic operation



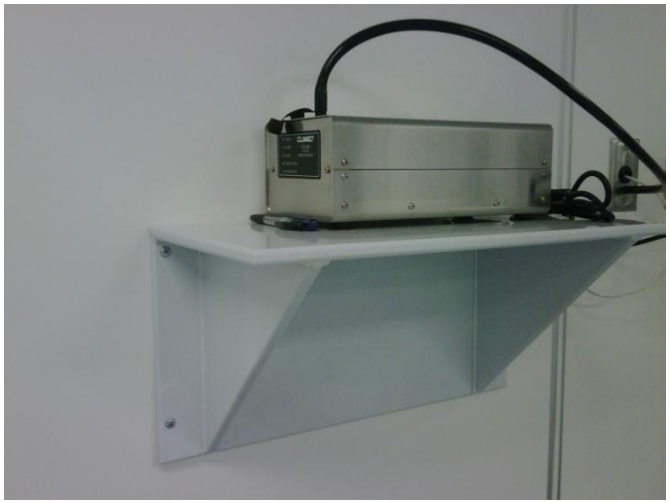
Conclusion: The Mobius 2 clean room consistently operates below 5000.

Mobius Project – Danvers MA Achieved LEED Gold Certification

- Demand Control Ventilation
  - Particle Counters- Controls Air Handling system to save Energy



"Set it and forget it"



Savings for 2 cleanrooms $ 51,652/yr

Tour of cleanroom manufacturing directly after conference



The Challenge

Reduce Energy Use 30% by 2015

Reduce Operating Costs

Maximize Staff Efficiency

Solve the Intellectual Property Challenge

Forecast effectively – Purchasing and Budgeting

Answering The Challenge

Develop Long Term Plan

- Leveraging Installed Technologies
  - Know Where are we
  - Identify Opportunities
  - Collect Data

What can the Industry do better

Focus on the End User

- Give Them the Right Tools
- Ease of System Operation
- Training

Phoenix Controls

David Gagnon

Director of Technical Services
Phoenix Controls

Biodesign Institute

Arizona State University



Phoenix Controls

Challenge

Achieve even more Energy Savings

- 800,000 sq.ft
- $150 Million Project
- AZ's Largest Bio Science Research Facility
- LEED® Gold Certification
- Lab of the Year 2006
- Looking for Even Better Performance!



Phoenix Controls

Solution

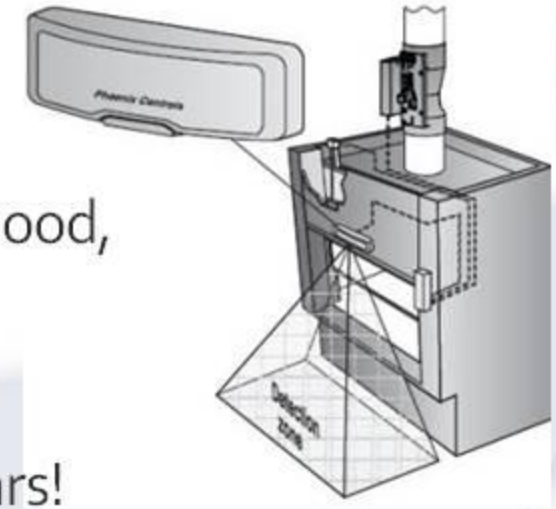
Fume Hood Controls & Demand-based Ventilation



Solution

- Occupancy management (ZPS)
- 66 hoods total
  - 26 in Biodesign B
  - 40 in Biodesign A







Results

- Saved approximately $4,000 per hood, per year
- Reduced carbon footprint by 34%
- On track to Save $1.4 M over 4 years!

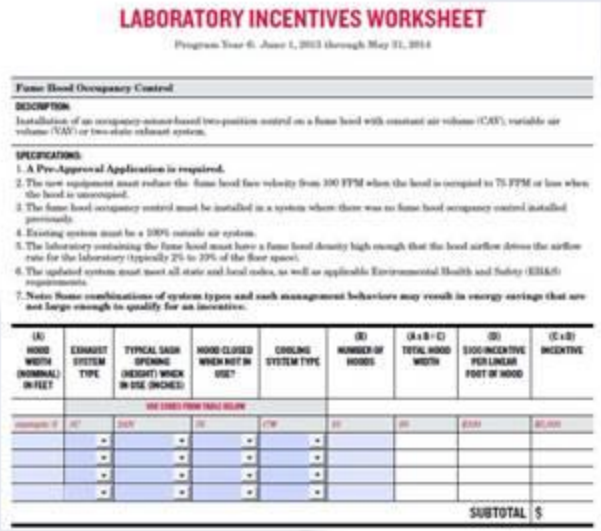


Phoenix Controls

Market Challenge

No Template for Incentives & Rebates

- No Prescriptive Measures
  - Each case requires custom application to utilities & government
- Need Standard Calculations by Application / Product
  - CFM and Energy Cost Reduction
  - KWH Savings per Device
- Phoenix Controls Developing Standards
  - Example: Fume Hood Occ. Sensor = $205/linear foot/year



LABORATORY INCENTIVES WORKSHEET

Program Year 6: June 1, 2013 through May 31, 2014

Fume Hood Occupancy Control

DESCRIPTION:

Installation of an occupancy-sensor-based two-position control on a fume hood with constant air volume (CAV), variable air volume (VAV) or two-state exhaust system.

SPECIFICATIONS:

1. **A Pre-Approval Application is required.**
2. The new equipment must reduce the fume hood face velocity from 100 FPM when the hood is occupied to 75 FPM or less when the hood is unoccupied.
3. The fume hood occupancy control must be installed in a system where there was no fume hood occupancy control installed previously.
4. Existing system must be a 100% outside air system.
5. The laboratory containing the fume hood must have a fume hood density high enough that the hood airflow drives the airflow rate for the laboratory (typically 2% to 10% of the floor space).
6. The updated system must meet all state and local codes, as well as applicable Environmental Health and Safety (EH&S) requirements.
7. **Note: Some combinations of system types and such management behaviors may result in energy savings that are not large enough to qualify for an incentive.**

(A) HOOD WIDTH (NOMINAL) IN FEET	EXHAUST SYSTEM TYPE	TYPICAL SASH OPENING (HEIGHT) WHEN IN USE (INCHES)	HOOD CLOSED WHEN NOT IN USE?	COOLING SYSTEM TYPE	(B) NUMBER OF HOODS	(A x B = C) TOTAL HOOD WIDTH	(D) $100 INCENTIVE PER LINEAR FOOT OF HOOD	(C x D) INCENTIVE
	USE CODES FROM TABLE BELOW							
example: 6	AC	24IN	YE	CTW	10	60	$200	$12,000
	-	-	-	-				
	-	-	-	-				
	-	-	-	-				
	-	-	-	-				
							SUBTOTAL	$

Phoenix Controls

EMS/HVAC System Degradation Resulting in Operational Inefficiencies

- No one is watching (It's an automation system).
- Only major system failures end up being alarmed.
- The "Real" alarm system is tenant complaint driven.
- No way of knowing how efficient system is operating.
- Gross system inefficiencies can go undetected for weeks, months or even years.

Energy Alerts

- Energy Alerts function similar to alarms although they go beyond monitoring equipment failures and deliverables to monitoring efficient operation.
- Expose the “Analytics” of the monitoring logic to be understood by the system operators.
- Customizable by the automation provider in partnership with the owner.
- In a moderate to large system, literally 1000’s or 10,000’s of items are continuously monitored using the distributed processing built into the system.
- Sometimes referred to as “Constant Commissioning”.

Taking Action

- Finding a “Champion” of the system to respond to system anomalies and initiate remedial actions.
- Competing with third party dashboard providers.

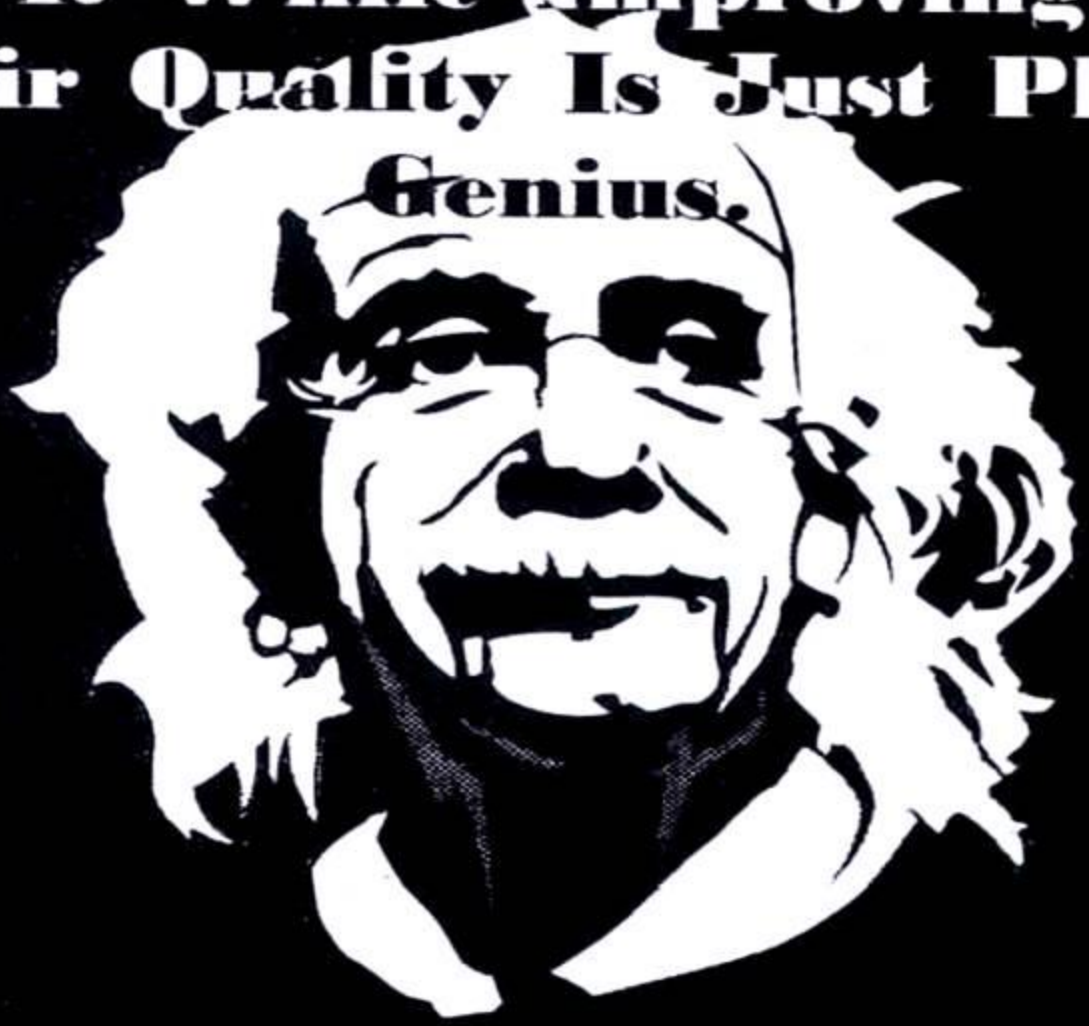
Presenter

Steve Di Giacomo, PE, CEM, CPMP

- Energy Management Associates (EMA)
- 508.533.1128
- Steve@EMA-Boston.com

EMA
ENERGY MANAGEMENT ASSOCIATES, INC.

Cutting Energy Costs Is Smart. Doing It While Improving Indoor Air Quality Is Just Plain Genius.



CUSTOMER PROBLEM

Reduce Air-Side O&M Costs while maintaining / improving Indoor Air Quality (IAQ)

APPLICABLE BUILDING SECTORS

- **CAV or VAV Labs** with 6 -12 ACHs, w/ & w/out hung ceilings

- **Offices** with min. VAV TB airflow setpoints set at say 50% (2:1)

- **Large Single Zones** with large variable occupancy, e.g., Libraries, Gyms, Café, Auditoriums served by dedicated HVAC systems w/ large (50%) minimum OA

Note: Careful, a small one percent (1%) decrease in human productivity can be equal to a building's entire Annual Energy Costs!

ENGINEERING SOLUTION

REDUCE AIRFLOW WITH CONTROLS UPGRADES & BAS /EMS PROGRAMMING

SOLUTION BY BUILDING SECTOR

- **Existing Labs** with no hung or hard ceiling – perform SF_6 Tracer gas study to set minimum airflows. VAV & Bournoulli boxes may require new airflow stations. New Lab designs will require double, triple and quadruple ganged boxes in order to achieve 6:1 ACH turndown, i.e., [2, 12] ACHs.

- **Offices** with min VAV TB airflow set-points set at, say, 50% of Max (2:1) will required simple BAS/EMS reprogramming plus the addition of CO2 sensors to override & increase TB airflow. This algorithm will save more O&M $$ than overriding the RTU or AHU OA Damper which floods the entire building with fresh air for the sake of a single zone. NOTE – RA CO2 DCV is deemed inappropriate without zone override of VAV TBs based on CO2

- **School Gyms, Café, Auditorium** with large variable occupancy, can simply control OA damper with a single zone CO2 sensor that controls OA damper. Special care required if there is an independent dedicated Exhaust – mind your space pressurization!

CHALLENGE:

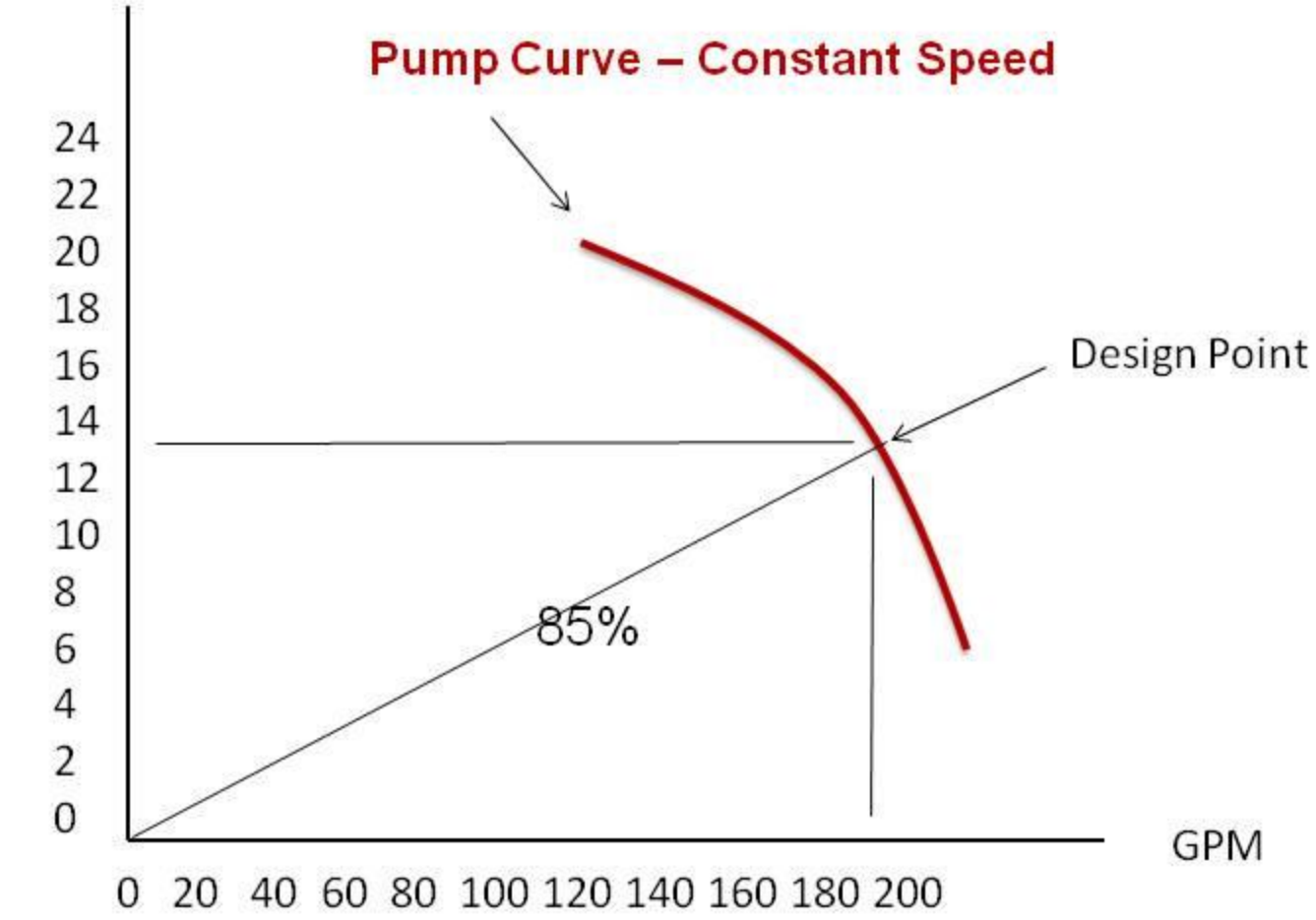
BUILDING SECTOR

- **NEW LABS**: determining the number of ganged Bournoulli TBs required is key, and this number is based upon the accuracy of TB airflow stations at low flow. This type data is often inaccurate in technical literature in EMA's experience. Need to override back to 12 ACHs for spills (manually or automatically or both).
- **EXISTING LABs**: TBs (Bournoulli) boxes may require replacement airflow stations. Need a method / means to override back to 12 ACH for spills.
  - **CHALLENGE → INSTALL PANIC BUTTON TO INCREASE LAB ACH. TRY TO AUTOMATE PROCESS WITH APPROPRIATE SENOR(S) (voc sensor, etc).**
- **Offices** - in lieu of dozens or hundreds of CO2 sensors, consider reducing the number of sensors by 93% by using AIRxpert or Aircuity to reduce overall project costs. Both these companies use technology that aspirate zone air-sample to a CO2 sensor from up to 16 zones per module.
  - **CHALLENGE → PERFECT COST EFFECTIVE ASPIRATING TECHNOLOGIES TO SINGLE SENSOR SUCH AS AIRxpert & Aircuity - PASS DATA TO BAS/EMS.**
- **School Gyms, Café, Auditorium** with large variable occupancy, can simply control OA damper with a single zone CO2 sensor that controls OA damper. We do not recommend differential CO2 DCV techniques unless the school is located in city.
  - **CHALLENGES → PERFECT LOW COST, ACCURATE, LIMITED DRIFT FREE OR SELF CALIBRATING CO2 SENSOR**

SIEMENS

Constant Speed Pumping

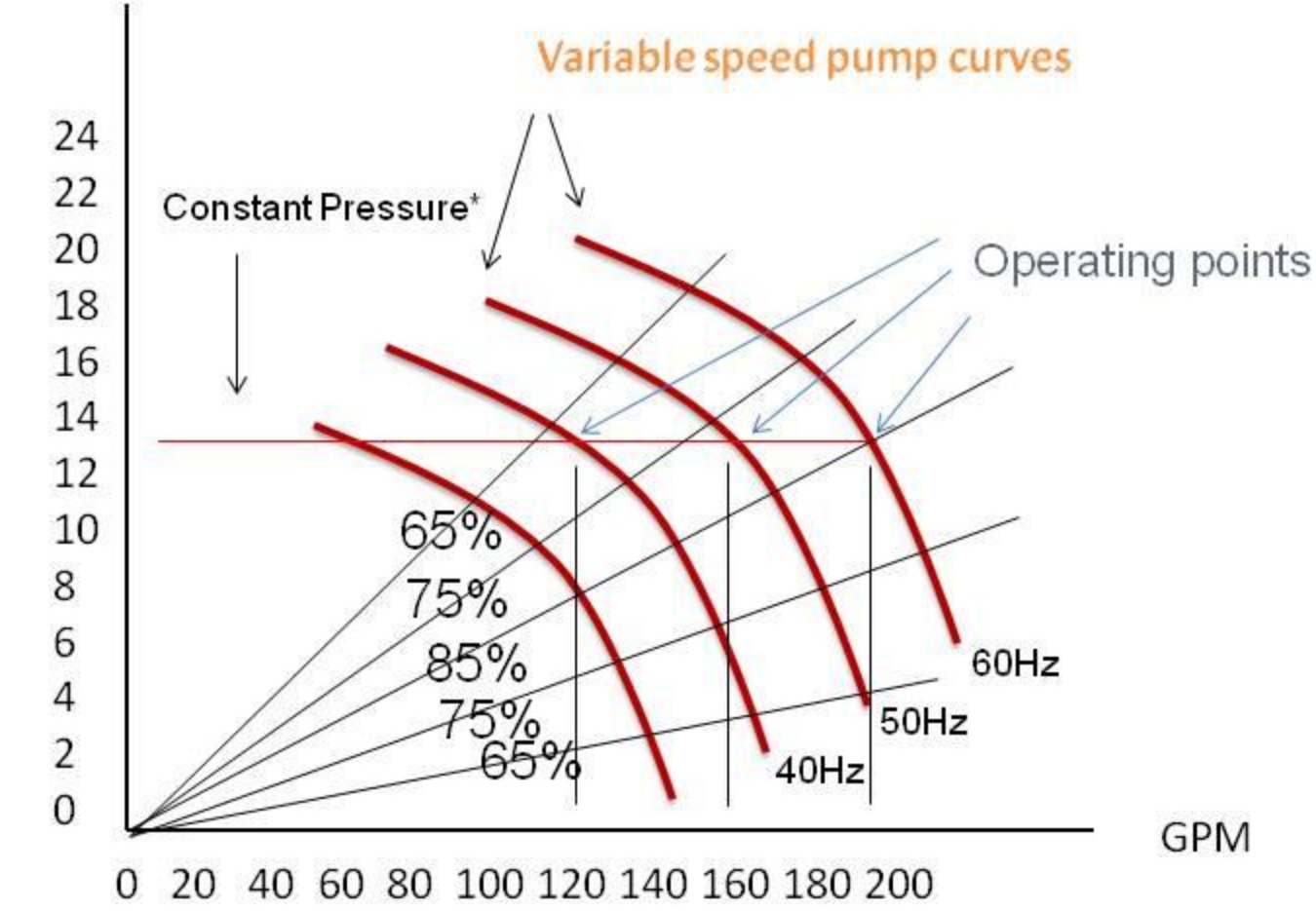




SIEMENS

Constant Pressure Pumping



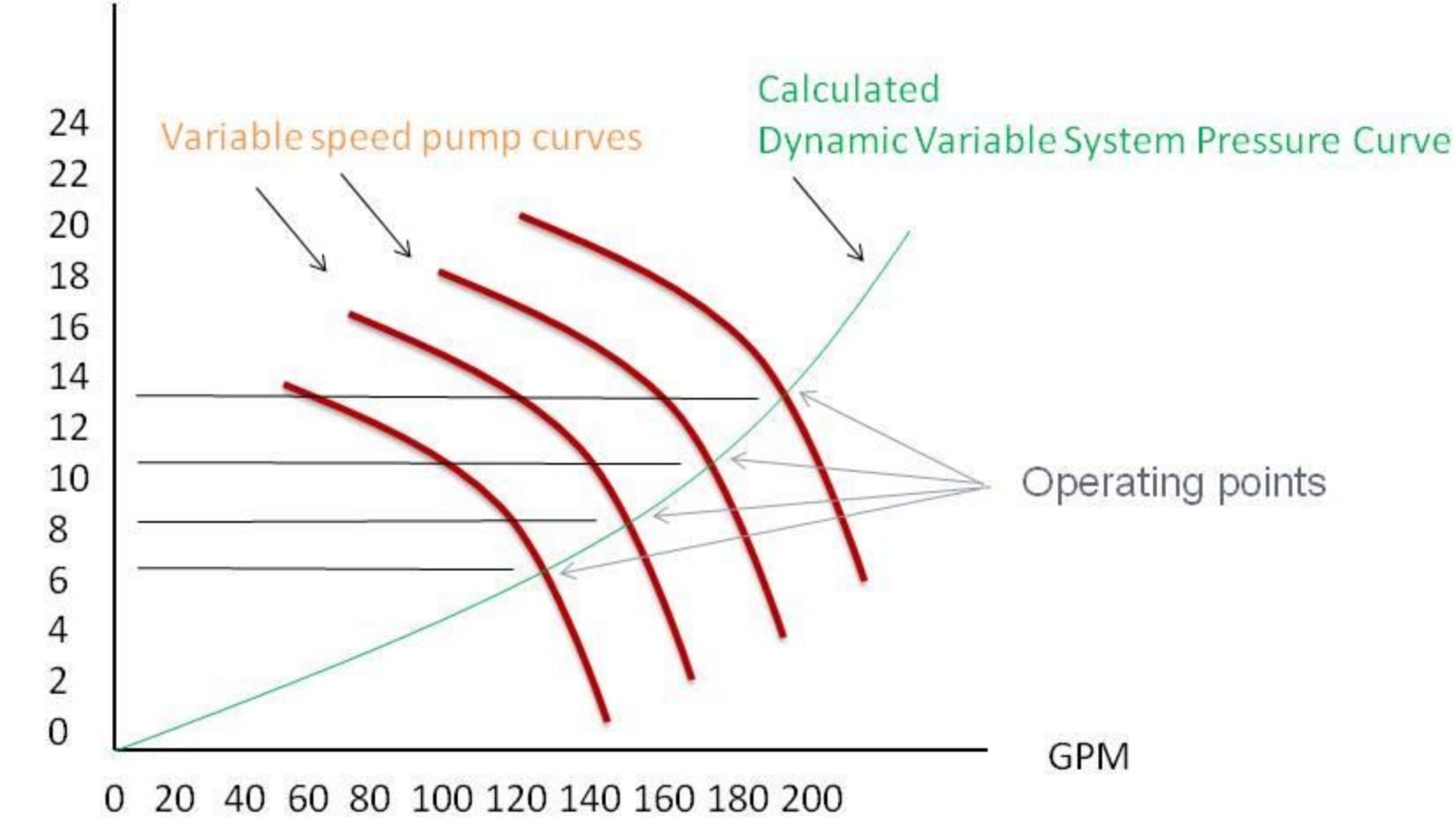


*requires VFD on Pump

SIEMENS

Variable Pressure Pumping





SIEMENS

Adaptive Loop Control



