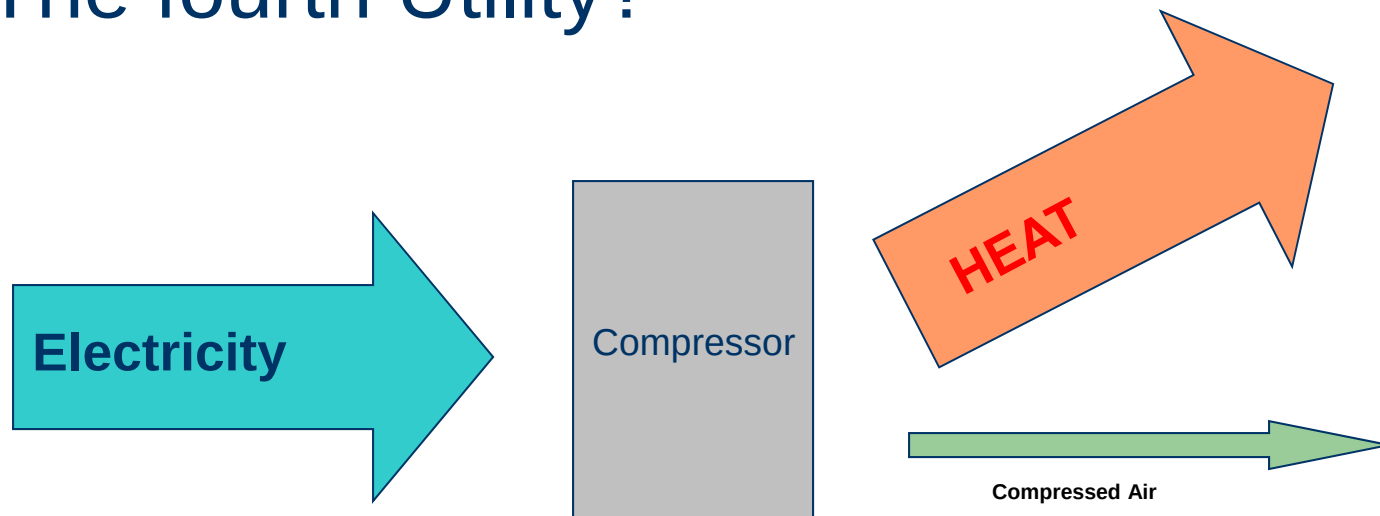


Compressed Air Systems Best Practice

Advanced Energy
Conference
2010

Compression 101

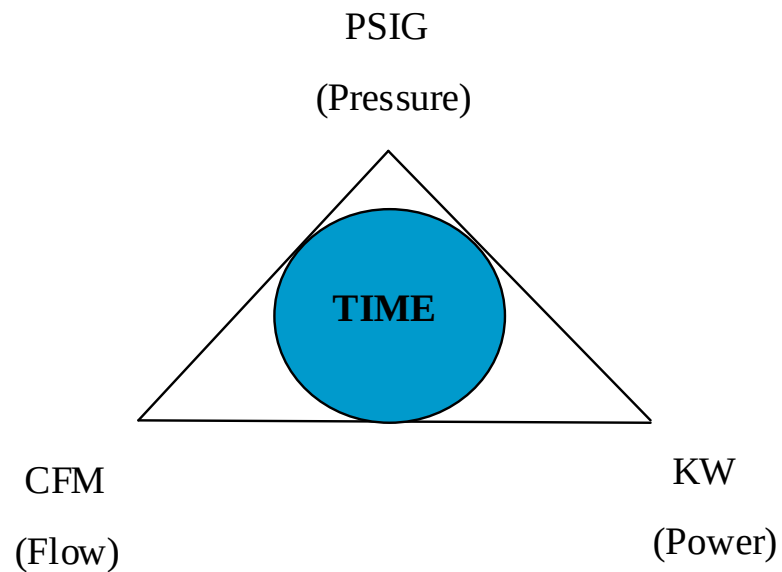
The fourth Utility?



10:1

Compression 101

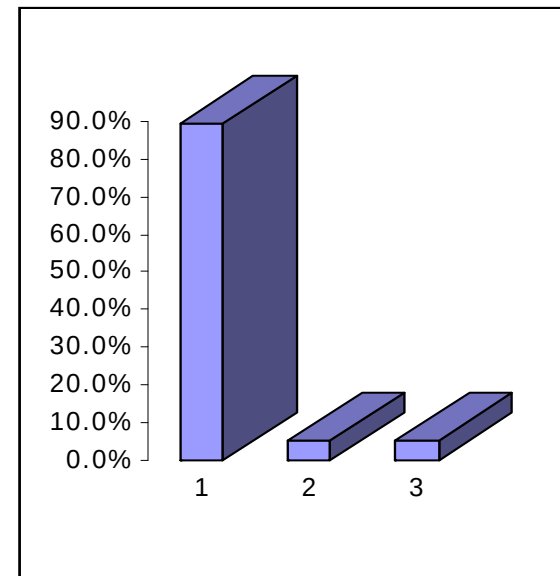
- Flow
- Pressure
- Power
- Time



Managing the Relationship

Life Cycle Costs

- Acquisition
- Installation
- Maintenance
- Power
- Reliability



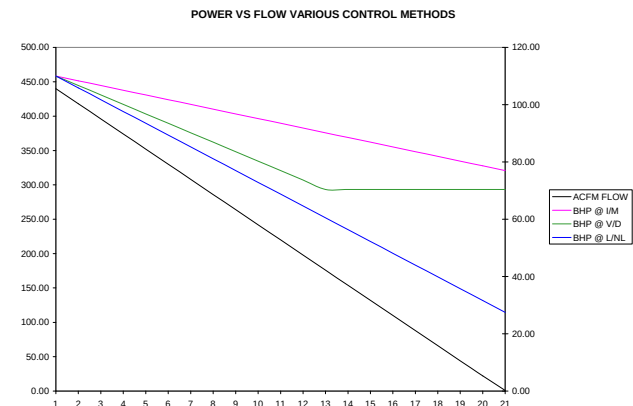
BHP	kW	\$ / kW	Hours	kWh	Annual Power	10 Year Elec	First Cost	10 Year Maint	Total 10 Year
165	129.5684	\$ 0.05	8760	1,135,019	\$ 56,750.97	\$ 567,509.68	\$ 68,101.16	\$ 68,101.16	\$ 703,712.01
						80.6%	9.7%	9.7%	
165	129.5684	\$ 0.10	8760	1,135,019	\$113,501.94	\$1,135,019.37	\$ 68,101.16	\$ 68,101.16	\$ 1,271,221.69
						89.3%	5.4%	5.4%	

Systems

- Supply (compressor room)
- Delivery (distribution piping)
- Demand (consuming processes)
- Inefficiency and waste should be isolated and eliminated in each segment

Unit Controls

- Compressor Control Options
 - Inlet Modulation
 - Variable Displacement
 - Load – No Load (on-off line)
 - Variable Speed

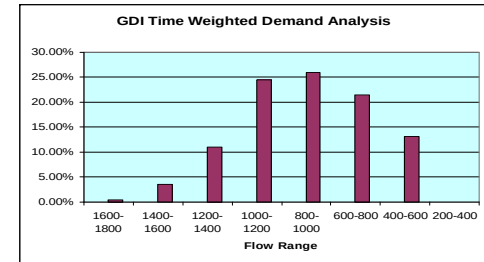
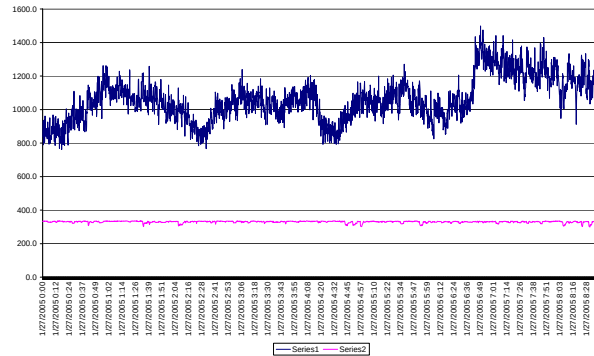


System Control

- Configuration and interface
- System control strategy must play the compressor unit at it's best position
- The most sophisticated control automation will fail if there is no time to execute
- Time = Tank with useful pressure differential
- Demand profile and pattern will dictate the configuration requirements

Evaluation and Solution Design

- Measure
- Analyze
- Model
- Test



Unit	Manufacturer	Model	Type	HP	DisPies	QpPies	FLow	DeskW	kW@QpPies	FankW	TotalkW	Cond	FLDE
Comp1				90kW	125	125	62	1158	1158		1158	VST	5.37
Comp2				100	125	115	40	873	829	30	859	LNL	4.89
Comp3				100	125	100	40	873	764	30	794	LNL	5.29
Comp4				100	125	100	40	873	764	30	794	LNL	5.29
Comp5				100	125	100	40	873	764	30	794	LNL	5.29
Comp6											00	HMD	
Comp7											00	HMD	

Row	%line	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	kW	Total	Hrs	kWh	\$/kWh	\$/hr	DE	DE
200	10%	153		794	794				296	800	20569	\$ 0.08	\$ 1463.3	5.46	0.05	
140	10%	126		794	794				264	800	22889	\$ 0.08	\$ 1332.9	5.36	0.05	
100	50%	80		794	794				203	800	11654	\$ 0.08	\$ 630.8	5.35	0.27	
100	100%	62		794	794				26	800	1936	\$ 0.08	\$ 1188.6	5.33	0.53	
100	100%	50		794	794				203	800	1936	\$ 0.08	\$ 1109.6	5.22	0.52	
100	50%	350		794	794				398	800	24652	\$ 0.08	\$ 1529.9	5.36	0.77	
90	50%	900		794					194	800	22516	\$ 0.08	\$ 1365.4	5.33	0.80	
80	100%	671		794					1465	800	13884	\$ 0.08	\$ 770.4	5.46	0.95	
70	100%	520		794					134	800	15304	\$ 0.08	\$ 663.6	5.38	0.93	
60	100%	385		794					1179	800	13804	\$ 0.08	\$ 656.2	5.09	0.91	
50	50%	900							90	800	3420	\$ 0.08	\$ 235.2	5.66	0.28	
40	50%	720							72	800	3536	\$ 0.08	\$ 149.2	5.66	0.28	
30	20%	572							572	800	1021.44	\$ 0.08	\$ 61.2	5.24	0.10	
20	10%	385							35	800	3326	\$ 0.08	\$ 22.6	5.39	0.05	
Total	100%											\$ 4665.5				530

Comparative Analysis

Item	Current	Case A	Case B	Case C
Equipment	\$ -	\$ 42,339.00	\$ 42,339.00	\$ 104,484.00
Installation	\$ -	\$ -	\$ -	\$ -
Tech Service	\$ -	\$ 6,890.00	\$ 6,890.00	\$ 6,890.00
Total First Cost:	\$ -	\$ 49,229.00	\$ 49,229.00	\$ 111,374.00
Annual kWh (model)	2,380,880	1,658,759	1,609,291	1,444,252
Electricity cost (model)	\$ 142,852.82	\$ 99,525.514	\$ 96,557.450	\$ 86,655.146
Maintenance cost (model)				
Cooling cost (model)				
Annual Operating Cost:	\$ 142,852.824	\$ 99,525.514	\$ 96,557.450	\$ 86,655.146
Simple ROI		1.14	1.06	1.98
Finance Term (mo)	60			
Multiplier	0.0214			
Monthly Payment	\$ -	\$ 1,053.50	\$ 1,053.50	\$ 2,383.40
Monthly Operating cost	\$ 11,904.40	\$ 8,293.79	\$ 8,046.45	\$ 7,221.26
Monthly Expense	\$ 11,904.40	\$ 9,347.29	\$ 9,099.95	\$ 9,604.67

Evaluation and Solution Design

Dynamic Efficiency

- CFM / KW
- Product delivered / power to produce
- Benchmarking, Validating, Managing

Time Weighted Demand Profile

- Data based Reality
- Solution modeling template

Solutions

- Start from process demand and work back
- Good data will lead to the solution
- Total life cycle cost focused
- Conventional wisdom can be costly

Take Away

- Savings potential is substantial
- Data will lead to the solution (measure)
- Energy is the principle cost component
- Reliability (down time will destroy savings)
- Prescriptive solutions should be vetted
- Solutions should deliver TLCC Savings
- Always Validate (M&V)