Energy Savings Descriptors in Florida's Newspaper Industry

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OUTLINE

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- Companies Profile
- Cost Variation: Energy and Demand
- Energy Profile
- The Process
- The Energy Audit
- An Interactive Energy Balance
- Energy Savings Recommendations
- Descriptors
- A short review on two ARs

COMPANY PROFILES

SIC 2711 = Newspaper Publishing and Printing

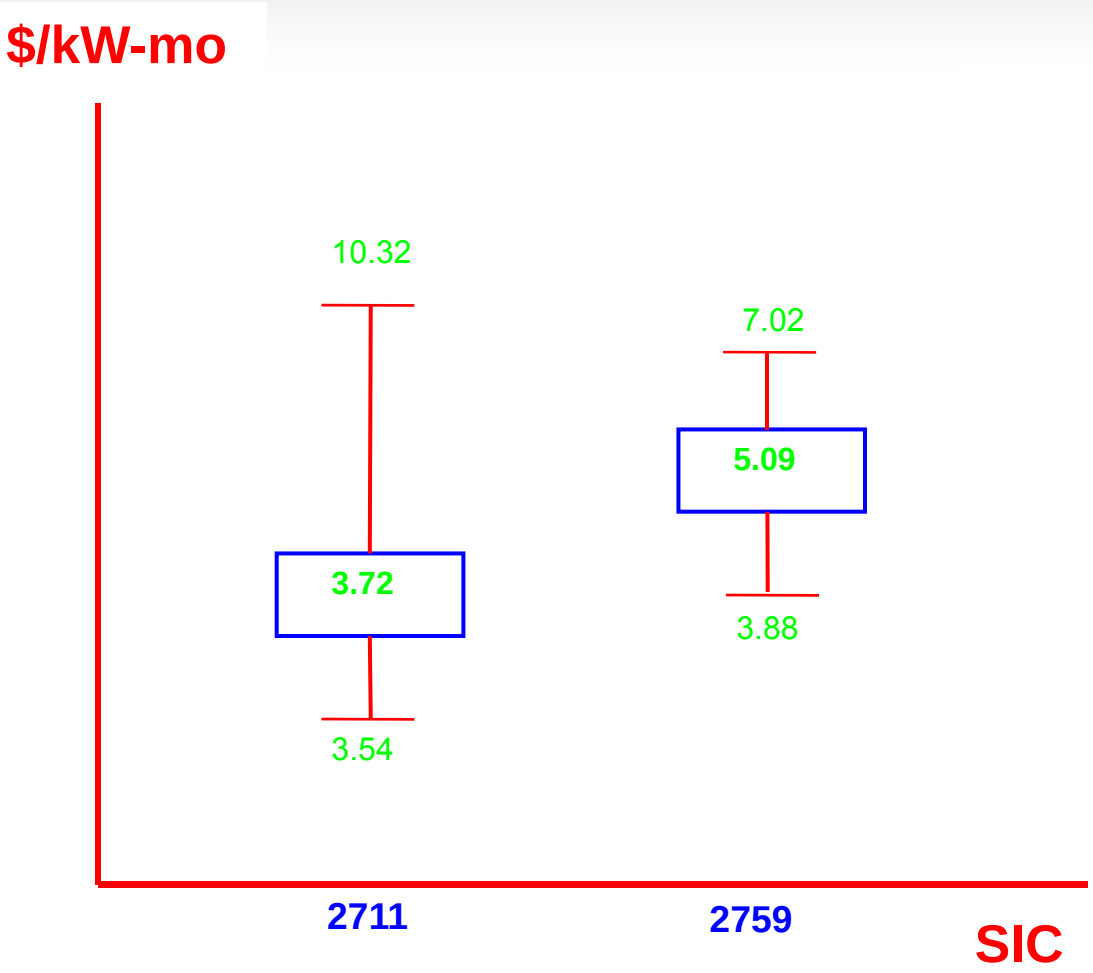
Plant	Sales (in $MM/yr)	Annual Production	Production Area ft²	$/ft²	Emps.	Taxes Prog.	E. Savings ($/yr)	% E. Savings
A316	10-29	15.6-21.8MM Newspapers	70,000	143 - 414	210	Yes	76,032	28
B315	5-10	29MM Newspapers	73,000	69 - 137	92	Yes	27,139	25
C312	30	8.6MM Newspapers	65,119	460.70	270	Yes	65,294	10
D281	35	28MM Newspapers	800,000	43.75	400	Yes	72,136	27
E267	15	23MM Newspapers	100,000	150.00	290	No	42,330	16
F246	330	134MM Newspapers	826,000	399.52	1950	No	459,031	28
G217	30	8.6MM Newspapers	70,000	428.57	293	No	50,123	24
H215	50	3.5MM Newspapers	125,000	400.00	430	No	42,330	16
F246	10	13MM Newspapers	30,000	333.33	92	No	452,031	28
G217	25	1343MM Papers	55,606	449.59	180	No	50,123	24
H215	16	162,389 Reams	80,000	200.00	75	No	39,548	9
N190	16	1 billion Envelopes	124,000	129.03	158	Yes	83,371	34
X55	25	25MM Directories	250,000	100.00	180	No	114,496	43
Y54	6	17.19 MM Newspapers	67,000	89.80	284	Yes	53,719	18
Z33	50	470 MM forms	29,400	1,700.68	48	Yes	66,956	27
			Average				**113,444**	**24**

COMPANY PROFILES

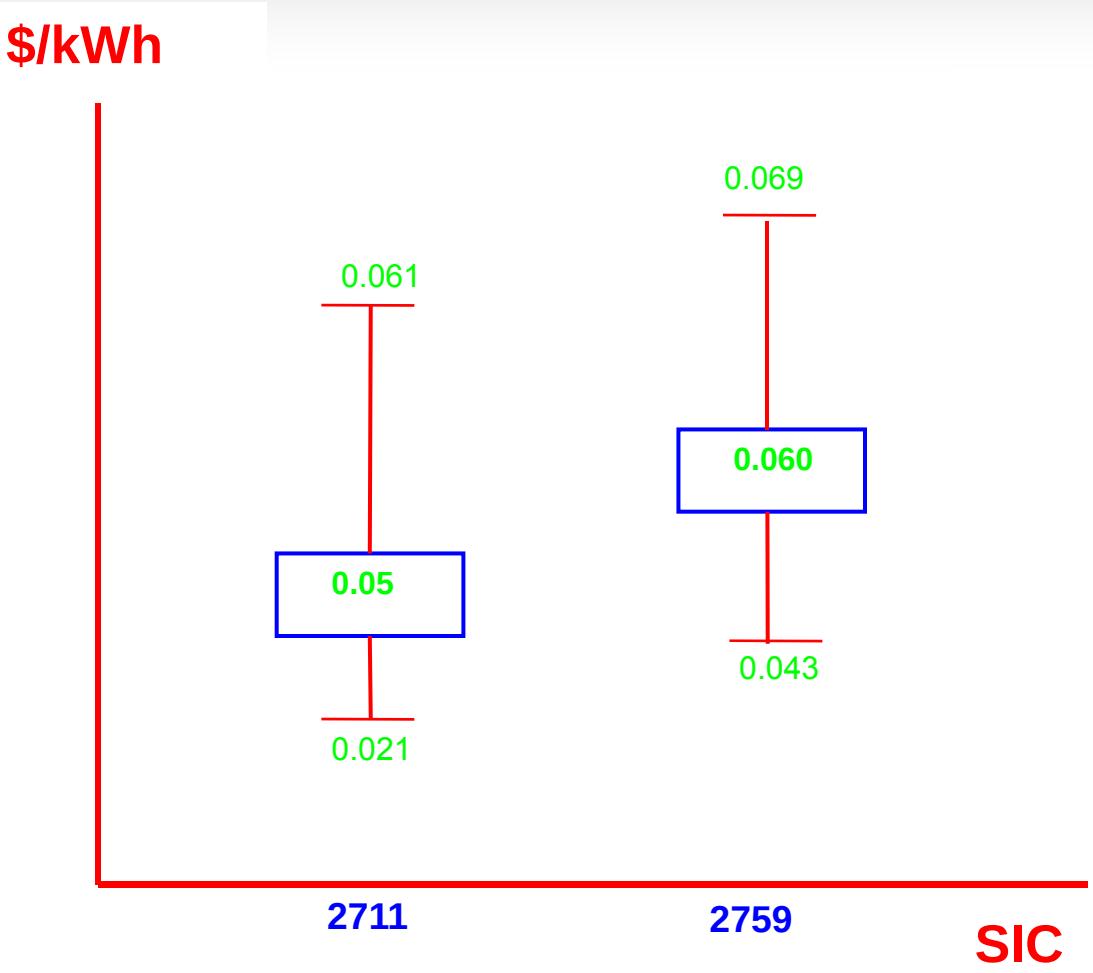
SIC 2759 = Miscellaneous Printing

Plant	Sales (in $MM/yr)	Annual Production	Production Area ft²	Production Area $/ft²	Workers	Taxes Prog.	E. Savings ($/yr)	% E. Savings
J211	6	166.4 MM Checks and Deposit Slips	28,000	214.29	57	Yes	$44,879	12
S85	4	6 MM Unit	16,000	218.75	40	No	$22,631	40
U75	8	450,000 units	48,000	166.67	80	Yes	$9,834	15
V64	5.5	29,520,000 impressions	22,000	250.00	50	Yes	$13,091	27
						Average	22,609	24

DEMAND COST VARIATION



ENERGY COST VARIATION



THE PROCESS

News Gathering

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Composing

↓

Plate Making

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Off-set Printing

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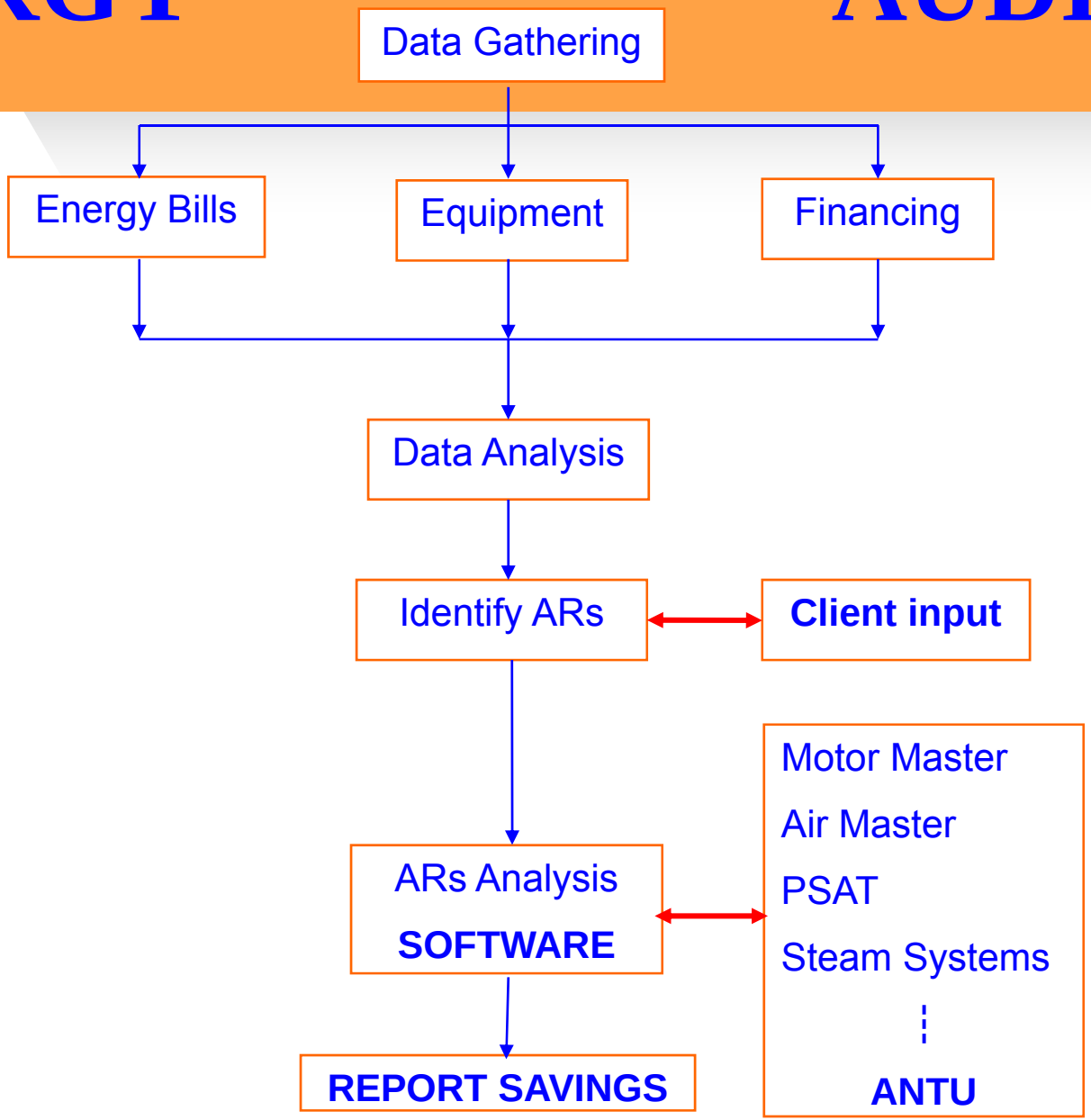
Stacking and Inserting

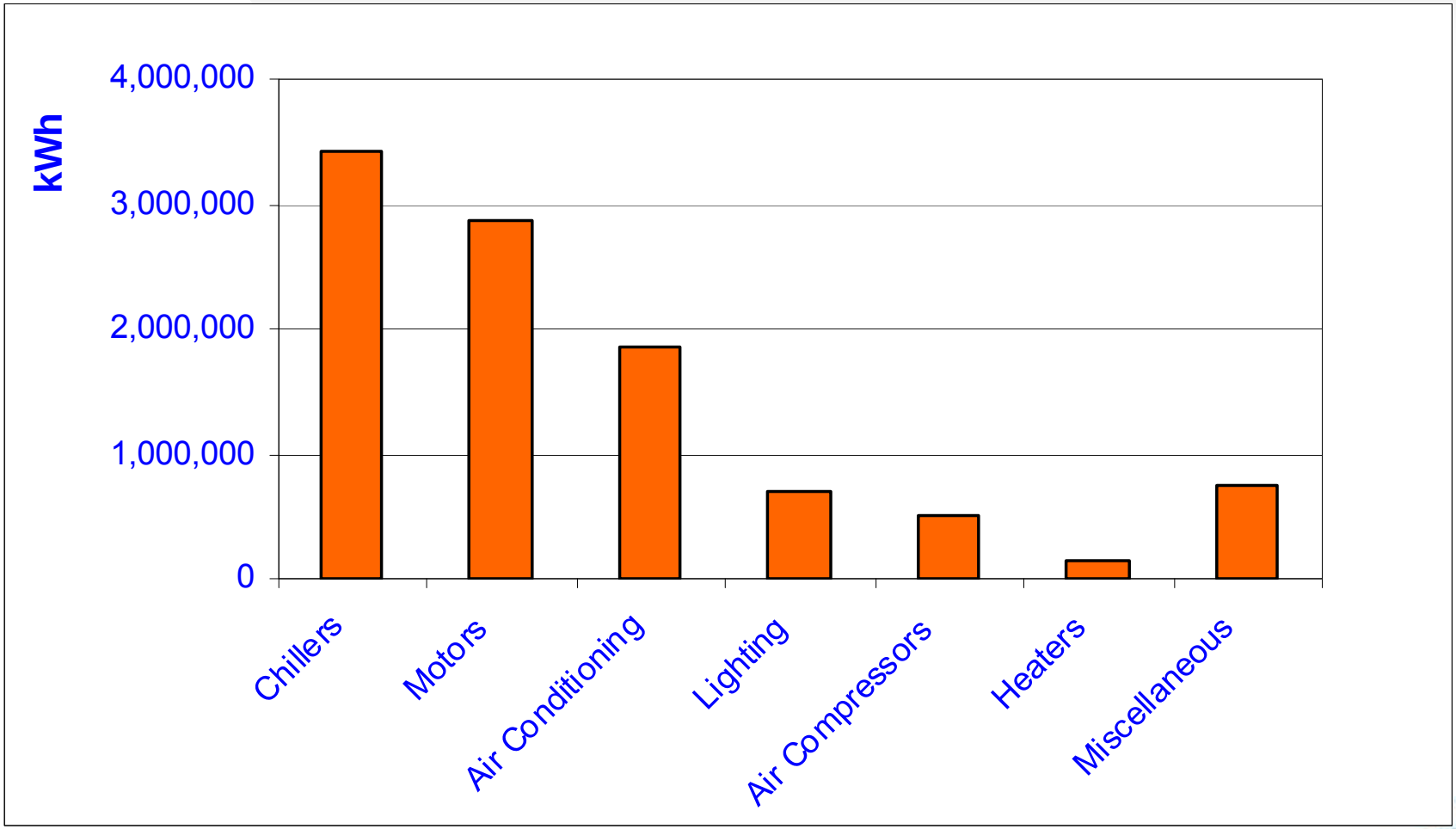
↓

Packaging and Circulation

ENERGY AUDIT

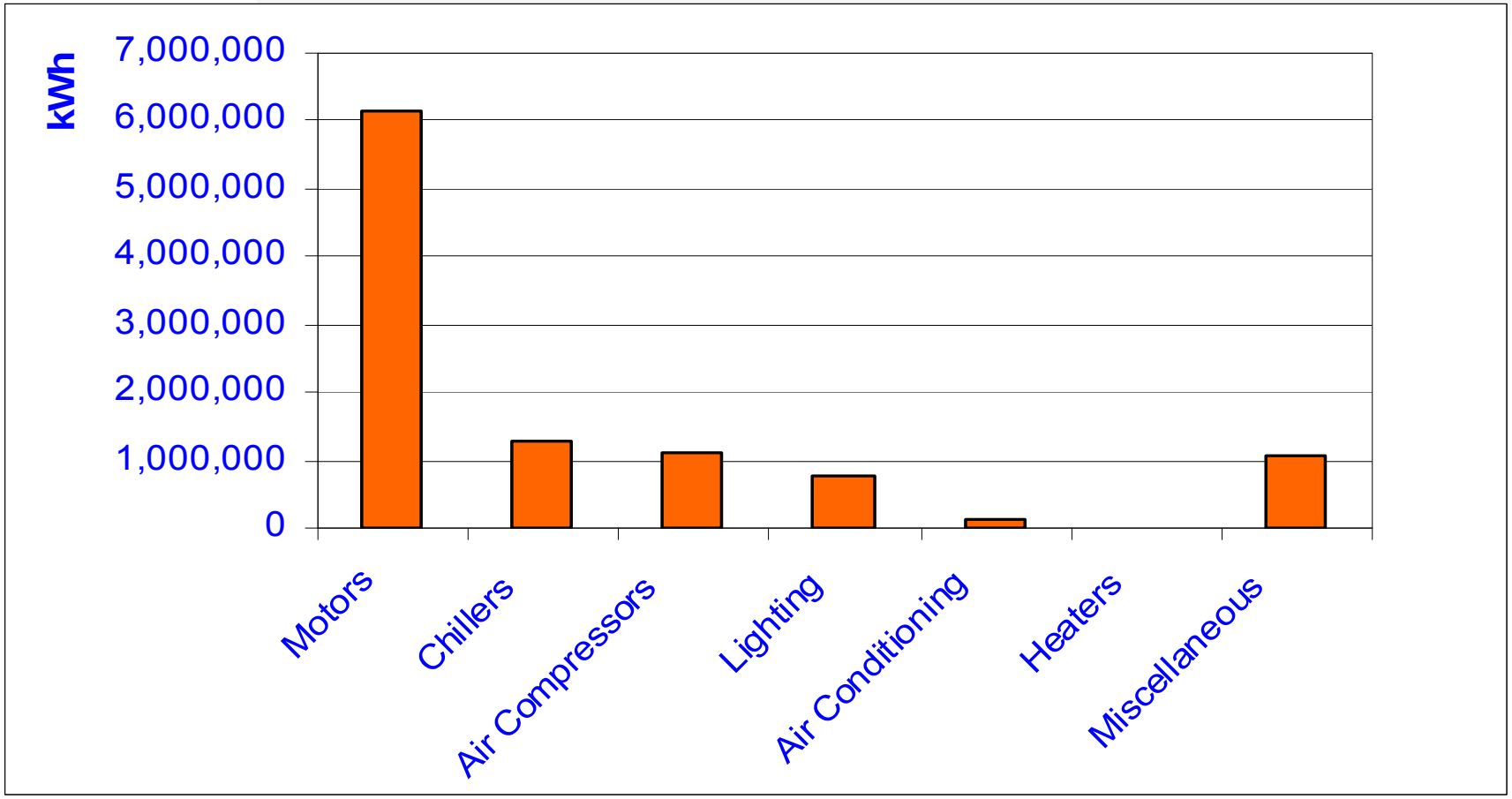


ENERGY USAGE FOR SIC 2711
(Newspaper Publishing and Printing)



ENERGY USAGE FOR SIC 2759

(Miscellaneous Printing)



Energy Recommendations by SIC

ENERGY RECOMMENDATIONS	2711	2759
Install High Efficiency Lighting	✓	✓
Turn Off Lights and AC	✓	✓
Install Hi/Lo System	✓	✓
Install Skylights and Sensors	✓	✓
Install High Efficiency Motors	✓	✓
Replace V Belts with Cogged V Belts	✓	✓
Repair Compressed Air Leaks	✓	✓
Reduce Compressed Air Pressure	✓	✓
Recover (Waste/Exhaust) Heat from Comps.	✓	
Install New Cooling Towers	✓	
Insulate Sections of Roof of Facility	✓	✓
Install Air Curtains	✓	✓
Turn Off Unused Equipment	✓	✓
Apply for Electricity Tax Incentive	✓	✓
Heat Recovery + Piping System		

DATA ANALYSIS

We can write the fraction of savings $F_{i,j}$ as:

$$F_{i,j} = \langle S_j \rangle \times [\, C_j / \sum_{j=1} T_j \,]$$

Where,

$F_{i,j}$ = Fraction of savings.
Counters: i is for SIC: 1 = 2711 and 2 = 2759
j is for the type of piece of equipment.
Runs from 1 to 11 as of the sequence

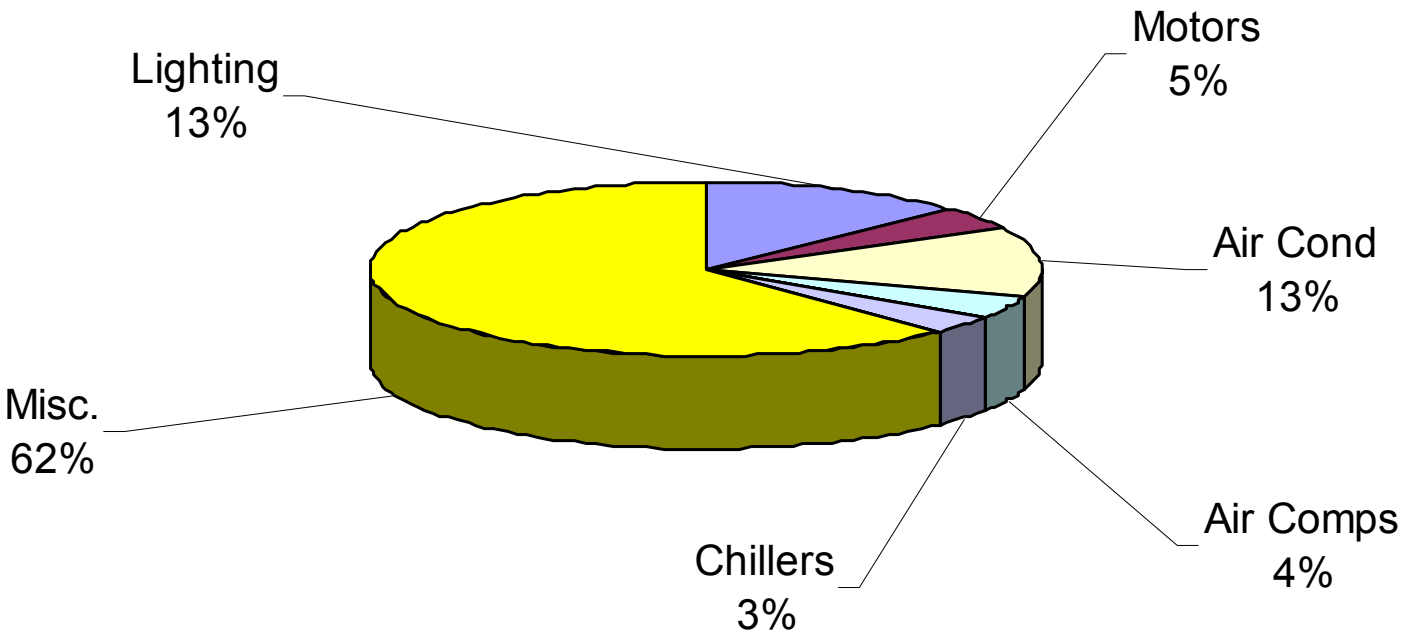
$\langle S_i \rangle$ = Average of Savings (kW, kWh, cost)
C_j = Current Consumption (kW, kWh, cost)
T_j = Total Current Distribution according to equipment and SIC

ENERGY SAVINGS FOR SIC 2711

							Implemented
-	Savings	Imp. Cost	SPP	ROI	Energy	kW Red.	Savings
Lighting	168,931	296,028	2	57	2,592,266	152	8,246
Motors	71,831	92,110	1	78	933,061	105	10,738
Air Cond	211,396	305,999	1	69	2,645,377	242	39,856
Air Comps	61,708	22,799	0	271	864,230	75	20,795
Amonia Comp							
Hyd. Comp							
Ref. Comp.							
Chillers	49,442	133,750	3	37	668,527	12	0
Heaters							
Dehumidifiers							
Miscellaneous	481,239	1,525,360	3	32	12,476,190	1,516	29,434
Total Savings	1,044,547	2,376,046	2	44	20,179,651	2,102	109,069

ENERGY SAVINGS FOR SIC 2711

Total = 20,407,851 kWh

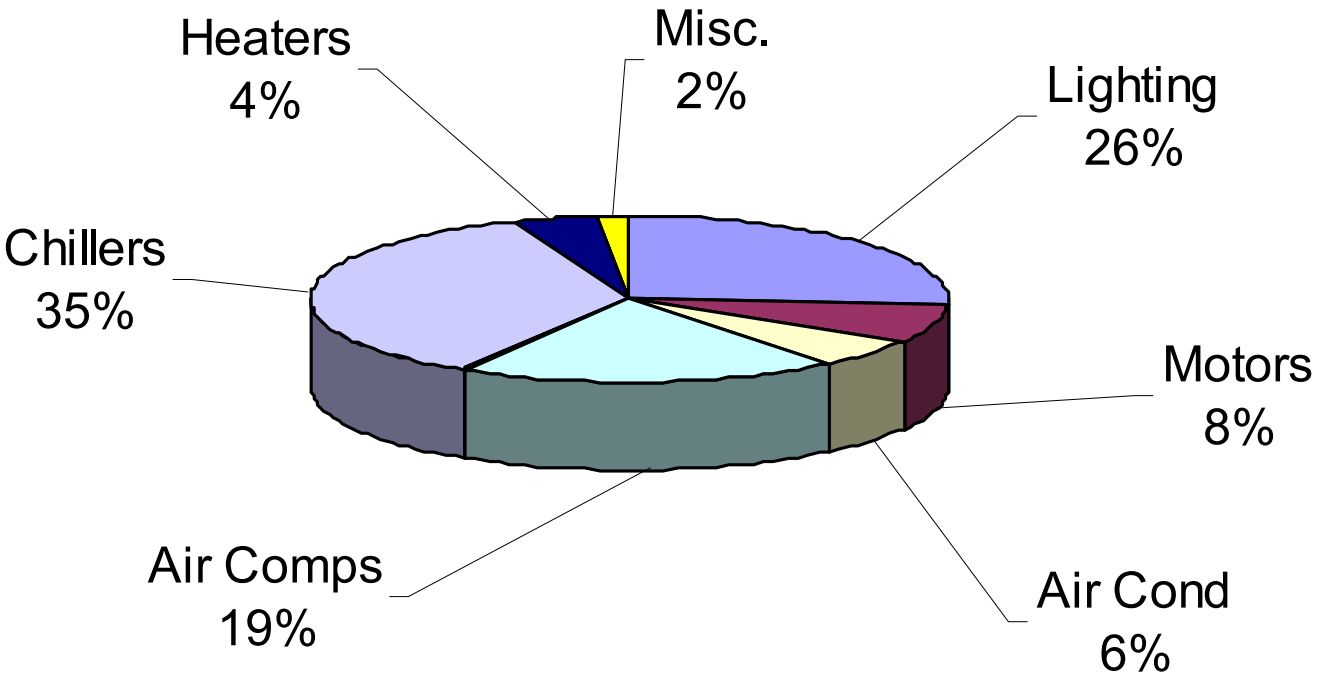


ENERGY SAVINGS FOR SIC 2759

							Implemented
	Savings	Imp. Cost	SPP	ROI	Energy	kW Red.	Savings
Lighting	31,313	47,332	2	66	497,140	25	14,718
Motors	9,705	15,325	2	63	144,261	12	417
Air Cond	65,373	37,545	1	174	107,206	13,477	8,144
Air Comps	18,536	4,950	0	374	373,400	31	17,818
Amonia Comp							
Hyd. Comp							
Ref. Comp.							
Chillers	14,650	28,996	2	51	682,865	220	0
Heaters	5,781	7,200	1	80	81,424	13	0
Dehumidifiers							
Miscellaneous	1,724	800	0	216	31,349	0	1,724
Total Savings	147,082	142,148	1	103	1,917,645	13,778	42,821

ENERGY SAVINGS FOR SIC 2759

Total = 1,917,645 kWh



DESCRIPTORS

Descriptors ($f_{i,k}$) are computed by taking the average consumption value of a given type of equipment $<L_{i,k}>$ and divide it by the sum of all for each SIC . This is:

$$f_{i,k} = <L_{i,k}> / \sum_{i=1}^{11} L_{i,k}$$

Counter *i* runs for all equipment considered (***i*** = 1,2,3, … 11).
Counter *k* accounts for demand (*k* = 1), energy (*k* = 2), and cost savings (*k* = 3)

For all SIC considered the descriptors must satisfy the following necessary Normalization condition:

$$\sum_{i=1} f_{i,k} = 1$$

Energy Distribution *Descriptors*

	2711			2759		
	kW	kWh	Cost ($)	kW	kWh	Cost ($)
(1) Lighting	0.052	0.067	0.075	0.069	0.074	0.073
(2) Motors	0.292	0.280	0.274	0.483	0.583	0.557
(3) Air Cond.	0.203	0.182	0.201	0.038	0.013	0.019
(4) Air Comps.	0.047	0.050	0.054	0.097	0.106	0.104
(5) Ammonia Comps	0.000	0.000	0.000	0.000	0.000	0.000
(6) Hydraulic Comps	0.000	0.000	0.000	0.000	0.000	0.000
(7) Refrig. Comps.	0.000	0.000	0.000	0.000	0.000	0.000
(8) Chillers	0.315	0.335	0.312	0.209	0.124	0.146
(9) Heaters	0.020	0.013	0.011	0.000	0.000	0.000
(10) Dehumidifiers	0.000	0.000	0.000	0.000	0.000	0.000
(11) Miscellaneous	0.070	0.073	0.073	0.103	0.100	0.101
TOTAL	1.000	1.000	1.000	1.000	1.000	1.000

DESCRIPTORS

SIC = 2711

Demand (k=1): $f_{i,k} = f_{i,1} = f_{2,1} + f_{3,1} + f_{8,1} =$ 0.292 + 0.203 + 0.315 = **0.810**

Energy (k=2): $f_{i,k} = f_{i,2} = f_{2,2} + f_{3,2} + f_{8,2} =$ 0.280 + 0.182 + 0.335 = **0.797**

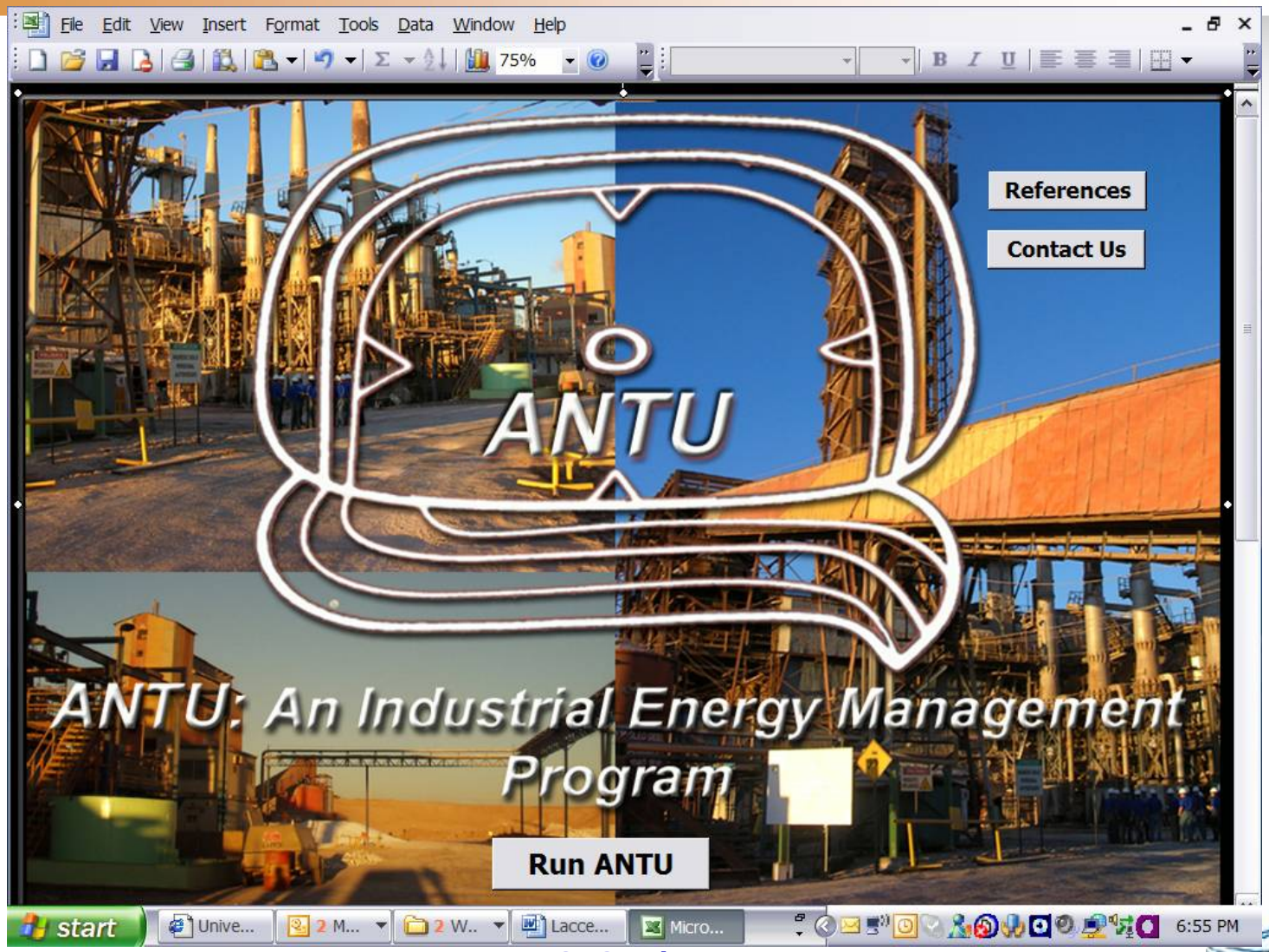
Cost (k=3): $f_{i,k} = f_{i,3} = f_{2,3} + f_{3,3} + f_{8,3} =$ 0.274 + 0.201 + 0.312 = **0.787**

SIC = 2759

Demand (k=1): $f_{i,k} = f_{i,1} = f_{2,1} + f_{4,1} + f_{8,1} =$ 0.483 + 0.097 + 0.209 = **0.789**

Energy (k=2): $f_{i,k} = f_{i,2} = f_{2,2} + f_{4,2} + f_{8,2} =$ 0.583 + 0.106 + 0.124 = **0.813**

Cost (k=3): $f_{i,k} = f_{i,3} = f_{2,3} + f_{4,3} + f_{8,3} =$ 0.557 + 0.104 + 0.146 = **0.807**



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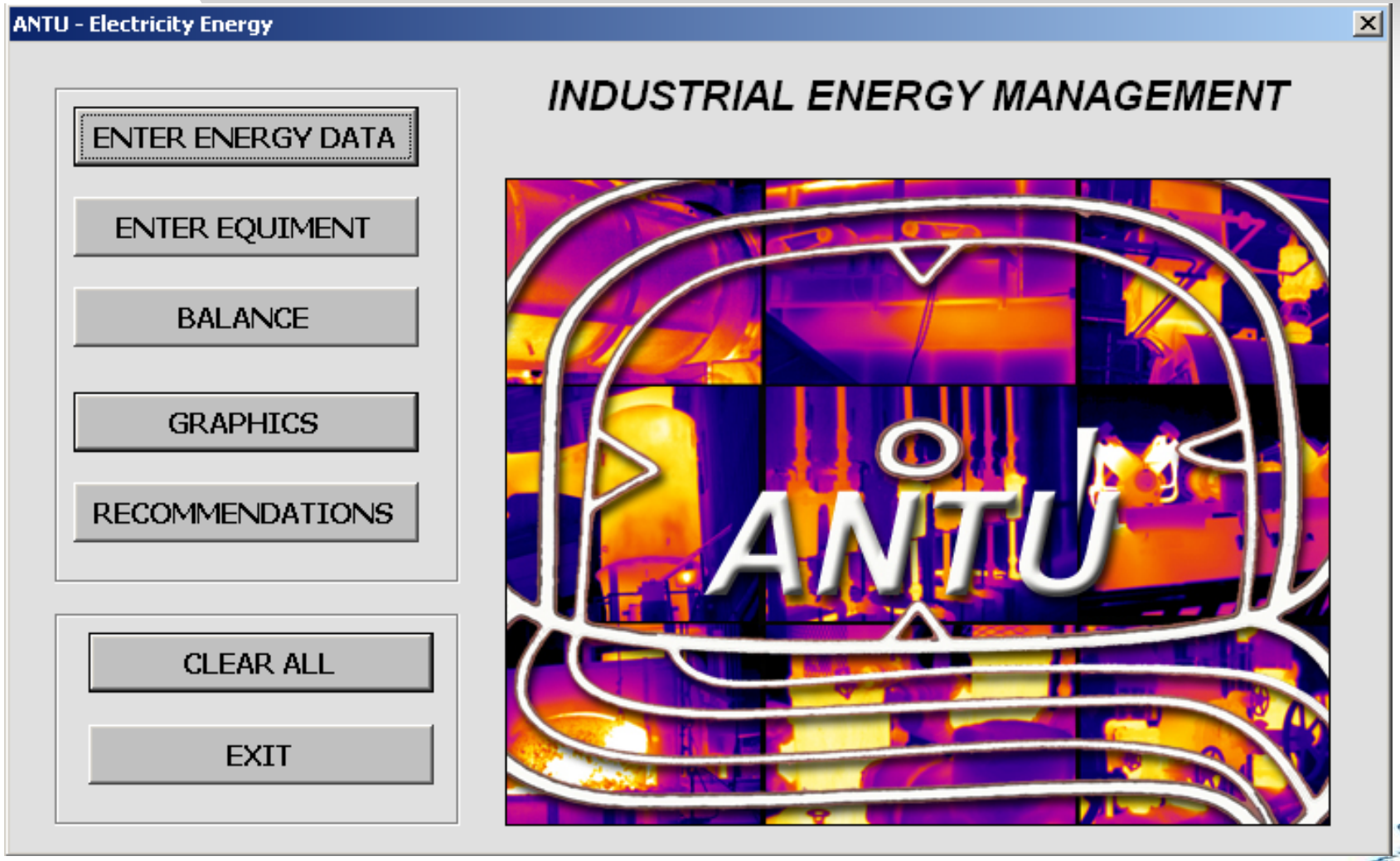
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ENTER ENERGY DATA
ENTER EQUIMENT
BALANCE
GRAPHICS
RECOMMENDATIONS
CLEAR ALL
EXIT
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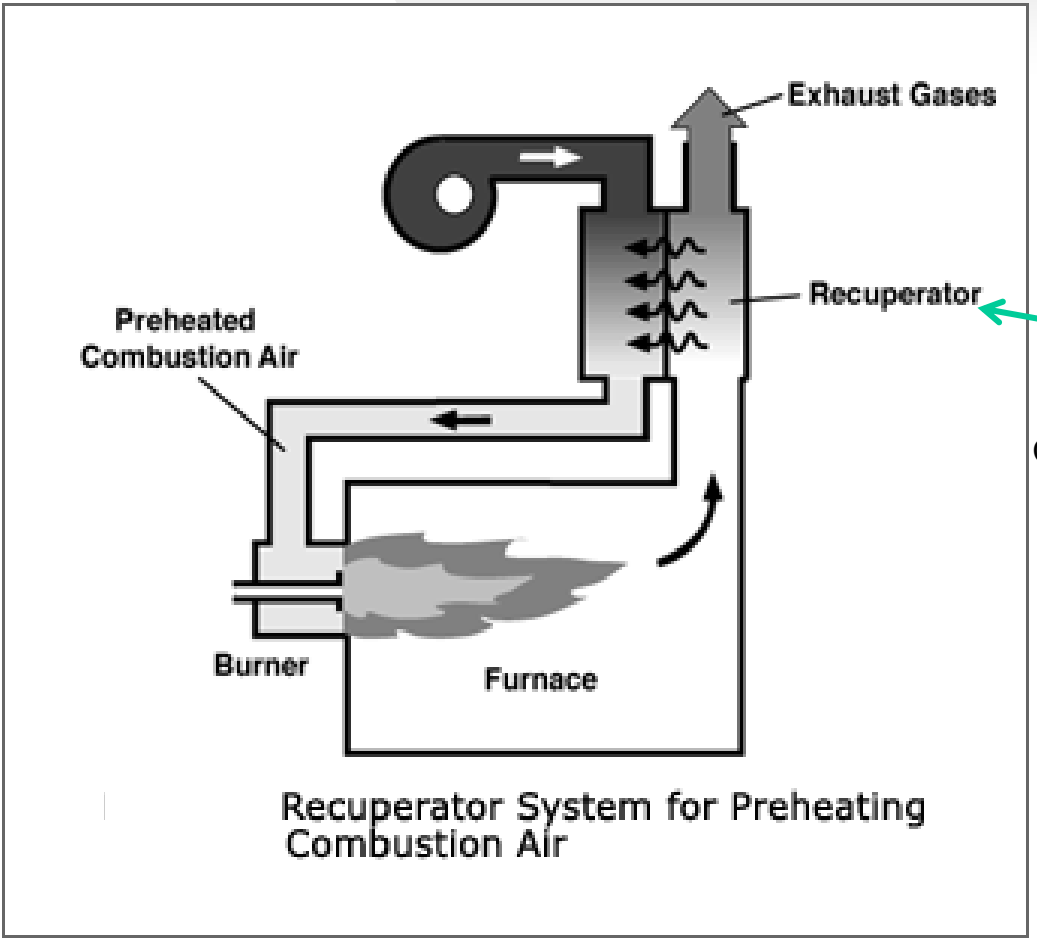
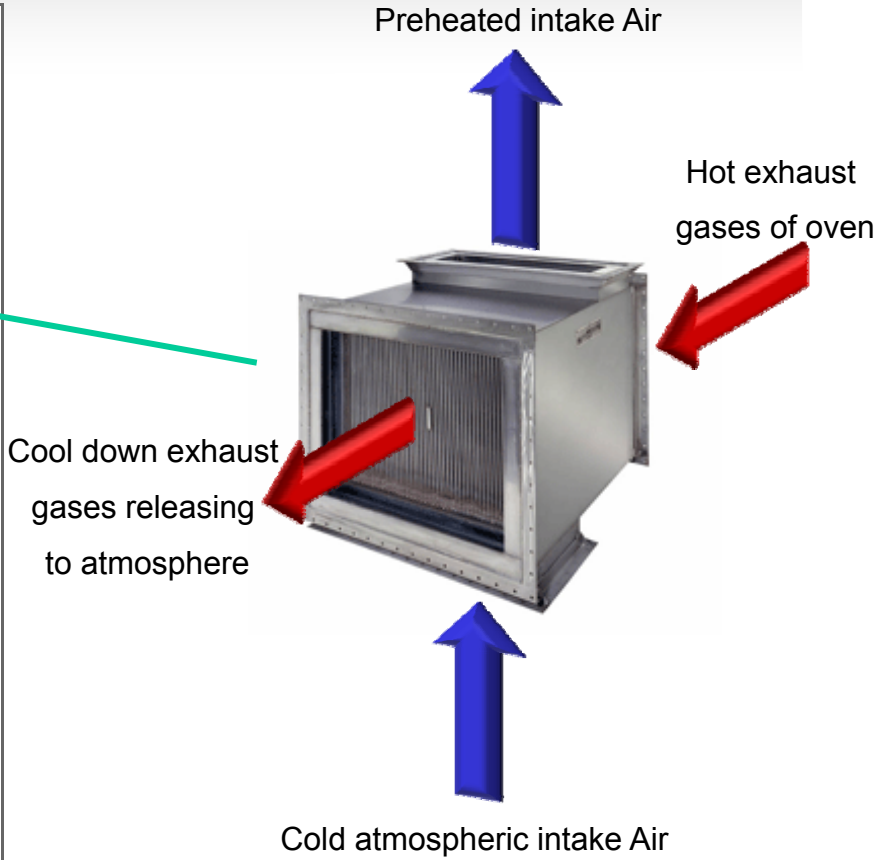
Overview on two of the most effective ARs

Heat recovery from exhaust gases of ovens, furnace and boilers





Heat Recuperator

(Heat exchanger)

Max Operating Temp
1500° F. (815° C)
Volume Range
100-10,000 CFM (170-17,000 m3/hr)
4' High temperature insulation
1/2' wide plate spacing
3' Stainless steel flanges
Allows internal thermal expansion

The High Temperature Insulated Heat Recuperator `IR` achieves top heat transfer efficiency by exposing a maximum surface area to the largest possible amount of hot gas.

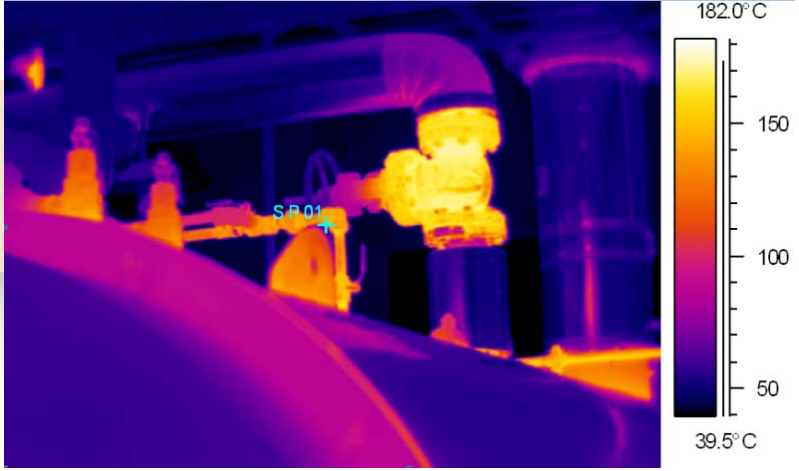
The unit uses a proprietary counter flow design that produces improved heat transfer between two airstreams. The plates are spaced 1/2' apart for maximum air flow and minimum pressure drop.

As your process air enters the unit, it is directed over the corrugated plates in a counter flow direction to the heated air. Heat from the waste stream is absorbed by the plates and transferred to the cooler airstream... then exits the unit as recovered heat you can reuse or recycle. Airstream temperature can be as high as 1500°F.

Optional airflow configurations are available to fit the needs of your high-temperature thermal incinerators, furnaces and combustion preheat systems.

By utilizing different plate sizes, the heat transfer effectiveness range is 50% to +70%.

The Simplest Calculation (10% error):



$$Ideal\ Percentage\ of\ the\ Energy\ Saving = \frac{Energy\ Wasted\ of\ the\ Existing\ System - Energy\ Wasted\ of\ the\ New\ System}{Energy\ Wasted\ of\ the\ Existing\ System} \times 100\%$$

So the above expression can reduce to:

$$Ideal\ percentage\ of\ the\ energy\ saving = \frac{\dot{m}c_p(T_{out})_{old} - \dot{m}c_p(T_{out})_{new}}{\dot{m}c_p(T_{out})_{old}} \times 100\%$$

$$= \frac{(T_{out})_{old} - (T_{out})_{new}}{(T_{out})_{old}} \times 100\%$$

$$Ideal\ percentage\ of\ the\ energy\ saving = \frac{(270+273)-(30+273)}{(270+273)} \times 100\% = 44\%$$

We are assuming that after installing the heat exchanger "ideally" we can reduce the temperature of the exhaust gases to 30 ° C. The performance of the heat exchanger can be vary between 50% to 70%.we will can assume that the performance is about 60%.

Percentage of the Energy Saving

= 0.44× 60% = 26%

So there is the real potential to save 26% of the Natural Gas consumption of Oven or Boiler (for the studied cases)

Payback period is usually less than 6 months.

CLOSED LOOP FOR COMPPRESSED AIR PIPING

For the turbulent flow which is always the case in the industrial applications pressure drop in the pipe line can be found as

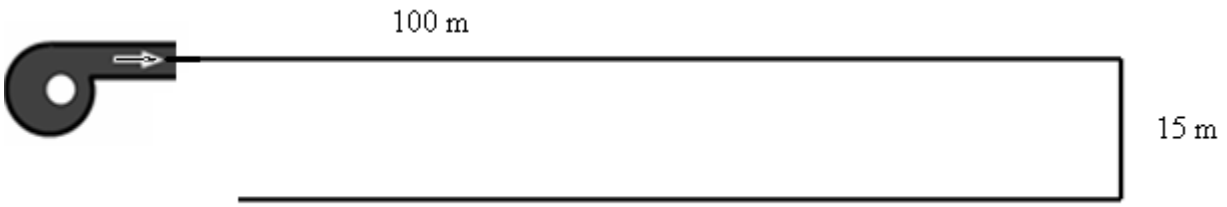
$$\Delta P = f(L/D)(\rho \frac{V^2}{2g})$$

$$f = 0.3164\,\mathrm{Re}^{-0.25}$$

From the above equation it can be seen that the pressure drop is proportional to $V^{1.75}$

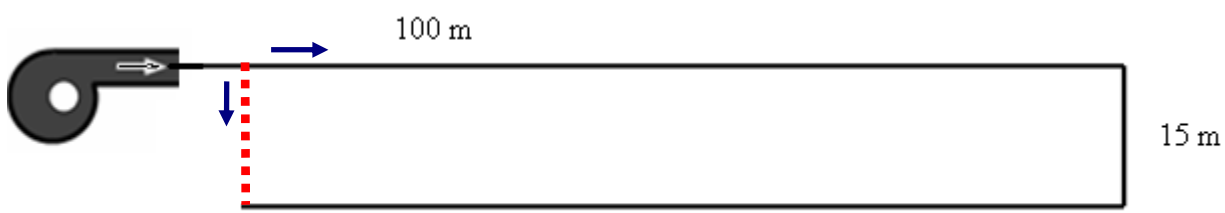
This means that if we can decrease the average velocity in the pipe line then we can decrease pressure drop with the factor of $V^{1.75}$

A rule of thumb is that every 2 psi decrease in operating pressure save 1% in operating energy costs



$$V_{existing} = \frac{Volumetric\ \ flow\ rate}{density \times pipe\ crosss\ \ sectional\ \ area} = 39(m/s)$$

$$E_{loss} = f\rho(L/D)(\frac{V^2}{2}) = 0.0147*1.2*(107(m)/.1016(m))*(39\text{^}2/2) = 14128.2(w)$$



$$\frac{E_{loss-new}}{E_{loss-old}} = \frac{19.5^{1.75}}{39^{1.75}} = 0.29$$

This means that **71%** of the energy loss due to pressure loss in pipe line can be recovered by closing loop.

Payback period is usually about 1 month.

CONCLUSIONS

- We have proposed a reduction of Newspapers Publishing and Printing, and Miscellaneous Printing production costs through energy saving measures
- Our analysis boils down to two specific SIC codes
- We identified areas that should be prioritized through Pareto Ranking
- The use of Descriptors to narrow down the areas for energy savings/management were shown
- A Tool for Benchmarking:

  Facilities with SIC codes considered here can identify savings possibilities and by comparison benchmark operations
- A short overview on two ARs.

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[1] 2008 Directory of Florida Industries. Harris Infosource. Twinsburg, Ohio.

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[5] Florida Department of Revenue, P.O. Box 7443, Tallahassee, FL 32314.

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Questions?

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