Seven Steps to Slash Your Compressed Air Electrical Costs

By Tommy McGuire

Compressed Air is so vital to industry that it is often called the "Fourth Utility"

Producing Compressed Air is one of the major energy-consumers in industry today.

Whether you are a small or large operation,
you can save 20% to 50% or more
of the electrical cost of operating your Air Compressor
by following the energy saving tips & formulas in this book.
The good news is that most of these tips cost very little to implement - making this an even more cost effective approach to saving money.

As a bonus-
your maintenance costs will be less and your equipment will last longer.

In today's atmosphere of "going green"-
these recomendations can save wasted energy
and add the "green" back to your bottom line and
saving you hundreds - even thousands of dollars a year!

Tommy McGuire

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Compressed Air Energy Saving Tips
By Tommy McGuire

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People are the #1 Energy Savers

Whether you are a small business or a large plant with multiple compressors...you need to run as efficiently as possible.
This book can help you do that! The formulas, recommendations and tips are compiled as a result of 30 years experience in the compressed air industry.

Apply the energy saving recommendations and other formulas to your own operation with the worksheets in the back and log your evaluations and savings. Use these time-tested tips as a great evaluation tool and you can save hundreds - even thousands - of dollars in electrical costs. Plus - these tips cost little to implement.

To insure continued savings - your business should adopt a good energy savings program and encourage your people to follow through. Support from the top down is most successful approach to saving energy. First develop the energy policy that is endorsed by senior management. Such as:
1- Reduce energy costs
2- Reduce the life cycle cost
3- Conserve natural resources
4- Reduce emissions
5- Enhance public perception

Set Goals for energy savings and lower life cycle cost. Such as:
1- If equipment is not needed turn it off
2- Keep equipment serviced
3- Stop-Look-Listen for unusual noise-leaks or hi-temperatures
4- Fix it before it breaks-down

Monitor energy used:
In a perfect world you would meter your air compressors electrical energy. But a more practical approach is to calculate annual savings as a percentage of energy reduction. We use the previous year's electrical cost and calculated energy saving formulas to find total energy used.

Reward those who follow your Energy Policy: Use incentives to keep your energy cost low.

Research & compare before you invest in compressed air equipment:
When specifying equipment look at total cost of ownership (TCO) not just the initial cost. So often initial cost is the deciding factor to select a compressed air system. While the initial cost may be only 10-20% of total cost of ownership and maintenance cost another 10%, the biggest total cost of ownership--70%-80%-- goes for energy to operate. With the ever increasing electrical energy cost, you need to look closely at the biggest cost of ownership --ENERGY.

For example, one compressor system may be cheaper to purchase, but may be more expensive to operate and maintain than another unit that may have a higher initial purchase price but operates more efficiently in the long haul.

Take the time to compare (TCO) and research first and then invest in the most energy efficient and long-term cost effective equipment.

1 How much does your air compressor cost you in electrical energy?

First you need to figure Your Electrical Cost Per KWH

1. Find your electrical utility bill

2. Find your total amount due on your utility bill

3. From you utility bill, find the total kilowatts used

4. Use this FORMULA:

Total Amount Due ÷ Total KWH Used = KWH Cost

Example:

Total Dollar Amount Due **Ex: $300.00**

Total KWH Used **Ex: 2500**

Amount Due Divided By Total KWH Used

$300.00 Due ÷ 2500 KWH Used = 0.12 Per KWH

Results:

Your Cost Per Kilowatt Hour is $0.12 Cents

Carry this figure forward to STEP 2

Before we see how much electricity costs, we have to understand how it's measured. When you buy gas they charge you by the gallon. When you buy electricity they charge you by the kilowatt-hour (kWh). When you use 1000 watts for 1 hour, that's a kilowatt-hour. The kilowatt hour is most commonly known as a billing unit for energy delivered to consumers by electric utilities.

2 How much does your air compressor cost you in electrical energy?

How to figure the ELECTRICAL ENGERY COST of running your Air Compressor

Use this formula:

Electrical cost = Total HP x .746 x hours x KWH cost ÷ motor efficiency

Example:

25 HP air compressor that runs 10 hours a day 5 days a week for a year with a $.12 KWH electric rate and a 90% efficient electric motor.

To figure your total horsepower (TOTAL HP):
Motor Data Plate HP (EX: 25HP) X 110% = **27.5 HP**

Most Air Compressors @ Max PSI Use 110% of the rated Horsepower

KILOWATTS per HP = .746 watts

746 watts per hour of electrical energy is required to convert to 1 Horsepower of mechanical energy. KWH= your cost per 1000 watts of electrical energy per hour.

Figure your YEARLY HOURS:
Hours running per day X # days per week X # weeks per year running = The total time the equipment runs in a year.
(Example: 10 Per Day X 5 Days Wk X 52 Wks = **2600 HOURS**)

MOTOR EFFICIENCY (EFF) can be found on the motor data plate as a percentage. (Example=**.90 %**) It is the ratio of input power minus the output power.

27.5 hp x .746 x 2600 hours x $.12 ÷ .90 = $7111.87 per year

Results:

ANNUAL ELECTRIAL COST FOR COMPRESSED AIR $7111.87
Carry this figure forward to STEP 4

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

How to figure the Size of your Air Leaks

Use this formula:

Load Time ÷ Total Time = % Air Leaks

1. Turn Off All Air Operated End-User Equipment.

2. Start Your Air Compressor and let it cycle Off/On two (2) times.

3. Then time the next cycle.

Example:

1. Time The Off-Line/Unload Time (Not Pumping Time) Using Your Watch. (Example: 5 Minutes)

2. Time The On-Line/Load Time (Pumping Time) Using Your Watch (Example: 2 Minutes)

3. Add The Off/Unload Time and The On/Load Time Together

Example: T(5 Minutes) + T (2 Minutes)=(Example: 7 Minutes)

2 Minutes Load Time ÷ 7 Minutes Total Time = 29%

Result:

29% of your air compressor's CFMs are maintaining your air leaks
Carry this percentage forward to STEP 4

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

4 Air leaks: Don't pay a high price for an easy fix

How to determine the Electrical Cost of your Air Leaks

Use this formula:

Electrical Cost X % of Leaks = Electrical Air Leak Cost

**Note: For our examples, we will be using the following...*
Electrical Cost Taken From Compressed Air Electrical Energy Cost example.
Air Leak Percentage Taken From Size of Air Leaks example.

Example:

$ 7111.87 per year	X	.29 %	=	$2062.45
Compressed Air Electrical Cost		Size of Air Leaks as A Percentage		Electrical Air Leak Cost

Results:

Annual Air Leak Electrical Cost = $2062.45

Your Response to this evaluation should be to FIX your air leaks and save a lot of money each year!

Original Compressed Air Electrical Cost from STEP 2	$7111.87 per year*
Less savings from fixing air leaks	**-2062.45**
NEW Annual Electrical Cost for Compressed Air	**$5049.42***

*** Carry this new annual cost forward into STEP 5**

*All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

5 Lower the pressure and increase your energy savings

How to figure the Electrical Cost of Air Pressure Changes

Use this formula:

Pressure change ÷ 2 = % of hp change x electrial cost=change

**Note:*
Every 2 psig pressure change up or down equals 1% change in horsepower

Remember, pressure costs money in two ways — power to produce increased pressure, and excess pressure produces excess flow that must be compressed.

For our examples, we will be using the following...
Electrical cost taken our previous example for compressed air electrical cost per year ***$5049.42***

Example:

Air compressor pumping up to 175 psig and stops.
Change compressor stopping pressure to 130 psig .
Pressure change 175 psig minus 130 psig = **45 psig change**
45 psig change divided by 2 = **22.5%** change in horsepower
NEW Yearly electrial cost= **$5049.42**

HP Change .225 x 5049.42 = $1136.12 Savings
Results:
Savings per year in electrial cost
by lowering your air pressure 45 psig =$1136.12

Your Response to this evaluation should be to REDUCE air pressure as much as possible without negatively affecting equipment operation...and SAVE more money

UPDATED Compressed Air Electrical Cost from STEP 4	$5049.42 per year*
Less savings from lowering air pressure	**-1136.12**
NEW Annual Electrical Cost for Compressed Air	**$3913.30***

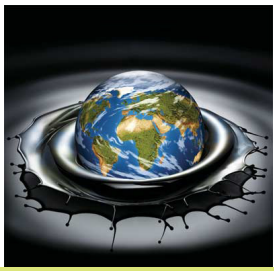
*** Carry this new annual cost forward into STEP 6**

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

6 Reduce Electrical Costs by using Synthetic Lubricants

How to figure the savings you can receive by switching to Synthetic Air Compressor Lubricants

Compressor synthetics lubricants can actually reduce energy consumption in many applications, up to 10% as compared to conventional oils.



Special Notes:

- *Do not use synthetic oil in a brand new piston compressor. Run compressor approximately 200 hours (to seat rings)before changing to synthetic oil.*
- *Screw & Vane Compressor do not need break-in time.*
- *Use same electrical line each time you check amp draw.*
- *With modulating inlet, take amp reading 10 psig before unit unloads*

Use this formula:

1st amp – 2nd amp = amp change ÷ 1st amp = % change x electrial cost = $avings

Example:

1. Check unit amp draw at operating temperature.
2. Take amp reading 1 psig before unit stops or unloads.
3. Note first amp reading *(example 64.6)*
4. Change oil when unit is at operating temperature.
5. Run unit 200 hours
6. Change oil when unit is at operating temperature. (oil is mixed)
7. Run unit 200 hours.
8. Take amp reading 1 psig before unit stops or unloads.
9. Note second amp reading *(example 59.1)*

Yearly air compressor electrical cost from previous example= $3913.30

64.6 – 59.1 = 5.5 ÷ 64.6 = .09 % x 3913.30 = $352.20 savings

Results:

Electrical savings per year by switching from a mineral based oil to a Synthetic Air Compressor Lubricant = $352.20

UPDATED Compressed Air Electrical Cost from STEP 5	$3913.30 per year*
Less savings from changing to Synthetic Lubriants	-352.20
NEW Annual Electrical Cost for Compressed Air	**$3561.10***

*** Carry this new annual cost forward into STEP 7**

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

7 Reduce Electrical Costs by Lowering Your Inlet Air Temperature

How to determine your savings you could receive by lowering your air compressor inlet temperature

Did you know that for each 5°F change in inlet air temperature can net a 1% change in electrical use? **By reducing inlet air temperature 10°F below 70°F, you save 2% on electrical usage.** Your benefit increases up to 8% on a 30°F degree day. Increase the compressor inlet temperature 10°F above 70°F – and it will **cost** you **2%** in additional electrical usage for every 10°F up to 10% at 120°F. *NOTE: Inlet temperature has very little effect on lubricated screw & vane compressors.*

Use this formula:

Temperature change ÷ 5 = % of electrical change x electrical cost per year

Example:

Manufacturer's specs for 25 hp piston air compressor:
91 CFM delivered @ 175 PSIG at CAGI Standards*

Outside temperature is **90° F**. The compressor inlet air temperature in the compressor room is **120°F**. Change compressor inlet temperature to outside temperature of 90° F.

120°F (minus) – 90°F = **30°F change**
Compressor annual electrical cost **$3561.10**

Temperature change 30 ÷ 5 = 6% change x $3561.10 =$213.67

Results:

Amount saved by lowering inlet temperature = $213.67

* Compressed air and gas institute (CAGI) standards
@ 60°F inlet temperature @ 14.5 PSIA absolute pressure @ 0% relative humidity
@ 770 RPM @ 2580 CFM cooling air flow @ 55,970 BTU heat rejection

Your Response to this evaluation should be to LOWER your compressor inlet temperature to SAVE more money

UPDATED Compressed Air Electrical Cost from STEP 6	$3561.10 per year*
Less savings from lowering inlet air temperature	**-213.67**
NEW Annual Electrical Cost for Compressed Air	**$3347.43***

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

Energy Savings
EXAMPLE WORKSHEET

USING EXAMPLE FIGURES *All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.	**Watch the Savings Grow**	**Watch the Electric Bill Shrink**
Annual total of electrical costs of operating EXAMPLE air compressor Figured using STEP 1 & STEP 2	Use the steps and formulas provided in this book to figure your own savings.	**EXAMPLE** Beginning Yearly Electrical Costs $7111.87
STEP 3 & STEP 4: LEAK REPAIRS made after Estimating savings using EXAMPLE	7111.87 Original Electric Cost Less -2062.45 Savings =	$5049.42 UPDATED Electric Cost
STEP 5: PRESSURE CHANGES made using EXAMPLE figures & formula	5049.42 UPDATED Electric Cost Less -1136.12 Savings =	$3913.30 UPDATED Electric Cost
STEP 6: Savings figured from changing to SYNTHETIC COMPRESSOR OIL	3913.30 UPDATED Electric Cost Less -352.20 Savings =	$3561.10 UPDATED Electric Cost
STEP 7: Savings figured from LOWERING INLET TEMPERATURE	3561.10 UPDATED Electric Cost Less -213.67 Savings =	$3347.43 NEW Electric Cost After implemeting the 7 Energy Saving Steps
TOTAL SAVINGS	**7111.87** Original Electric Cost **-3347.43** NEW Electric Cost **$3764.44** Figure % of Savings **3764.44 ÷ 7111.87** =	**Yearly Electric Costs Reduced To** **$3347.43** **53% Savings!**

All the EXAMPLES used in this book are implemented in the order as listed and the accumulative savings are based on each consecutive result.

Your Energy Savings
STEP 1 WORKSHEET

Total Amount Due ÷ Total KWH Used = KWH Cost

Figure Your Electrical Cost Per KWH

1. Find your electrical utility bill

2. Find your **total amount due** on your utility bill: _____

3. From you utility bill, find the **total kilowatts (KWH) used** _____

4. Use this FORMULA:

Total Amount Due ÷ Total KWH Used = KWH Cost

_____	÷	_____	=	$ _____
Total amount due		Divided by Total Kilowatts (KWH) Used		Your Cost per KWH You will use this cost per KWH in STEP 2

Energy Savings
STEP 2 WORKSHEET

Total HP x .746 x hours x KWH cost ÷ motor efficiency = Yearly Electrical Cost

Figure the ELECTRICAL ENGERY COST of running your Air Compressor

To figure your total horsepower (TOTAL HP):

Motor Data Plate HP _____ **HP** X 110% = _____ **HP**

Most Air Compressors @ Max PSI Use 110% of the rated Horsepower

KILOWATTS per HP = **.746 watts**

746 watts per hour of electrial energy is required to convert to 1 Horsepower of mechanical energy. KWH= your cost per 1000 watts of electrical energy per hour.

Figure your YEARLY HOURS:

	x		**x**		**=**	**YEARLY HOURS**
# Hours running per day	X	# days per week	X # weeks per year running		= The total time the equipment runs in a year.	

MOTOR EFFICIENCY (EFF) can be found on the motor data plate as a percentage. It is the ratio of input power minus the output power.

hp	**x .746 x**		**hours x**	**$**	**÷**		**=**	**$**
Your Compressor's Horse Power		Hours Compressor runs a Year		Your Cost per KWH	Divided by % Motor Efficiency			Your Annual Electical Cost To Operate your Air Compressor

Results:

ANNUAL ELECTRIAL COST FOR COMPRESSED AIR $_____

Use this figure in STEP 4

Energy Savings
STEP 3 WORKSHEET

Load Time ÷ Total Time = % Air Leaks

How to figure the Size of your Air Leaks

1. Turn Off All Air Operated End-User Equipment.

2. Start Your Air Compressor and let it cycle Off/On two (2) times.

3. Then time the next cycle.

TIME COMPRESSOR:

1. Time The Off-Line / Unload Time (Not Pumping Time) Using Your Watch.

UNLOAD TIME _____minutes

2. Time The On-Line / Load Time (Pumping Time) Using Your Watch

LOAD TIME _____minutes

3. Add The Off / Unload Time and The On / Load Time Together

Total Time _____minutes

Example: T(5 Minutes) + T (2 Minutes)=(Example: 7 Minutes)

_____Minutes Load Time ÷ _____Minutes Total Time = _____%

Load TIme Divided by Total Time

Result:

_____% of your air compressor's CFMs are maintaining your air leaks

Use this figure in STEP 4

Energy Savings
STEP 4 WORKSHEET

Electrical Cost X % of Leaks = Electrical Air Leak Cost

How to determine the Electrical Cost of your Air Leaks

$_____ x _____% = $_____

Compressed Air Electrical Cost | Size of Air Leaks as A Percentage | How much Air Leaks Cost You Anually

Results:

Annual Air Leak Electrical Cost $_____

Original Compressed Air Electrical Cost $_____ per year*

Less savings from fixing air leaks -_____

NEW Annual Electrical Cost for Compressed Air $_____*

* Use this figure in STEP 5

Energy Savings
STEP 5 WORKSHEET

Pressure change ÷ 2 = % of hp change x electrial cost=change

How to figure the Electrical Cost of Air Pressure Changes

Every 2 psig pressure change up or down equals 1% change in horsepower

Your Air compressor pumps up to _____ psig and stops.

Change compressor stopping pressure to _____psig .

Subtract change psig from original psig to get Pressure change = _____**psig change**

_____psig change divided by 2 = _____**%** change in horsepower

. x = $ Savings

HP % Change x New Annual Electrical Cost from STEP 4

Results:

Savings per year in electrial cost by lowering your air pressure $_____

UPDATED Compressed Air Electrical Cost from STEP 4 $_____ per year*

Less savings from lowering air pressure -_____

NEW Annual Electrical Cost for Compressed Air **$_____***

* Use this figure in STEP 6

Energy Savings
STEP 6 WORKSHEET

1st amp – 2nd amp = amp change ÷ 1st amp = % change x electrial cost=$aving

How to figure the savings you can receive by switching to Synthetic Air Compressor Lubricants

1. Check unit amp draw at operating temperature.
2. Take amp reading 1 psig before unit stops or unloads.

3. Note **first amp reading** _____

4. Change oil when unit is at operating temperature.
5. Run unit 200 hours
6. Change oil when unit is at operating temperature. (oil is mixed)
7. Run unit 200 hours.
8. Take amp reading 1 psig before unit stops or unloads.

9. Note **second amp reading** _____

UPDATED Yearly air compressor electrical cost from STEP 5 = **$**_____

_____	–	_____	=	_____	÷	_____	= % x	_____ = $ _____ savings
1st amp reading less 2nd amp reading				Divide amp change by 1st amp reading = % change				x annual electrical costs = your savings

Results:

Electrical savings per year by switching from
a mineral based oil to a Synthetic Air Compressor Lubricant $_____

UPDATED Compressed Air Electrical Cost from STEP 5 $_____ per year

Less savings from changing to Synthetic Lubriants -_____

NEW Annual Electrical Cost for Compressed Air $_____*

* Use this figure in STEP 7

Energy Savings
STEP 7 WORKSHEET

Temperature change ÷ 5 = % of electrical change x electrical cost per year

How to determine your savings you could receive by lowering your air compressor inlet temperature

The compressor inlet air temperature in the compressor room is _____**°F**.

Lower compressor inlet temperature to _____**° F.**

Figure compressor inlet temperature change = _____**°F change**

Compressor annual electrical cost brought forward from STEP 6 **$**_____

_____ **÷ 5*** **=** _____ **% change x $** _____ **= $** _____

Inlet Temperature Change | Divided by 5* = % of electrical change | x Elecrical cost per year as brought froward

* For each 5°F change in inlet air temperature can net a 1% change in electrical use

Results:

Savings realized by lowering inlet temperature $_____

UPDATED Compressed Air Electrical Cost from STEP 6 $_____ per year

Less savings from lowering inlet air temperature -_____

NEW Annual Electrical Cost for Compressed Air **$**_____

Your Energy Savings
WORKSHEET

USING YOUR FIGURES	Watch Your Savings Grow	Watch Your Electric Bill Shrink
Annual total of electrical costs of operating your air compressor Figured using STEP 1 & STEP 2	Use the steps and formulas provided in this book to figure your own savings.	Beginning Yearly Electrical Costs $ _____
STEP 3 & STEP 4: LEAK REPAIRS made after estimating your savings	$ _____ Original Electric Cost Less - $ _____ Savings =	$ _____ UPDATED Electric Cost
STEP 5: PRESSURE CHANGES made using your figures	$ _____ Original Electric Cost Less - $ _____ Savings =	$ _____ UPDATED Electric Cost
STEP 6: Savings figured from changing to SYNTHETIC COMPRESSOR OIL	$ _____ Original Electric Cost Less - $ _____ Savings =	$ _____ UPDATED Electric Cost
STEP 7: Savings figured from LOWERING INLET TEMPERATURE	$ _____ Original Electric Cost Less - $ _____ Savings =	$ _____ NEW Electric Cost After implemeting the 7 Energy Saving Steps
TOTAL SAVINGS	$ _____ Beginning Electric Cost Less - $ _____ NEW Electric Cost after STEP 7 = _____ SAVINGS _____ ÷ _____ = _____% New electric cost divided by Beginning electric cost	**Yearly Electric Costs Reduced To** $ _____ Will equal the PERCENTAGE of Savings you achieved by implementing these SEVEN STEPS to Slash Your Compressed Air Electrical Costs

RESOURCES

Tommy McGuire
Owner of McGuire Air Compressors

Since 1981, Tommy has owned and operated McGuire Air Compressors in Graham, NC. Before that, he was a CERTIFIED MASTER MECHANIC in the automotive industry. He grew up working in his Dad's auto repair shop and "learned to fix almost anything."

Tommy's knowledge of air compressor systems, air dryers, controls, and related equipment is quite extensive. He even assists many engineers and contractors in determining what equipment they need for the most efficient compressed air system.

He and his staff of Certified Service Technicians have worked with compressors from ½ horsepower to over 700 hp. McGuire Air Compressors, Inc. is located in a 10,000 square foot facility in the heart of Piedmont North Carolina.

REAL PEOPLE with REAL AIR COMPRESSOR EXPERIENCE!

The formulas, recomendations and information in this book have been collected throughout Tommy McGuire's career in the Compressed Air Industry.

Most major resources for industry standards used in this E-book are taken from:

Compressed Air & Gas Institute, http://www.cagi.org/

US Government Department of Energy, http://www.eere.energy.gov

North Carolina State University, http://www.ncsu.edu/
DOE Level 1- Fundamentals of Compressed Air Systems
DOE Level 2- Advanced Management of Compressed Air Systems

Formula Symbols:

Add +	Divide ÷	Percent %
Subtract/Less -	Multiply x	Equals =

Tools Needed To Lower Compressed Air Electrical Cost

CLIPBOARD	(keep up with the paper work)
CALULATOR	(help with the formulas)
STOP WATCH	(to check the operational times)
PEN	(to record your findings in the manual worksheets)
SCREW DRIVER	(to adjust pressure switch)
TEMP GUN	(to check the compressor inlet temperature)
AMP CLAMP METER	(to check the motor ampere draw)
ADJUSTABLE WRENCH	(to adjust switch or loose oil filler plug)
FUNNEL	(to drain and refill the compressor oil)
EMPTY PAILS	(to catch the old compressor oil)






This list tool may vary by the brand and type of compressors you have…but this will get you off to a good start.

Through these seven steps we've shown you how to perform **FOUR of the biggest compressed air energy-savers.**

There are many other compressed air electrical energy saving steps you can apply to your system - but **these SEVEN STEPS are the least expensive to implement and can provide you with the biggest savings.**

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Visit our web sites for more information:

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Offering Deltech Refrigerated Air Dryers

www.hosereels.biz
Offering Reeltech Industrial Hose Reels