

# NONRESIDENTIAL MARKET SHARE TRACKING STUDY

## APPENDIX E INDUSTRIAL SUPPLIER/EXPERT PRE-SURVEY INTERVIEW RESULTS

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**California Energy Commission**

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**CONSULTANT REPORT**

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***Nonresidential Market Share Tracking Study:  
Industrial Technology Supplier/Expert  
Pre-Survey Interview Results***

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## Summary of Findings

Aspen Systems engineering staff interviewed 28 vendors and industry experts for the eight technologies of interest to help refine the Nonresidential Market Share Tracking Study’s industrial end-user survey instrument questions and to help develop pre-survey estimates of market share. Exhibit 1 shows the number of interviewees by industry type:

**Exhibit 1: Completed Interviews by Technology**

Technology	Interviews Completed
Motors and motor rewind practices	4
Compressed-air systems	2
Automated lubrication systems	2
Blower maintenance	1
Electronic controls for process equipment shutdown	5
Closed-loop recirculation	6
Process overhaul	4
Refrigeration	4
<b>Total</b>	<b>28</b>

This summary addresses major trends identified in the interviews that will help in the re-designing of end-user questions and will provide assistance in determining pre-survey estimates. Following the summary are detailed reports on each interview.

### Motors

The research group believed that the motors section of the questionnaire in general was in need of only minor refinement, but that rewinding issues in particular needed more attention. Aspen interviewed two motor vendors: one motor rewind vendor, and one expert on motor rewind practices. The major findings are as follows:

- “Premium efficiency” is a term with which we can expect users to be familiar in regards to motors. Although premium-efficiency market penetration is less than the majority of motors sold, it is a mature market in that the buyers and sellers are aware of efficiency as an option. Significant portions of motors sold are not traditional burnout replacements.
- Aspen will expand the “informed shopper” question regarding rewinding. Aspen will also expand on the behavior factor issue of why customers choose rewinding. The most significant options being added are “fast turnaround time,” and “specialty motor costs less to rewind than replace.” Secondary sources were found that give good data for pre-survey market penetration estimates.

### Compressed Air

The compressed-air findings were largely affirming. The two vendors interviewed both agreed that system-wide waste was the biggest source of inefficiency and that customers need to be educated on financial and productivity related reasons to invest in compressed-air system

improvements. The interviewees provided indicators to judge the system operating efficiency that reflected most of the questionnaire's multiple choice answers already provided. We did gather more detail on air filter practices, on pressure problems, and on programmatic techniques to promote efficiency. Aspen has identified secondary sources that will assist in making pre-survey estimates of market size.

### **Automated Lubrication**

Aspen contacted two vendors of automated lubrication equipment. They both were uninformed about the function and market conditions of automated lubrication products they sell, as lubrication devices are just a small part of larger diversified product offerings. Aspen therefore contacted two manufacturers directly (one customer service manager and one marketing manager) to discuss their products.

While it is undeniable that lubrication affects energy efficiency under all circumstances, the interviewees representing that industry generally consider the energy savings potential of these systems to be "off of the radar screen" in terms of benefits. Maintenance labor savings and increasing lubricated equipment reliability are considered far more important. Programmatically, there are opportunities to introduce the CA market to the concept of lubrication for energy savings, but it means starting from a base level of negligible awareness. Case studies might be appropriate.

Regarding questionnaire design, we found that the topic is sufficiently limited in terms of number of questions and sufficiently potentially applicable to all customers that it would be appropriate to incorporate questions on lubrication into a single general maintenance section rather than as a stand-alone section. Aspen also learned about automated lubrication retrofit applications to help refine an individual question that was lacking in quality answers. Because there are so many types of potential applications with subtle features and requirements, we learned little to help construct a rule-of-thumb checklist of potential applications at individual customer facilities.

One of the interviewees shared aspects of his business plan that indicated his company's perception of market size, which will be of valuable assistance as a pre-survey estimation data point.

### **Blower Maintenance**

The most valuable outcome of the blower vendor interview was that the respondent was able to modularize the different maintenance practices associated with industrial blowers and simplify the key query regarding maintenance into a single question. We may not be able to reduce it quite that far without posing a leading question, but the goal is clear: "Do you follow the manufacturer's recommended maintenance procedures for each of the blower's components (motor, coupling, fan, bearings)?" There should be multiple ratios that measure market penetration of blower and general energy efficient market practices. The interviewee gave limited data that could help with survey pre-estimates of market size.

### **Electronic Control of Process Equipment**

Our interview goals were to help us understand what companies are providing controls to the

manufacturing industry and if they were active in promoting energy management and load shedding as a key feature of their controls. We interviewed companies with SCADA products, as we knew that load shedding for irrigation districts was well understood.

Our key findings are:

- There is very little presence of energy management or load shedding used in process control.
- Controls are primarily installed for productivity, diagnostics, and quality issues. Energy is apparently not an important concern. First costs are a major factor in deciding on new control systems.

### **Closed-Loop Recirculation**

Our knowledge of closed-loop systems was very limited, so our interviews were designed to gain information about the technology and its application. This would allow us to reframe questions in the questionnaire and perhaps learn some market characteristics.

The key findings are:

- The research should include the full spectrum of water recovery and reuse rather than just solely investigating closed-loop recirculation and filtration. All water re-use that displaces new water purchases reduces water supply and sanitation burden and associated energy use by municipalities and water authorities.
- Most water recovery systems are designed to clean wastewater (not sanitary sewer waste) to a purity that rivals the original water supply.
- Water recovery and reuse is generally just a component of the overall treatment of the wastewater for chemicals and other undesirable elements.
- The cost-effectiveness of installing these systems is almost always associated with two issues: lack of water supply and lack of a local wastewater treatment facility with capacity for additional discharge. End-user energy costs generally are not a consideration; in fact end-user energy cost may increase due to additional pumping requirements.

### **Process Overhaul**

Aspen approached the interviews in this section with the objective of answering two key questions: (1) How can we constrain the seemingly infinite variety of possibilities implied by the term “Process Overhaul” in the context of energy efficiency?; and (2) Once constrained, how can we quantify market share and market potential? Aspen interviewed two private independent consulting industrial engineers and two consultants from federal- and state-funded non-profit consulting groups. The outcome of our interviews reinforces our concerns over the uniqueness of each overhaul. None was able to identify particular industries or processes that represent particularly attractive energy efficiency opportunities, though they could specify generally energy-intensive industries. The interviewees predicted that our research would find that energy plays only a minute role in process overhaul decision-making, except in the case of fuel-source decisions. The collective implication from the interviews is that the data we wish to collect,

process overhaul energy savings market size, market share, energy-related costs and savings, are simply not collectable in quantitative fashion. The questions are easy to ask but answers will be of low quality. Based on this scoping study, Aspen recommends that this technology be analyzed in qualitative fashion only.

### **Refrigeration**

Aspen's pre-existing knowledge of refrigeration was well-developed, so the interviews were designed to confirm a few assumptions made on the depth-survey questionnaire and to provide updates on key technology elements.

The key findings:

- Screw compressors driven by variable-speed controls are an emerging technology not yet sold on the market. Oil and rotor sealing constraints associated with lowering the rotational speed of the compressor apparently have recently been overcome by new designs. These new compressors will become available over the next year and will have never-before-seen part-load efficiencies (IPLV) down to 0.2. The primary application will be for commercial chillers.
- Floating head below 70 degrees saturated condensing temperature is rarely done; however head is usually allowed to float to some degree in all designs. Electronic expansion valves, which would allow some systems to float the head pressure down, have not been widely accepted by the industry. Apparently, these valves are problematic. Other design concepts (surge receiver, liquid pump amplification) are not in use or problematic as well.
- Industrial refrigeration systems are most readily identified in the field by compressor horsepower, not tons of refrigeration. The noted exception is process chillers, which are usually identified by tons of refrigeration.



Technology	Motors
Contact responsibilities or title	Sales department representative
Contact date	October 10, 2000
Contact background	Equipment supplier. Contact specifically handles motors. Sell almost exclusively to industrial, not commercial customers.

**Questionnaire Support**

**What department in your customers’ organization buys motors from you (what are the purchasing channels)?**

I pretty much exclusively work with purchasing departments, not facilities engineers.

**Should we expect customers to be familiar with the term “premium efficiency” and its meaning?**

Yes.

**What types of motor purchase questions do you think they will be best able to answer: per motor-purchase questions or general patterns of behavior?**

No opinion.

**Market Potential Pre-Survey Estimation**

**How big is the industrial market in CA?**

Don’t know. (Editor’s note – very good national-level distribution data on this question for pre-survey estimate purposes are available on p. 41 of the *United States Industrial Electric Motors Market Opportunities Assessment*.)

**To what extent does the market follow efficient practices?**

About 10% buy premium efficiency motors. It’s more likely to be the larger customers that follow this practice, which is not necessarily the same thing as larger motors. (Editor’s note – very good national-level data on this question for both new motor purchases and for rewind practices are available on pp. 76 & 80 of the *United States Industrial Electric Motors Market Opportunities Assessment*.)

**Other**

**What is range of hp you sell? What is the average hp sold?**

We sell motors in the range of ¼ to 250 hp. The average size motor sold is in the 1 to 7.5 hp range. I can’t be more specific than that.

**Please describe your sales distribution by size.**

It’s a lot of the horsepower, but in terms of number of motors sold, we sell very few 200 hp and

larger motors. I can't estimate percentages for a distribution of sales by size, but I can tell you that fractional hp motors are the single biggest size category for sales.

**Can you estimate your volume of sales in hp?**

No, I don't even know my own horsepower sales, much less the company's sales.

**How do you think your sales distribution compares to the industrial market as a whole (do you specialize on selling bigger or smaller motors, on average)?**

Didn't answer.

**Other key findings**

- The utility rebates are doing a good job of creating awareness and supporting premium efficiency motor sales.
- Doesn't really recommend other things for the CEC to do.
- About ½ the motors they sell are for new equipment and half for MRO stock replacements.

Technology	Motors
Contact responsibilities or title	Sales department
Contact date	October 10, 2000
Contact background	Larger than average industrial motor vendor.

**Questionnaire Support**

**What department in your customers’ organization buys motors from you (what are the purchasing channels)?**

Some buyers are maintenance chiefs; some are purchasing departments, few or none were equipment manufacturers. The interviewee gave the impression that about half the buyers were maintenance chiefs and half were purchasing departments.

**Should we expect customers to be familiar with the term “premium efficiency” and its meaning?**

Yes. The interviewee was confident about this for his customers.

**What types of motor purchase questions do you think they will be best able to answer: per motor-purchase questions or general patterns of behavior?**

No opinion.

**Market Potential Pre-Survey Estimation**

**How big is the industrial market in CA?**

Don’t know.

**To what extent does the market follow efficient practices?**

About 50% specify premium efficiency. Keep in mind that I suspect I have larger customers than the typical motor vendor.

**Other**

**What is range of hp you sell? What is the average hp sold?**

Sell 1 to 500 hp motors.

**Please describe your sales distribution by size.**

“Not very many” 200 hp and over. Median motor size sold is about 50 hp. Doesn’t know most common motor size sold, but would be less than 50 hp.

**Can you estimate your volume of sales in hp?**

No, not horsepower or number of motors.

**How do you think your sales distribution compares to the industrial market as a whole (do**

**you specialize on selling larger or smaller motors, on average)?**

Probably bigger than average because so many industrial customers.

**Other key findings**

- Doesn't see need for extra CEC help in promoting premium efficiency

Technology	Motors – Rewinding
Contact responsibilities or title	Sales Manager
Contact date	October 23, 2000
Contact background	Retail motor rewinder. Also sells motors and pumps.

**Questionnaire Support**

**If a customer is shopping for “good practice” rewinding, what should they be looking for or asking for?**

1. The most important aspect of a quality rewind is the insulation in the windings and in the slots. When rewinding we use a grade of insulation with spike resistance to meet variable frequency drive requirements and temperature resistance specifications.
2. Workmanship. With rewinders generally the windings can be laid in more gently, with a better fit, for a longer life.
3. We also offer a premium winding product we call “Class H,” which has extra dips in the chemical bath, more care and inspection, and allows us to offer a longer two-year warranty.

**Do you think that EASA has name recognition among end-users?**

Very little. My only customers that know about EASA are the municipals (because they deal with EASA for other reasons than motor rewinding issues –ed.)

**Market Potential Pre-Survey Estimation**

**At what size motors typically do customers start getting rewinds instead of replacements?**

We rewind everything from ¼ hp to 200 or 300 hp. Up at the 500 hp and higher our cranes and baths just aren’t big enough to handle. 50 to 100 hp motors are real common for our customers. Many of our customers are mining and agriculture. The smallest size motors that we routinely rewind are 15 to 20 horsepower. The cost-effectiveness breakpoint seems to be around 30 hp. <Why do customers bring in smaller motors, then?> For two reasons. First, if they have a specialty motor, we can be less expensive than buying a new motors. Second, we offer fast turnaround if necessary. Say a guy needs a new (non-stock) motor. It may take 3 or 4 days to get to his dock. We can work overnight and get the burned-out motor back to him in 14 hours. We just had that happen and a mill recently. A motor when down at the silo and totally shut down their operation. They were out of business. We were able to work overnight and get the motor back to them in 14 hours.

**Above that size, what is the current percentage of the market met by rewind versus new motors for your customers?**

In the 10 to 30 hp range, I would estimate that 60% of the motors my customers install are new and not rewind. Above 30 hp, about 20% of the motors are new. Of course it depends on how the motor fails. I’m talking about those that just need to be rewind or need new bearings, or

both. If a bent shaft, other major damage like a damaged rotor, they're often not cost-effective to re-build.

**Do you have a sense for how your customers compare to the rest of the state in this regard?**

I don't know. I can tell you we have a lot of small industrial customers and farmers with pumps. No real residential customers.

**Other**

**What is the typical change in efficiency after a motor has been rewound, if any?**

Well, we use the exact same materials in most cases. We rarely redesign for a higher efficiency. Frankly these new high efficiency motors run hotter, which means a shorter life. Look at the fan for example. The motor fan requires about 1 hp by itself. Well, they made it smaller to reduce that and it does, but it cools less also. That's another reason a lot of our customers like the older motors.

**Why do people choose rewinding over new motor purchases?**

First cost or turnaround time.

**Other key findings**

- Do customers ever ask for tours for quality inspections (this was recommended in one of the brochures)? No. They ship the motors in or we can pick them up for them, but they don't come here.

Technology	Motors – Rewinding
Contact responsibilities or title	Technical Support Specialist
Contact date	October 24, 2000
Contact background	

*This questionnaire has been completed based on a relatively short telephone interview plus the contents of two EASA articles forwarded after our conversation, both of which the interviewee authored. One of the articles was forwarded as a response to a question. This was an industry expert, not a vendor, so the questions posed differed from those above.*

**Questionnaire Support**

**If a customer is shopping for “good practice” rewinding, what should they be looking for or asking for?**

1. An oven with a chart recorder for temperature to show whether the windings are burned out an appropriate temperature. 750F or possibly 900F for new newer motors is the maximum.
2. A core-loss test should be performed before and after the old windings are removed.
3. The wire in the new winding must be no smaller than that in the original winding. This affects current density, which must remain high, over 600 CM/A, for good efficiency. Smaller diameter wire is easier to work with.
4. Lap windings are more efficient than concentric windings.
5. The stator winding should be exactly like that removed in terms of wire size, winding type, turns, span, and coil extension. Lap conversions should only be done if calculations prove that total winding resistance can be reduced.
6. Do not convert from open or shielded bearings to closed bearings. Use non-contact shields if necessary, but not closed bearings.
7. Replacement fans should be as close as possible to the original.
8. The service center should perform a core loss test for burnout watts per pound to document condition.
9. The winding temperature should be measured.

Most important is to require a repair report. Winding resistance serves as a good quick-check of the finished job and core-lost test results confirm that no damage resulted from the motor failure or burnout process.

**Other**

**What is the typical change in efficiency after a motor has been rewound, if any?**

If rewound using the exact same materials, the efficiency change should be negligible. If the

rewinder starts with a standard efficiency motor and upgrades to lap winding, which isn't common but not unheard of either, the efficiency can actually improve. If they cut any corners at all, such as improper greasing, wrong size fan, or other, the efficiency will drop, and the drop can be significant.

Rewind shops can help significantly improve efficiency. For example, a rural motor may be supplied with a low voltage. The motor can be rewound to run optimally at the exact voltage at the plant. This is faster and likely cheaper than buying a new custom motor. (Possible program opportunity: Monitor motor voltage and rewind or replace with motor rewound at supplied voltage. Researchers investigated this claim further. According to test data by EPRI and universities, efficiency increases or decreases between 2% and 6% as a function of motor size, voltage, and load variance. See bibliography reference for further data.)

### **Why do people choose rewinding over new motor purchases?**

The recommended decision tree poses six questions that are not variations of "it costs less":

1. Has the stator core been "significantly" damaged? (no means repair is more likely)
2. Has catastrophic failure occurred? (no means repair is more likely)
3. Is it an EPACT motor? (no means repair is more likely; higher repair cost if yes)
4. Are replacement funds available? (no means repair is more likely)
5. Is replacement lead time acceptable? (no means repair is more likely)

### **What do different failure modes mean about the likelihood of repair versus replacement, and how often do they occur?**

#### *Repair More Likely*

Bearing (51%)

Stator winding (16%)

Rotor bar (5%)

Unknown (10%)

#### *Replacement more likely*

External (environment, voltage, load, likely to occur again, 16%)

Shaft/coupling (2%)

### **Other key findings**

- Why are new motors more efficient? Longer stators and rotors reduce core losses. More copper reduces copper losses. Smaller fans on TEFC motors are optimized and smaller. More efficient open or shielded bearings are used instead of enclosed bearings. Bearings are packed more carefully with just the right amount of grease. Too much and too little grease are inefficient.



Technology	Compressed Air
Contact responsibilities or title	Sales Manager
Contact date	
Contact background	Compressor and related services

### Questionnaire Support

#### **What are the best indicators of an efficiently managed compressed air system?**

The biggest problems I've seen in systems are sequencing, idling units, leaks, bad distribution, which all seems to come back to high pressure and part load control waste.

#### **What is a prudent inlet air filter change interval, in hours?**

It varies by ambient conditions. Separate into wet and dry seasons, for example, and other ambient conditions like shop air cleanliness all significantly affect appropriate change intervals. If you need a single number, use 2000 hours as very general rule. I might add that in-line filters that clean compressed air also are a problem when not being cleaned enough.

#### **Do you think customers can estimate annual savings or implementation costs associated with compressed air system upgrades?**

No. Customers can't estimate air energy savings or costs because they don't care about anything but getting widgets out the door.

### Market Potential Pre-Survey Estimation

#### **How big is the market in CA's industrial sector?**

Interviewed before this series of questions was added.

#### **To what extent does the market follow efficient practices?**

Generally I don't think they do at all. I'm extremely pessimistic about promoting energy efficiency with customers. There may be someone in the organization that cares about energy, but it is not my direct customer and I have trouble getting through to the right person. (Editor's note – national-level data on some behaviors for pre-survey estimate purposes are available on pp. 33-42 of Aspen's New England Compressed Air Study, pp. 2.24-2.32 of Aspen's PSEG study, and p. 82 of the *United States Industrial Electric Motors Market Opportunities Assessment*.)

#### **What would you look for to determine the extent the market follows efficient practices (if not answered in first question)?**

See first question.

### **Other**

#### **Do you provide system-wide services such as leak identification, leak repair, flow controllers, or pressure reduction?**

We just started promoting maintenance contracts in the last two years. We expect to be servicing 50% of our customers soon.

#### **What do you most often find to be customers' problems?**

See first question.

#### **How would you recommend influencing customer behavior to practice more efficient system operation?**

Customers care about productivity, period. That's what you have to sell to sell efficiency. (Interviewee expanded on this theme for about ten minutes.)

#### **Please describe your sales distribution in terms of horsepower and services sold.**

Not asked.

### **Other key findings**

- Glad PGE is out there promoting efficient compressed air and hope they can get to customer decision-makers and persuade them to care about energy (CAC implied)
- We are the fourth to call about this sort of thing, all from different organizations
- Double-acting water-cooled, two-stage reciprocating compressors are effectively history. Even though they are the most efficient, the installation cost is 10x that of screws and the material cost is 2x. (Maintenance also is higher –ed.)

Technology	Compressed Air
Contact responsibilities or title	Sales Manager
Contact date	October 12, 2000
Contact background	Compressor and related services

### **Questionnaire Support**

#### **What are the best indicators of an efficiently managed compressed air system?**

Few leaks and good piping layout. If the pressure differential between that supplied the compressor and that used by air equipment is low, then they probably have a well-managed (distribution) system.

#### **What is a prudent inlet air filter change interval, in hours?**

It depends on inlet conditions. We recommend using a pressure differential gage to determine when to change filters. If you need a single number, quarterly is a decent rule of thumb.

#### **Do you think customers can estimate annual savings or implementation costs associated with compressed air system upgrades?**

They may be able to estimate operating costs; they'll depend on contractors to estimate savings potential.

### **Market Potential Pre-Survey Estimation**

#### **How big is the market in CA's industrial sector?**

Not asked.

#### **To what extent does the market follow efficient practices?**

Not well.

#### **What would you look for to determine the extent the market follows efficient practices (if not answered in first question)?**

Pressure differential between discharge and end-uses.

### Other

#### **Do you provide system-wide services such as leak identification, leak repair, flow controllers, or pressure reduction?**

Yes. We sell leak detection and sometimes leak repair. We also are willing to rent leak detectors to our customers for \$200 to \$250 per week. If a small customer, under 50 hp, our price will include “cleanup” work on system to get it in shape. We will do a piping layout analysis. We apply technology to make production work correctly as well as sell compressors. We also sell automated flow controllers but more often are likely to sell simply \$200 fixed regulators.

#### **What do you most often find to be customers’ problems?**

Wasted air and excess pressure. We find lots of customers with piping systems with too many branches that are too small, and with too little distributed receiver capacity, which causes “false” demand and therefore higher pressure settings.

#### **How would you recommend influencing customer behavior to practice more efficient system operation?**

You need to emphasize helping provide a steady supply of clean air, at least here in Silicon Valley. Also, target larger customers. They are just starting to pay attention to efficiency concerns here in CA. Smaller customers don’t.

#### **Please describe your sales distribution in terms of horsepower and services sold.**

About 80% of our compressors sold are under 50 hp (no percentage of hp distribution estimate provided.)

### Other key findings

None.

Technology	Automated Lubrication
Contact responsibilities or title	Technical Customer Service
Contact date	October 10, 2000
Contact background	Manufacturer of engineered automatic lubrication systems for industry.

**Questionnaire Support**

**What do you look for in a piece of equipment to determine if it is a candidate for automated lubrication?**

Devices that currently are manually lubricated. Since start-up is commonly the most important period for the types of lubrication our equipment performs, we sometimes look for equipment that starts and stops a lot.

**How common is it as a retrofit?**

Not very common unless there is a problem.

**What are examples of retrofittable equipment for automated lubrication systems?**

- Off-road transportation equipment
- Automotive engines (pistons and valves prior to start-up)
- Chains such as overhead conveyors used in the automotive industry
- Ultra-high speed spindles on cutting tools such as drills and milling machines
- Cleanliness-critical applications such as pharmaceuticals, where we can entrain a single drop of oil for four minutes in the molds making pill capsules

Food services such as adding soy oil to stainless steel conveyor belts that transport candy

**Do you think expansion is likely as an energy-saving technique over the next few years?**

Not as an energy-saving technique. We do think it is a big untapped market generally, though.

**Do you promote or can you estimate energy savings from installations?**

No, they're not really promoted as energy savers. On really big motors like heavy-duty chain conveyors we have seen amperage drops after application. We emphasize labor savings and line operation dependability.

**Market Potential Pre-Survey Estimation**

**How would you define the market?**

Not asked. (Interview completed before this battery was added.)

**How would you distinguish between efficient and inefficient?**

Not asked. (Interview completed before this battery was added.)

**How big is the industrial market in CA?**

Not asked. (Interview completed before this battery was added.)

**To what extent does the market follow efficient practices?**

Not asked. (Interview completed before this battery was added.)

**What would you look for to determine the extent the market follows efficient practices?**

Not asked. (Interview completed before this battery was added.)

**Other**

**Please describe your sales distribution.**

Not asked.

**Other key findings**

None.

Technology	Automated Lubrication
Contact responsibilities or title	Business Line Manager
Contact date	October 17, 2000
Contact background	Manufactures several lines of automatic lubrication systems for industry. The are a market leader.

#### **Questionnaire Support**

##### **What do you look for in a piece of equipment to determine if it is a candidate for automated lubrication?**

Look for applications where staff has trouble getting too much or too little oil or grease applied. We look at equipment that has the highest use of oil and grease with the highest “repeatability” of motion.

##### **How common is it as a retrofit?**

Fairly common, but not as a primarily energy-saving project.

##### **What are examples of retrofittable equipment for automated lubrication systems?**

(besides those cited above)

Mining, such as drag line shovels

##### **Do you think expansion is likely as an energy-saving technique over the next few years?**

No, it will never be broadly successfully marketed primarily as an energy-saving technique.

##### **Do you promote or can you estimate energy savings from installations?**

Sometimes, but not regularly. For example, in the automotive industry they often have current gages on bigger conveyor motors, and we can show them before/after amperage drops. But it is not a core part of our marketing. Customers would see such a pitch as fluff because it isn’t quantified. Such talk could cost us credibility. Remember, friction losses generally are only a small percentage of total energy use for most applications, so reducing those losses doesn’t amount to much for many applications, especially smaller ones. Installation has got to be justified based on labor savings and extending machine life to be financially viable.

#### **Market Potential Pre-Survey Estimation**

##### **How would you define the market?**

In my business plan I estimate that the worldwide sales potential for automated lubrication equipment is about \$~~<deleted for public copy>~~ (for first-time installations, not annual sales, I believe –ed.). Of that 40% to 60% probably is in the U.S.

**How would you distinguish between efficient and inefficient?**

Both under and over-lubricated devices waste energy; over-lubricating is especially wasteful with grease. Not to mention environmental concerns.

**How big is the industrial market in CA?**

This is the editor's estimate, not an interviewee's: California is 14% of total U.S. market based on GSP/GDP. Reference: California's GDP is \$1,205 billion, the U.S. GDP is \$8,709 billion, per World Bank: World Development Indicators database, 8/2/00 and California GSP — CA Department of Finance estimate, updated: September 26, 2000, filename: bbrank, downloaded from the [http://www.dof.ca.gov/html/fs\\_data/LatestEconData/FS\\_Misc.htm](http://www.dof.ca.gov/html/fs_data/LatestEconData/FS_Misc.htm) website on October 31, 2000.

**To what extent does the market follow efficient practices?**

Regarding energy, there is lots of opportunity.

**What would you look for to determine the extent the market follows efficient practices?**

See above.

**Other**

**Please describe your sales distribution.**

*<deleted for public copy>.*

**Other key findings**

Would really welcome either receiving or working together to develop case studies that result in publishable data that proves energy savings. That is how the CEC could help us.



Technology	Blower Maintenance
<b>Contact responsibilities or title</b>	Sales representative or manager
<b>Contact date</b>	October 18, 2000
<b>Contact background</b>	A market leader specializing in industrial blowers.

### Questionnaire Support

#### **Most common high pressure applications:**

Fluid beds

Process systems

Some combustion burners

Agricultural, such as blasting air up through a silo full of walnuts

Many more applications at lower pressures such as cotton gins, boilers, dust collectors

### Market Potential Pre-Survey Estimation

#### **How would you define the market for efficient blower maintenance practices?**

Except for non-routine events such as original installation and solving one-time problems, which are done by our service engineers, our customers all maintain their own blowers.

#### **How would you distinguish between efficient and inefficient (maintenance)?**

I would just check on motor bearings, depending on whether they are re-greasable or sealed. On arrangement-eight (non-direct coupled) fans, they have their own lubrication chart that should be followed in addition to possible motor bearing lubrication. Generally, the coupling typically does not require lubrication. Improper initial alignment probably is the number one cause of problems. Improper foundation mounting, not being level, is the second biggest problem; it leads to vibration. Build-up of dirt on blades is relatively even; however, it breaks off of the fan irregularly, causing imbalance and vibration. I would look for regular opening of the fan housing for blade cleaning, especially if the blower is operating in a moist environment. If there are notched V-belts, check for proper tension, even tension, and alignment of sheaves. Belts should not only be replaced simultaneously but also should be ordered and specified as “machine-matched” to account for length variation due to manufacturing tolerances. If there are volume controls, I would inspect the move parts.

#### **How big is the industrial market in CA?**

Can't estimate. Our office sells about <quantity deleted for public copy> fans and blowers per year. The “vast majority” are under 1 psi fans and blowers, at least 90%. Interviewed firm has <quantity deleted for public copy> offices in California.

#### **To what extent does the market follow efficient practices?**

Hard for him to say. “I have had very few service problems in my 25 years with the company” except when customers misapply equipment. Example provided of standard blower in ash environment.

### **What would you look for to determine the extent the market follows efficient practices?**

It is pretty simple, really. Determine if customers are following manufacturer (motor, coupling, fan, bearing) recommendations for maintenance intervals, if any, for each component.

### **Other**

No questions specified.

### **Other key findings**

- Will have central marketing mail a publication guide.
- From discussion it seems like 1 to 2 psi is a good low-end break point for defining industrial (high pressure) blowers versus fans
- High-pressure blowers are far more likely to be direct-coupled rather than belt-driven.

Technology	Electronic Process Controls
Contact responsibilities or title	Sales
Contact date	October 20, 2000
Contact background	Distributor and a manufacturer's representative for SCADA and industrial automation controls.

### **Whom do you sell your controls to?**

50% of the controls are sold to end-users and 50% are sold to controls or electrical contractors. They also consult to customers and end-users as well. Most of their SCADA systems are sold to irrigation districts.

### **Do control manufacturers emphasize or feature the energy saving capabilities of their equipment?**

It is a common element, but they don't really feature energy savings. It is not the reason that controls are bought. Productivity and control are the main reasons.

### **Where do you think the best opportunities are for load shedding or energy efficiency?**

He thought the food industry and irrigation districts had the best opportunities for energy efficiency. He also stated that the mid-size to small size contractors are largely unaware of the energy efficiency capabilities of the controls.

### **Other key findings**

- The paper industry and any 24/7 operated facility were probably least likely to shed load for saving money.

Technology	Electronic Process Controls
<b>Contact responsibilities or title</b>	
<b>Contact date</b>	October 25, 2000
<b>Contact background</b>	SCADA controls contractor, primarily serving the water irrigation industry.

**Do you provide controls for manufacturing processes?**

They do provide some controls for manufacturing, but it is in the range of 2% of their business. It generally would involve some specialty application. They are generally too pricey for industrial applications.

**Market practices**

**Do you provide energy management features or load shedding features as part of your control systems?**

It can be done.

**In your experiences, have you seen this type of energy management control in practice?**

N/A

**Do you offer maintenance contracts for your control systems? Are service contracts increasing?**

N/A

**Do you offer re-commissioning of control systems?**

N/A

**Who decided on the energy savings features of the controls?**

N/A

**Other key findings**

Technology	Electronic Process Controls
Contact responsibilities or title	Sales
Contact date	October 25, 2000
Contact background	Manufacturer and distributor of electrical components and controls. They offer technical consulting services to the industrial/commercial sector.

**Do you provide controls for manufacturing processes?**

Yes they do. They provide automation controls. They also provide controls for electrical power systems.

**Market practices**

**Do you provide energy management features or load shedding features as part of your control systems?**

It has been available, but users are largely unaware of the energy saving capabilities of the controls. Diagnostics is a more common benefit valued by the end-user.

**In your experiences, have you seen this type of energy management control in practice?**

The automotive industry has used the energy saving features of the controls. The interviewed firm is interested in promoting and selling energy efficiency-they think this market is just beginning. They are part of the ODVA-Open Device Vendors Association that was created to advance inter-operability of control systems. They think this will advance the abilities of controls to provide energy management.

**Do you offer maintenance contracts for your control systems? Are service contracts increasing?**

Yes. (no further information)

**Do you offer re-commissioning of control systems?**

N/A

**Who decided on the energy savings features of the controls?**

N/A

Technology	Electronic Process Controls
Contact responsibilities or title	Area Manager
Contact date	October 25, 2000
Contact background	Consulting engineering firm that provides integrated solutions to the industrial sector, focussing on the oil business.

**Do you provide controls for manufacturing processes?**

Yes.

**Market practices**

**Do you provide energy management features or load shedding features as part of your control systems?**

Customers do not ask for it. It is not a premium feature of any of the control systems they design.

**In your experiences, have you seen this type of energy management control in practice?**

*<answer deleted for public version>*

**Do you offer maintenance contracts for your control systems? Are service contracts increasing?**

N/A

**Do you offer re-commissioning of control systems?**

N/A

**Who decided on the energy savings features of the controls?**

N/A

**Other key findings**

Technology	Electronic Process Controls
<b>Contact responsibilities or title</b>	Sales Engineer
<b>Contact date</b>	October 26, 2000
<b>Contact background</b>	Engineering/system integration firm. Provides services for SCADA and industrial process controls.

**Do you provide controls for manufacturing processes?**

Yes.

**Market practices**

**Do you provide energy management features or load shedding features as part of your control systems?**

Older control systems really couldn't control for energy savings, but the new ones can. Especially when using the PLCs and the high-end software applications. Most customers don't ask for this feature, however. Cost is their primary concern. One of our primary sales points is that the proposed control systems can help save them money by reducing their energy costs.

**In your experiences, have you seen this type of energy management control in practice?**

N/A

**Do you offer maintenance contracts for your control systems? Are service contracts increasing?**

We have service technicians. We usually get the customer involved in the design and help them with maintenance issues. We have been getting asked what a maintenance contract would cost.

**Do you offer re-commissioning of control systems?**

N/A

**Who decided on the energy savings features of the controls?**

We first start with the field operators or process experts, the guys who run the equipment. When it comes time to make the final decision, it is usually the plant manager.

**Other key findings**

They just sold a control system to a feed mill that wanted better control capabilities for their mixing of corn and barley. They regulate the mixing by slowing down or speeding up the conveyors of each mix. Refined control was the benefit they wanted. We were called in the field operators, but it was the plant manager that approved the expense.

Technology	Water Recovery and Reuse (Closed Loop)
Contact responsibilities or title	Consultant
Contact date	October 10, 2000
Contact background	Expert in the area of water and wastewater systems for industrial facilities.

### Who is using closed-loop systems?

Water recovery and reuse is primarily done in the food industry. The electronics industry is not a good candidate because its water supply needs cannot be met with recycled water. They require ultra pure water for their processes. Their water use is also too low to make good economical sense. Paper industry uses recovery, but the paper industry in California is not that significant.

### How do you determine who is a good candidate for closed loop?

There are many factors, but key ones are locational: the lack of a good water supply and the wastewater treatment facilities are non-existent or can no longer take any more discharge.

### Other key findings

- Discharge flow rates below 50,000 GPD are not good candidates as the economics are not justified. Food industry flows of 1,000,000 GPD or more have proven to have good paybacks.
- Water recovery and reuse via filtration generally refers to reclaiming drain water (not sewer or “black” water) to the quality of supply water (potable water).
- Gray water systems, used primarily for irrigation and plant washdown of equipment can be part of a recovery system. However, they are seen as very expensive because new, separate piping systems have to be added to the plant.
- The amount of water reclaimed is driven by the specifics and economics of each unique application.
- The different types of filters are driven by the application:
  - Membrane-high filtering efficiency, high energy costs. They tend to use high recirculating rates (large pumps). Filters down to 25 microns or less.
  - Coarse screen-the most prevalent, less energy intensive, less filtering efficiency. 25 microns or more.
  - Other types:
    - Parabolic wedge wire screens
    - Nanofiltration-(high pressure, up to 2000 psi)
    - Oscillating membrane-more energy efficient than standard membrane (lower flow rates)



## **6. Closed-Loop Recirculation**

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- Water recovery and reuse is a net energy gain, regardless of filter type.
- The Stockton wastewater treatment plant is out of capacity.

Technology	Water Recovery and Reuse (Closed Loop)
Contact responsibilities or title	Sales
Contact date	October 12, 2000
Contact background	Installs hydraulic components for various mechanical systems. They have supplied parts for wastewater systems.

**Who is using water recovery systems?**

They do not install recovery systems. Not familiar with them. They have supplied hydraulics for various types of wastewater systems.

**How do you determine who is a good candidate for water recovery?**

Same as above.

**Other key findings**

*Surveyor's note: This company provides components that are sometimes used in the water recovery process. However, he does not recognize water recovery as a potential market.*

Technology	Water Recovery and Reuse (Closed Loop)
Contact responsibilities or title	Sales
Contact date	October 17, 2000
Contact background	Manufactures membrane filters for a wide variety of applications, including water recovery systems. They also manufacture and sell membrane filtering systems.

### Who is using water recovery systems?

The major users are the food industry, paper & pulp industry, and textile industry. They see the electronics industry as a small market.

### How do you determine who is a good candidate for water recovery?

Recovery systems are very complex and cannot be used in all facilities.

### Do you perceive recovery as a market and if so, how do you view the California market?

Most of their sales are outside of California at present. They don't track recovery systems as a market; it is a customized design.

### Other key findings

- They usually focus on by-product recovery and water recovery is usually just part of the whole overall design.
- Membrane filters have a wide variety of uses, not just in water recovery.
- Closed loop means many different things to different people; he says the textile industry (not present in California) call systems closed loop when they eliminate wastewater discharge.

### E-mail response with further information presented by interviewee

- A good candidate is one that either has a regulatory issue that membranes are required for, or one where there is product recovery or by products to be made from the waste water with a reasonable ROI.
- Minimum recovery rate is very site specific, and depends on regulatory issues as well as economics. In some cases plants simply close and move rather than face the cost of wastewater improvement.
- Yes this is a growing market for wastewater processing. We do target specific industries, but these are confidential at this time.
- The biggest barrier is always "If it ain't broke, don't fix it." There has to be a clearly defined need for relatively new membrane technology before most companies will even consider it.
- As we discussed, the term "closed" means different things in different industries. Yes, water re-use can be referred to as a "closed loop," but remember that there is going to be some

## 6. Closed-Loop Recirculation

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waste leaving a facility somehow — either trucked out as solid waste for landfill, burned or evaporated, or spread on land owned by the client that processes the waste water. Byproduct or product recovery is the best solution where it is possible, but even with these there is some waste that has to “leave” the facility somehow. I don’t think that some people really understand this yet. Even consumers that recycle have some trash they have to get rid of. Simply put, you can’t have water continuously enter a processing facility and have it simply “disappear,” even with water re-use. So some substantial education of the consuming public needs to be done so that they can discuss what they will tolerate in waste disposal from industry.

Technology	Water Recovery and Reuse (Closed Loop)
<b>Contact responsibilities or title</b>	Wastewater Dept
<b>Contact date</b>	October 17, 2000
<b>Contact background</b>	Works with industrial facilities on their wastewater issues.

### **Who is using water recovery systems?**

The big users are refineries, fabric dye shops (now relocating out West), paper mill industry, and metal plating shops.

### **How do you determine who is a good candidate for water recovery?**

All industries are candidates. Water conservation and recycling is very important.

### **Do you perceive recovery as a market and if so, how do you view the California market?**

A3: We promote the use of recovery and conservation to our customers.

### **Other key findings**

- LA county is not short of capacity at their wastewater treatment facilities. It could be that Orange County has a capacity problem.
- He felt the best way to determine recovery rates was by using a method called the water PINCH process. It is a scientific method to optimize processes.
- He knows of (2) paper mills that produce about 3,000,000 GPD and that they use reclaimed water extensively. He says they prefer the reclaimed water to the water supply because it has no chlorine.
- He thought the fabric dyeing industry was a good industry to target.
- Refineries are using reclaimed water for cooling towers.
- Other water minimizing or conservation technologies should be considered before water recycling. Metal finishing shops can change their process from rinsing tanks to dip tanks and use a lot less water. (Process overhaul?)
- McGraw Hill publishes a very good book on industrial wastewater. The authors are Dr. Mann and Liu, and the book is entitled *Industrial Water Use*. Retail price- \$99.95.
- Faxing us water reuse case studies from Wastewater Magazine. The editor of the magazine is Jay Landers, and his phone number is (703) 684-2463. His fax number is (703) 684-2492. His e-mail is jlanders@wef.org.
- Other contact is Rob Schweinfurth, WEF Industrial Waste Committee Staff Liaison on reuse, monographs, and seminary workshops. His phone number is (703) 684-2400.
- Makita Corporation in La Mirada, CA installed a wastewater treatment and recovery system for its manufacturing plant in Buford, GA.
- Wastewater from people, not plants, is what determines the size and capacity of wastewater

## **6. Closed-Loop Recirculation**

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treatment facilities. He attributes only 15% of the wastewater treated by LA County is from manufacturing processes.

Technology	Water Recovery and Reuse (Closed Loop)
Contact responsibilities or title	Sales
Contact date	October 17, 2000
Contact background	Manufacturer of waste recycling products and systems for the electronic industry, specializing in printed circuit board manufacturing processes.

**Who is using water recovery systems?**

They specialize in the electronics industry only.

**How do you determine who is a good candidate for water recovery?**

They feel circuit board manufacturers are the best candidates.

**Do you perceive recovery as a market and if so, how do you view the California market?**

They do install water recovery systems, but they feel they are too expensive to economical for the electronics industry. They primarily do chemical recovery systems to eliminate hazardous sludge, or waste. They do not market their products in California as of yet as they are plenty busy in Illinois.

**Other key findings**

- Referred to Closed Loop technology as recycling of water so no water goes down the drain (and out to the wastewater treatment plant.)
- Dispent chemistry: the chemical rinse (after rinse) used in etching, plating, and stripping processes.
- Respondent indicated customers can buy water cheaper than they can recycle it in Illinois.

<b>Technology</b>	<b>Water Recovery and Reuse (Closed Loop)</b>
<b>Contact responsibilities or title</b>	Sales
<b>Contact date</b>	November 7, 2000
<b>Contact background</b>	Provides equipment and technical expertise (for water and chemical recycling) to metal finishing and electronic manufacturing companies in the Massachusetts and Vermont area.

### **Reasons customers install water recycling systems**

- The cost of water and sewer services in the New England area is high. \$15/1000 gallons.
- Recycled water is warmer than city supply water, so it rinses metals more effectively.
- Recycled water is purer than city supply water. Less heavy metals-up to 5% cleaner in most cases.
- The company is expanding the plant or operations and they are not allowed any more discharge into the wastewater treatment facility.

### **Technical issues**

- When you recycle water, you build up a concentration of salt. Disposing of the salt can be costly and a burden.
- You cannot filter out the alcohol.

### **Barriers to installation of recycling systems**

- The first cost of installing these systems is a significant barrier.
- A lot of real estate is needed because the tanks involved require a lot of space.
- The recycling system requires significant maintenance.
- It is often viewed by upper management as a direct expense instead of a capitalized cost — this leads to an unfavorable economic analysis.

### **Market Actors**

- The metal finishing and electronics industries are good candidates for recycling. Around 60% of the customers in the New England area have some type of recycling system. The typical system sizes range from 60 to 75 gpm. (90,000 GPD.)
- The microelectronics industry does not install recycling systems because of their stringent requirements for pure water and the fact you can't get the alcohol out of the water.



Technology	Process Overhauls
Contact responsibilities or title	Vice President
Contact date	October 24, 2000
Contact background	Federally funded, non-profit consulting group with (7) regional centers in central and southern California. Focuses its services primarily on manufacturers with less than 500 employees.

**Is there an industry sector that shows the greatest potential for revamping, or overhauling their process?**

Not particularly. If she can think of a specific sector, she will call us back. They market to (14) different industrial sectors, as California’s industry is quite diverse.

**Is energy savings ever a primary focus?**

A2: She says it might be in San Diego now. There is one industrial sector. Metal finishing industries are very energy intensive, and energy reduction is always a primary concern. The drivers for overhauling the processes are quite different from industry to industry. They may include: a mandate to reduce emissions, control costs, improve quality of product, improve delivery to meet industry demands, or even parent company mandates about reducing inventory (Reducing inventory can create a requirement to change the process.)

**Other key findings**

Regarding their Marketing Practices:

- Their territory is Southern California up to San Luis Obispo and Fresno.
- There are 80,000 or so industrial manufacturers in California-84% of these have 250 employees or less. They state 53,000 small manufacturers are in Southern California.
- They use telemarketing, business to business, and outreach programs to reach their customers. They do not come knocking on their door.
- They contact 3,500 customers (yearly) through some type of outreach (seminars, workshops, etc.). They provide 350 manufacturers with in-depth services.
- Industry sources have reported that CMTC support has helped produce the creation of 4,000 jobs in the manufacturing industry.
- Typical process involves meeting with the customer and walking their facilities. They discuss the facility’s particular issues and how they might be solved. They then meet with senior management of the company and discuss/decide how they might be able to improve their processes or solve their problems. Oftentimes, they end up bringing in other experts to help.

Regarding their Research Work:

- They have responded to a solicitation put forth by the east coast-based Industry Research Center (IRC), a 501c6 non-profit organization. The organization proposed to study four market sectors (electronics, food, automotive, aerospace, couldn't remember the other). The goal is to determine key market drivers in regards to energy. She believes it is mainly focussed on natural gas.
- If they are awarded the project, they would like to meet with the CEC to tell them about their work and see if there is a way they can work together.

Technology	Process Overhauls
Contact responsibilities or title	Consultant
Contact date	October 24, 2000
Contact background	Contact is a senior industrial engineer that works as an independent consultant for industrial process design projects mostly in the semiconductor industry.

**Can customers tell if absolute energy use or energy use per unit production changes as a result of overhauls?**

No.

**Can customers estimate implementation costs or energy-related savings?**

Maybe on cost. Definitely not on savings. Processes are changed for reasons of quality and productivity. Energy is such a low consideration I've never heard of it being measured. I've never been asked to provide energy impact estimates on any of the projects I have worked on.

**What questions would you ask to identify energy effects associated with process overhauls?**

Doesn't think there are such questions.

**How would you define the market?**

Not answered.

**How big is the market in CA?**

Well it's not like facilities overhaul their processes every ten years. Around here process changes are continuous. The frequency of process overhauls probably is in the range of 1 year to 18 months for more capital-intensive plants.

**To what extent does the market follow efficient practices?**

If they do it is entirely coincidental. I had an instance once a few years ago where I specified some servo motors be energy efficient, which was an option. That's about it. I have heard of Purchasing Departments having standard clauses for things like high efficiency motors.

**What would you look for to determine the extent the market follows efficient practices?**

Not asked.

**Is energy efficiency ever the driving force behind a process overhaul? If yes, what types of processes?**

Energy use is such a small component of cost for most manufacturers except for perhaps chemicals that I don't think it's ever the driving force. I therefore doubt you can influence them to change their behavior.

### ***Other key findings***

- Possibly the only way to affect energy use in process overhauls is to work directly with the equipment manufacturers to make more efficient equipment. Perhaps look particularly to contractors that deal with clean rooms. They use a lot of energy.

Technology	Process Overhauls
Contact responsibilities or title	Consultant
Contact date	October 25, 2000
Contact background	Contact is an industrial engineer that works as an independent consultant for industrial process design projects. Recently returned from a big assignment in Southeast Asia.

**Can customers tell if absolute energy use or energy use per unit production changes as a result of overhauls?**

None have ever raised the issue of energy in my projects. It is all about simplifying equipment, reducing manpower, increasing speed, and increasing reliability. Perhaps with the big jump in oil prices there will be interest in the future, but not now. The manufacturer often is limited in choice to the tool needed for the process. There is no energy option.

**Can customers estimate implementation costs or energy-related savings?**

Generally, process overhauls are going to improve productivity. Otherwise why do them, right? To the extent that productivity increases the energy cost per widget produced is likely to go down. Can customers estimate this savings? No.

**What questions would you ask to identify energy effects associated with process overhauls?**

Again, it's labor and quality, not energy.

**How would you define the market?**

Not asked.

**How big is the market in CA?**

Not asked.

**To what extent does the market follow efficient practices?**

Only incidentally. See above.

**What would you look for to determine the extent the market follows efficient practices?**

About the only indicator could possibly be fuel type. *<implied, not an explicit answer –ed.>*

**Is energy efficiency ever the driving force behind a process overhaul? If yes, what types of processes?**

No. See above.

### ***Other key findings***

- In my SE Asia project we reduced energy costs by 50% in a huge warehouse HVAC replacement project simply because of the use of new efficient equipment.

Technology	Process Overhauls
Contact responsibilities or title	Vice President
Contact date	October 25, 2000
Contact background	A state and federally funded non-profit consulting group, focussing on business development, manufacturing technology, and workforce training and development.

**Is there an industry sector that shows the greatest potential for revamping, or overhauling their process?**

Not really. She was unsure of about energy efficiency.

**Is energy savings ever a primary focus?**

A2: No, one thing they have been promoting is Lean Management Practices, which means reduce all waste associated with the process. Conceptually, this could include energy.

**Other key findings**

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Technology	Refrigeration
Contact responsibilities or title	Owner
Contact date	October 9, 2000
Contact background	Company that services and installs chillers for commercial and industrial customers.

**Do you see potential for the installation of Ammonia chillers?**

They do not service or install ammonia chillers.

**Do you service VFD screw compressors and, if so, do you see this as a growing market?**

A2: They have not seen any VFD screw compressors. He believes that they are still in the R&D phase of evolution.

**Other key findings**

- Most industrial chillers he sees are part of the microelectronics industry.
- He has only seen ammonia in large food storage warehouses.



Technology	Refrigeration
<b>Contact responsibilities or title</b>	Sales Engineer
<b>Contact date</b>	October 9, 2000 & October 13, 2000
<b>Contact background</b>	Manufactures, designs, installs, and services commercial & industrial refrigeration systems. Respondent sells to the industrial sector.

**Do you install heat recovery systems and if so, do you target this as a potential growth area for your business?**

Yes, they do install heat recovery systems, but only as part of new or expanded refrigeration systems. No, they do not target heat recovery systems; they are viewed as just another part of the system. You install the systems if it is practical to do so. By themselves, the economics are not good.

**Do you see potential for the installation of ammonia systems?**

They have not been installing ammonia systems; just servicing them. They have never seen an ammonia system replace another refrigerant-based system as part of a retrofit. Most of the ammonia systems they service are in wineries. It takes specially trained service mechanics to install and service ammonia systems and they have only a few.

**Do you install VFD screw compressors and, if so, do you see this as a growing market?**

They have not installed nor have ever seen a VFD screw.

**Do you install floating head controls? Do you let the head pressure float below 70 degrees?**

A4: All systems have floating head control to some degree. However, they do not float the head below 70 degrees as the thermostatic expansion valves generally used (except for ammonia) will not function. The electronic expansion valves that were supposed to solve this program have been a failure and are not in use any more.

**Other key findings**

- Mark stated that service mechanics still identify systems in the field by compressor HP, refrigerant type, and general type of system.
- A pilot test was done using an ammonia based refrigeration system for supermarket in Chicago. It didn't turn out well.
- They have not seen anything new as far as newer, more efficient compressors. The last major introduction was scroll compressors (for supermarket multi-stage racks) and VFDs for open-drive, reciprocating compressors.

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Technology	Refrigeration
Contact responsibilities or title	Sales Engineer
Contact date	October 12, 2000
Contact background	Company is a distributor of HVAC and refrigeration products.

**Do you sell ammonia chillers? If so, who is the primary target?**

They do not sell ammonia chillers.

**Do you sell VFD screw compressors and, if so, do you see this as a growing market?**

They currently do not sell VFD screw compressors. He recommends that we call the local Carrier representative.

**Other key findings**

- They do track all chiller equipment sales in Northern California. He is not sure he would have permission to share that data, however.

Technology	Refrigeration
Contact responsibilities or title	Sales Engineer
Contact date	October 12, 2000
Contact background	Company is a manufacturer of HVAC and refrigeration products.

*Surveyor's note: This interview consisted of only one question, as the sales representative interviewed generally does not work in the industrial sector of the business. He could, however, confirm the status of VFD screw compressors.*

### **Do you sell VFD screw compressors? Is there market potential?**

Screw compressors driven by VFDs are new technology. They are currently doing R&D on new oil-less, ceramic compressors utilizing (3) screws (2 males, 1 female) with VFD speed control. Expect to release for sale in 2001. Chillers using these compressors will have extremely high part load efficiencies (IPLVs of 0.2). Will be mostly for commercial HVAC.

### **Other key findings**

- When product line becomes available, he is willing to provide technical literature on the new technology.

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### **Water Recovery and Reuse**

“Growth Without Discharge,” Rick Marotte, Larry Peck, and Peter Gill, *Industrial Wastewater Magazine*, Editor: Jay Landers, 1-703-684-2463, Sept./Oct. 2000.

“Recycling in the Desert” By Lawrence V. Krzesowski, Gloria Garza, and Kameshwar Gupta, *Industrial Wastewater Magazine*, Editor: Jay Landers, 1-703-684-2463, Sept./Oct. 2000.

“Industrial Water Use” Authors Mann & Liu. Available from McGraw Hill Publishing.

The School of Water Sciences, Cranfield University, UK.

PG&E Smarter Energy website –

[www.pge.com/customer\\_services/bus/energy/smart/html/industrial\\_waste.html](http://www.pge.com/customer_services/bus/energy/smart/html/industrial_waste.html).

### **Process Overhaul**

California Manufacturing Technology Center website – case studies  
[www.cmtc.com/pressroom/successstories.asp](http://www.cmtc.com/pressroom/successstories.asp).

### **Refrigeration**

“Expanding the Use of Ammonia,” Paul de Larminat, Ph.D, technical director of York-France, *ASHRAE Journal*, March 2000.

## Attachment. Industrial Supplier Interview Guide

The below table is a set of questions for Aspen to ask to help design the questionnaire, develop pre-survey market size expectations, plus selected supplemental questions. The table also includes potential contacts to ask the questions. Not all respondents will answer all questions.

Technology (Target Number of Interviews)	Questions to Ask to Help Design End-User Questionnaire	Where to Get Supplier/Expert Contact Information	Suppliers/Experts to Ask
<b>Motors (2)</b>	<p><b>Questionnaire Support</b></p> <p>What department in your customers' organization buy motors from you (what are the purchasing channels)?</p> <p>Should we expect customers to be familiar with the term "premium efficiency" and its meaning?</p> <p>What types of motor purchase questions do you think they will be best able to answer: per motor purchase questions (e.g., Q9) or general patterns of behavior (e.g., Q1-4)?</p> <p>Market Potential Pre-Survey Estimation How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p><b>Other</b></p> <p>What is range of hp you sell? What is the average hp sold?</p> <p>Please describe your sales distribution by size.</p> <p>Can you estimate your volume of sales in hp?</p> <p>How do you think your sales distribution compares to the industrial market as a whole (do you specialize on selling bigger or smaller motors, on average)?</p>	<p>Yellow Pages</p> <p>PGE Supplier Directory</p> <p>MSOE contacts</p>	<p>Bearing Engineering Company 5000 E. 2nd Street, Suite A Benicia, CA 94510 707-745-9355</p> <p>5861 Christie Avenue Emeryville, CA 94608 510-653-3913</p> <p>901 25th Street San Francisco, CA 94107 415-431-1500</p> <p>892 Marina Blvd. San Leandro, CA 94577 510-357-9812</p> <p>Culver Armature &amp; Motors 3020 "X" Street Sacramento, CA 95817 916-451-5858</p> <p>Dunn's Electric Motor Service 2821 Fruitridge Road Sacramento, CA 95820 916-455-0428</p> <p>Electric Motor &amp; Supply 250 Broadway Fresno, CA 93721 559-486-0960</p> <p>Electric Motor &amp; Supply 8242 W. Doe Avenue Visalia, CA 93291 559-651-8450</p> <p>ESAW –rewinding practices</p>

Technology (Target Number of Interviews)	Questions to Ask to Help Design End-User Questionnaire	Where to Get Supplier/Expert Contact Information	Suppliers/ Experts to Ask
			<p>St. Louis, MO</p> <p>GE Supply 31285 San Clemente Street Hayward, CA 94544 510-476-3400</p> <p>Industrial Electric Service Co. 1601 Samoa Boulevard Arcata, CA 95521 707-822-2485</p> <p>Industrial Electric Service Co. 3500 N. State Street Ukiah, CA 95482 707-468-5400</p> <p>San Leandro Electric Supply 633 San Leandro Boulevard San Leandro, CA 94577 510-638-7760</p> <p>Milwaukee School of Engineering John Brauer, Ph.D., P.E. Adjunct Associate Professor, EE &amp; CPS 1025 N. Broadway Milwaukee, WI 53202 414-277-7395</p>
<b>Compressed Air (2)</b>	<p><b>Questionnaire Support</b></p> <p>What are the best indicators of an efficiently managed compressed air system?</p> <p>What is a prudent air filter change interval, in hours?</p> <p>Do you think customers can estimate annual savings or implementation costs associated with compressed air system upgrades?</p> <p>Market Potential Pre-Survey Estimation How big is the market in CA's industrial sector?</p> <p>To what extent does the market follow efficient practices?</p>	<p>Yellow Pages</p> <p>PGE Supplier Directory</p> <p>SVP Contacts</p> <p>JBM personal contacts</p> <p>MSOE contacts</p>	<p>Accurate Air Engineering Tim Domer 510-651-3565</p> <p>West Coast Compressor (Quincy) Rich Harrigan 510-783-1139</p> <p>Summit Industrial Equipment (Kaeser) Craig Boski 877-873-7866</p> <p>D&amp;D Compressor (Powerex, also Zeks flow controllers)</p>

Technology (Target Number of Interviews)	Questions to Ask to Help Design End-User Questionnaire	Where to Get Supplier/Expert Contact Information	Suppliers/ Experts to Ask
	<p>What would you look for to determine the extent the market follows efficient practices (if not answered in first question)?</p> <p><b>Other</b> Do you provide system-wide services such as leak identification, leak repair, flow controllers, or pressure reduction?</p> <p>What do you most often find to be customers' problems?</p> <p>How would you recommend influencing customer behavior to practice more efficient system operation?</p> <p>Please describe your sales distribution in terms of horsepower and services sold.</p>		<p>Edna Rodriguez 408-947-0491</p> <p>Canyon Compressor (Sullair) Bob Pushwire 888-226-9664</p> <p>Ingersoll-Rand Gerald Barren 800-990-8882</p> <p>Milwaukee School of Engineering Jeffrey L. Bitant Assistant Director, Fluid Power Institute, Research &amp; Testing Labs. 1025 N. Broadway Milwaukee, WI 53202 414-277-7196</p>
<p><b>Automated Lubrication Systems (4)</b></p>	<p><b>Questionnaire Support</b> What do you look for in a piece of equipment to determine if it is a candidate for automated lubrication?</p> <p>How common is it as a retrofit?</p> <p>What are examples of retrofittable equipment for automated lubrication systems?</p> <p>Do you think expansion is likely as an energy-saving technique over the next few years?</p> <p>Do you promote or can you estimate energy savings from installations?</p> <p>Market Potential Pre-Survey Estimation How would you define the market?</p> <p>How would you distinguish between efficient and inefficient?</p> <p>How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p> <p><b>Other</b></p>	<p>Brian Laan, from Clint Lowell.</p> <p>Web search of manufacturers</p> <p>Motor equipment vendors</p> <p>MSOE contacts</p>	<p>Alemite Mfr. Principally automotive &amp; stationary engines, not industrial equipment</p> <p>Bearing Agencies (also see <i>Motors</i>) Rich _____ 277 7th Street San Francisco, CA 94103 415-621-8363</p> <p>Laan, Brian former CEC staff 519-850-0133</p> <p>Lincoln Industrial Jim Hawk St. Louis 314-679-4297</p> <p>Motion Industries, Inc. Keeping Industry In Motion 516 McCormick Street San Leandro, CA 94577 510-562-6911 Carla Freeman, then Tom Lene, Branch Manager. Knew nothing about</p>



Technology (Target Number of Interviews)	Questions to Ask to Help Design End-User Questionnaire	Where to Get Supplier/Expert Contact Information	Suppliers/ Experts to Ask
	Please describe your sales distribution.		<p>technology &amp; applications. Just sells systems. Referred to manufacturer in St. Louis, Lincoln.</p> <p>Orsco Pat Jakel, Michigan 810-997-0300</p> <p>Milwaukee School of Engineering Thomas Wanke, CFPE Associate Director, Applied Technology Center 1025 N. Broadway Milwaukee, WI 53202 414-277-7191</p>
<b>Blower Maintenance (1)</b>	<p><b>Questionnaire Support</b> No vendor consultation required to refine questionnaire.</p> <p>Market Potential Pre-Survey Estimation How would you define the market for efficient blower maintenance practices?</p> <p>How would you distinguish between efficient and inefficient?</p> <p>How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p>		Chicago Blower
<b>Electronic Process Control (EPC) to shut idle equipment off (4)</b>	<p><b>Questionnaire Support</b> What are key characteristics that suggest good candidates for EPC (industry type, size, particular processes, etc.)?</p> <p>Can they estimate costs or savings associated with energy efficiency?</p> <p><i>Are you successful selling maintenance contracts with systems? Are they necessary for long-term effectiveness?</i></p> <p>Market Potential Pre-Survey Estimation How would you define the market?</p>	<p>Jay Bhalla at SCE. Contact information to be provided by Pierre Landry.</p> <p>Inspired by SCADA, Ricardo Amon to provide contact information to investigate non-agricultural applications.</p> <p>Check with Sean</p>	<p>Energy Controls And Concepts 1758 Orange Tree Lane Redlands, CA 92373 909-335-1699</p> <p>Energy Management Technologies 20944 Corsair Boulevard Hayward, CA 94545 510-783-7790</p> <p>Honeywell Industrial Automation and Control San Jose, CA</p>

Technology (Target Number of Interviews)	Questions to Ask to Help Design End-User Questionnaire	Where to Get Supplier/Expert Contact Information	Suppliers/ Experts to Ask
	<p>How would you distinguish between efficient and inefficient?</p> <p>How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p> <p><b>Other</b> Do plant engineers look at EPC to optimize lines?</p> <p>What is penetration over the last few years?</p> <p>Do you think load management concerns will increase interest?</p>	Mooney.	<p>Scientific Environments 50 Dickerson Lane Napa, CA 94558 707-265-9000</p> <p>Smart Systems 23104 C Bernhardt Street Hayward, CA 94545 510-785-3256</p> <p>Westinghouse</p>
<b>Closed Loop Recirculation (CLR) (4)</b>	<p><b>Questionnaire Support</b></p> <p>What determines recycling capacity for a closed loop system?</p> <p>What are the key indicators of applicability (flow rate, chemicals suspended, industry type and size, etc.)?</p> <p>Who are the best candidates for closed loop?</p> <p>What reasons have companies installed closed loop?</p> <p>Market Potential Pre-Survey Estimation How would you define the market (e.g., gpd discharge)?</p> <p>How would you distinguish between efficient and inefficient (e.g., percent of discharge recirculated)?</p> <p>How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p> <p><b>Other</b> What is the percentage of effluent flow that you think could be recirculated? What percentage currently is recirculated?</p>	<p>Amory Lovins, Cost of Capital book has case study examples</p> <p>Dr. Strasser, from Clint Lowell</p> <p>EPA Web site.</p> <p>Check with Sean Mooney.</p>	<p>Hydraulic Controls Inc. Don, Sales 2136 Stagecoach Road Stockton, CA 95215 209-466-1531</p> <p>Strasser, Dr. Jurgen Consultant 925-299-1777 Expert on water/wastewater design and recovery systems</p>

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	Please describe your sales distribution.		
<b>Process Overhaul (4)</b>	<p><b>Questionnaire Support</b></p> <p>Can customers tell if absolute energy use or energy use per unit production changes as a result of overhauls?</p> <p>Can customers estimate implementation costs or energy-related savings?</p> <p>What questions would you ask to identify energy effects associated with process overhauls?</p> <p>Market Potential Pre-Survey Estimation How would you define the market?</p> <p>How would you distinguish between efficient and inefficient?</p> <p>How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p> <p><b>Other</b></p> <p>Is energy efficiency ever the driving force behind a process overhaul? If yes, what types of processes?</p>	<p>Pierre Landry to provide information on California Mfg. Technology Center. (May also be useful for electronic control.)</p> <p>See Bhalla also.</p> <p>Check with Sean Mooney.</p>	<p>Associated Engineering &amp; Construction 1771 Timothy Drive San Leandro, CA 94577 510-357-5729</p> <p>Kaman Industrial Technologies 2145 Park Avenue, Suite 8 Chico, CA 95928 530-345-5171</p> <p>Lawrence-Nye-Anderson Associates, Consulting Mechanical Engineers, Inc. 7580 N. Ingram Avenue, Suite 104 Fresno, CA 93711 559-431-0101</p> <p>Power &amp; Systems Inspection Group PO Box 137 Millbrae, CA 94030 800-843-1085</p> <p>Salas O'Brien Engineers, Inc. 498 Foam Street Monterey, CA 93940 831-657-0251</p> <p>305 S. 11th Street San Jose, CA 95112 408-282-1500</p> <p>Summit Industrial Equipment, Inc. 2180 Enterprise Boulevard W. Sacramento, CA 95691-3428 916-372-5890</p> <p>Taylor Engineering LLC 1305 Marina Village Parkway, Suite 101 Alameda, CA 94501-</p>

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			1028 510-749-9135  Watson & Co. Energy Consultants 1975 Norton Road McKinleyville, CA 95519 707-839-1763
<b>Refrigeration (3)</b>	<p><b>Questionnaire Support</b> How do facility people identify refrigeration system size. (tons, horsepower or other, to determine if hp is the proper way to ask in our questionnaires, ask Hussman in particular).</p> <p>Do you offer variable speed screw compressors, or are you aware of competitors that do? (Earlier interviews indicated that VSD screws are not on the market-R&amp;D only). How often have you installed them?</p> <p>How many heat recovery systems are you installing and when? What makes a good candidate for heat recovery?</p> <p>Market Potential Pre-Survey Estimation How big is the industrial market in CA?</p> <p>To what extent does the market follow efficient practices?</p> <p>What would you look for to determine the extent the market follows efficient practices?</p> <p><b>Other</b> How much of a presence is there of ammonia systems and are you seeing any replacement of CFC, HFC refrigerant systems by ammonia systems. (Relates to our questions and an ASHRAE Journal article that says replacement/ packaged chiller ammonia systems is happening in Europe and could begin in USA).</p> <p>Do you service ammonia chiller packages? (Ask American in particular.) Do you see an opportunity for ammonia systems to replace standard ref. systems? What type of industrial customers do you serve?</p> <p>Please describe your sales distribution.</p>	DR contacts	<p>American Chillers Steve Ghilardi, Owner Sacramento, CA 916-457-7800</p> <p>Carrier Corporation Zach Blake, Sales Engineer Sacramento, CA 916-387-3000 Specifically to find out VSD information</p> <p>Hussmann Corp. Mark Munguia, Sales Engineer 4244 S. Market Court Sacramento, CA 95834 916-920-4993</p> <p>Independent Refrigeration 1316 Rheem Avenue Richmond, CA 94801 510-222-2254</p> <p>Val Air Corporation Rod Kaida, Sales Engineer Sacramento, CA 916-387-3000 Carrier distributor</p>

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