

# PROPOSAL FOR COMPREHENSIVE COMPRESSED AIR PROGRAM FOR THE PG&E SERVICE AREA

Prepared for

**California Public Utilities Commission  
San Francisco, California**

**Confirmation Number:**

**KEMA-XENERGY PROPOSALS SUBMITTED**

<b>Program Name</b>	<b>Utility Area(s)</b>
Comprehensive Compressed Air Program	PG&E, SCE, SDG&E
EEOGOV B.E.S.T. Program	PG&E, SCE
Enhanced Automation Initiative	PG&E, SCE
Green Building Education and Technical Assistance Program	PG&E
Positive Energy Loan Program	PG&E
Wastewater Treatment Improvement Program	PG&E, SCE

**Contact Person**

John Skelton, KEMA-XENERGY  
870 High Street, Suite 103  
614-844-6936  
jskelton@kema-xenergy.com

Prepared by

**KEMA-XENERGY Inc.  
Oakland, California**

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## 1.1 PROGRAM CONCEPT

This proposal builds on the success of the Comprehensive Compressed Air Program (CCAP), funded by the California Public Utilities Commission (CPUC) during 2002-03 and delivered in the Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) service areas. For the 2004-05 version of CCAP (referred to as CCAP2), the program is again offered in the SCE and SDG&E service areas and is extended to the Pacific Gas & Electric (PG&E) service area as well. Narrative proposals for each of the three service areas are identical. Numerical information is provided for each service area and for a total statewide program. It should be noted that the proposed program for the SDG&E service area is only offered as an incremental program to one of the other service area bids (PG&E and/or SCE).

## 1.2 PROGRAM RATIONALE

Although a few changes have been added to the original CCAP program, CCAP2 brings together essentially the same approach and project team. Like its predecessor, CCAP2 combines expert technical assistance with financial incentives to help industrial customers improve their compressed air systems. As such, CCAP2 is classified as a hardware/incentive program.

CCAP2 overcomes the traditional barrier of many industrial programs in which customers are unwilling to implement recommended projects. CCAP2's strategy of proactively managing the entire process from initial system audit through project implementation and beyond helps the program achieve "close rates" that exceed 65%. A program's "close rate" is the percentage of customers that implement at least a portion of the audit recommendations.

These metrics compare very favorably with almost any other proposed program, including the Standard Performance Contract (SPC) program. The original CCAP Program (2002-04) established some very high benchmarks – e.g., a savings level of 16,000 MWh (net), and a levelized program cost of \$27.90 per MWh.

The CCAP Program is on track to meet or exceed these savings targets. Despite the economic downturn, some 60% of the overall program savings goal of 16,000 MWh is reflected in incentive agreements signed to date by participating customers. Seven sites have completed projects and a savings level equal to 30% of the goal has been installed or is more than 50% complete.

### 2002-2003 CCAP Goals and Results

- 50 customer audits planned (47 completed to date)
- 7 customer sites have completed their projects
- 60% of savings goal accounted for in signed incentive agreements to date

Customer satisfaction with the program has been high, as indicated by the CCAP customer perspectives included below. A recent visit to a customer site by CPUC staff reflected the view of many program participants that their reductions in electric costs would not have been achieved without the customer's participation in CCAP.

*“With CCAP, we have reduced our energy bills for compressed air by more than 50%. Our new compressor is working great. When we had a question about any compressed air issue, the project staff have always gotten us the answer. We were so pleased with the program that we helped recruit another plant to participate.”*

*-- Burt Siegelman, President, TechFlex*

*“The CPUC compressed air program has been a great help to Air Industries. We are under a contract with our main supplier to reduce our production costs on an ongoing basis. The savings of more than \$50,000 that we expect to gain from improving our compressed air system will help us achieve this goal. Quite frankly, without the CPUC program, it is unlikely we would have captured any of these savings in our air system.”*

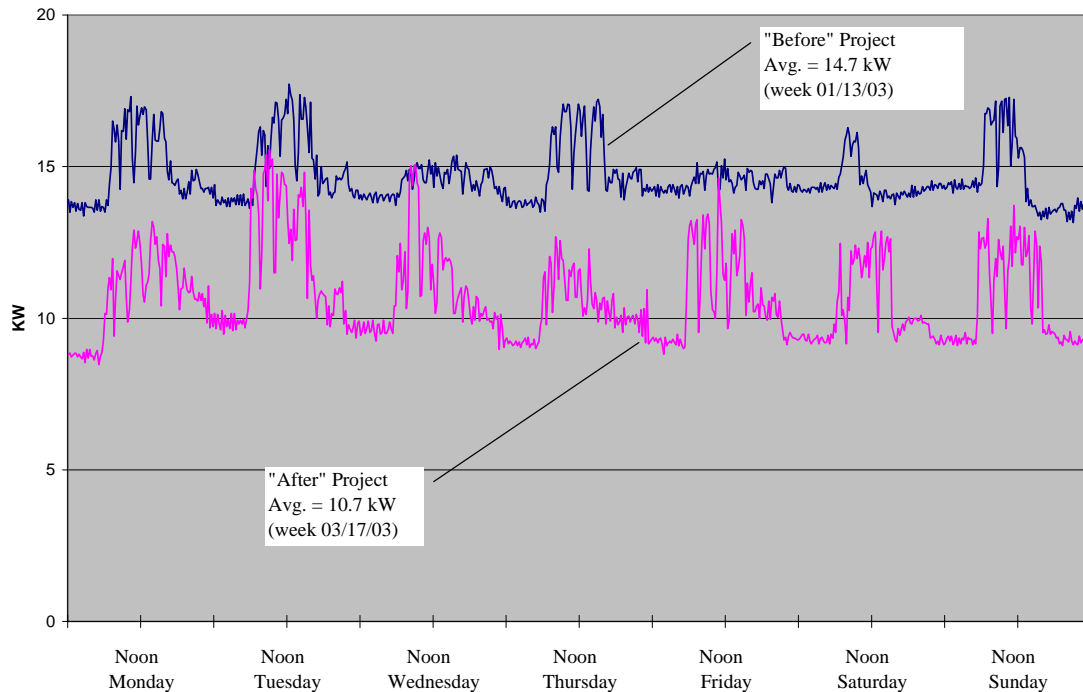
*-- Erik Harsch, Senior Purchaser, Air Industries*

*“The CCAP Program has really performed at our plant in El Monte. By implementing 14 of the audit recommendations, we expect to cut our electric bill by \$400,000 and our electric demand by more than 500 kW. As part of another energy program, the KEMA-XENERGY team helped us capture significant energy cost reductions at our Madera plant served by PG&E. In the Madera project, the savings levels they projected in their audit report were within one percent of the actual savings level achieved.”*

*-- Brad Runda, Energy Manager, Saint-Gobain Container*

A key indicator of CCAP's success (or any program's success) is the percentage of those customers who actually move forward with projects. The goal set for the CCAP in 2003-2004 is 80 percent. Some 30 percent of customers participating in CCAP have already signed incentive agreements, with our expectation of the final number falling in the range of 65-85%.

The bottom-line is energy savings – verifiable energy savings. The graph on the next page displays electric demand for CCAP “Customer #2” over a week's time “before” and “after” CCAP audit recommendations were implemented. The actual savings of 4.0 kW was a little more than the savings of 3.7 kW projected in the original audit report.

**Compressed Air Program Savings: Advanced Sterilization Products**

There are several factors that helped ensure the success of the initial CCAP program. These success factors include:

- **Expertise** — CCAP staff are nationally recognized experts specializing in compressed air systems.
- **Focus** — CCAP only works with compressed air systems.
- **Independence** — CCAP strives to improve and optimize the system rather than selling new equipment or promoting brand names.
- **Comprehensive** — CCAP reviews encompass all components of compressed air systems and supports customers at every step of the process from the initial audit through measure installation and beyond.
- **Productivity Improvements** — CCAP augments energy savings with improvements in air system quality, which can extend equipment life, reduce maintenance, improve product quality, and increase product throughput levels.
- **Vendor Leverage**—CCAP leverages the existing compressed air system distribution chain to qualify customer leads and expedite measure installation.

Selling energy efficiency to industrial customers is very different than any other sector. A common misconception is that industrial customers want programs that provide a comprehensive assessment of all energy saving opportunities. In fact, industrial customers are not very interested in service providers that have general expertise in energy efficiency.

What these customers really want are service providers that understand their business, have expertise in their processes, and provide solutions that are consistent with their business goal and constraints. They want to work with specialist and they want to keep the business relationships as simple as possible. Industrial customers prefer a focused approach.

A focus on compressed air provides the customer with a simple business proposition that is easy to understand. A compressed air focus does not imply that the KEMA-XENERGY team will ignore other potential saving opportunities. In CCAP2, if we encounter other opportunities that are outside of the program scope, we will assist the customer in identifying other programs and will ensure that the lead is transferred in an effective and documented manner.

Many incentive programs provide audit and design services to customers who never implement the proposed measures. A low implementation rate adversely affects the cost-effectiveness of the program. The incentive amount is a big factor in determining implementation rates, but the quality and scope of technical assistance services provided can be far more important. In recent compressed air programs offered by KEMA-XENERGY, approximately two-thirds of participating customers have installed at least a portion of the recommended measures. Factors such as expertise, independence, leveraging existing vendor relationships, and assisting customers with each step of the process have all been instrumental in achieving this high implementation rate. The key factor is to concentrate the entire process from audit to installation in as short a time period as possible.

Collectively, CCAP2 team members have conducted more than 1,200 compressed air system assessments and have managed the installation of more than 600 air system projects. They average over 25 years of

Industrial plant staff generally do not have the time or sense of urgency to improve their compressed air systems. Working to make sure the right customers are recruited for the program and providing unbiased and credible technical assistance judgment throughout the entire process helps remove these barriers. Being able to directly link changes in the air system to improvements in manufacturing productivity and product quality or to eliminating production bottlenecks will help create the needed sense of urgency.

KEMA-XENERGY's success in previous CCAP Programs was based principally on the technical expertise and customer relationship building skills of our lead auditors. It is vital that customers have absolute confidence in the competence of the auditors. This fact takes on even more importance when working with large industrial customers with complex air systems—a key target in the CCAP2 Program. Our team's senior compressed air professionals (Hank Van Ormer and Henry Kemp) are recognized as national experts and major contributors to the Compressed Air Challenge (CAC) Program led by the US DOE. They have led more than 60 training workshops.



industrial compressed air experience and have published numerous guidebooks and articles on opportunities in compressed air system efficiency.

In addition to using national experts, the CCAP2 approach is based on applying an intense level of effort to keep the customer focused on the potential savings projects all the way from the initial audit through project implementation. These customers are not simply provided audit results and then left to pursue the projects on their own. We provide post-audit technical support where we can assist the customer in equipment selection and design assistance if desired by the customer. We also handle all incentive paperwork for the customer and conduct post-implementation measurements to assure the customer that the expected savings were achieved.

Predicting success is always easier than achieving it. Even with incorporating the lessons we have learned from our other highly successful air programs, our approach is essentially the same for the CCAP2. The audit leaders proposed for CCAP2 are the same ones who have the proven track records in the previous programs. This continuity helps reduce any uncertainty in making such predictions of energy savings success.

CCAP and CCAP2 are not the first comprehensive compressed air programs developed by KEMA-XENERGY. The basic program models have been developed over three previous programs, which are listed below and described more fully in Section 7. Each program was successful in exceeding its savings goals.

#### **Previous CCAP-Type Programs**

##### **Central Vermont Public Service (1999-2000)**

- \$158 in program costs per MWh (first year savings)
- Total savings level of 6,200 MWh
- Costs include engineering, customer incentive, and utility staff expense

##### **NYSERDA (1999--2001)**

- \$80 in program costs per MWh (first year savings)
- 4,000 MWh in savings

##### **PG&E Cross-Cutting Demand Reduction (2000-02)**

- Original Goal = 550 kW -- Actual Savings = 1000 kW
- Another 1000 kW added after the formal end of the program

### **1.3 PROGRAM OBJECTIVES**

The program objective for CCAP2 is to meet or exceed the program goals set for the current CCAP. The table below shows some of the key characteristics proposed for each of the individual utility service areas in CCAP2. Electric savings on a net basis for all three utilities total 28,600 MWh and 3.575 MW. The PG&E service area accounts for 45% of the savings; SCE, 45% of the savings; and SDG&E, 10%.

These savings will be captured by implementing cost-cutting recommendations developed in 55 audits. Installation or hardware measures are expected at 33 sites, while operational or

maintenance measures are expected at 44 sites. Average energy savings are 800 MWh per site actually competing some of the audit recommendations. The Program Budget for all three service areas totals \$3.6 M.

Although the number of audits and overall electric savings varies by utility, the key ratios, such as the TRC Ratio or the “close rate” or the portion of completed projects out of the total number of audits, are close to being the same for each utility service area. For example, the TRC Ratio ranges from 3.24 to 3.27.

Program Characteristics	SCE	SDG&E	PG&E	Total
Audits	25	5	25	55
Sites Installing Hardware Measures	15	3	15	33
Close Rates for Hardware Measures	60%	60%	60%	60%
Electric Savings (net)	13,000 MWh	2,600 MWh	17,000 MWh	28,600 MWh
Demand Reduction (net)	1.675 MW	0.325 MW	1.625 MW	3.575 MW
Program Budget	\$1.65 M	\$0.33 M	\$1.65 M	\$3.633 M
TRC Ratio	3.27	3.24	3.27	3.26
Levelized Program Cost	\$21.60 /MWh	\$21.90 /MWh	\$21.60 /MWh	\$21.63 /MWh

While the comprehensive audits of customer air systems is probably the most visible CCAP2 activity, the program includes a full range of activities shown in the following table.

Service	Key Activities	Value
Customer Screening	Telephone Interview Energy Usage Review	<ul style="list-style-type: none"> <li>Ensures that customer time and program resources are not wasted</li> </ul>
Site Audit & Benchmarking	Pre-visit Data Collection 3-5 Day Site Visit Short-term Monitoring Analysis and Report Development	<ul style="list-style-type: none"> <li>Establishes credibility of CCAP2 team</li> <li>Provides customer with assessment of current system and recommendations for energy savings</li> <li>Develops baseline for savings verification</li> </ul>
Post Audit Support	Audit Review & Follow-up Design Assistance Procurement Support Vendor Coordination	<ul style="list-style-type: none"> <li>Reduces customer’s hassle and transaction costs associated with pursuing the project</li> <li>Encourages customer to implement</li> <li>Reduces barriers</li> <li>Increases implementation rate</li> </ul>
Implementation	Technical Advice Construction Management (paid fully by the customer)	<ul style="list-style-type: none"> <li>Assesses implementation issues that arise</li> <li>Provides solutions</li> </ul>
Post-Implementation	Post-Project Inspection Savings Verification Incentive Processing	<ul style="list-style-type: none"> <li>Ensures that savings were achieved</li> <li>Builds customer satisfaction</li> <li>Develops case study for further marketing</li> </ul>

The overall savings goals and costs for the SCE and SDG&E portions of the CCAP2 program are close to those for the original CCAP program, which included only those two service areas. The higher budgets for CCAP2 reflect increases in customer incentives to more closely parallel those offered through the SPC program.

As shown below, figures for the new PG&E addition in CCAP2 are at the same level as the proposed figures for SCE in CCAP2. KEMA-XENERGY gained a great deal of familiarity with the PG&E service area in its highly successful cross-cutting demand program for PG&E listed previously as one of the precursors to CCAP and described more fully in Section 7.

#### Comparison of CCAP vs. CCAP2 Goals

	CCAP (2002-03) SCE & SDG&E	CCAP2 (2004-05)	
		SCE + SDG&E (Only)	PG&E (Only)
Total Electric Savings (net)	16,000 MWh	15,600 MWh	13,000 MWh
Total Demand Savings (net)	2.4 MW	1.95 MW	1.625 MW
Overall Program Budget	\$1,600 K	\$1,982 K	\$1,650 K

One difference in comparing CCAP and CCAP2 is the overall reduction in the relative demand impact – 2.4 MW in CCAP vs. 1.95 MW for in CCAP2 (SCE and SDG&E). In the original formulation for CCAP a goal was set to provide 70% of the CCAP audits to customers with less than 800 kW in an effort to extend the CCAP program to smaller industrial customers.

Generally, smaller customers operate fewer hours per week than large ones and an average of 6,667 operating hours annually was used for the mix of customers projected for CCAP. CCAP2 will not be limited by customer size quotas, and as a result, 8000 hours has been incorporated at as the assumed number of operating hours for CCAP2 customers. This change means CCAP2 will register a smaller demand reduction than CCAP for the same level of energy savings.

There are additionally even more important changes being incorporated in CCAP2 that do not directly show up in the numerical comparison. First, the customer incentives are being reconfigured to roughly parallel the 8 cents per kWh offered through the SPC program rather than the 2 cents per kWh saved incorporated in CCAP. This means that although the overall budgets have remained the same between CCAP and CCAP2, the share of the overall budget in CCAP2 has gone up for incentives and down for technical assistance provided by KEMA-XENERGY.

The second change centers on reducing the time period between conducting the customer audit and receiving a signed incentive. In CCAP, this time period was measured in terms of 4-8 months. CCAP2 seeks to reduce this time period to an average of one month. This will also help control program costs by eliminating the need to constantly re-contact customers to obtain the agreement, and ultimately, implementation of the project.

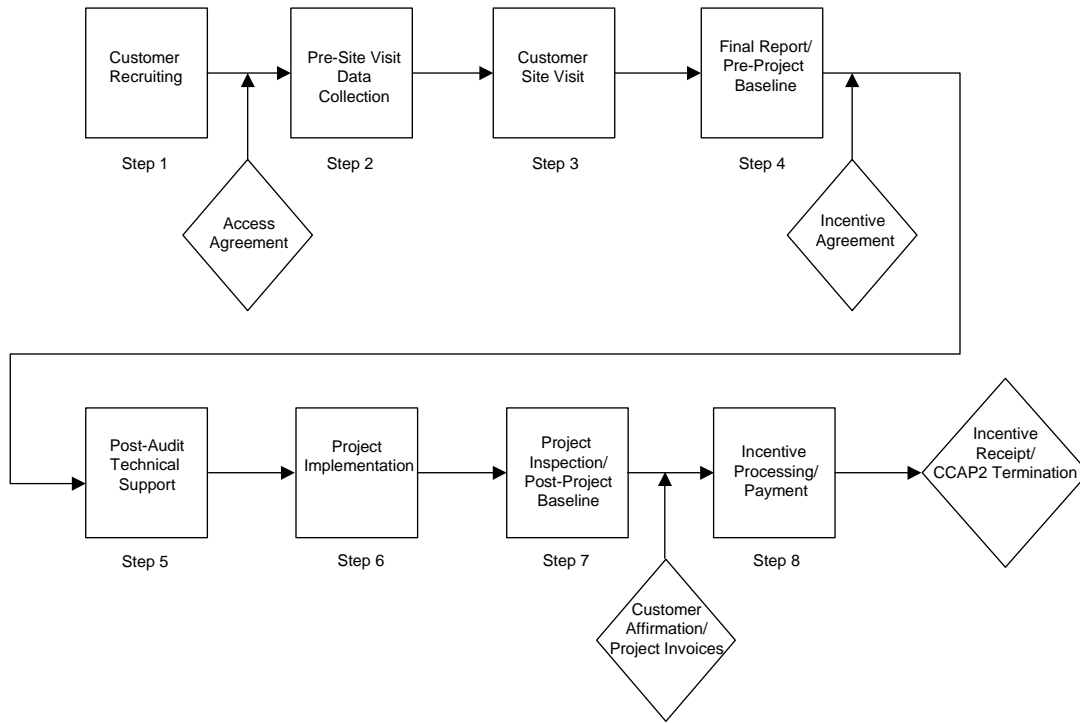
In summary CCAP2 takes most of the pieces of the successful CCAP being implemented in 2002-03 and doubles it by adding PG&E and adds some important changes regarding incentive structure and getting customers to move more quickly. The following table lists the key CPUC selection criteria along with how CCAP2 meets those criteria.

Selection Criteria	CCAP2 Program Feature
Cost-Effectiveness	TRC Ratio = 3.26 TRC levelized program cost = \$21.63 per MWh
Long-term Annual Energy Savings	28,600 MWh (net) for all three utilities Many system improvements reflect significant long-term changes – more efficient equipment, re-piping, control systems, etc. Importance of relationship management skills
Electric Peak Demand Savings	3.575 MW (net) for all three utilities Based on customer operating hours = 8,000 annually
Equity	No hard-to-reach targets, though some sites are in rural areas
Ability to Overcome Market Barriers	Project close rates averaging over 60% in previous air programs Importance of auditor credibility and relationship mgmt skills Use of trade allies for customer leads and fast installations
Innovation	Description of productivity impacts of air system improvements Development of standardized report template to expedite analysis and report preparation Reduce elapsed time between audit and signed incentive agreement to one month
Coordination With Program Run by Other Entities	Formal process for directing non-air leads to appropriate programs and contacts Modify CCAP2 incentive to parallel SPC incentive structure CCAP2 staff heavily involved with DOE CAC activities Tech transfer activities to spur CPUC support
Secondary Criterion: (1) Program Design (2) Budget (3) Program Clarity (4) Program Experience (5) Constrained Trans	Four previous air programs, including CCAP (2002-03) Four previous air programs, including CCAP (2002-03) Quantified program objectives Four previous air programs, including CCAP (2002-03) Some sites may be in transmission-constrained areas

### 2.1 PROGRAM IMPLEMENTATION

The primary steps in implementing the CCAP2 are depicted below. Included on the flowchart are a set of diamond-shaped figures, which represent those points where the customer signs an agreement or memorandum-of-understanding (MOU).

**Figure 1. Program Implementation Steps**



Although the steps themselves are rather straightforward, the CCAP2 approach differs from other approaches in terms of the relative emphasis placed on the various steps.

The sequence and content of steps proposed for CCAP2 are essentially the same as what has been used in CCAP and by KEMA-XENERGY in its other compressed air programs. This continuity helps avoid incurring costs to develop a new program design and provides some degree of assurance that the model works and generates the needed savings levels. Each step is briefly described in the pages that follow.

### *Step #1—Customer Recruiting*

We place great emphasis on this step. Having a good pool of viable customer candidates to participate in a program can probably double a program's "close rate" – i.e., the percentage of audits that result in at least some of the audit recommendations being implemented by customers. The close rate was 80 percent for the PG&E program and will exceed 65 percent for CCAP -- both of which are much higher than industry norms for any DSM program other than a direct install program.

Prior to the compressed air programs, KEMA-XENERGY has applied a "20 QUESTIONS"-style approach to rate and qualify potential candidates for energy projects. Experience has whittled this list of 20 questions down to two:

1. Does this customer have potential energy savings projects?
2. Will this customer move forward quickly to implement reasonable energy savings recommendations?

The key then becomes how to determine the answers to those questions quickly and cost-effectively. In KEMA-XENERGY's two most recent programs in California (for the CPUC and for PG&E), the lead list was developed by working with compressed air system vendors and other third parties, which contact the individual plants in the area on a regular basis and which are the most aware of potential program candidates.

Our trade allies have a number of potential candidates who were not ready in time to participate in CCAP before all the audit slots were filled, but who would represent the first participants in CCAP2. As a point of reference, 10 of the CCAP2 Program's 55 audit targets have already been pinpointed on a preliminary basis. The bulk of the customer-recruiting phase, including the renewal of working relationships with the local vendors, will be completed within the first month of the project.

A description of the program goes out with every contact. Such a description should be brief and factual; it does not need to be fancy, because we are recruiting out of pool of candidates that have already been screened. Refer to the sample program description used in CCAP, which is shown on the next page.

### *Step #2—Pre-visit Data Collection*

This is a step that CCAP2 probably de-emphasizes relative to other approaches. Frankly, getting extensive data from a customer who really does not know the answers or does not have the time can be a major challenge, and the data are often incomplete and incorrect anyway. CCAP2 collects a minimum level of data from the customer before the site visit -- basically a list of equipment and models, recent electric rate bills, and a list of air system problems, bottlenecks, or air quality concerns.

During this pre-audit time period, the customer receives a program description, an application to participate in CCAP2 and an access agreement. At this time, the customer signs an access

agreement that delineates the responsibilities of the customer and of KEMA-XENERGY as part of the CCAP2 program. The CCAP application and access agreements are depicted below.

### CUSTOMER SITE ACCESS AGREEMENT

This Agreement sets forth the understanding between XENERGY and \_\_\_\_\_ ("Customer") located at \_\_\_\_\_ ("Site"), regarding a compressed air system evaluation ("Review") at Customer Site pursuant to the Comprehensive Compressed Air Program ("CCAP"). A description of CCAP is attached. The goal of CCAP is to help Customers identify and implement projects that will reduce energy costs and will improve compressed air quality and productivity.

XENERGY and Customer agree that:

1. XENERGY will \_\_\_\_\_ to implement \_\_\_\_\_ reasonable \_\_\_\_\_ vendor or ec
2. Customer will \_\_\_\_\_ bills; data on \_\_\_\_\_ quality and p \_\_\_\_\_ improvement
3. Conduct of t \_\_\_\_\_ and future a \_\_\_\_\_ standard pro \_\_\_\_\_ of Customer \_\_\_\_\_ measurement
4. Should XEN \_\_\_\_\_ repair the m \_\_\_\_\_ Customer w \_\_\_\_\_ XENERGY l \_\_\_\_\_ location and \_\_\_\_\_ copy to XEN
5. Customer ac \_\_\_\_\_ potentially a \_\_\_\_\_ incentives o \_\_\_\_\_ program and \_\_\_\_\_ for compress
6. Customer w \_\_\_\_\_ consumption \_\_\_\_\_ estimates in \_\_\_\_\_ person resp

AGREED AND ACC \_\_\_\_\_

CUSTOMER  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_  
10/31/02

### COMPRESSED AIR AUDITS: APPLICATION FORM

Thank you for your interest in applying to XENERGY's Comprehensive Compressed Air Program (CCAP) to help industrial customers in Southern California improve their compressed air systems and reduce electric bills. In order to evaluate your application, we need the following:

1. A signed copy of the attached CCAP "Customer Site Access Agreement"
2. Copies of the most recent 12 months of electric bills
3. Completion of the equipment and air system survey below.

Once we have received your information and your application has been approved, we will schedule a convenient time for the site audit. CCAP Program questions can be directed to Hank van Ormer at (614) 580-2711, Bill Phillips at (410) 533-8876, or John Skelton at (614) 844-6936 [jskelton@xenergy.com].

Company Name \_\_\_\_\_  
City/State/Zip \_\_\_\_\_  
Contact \_\_\_\_\_  
Contact \_\_\_\_\_

Air System Operation \_\_\_\_\_  
Plant Products \_\_\_\_\_  
Planned Changes to P \_\_\_\_\_  
Planned Changes to A \_\_\_\_\_

Make	

**SYSTEM TOP**

Dryer Performance/Ma \_\_\_\_\_  
Compressor Performa \_\_\_\_\_  
Air System Reliability \_\_\_\_\_  
Air System Capacity \_\_\_\_\_  
Air System Pressure \_\_\_\_\_  
Oil or Water in Air Sys \_\_\_\_\_  
Other Issues or Proble \_\_\_\_\_

10/31/02

### COMPRESSED AIR AUDITS: PROGRAM INFORMATION

Xenergy is under contract with the California Public Utilities Commission (CPUC) to help industrial customers in Southern California improve their compressed air systems and reduce electric bills. The program provides a number of specific benefits to participants at no cost other than their commitment to move quickly in implementing cost-effective projects that are identified. Activities provided as part of compressed air program include:

1. Air system audit that will identify specific projects to reduce electric use and improve air quality and quantifies costs/savings associated with such projects
2. Survey of air system leaks
3. Post-audit customer assistance to provide additional project specification and coordination to help implement identified projects
4. Cash incentive equal to the installed cost of a project up to 2 cents per net kWh saved or about \$20K for a project reducing compressor horsepower needs by 200 hp.

All customers served by SCE or SDG&E electric companies are eligible to participate. Our program includes a total of 50 audits with a requirement that at least 80% of those audits result in customers implementing audit recommendations. About 70% of the audits have been earmarked for customers with less than 800 kW in total electric demand.

Audits need to be on the schedule by no later than September 2003. Implementation of recommended projects should be completed by December 2003.

Executive summaries of audit results will be provided before the end of the audit site visit. The full audit report will follow later. Customers should expect to move forward with implementation (e.g., ordering equipment) within a month or so of receiving the final report. If this timetable is too quick, then customers should pass on participating in this particular program.

Based on our previous air programs in California, customers will reduce electric use by at least 30% and realize significant improvements in the quality of their air system. Pay back periods for recommended projects have averaged less than 15 months. Over 80% of participating customers have implemented at least a portion of the recommended projects.

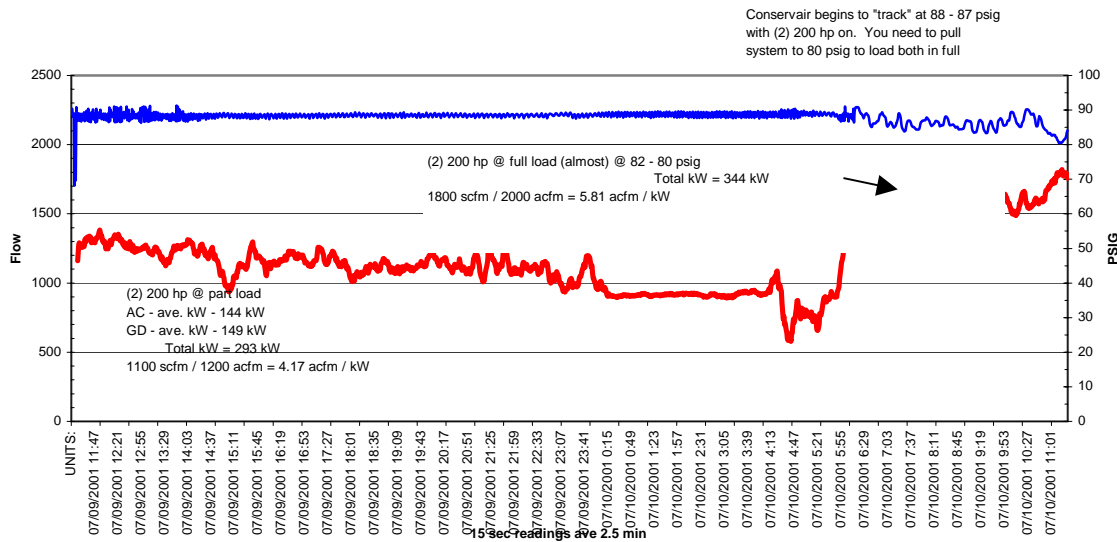
Program participants are not obligated to use any particular vendor to supply equipment or install projects, as long as the customer's preferred equipment brand or vendor can meet the requirements and performance specifications of the recommended projects.

Program questions can be directed to Hank van Ormer at (614) 580-2711, Bill Phillips at (410) 533-8876, or John Skelton at (614) 844-6936 [jskelton@xenergy.com].

01/01/03 —XENERGY.



At times, CCAP2 will send a technical representative to the plant prior to the site visit by the senior audit team in order to meter the electric demand or air flows in the system, to make drawings of the system, and to identify improvements in the use of compressed air. A sample set of metered data for pressure (psig) and air flow (cfm) is provided below.



### *Step #3 – Customer Site Visit(s)*

The customer site visit is an intense 3 to 5 days with a goal of not only evaluating the customer’s air system but also cementing the new business relationship with the customer. The lead auditor has about the first four hours on the site to establish technical credibility with the customer. The audit starts with a tour of the facility and the various major system components. Measurement activities are initiated based on a preliminary measurement and modified based on what is actually occurring in the plant. Data characterizing both the major pieces of equipment in the air system and the data from the measurement activity is required for the plant assessment.

During an audit week, auditors literally work around the clock so that by the end of the site visit, the auditor can conduct a briefing with the customer to list the major recommendations and estimated savings levels and payback periods. Compressing the entire cycle from initial customer contact to customer implementation can also significantly enhance the “close rate” on audit recommendations.

### *Step #4 – Final Audit Report/Pre-project Baseline*

A sample Executive Summary from one of the CCAP audits is shown on the next page. The recommendations reflect 16 different measures totaling 521 kW in savings. Note that the customer is implementing 14 of those recommendations.



- Stop flow of low-pressure air for conduction air
- Replace air vibrators with electric
- Install appropriate flow regulator; hold system pressure to steady 85 psig.
- Supply air broom air amplifiers where practical.
- Fluctuate bearing cooling air to Epberg, if appropriate.

**OTHER INVESTIGATIONS OR LONG-TERM STRATEGIES – PHASE 2**

After the basic system would be in order. The quality projects include

- Continue the
- Review the p
- Review any p high rate flow
- Review regula
- Continue to re and/or change
- Review air-op units—for exact operated uses

PROJECT	SAVINGS PROFILE	ENERGY AND OTHER SAVINGS			TOTAL PROJECT COST (\$)
		AVG kW	kWh	SAVINGS (\$)	
13. Eliminate high-pressure blow air for apparent bearing cooling – EP	55 cfm	11.6	101,966	\$9,075 /yr	-0-
14. Low-pressure air: Stop flowing compressed air for continuation along with fan air; fix or replace fan	100 cfm	11.8	103,370	\$9,200 /yr	-0-
15. Replace venturi vacuum generator with central vacuum system	89 cfm	14.8	129,966	\$11,567	\$21,082
16. Replace two air vibrators with electric	20 cfm	4.0	35,326	3,144	\$400
<b>TOTAL</b>	HP – 1,874 cfm LP – 764 cfm HP – 76.3 kW	521.3	4,566,300	\$406,401	\$94,162

Recovery translating unloading accomplish #10, #11

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**ABC COMPANY  
Compressed Air System Review: Executive Summary**

ABC Company now spends \$1,695,950 annually on energy to operate the compressed air system at Anywhere, USA. This figure will increase as electric rates are raised from their current average of 8.9 cents per kWh. The set of projects recommended below could reduce these energy costs by \$406,401 or 24%. Estimated costs for completing the projects total \$94,162, which represents a simple payback of four months.

PROJECT	SAVINGS PROFILE	ENERGY AND OTHER SAVINGS			TOTAL PROJECT COST (\$)
		AVG kW	kWh	SAVINGS (\$)	
<b>AIR COMPRESSOR SUPPLY</b>					
1. Run all low pressure compressors as required to supply all low pressure demand	23 kW	23	201,480	\$17,932 /yr	\$0
2. Repair blow off valve and control on low pressure Unit #2 centrifugal	614 cfm	72.4	634,697	\$56,488 /yr	\$3500
<b>AIR TREATMENT</b>					
3. Shut off PR 300 and Pioneer dryer in supply	2.88 kW	2.9	25,146	\$2,238 /yr	\$0
4. Replace timer-activated drains with level-activated drains	6.2 cfm	1.3	11,123	\$990 /yr	\$800
<b>OTHER ENERGY CONSERVATION EQUIPMENT</b>					
5. Replace existing motors with high-efficiency units on Unit #10 Atlas Copco – current ME = .80	35.2 kW	35.2	308,352	\$27,443 /yr	\$18,000
6. Replace existing motors with high-efficiency units on Unit #11 Atlas Copco – current ME = .90	15.2 kW	15.2	133,152	\$11,850 /yr	\$22,000
<b>DEMAND-SIDE SYSTEM</b>					
7. Install pressure flow regulators in high-pressure system—hold systems at 85 psig	450 cfm	95.2	834,269	\$74,250 /yr	\$15,000
8. Implement an ongoing leak management program. Estimated leak total 500 cfm—260 cfm tagged already	434-446 cfm High Pressure	94.4	826,854	\$73,590 /yr	\$9,800
	50 cfm Low Pressure	5.9	51,685	\$4,600 /yr	
9. Various open blow replacements – High pressure: Replace squeezer (12) blow-off devices with high-thrust jet wedge air amplifier	346 cfm	73.2	641,461	\$57,090 /yr	\$1,500
10. Divert non-spec product with mechanical rather than blow off at 24 (approx) locations	4 cfm	0.8	7,416	\$660 /yr	\$480
11. If "air brooms" must be used, install air amplifier based on 10% utilization with 50 "air brooms"	100 cfm	21.2	185,393	\$16,500 /yr	\$1,000
12. Replace existing air lines to feeder air cylinder with new lines w/o holes	180 cfm	38.1	333,707	\$29,700 /yr	\$600

Most of the analytical work associated with the audit is completed during the site visit. The week directly following the site visit is used to tie up loose ends, gather vendor quotes, and finalize estimates. The report is in the form of a three-ring notebook that includes the main report, air system measurement graphs, the completed plant survey form or data collection sheets, spec sheets for the customer's current equipment, vendor quotes and proposed equipment brochures, and journal articles and write-ups pertinent to the customer's system or operating problems.

#### ***Step #5 – Post-audit Technical Support***

This is another step in which CCAP2 places a greater emphasis than other approaches. The goal is to close the project as quickly as possible after the site visit before the customer is distracted by other issues in the plant. A key in achieving this goal is to provide whatever information the customer requires in moving forward. The customer should be contacted at least once a week until the project is firmly committed and ultimately implemented with savings verified.

Evidence of such commitment is acquired through the signing of the Incentive Agreement. A sample incentive package, including a cover letter, the agreement, and a spreadsheet showing the incentive calculation is provided on the next page.

As part of post audit technical support, CCAP2 will also assist the customer with project design by developing a schematic of the proposed changes, specifying pipe sizes, and sizing equipment. We also assist with procurement activities such as vendor coordination, bid review, and assessment of the advantages of different equipment and brands.

#### ***Step #6 – Project Implementation***

CCAP's role in this step is primarily that of being a customer's advocate. Because the vendor knows that CCAP2 is involved, the vendor is highly motivated to implement the project in an orderly fashion. It is an unfortunate reality that over 35% of all compressed air system installations have a major flaw in the installation – stories like dryers being installed backwards or new piping so small in diameter that the new system is less efficient than the previous system the customer paid to replace. Vendors know that our post implementation inspection will help uncover installation flaws, and thus they focus on minimizing these types of problems. If problems occur during installation, CCAP2 staff can be a useful resource to identify alternatives.

#### ***Step #7—Project Inspection/Post-project Baseline***

The purpose of this step is to ensure that the projects associated with earning the incentive are completed and to collect the necessary data to establish the post-project baseline of energy use for the new system. Prior to the initiation of this step, the customer confirms that each of the projects has been completed and forwards vendor invoices associated with such projects.

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**CCAP INCENTIVE AGREEMENT**

This Agreement sets forth the understanding between KEMA-XENERGY and ABC Company ("Customer") located at 123 Main Street, Anywhere, USA, 12345 ("Premises"), regarding a compressed air review and incentive plan ("Project Plan") in conjunction with the Comprehensive Compressed Air Program ("CCAP"). The purpose of CCAP is to help industrial customers reduce power costs and improve energy efficiency in their compressed air systems.

KEMA

1.



2.

Friday, May 30, 2003

3.

Mr. John Doe  
 ABC Company  
 123 Main Street  
 Anywhere, USA 12345

4.

Dear Mr. Doe:

Thank you for your participation in the Comprehensive Compressed Air Program sponsored through the California Public Utilities Commission. The program helps industrial customers reduce power costs and improve energy efficiency in their compressed air systems.

5.

This letter outlines the next steps in the program for you to consider. If you want to move ahead and implement the audit recommendations, then review and sign the attached Incentive Agreement.

6.

The Agreement provides an incentive commitment for the entire set of audit recommendations. If you want to modify or complete only a portion of the audit recommendations, then please contact me directly and we can revise the Incentive Agreement.

The deadline for signing the Incentive Agreement is July 1, 2003. Signing by this date ensures your access to the incentive funds. Incentive fund availability will be decided on a case-by-case basis for agreements received after the deadline. A pre-addressed and stamped envelope is provided for your convenience. Agreements may be faxed to me, as well.

AGREEMENT

CUSTOMER

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

05/22

One of our auditors will be contacting you shortly to answer questions about the audit recommendations, the CCAP program, or anything else you might need.

Thank you for your interest.

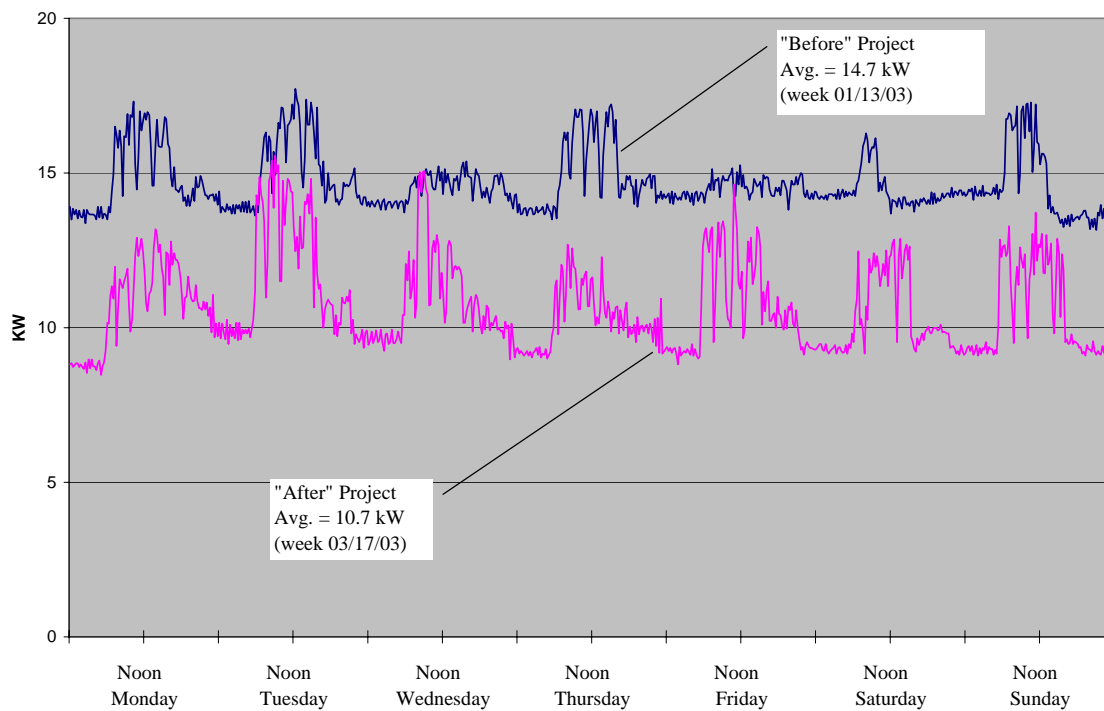
Sincerely yours,

John C. Skelton  
 CCAP Program Manager

CCAP produces a savings verification report with a graphic depicting electric demand of the air system “before” and “after” implementing the savings measures. These reports will summarize what measures were installed and document any differences from what was recommended. If necessary, variances between metered results and engineering estimates of savings are assessed. When warranted, new savings calculations are produced. The incentive amount may be adjusted if the customer or installing contractor did not follow the terms in the incentive agreement.

Provided below is an example savings initiative graphic showing the “pre-project” and “post-project” electric use baselines.

**Compressed Air Program Savings: Advanced Sterilization Products**



### *Step #8—Incentive Processing*

This final step is often the easiest. KEMA-XENERGY sometimes has the coordinating vendor who provided the initial lead deliver the incentive check. The step concludes with the customer confirming its receipt of the check and the termination of the project and any additional CCAP2 responsibilities.

## **2.2 MARKETING PLAN**

Compressed air systems present significant opportunities for energy savings in the industrial sector. Based on the more than 200 compressed air audits we have conducted over the last five years, audit recommendations generally produce a savings level of 20 to 40% of the total electricity used to produce compressed air, often more in smaller plants. Compressed air represents 15 to 30% of the total electric bill for many plants we have audited.

A few utility programs and groups such as the Compressed Air Challenge (CAC) led by US DOE have been very active and successful in generating awareness about compressed air opportunities and providing training and tools to help capture them. The difficulty that remains is getting customers to commit and install projects.

### *Market Business*

Discussed below are a number of market barriers that we have encountered in marketing compressed air projects, and some of the approaches we have used to overcome such barriers. Our project close rates (around 60% in Vermont and NYSERDA, 80% for PG&E, and 65-85% in CCAP) demonstrate that these barriers can be overcome.

- **“Make it easy.”** The major market barrier is getting the customer to focus and act on any issue related to energy other than energy availability. Marketing strategies will likely fail if they require an upfront payment, signatures, or much effort from the customer before the audit. Production, not energy savings, is their chief concern. CCAP2 provides the compressed air audits at no cost to the customer and counts on a good customer screening process to prevent customers from wasting program resources. We “get in the door” of the right customer and count on the technical expertise and customer relationship management skills of our lead auditors to obtain buy-in quickly.
- **“Make it quick.”** Even a week’s delay after the initial customer contact can seriously erode the chances for closing a project. We produce an executive summary of what will be the final report before the auditor even leaves the customer’s facility. This collaborative process produces both a clear understanding of customer needs and a commitment from the customer to move forward with the proposed projects. As part of the NYSERDA Program, KEMA-XENERGY developed an automated report template that greatly expedites preparation of audit reports, so that the auditor reaches this “commitment” stage by the last day of the site visit.

- **“Make it relevant.”** Identifying and quantifying productivity benefits associated with air system improvements can galvanize the interest of the entire customer staff. Having compressed air systems directly impact production issues encourages customers to prioritize air system improvements.
- **“Make it right.”** More than half of the typical customer contacts don’t really understand their compressed air systems. If the lead auditor cannot establish technical credibility and a “partner” type relationship with the customer contact by lunch of the first day, the project will most often fail to close. Key approaches for helping this happen include:
  1. Recruit lead auditors knowledgeable and objective about compressed air systems
  2. Provide a clear snapshot of a customer’s air system, its operating costs, and how the system will change with the recommended improvements
  3. Incorporate the right level of measurement to fit the specific situation of the customer and characteristics of the air system and to provide tangible evidence to support the auditor’s recommendations – our measurement activities range from a minimum of electric demand and pressure readings over short periods of time to trended measurements of electric demand and/or air flow over a 48-hour or 7-day period
  4. Provide a comprehensive report of the audit findings that the customer contact can use to gain management approval and guide project design and installation.

### *Marketing Plan*

The Customer Recruiting process is described in the Program Implementation write-up (Section 2-1). Essentially, KEMA-XENERGY employs a highly targeted direct contact marketing approach. KEMA-XENERGY works closely with local compressed air system vendors and other third parties to identify customers with energy savings opportunities in their air systems and a commitment to implement any reasonable audit recommendations to improve their systems.

One of the final activities of the CCAP Program will be to hold a workshop in the PG&E, SCE and SDG&E service areas to communicate results of CCAP and to generate additional interest in CCAP2. Trade associates and utility contacts will be solicited to provide widespread publicity for the workshops.

The CCAP2 Program entails audits at 55 different industrial sites. The number of audits associated with KEMA-XENERGY’s previous CCAP-type programs has ranged from 10 to 50 audits. None of those programs has ever had difficulty in recruiting interested customer participants. Because KEMA-XENERGY’s close rate in getting customers to implement at least a portion of the audit recommendations is approaching 80 percent, KEMA-XENERGY is not only getting the quantity of customers needed for its programs, but also the quality.

At present, 10 of the 55 intended audit sites needed for the CCAP2 program have already been targeted on a preliminary basis.

The program description displayed in the Program Implementation write-up (Section 2-1) is the only “marketing material” plan. Budget estimates for outreach costs in Section 7 include only labor and total \$5K for SCE, \$1K for SDG&E, and \$5K for PG&E.

### *Market Coordination*

Market coordination holds a great deal of potential for both CCAP2 and other programs operating within the same customer segment. The first level of coordination is to exchange program description materials so that a more clear understanding can be reached in determining what programs make the most sense for a customer in a given situation. CCAP2 staff will be happy to pass out information about other programs, when the staff are visiting customer sites. In the same vein, we would be happy for the staff of other programs to serve as an additional channel for our program information.

Another area of coordination involves handing off of specific project leads. It is not unrealistic to expect that CCAP2 staff could encounter significant leads for projects or measures outside the compressed air arena. It would be our intent to establish some set of protocols where these qualified leads are handed off and picked up in a systematic fashion by the appropriate program.

## **2.3 CUSTOMER ENROLLMENT**

Customer enrollment in CCAP2 is straightforward. The customer is accepted into the program once the application form and access agreement are signed, 12 months of electric bills have been forwarded, and the key customer contact has been interviewed by CCAP2 staff.

## **2.4 MATERIALS**

There are no direct materials associated with this project. All standard office-related materials are included in the overhead fee structure.

## **2.5 PAYMENT OF INCENTIVES**

Payment of incentives is Step #8 in the CCAP2 Program Implementation. Incentives are paid after the incentive agreement is signed, the proposed measures have been installed, the installation has been inspected, and the customer has affirmed completion of the project and submitted invoices associated with project implementation.

## **2.6 STAFF AND SUBCONTRACTOR RESPONSIBILITIES**

The CCAP Program brings together the same team that has been successful in completing the four previous CCAP-type programs – specifically CPUC, PG&E, NYSERDA, and Central Vermont. Each of those programs has met or exceeded (or is on track to exceed) projected savings goals by a significant margin. This project team continuity helps to develop a list of “lessons learned”, minimizes staff training, controls costs, and provides greater certainty in meeting savings goals.



A table summarizing the qualifications of each of the key staff is provided below.

The CCAP2 will be managed by John Skelton. John has over 25 years experience designing and implementing technical services for industrial customers. During the past six years he has managed the other four CCAP-type compressed programs highlighted in this proposal.

Hank van Ormer and Henry Kemp will serve as senior auditors for the CCAP Program. They are universally recognized as leading compressed air experts in the country. They have led most of the audits in the previous four programs and have accounted for more than 600 plant audits, 400 air system installations, and 60 technical training workshops. They are advisors and certified instructors in DOE's Compressed Air Challenge (CAC) Program. Corporate clients include General Motors, Saint-Gobain, Alcoa, and Nestle.

Ron Koch, PE, JD, will continue his role from CCAP as information director and contract manager. Additional auditing staff include Scott and Don van Ormer, Dave Beary, and Bill Phillips. At least one of them has been involved in every audit from the four previous CCAP-type Programs.

All of these staff are available over the 24-month period to work on the CPUC. Because over 55 audits are expected to be completed during this period, it is difficult to project specific manpower loadings. However, it is also expected that these key staff will average 50-70% of their time (aggregated across all three utility service areas) during the critical audit phase of this program, which occurs from 2Q-2004 through 2Q-2005.

Rich Barnes will serve as KEMA-XENERGY's officer-in-charge for the CCAP Program. Organizationally, all the KEMA-XENERGY staff working on the CCAP Program belong to KEMA-XENERGY's Implementation Division, which is managed by Rich.

<p><b>Hank van Ormer</b> 30+ years as a compressed air professional 300+ industrial plant audits CAC* technical advisor and certified Level I/II instructor</p>	<p><b>Henry Kemp</b> 30+ years as a compressed air professional 100+ industrial plant audits CAC technical advisor and certified Level I/II instructor</p>
<p><b>Dave Beary</b> 30+ years as a compressed air professional 50+ industrial plant audits CAC Level I/II training</p>	<p><b>Bill Phillips</b> 30+ years as a compressed air professional 100+ industrial plant audits 300+ air system installations</p>
<p><b>Scott van Ormer</b> 15 years as a compressed air professional 30+ industrial plant audits CAC Level I/II and AirMaster training</p>	<p><b>Don van Ormer</b> 5 years as a compressed air professional 30+ industrial plant audits CAC Level I/II and AirMaster training</p>
<p><b>John Skelton</b> CCAP, PG&amp;E, NYSERDA, and CVPS Project Manager 25 years in designing industrial programs KEMA-XENERGY Proj Mgr for previous CASE programs</p>	<p><b>Ron Koch</b> CEM, PE, JD KEMA-XENERGY support for previous CASE programs CAC Level I training</p>

\*CAC is the acronym for the "Compressed Air Challenge" program funded through the U.S. Department of Energy.



## 2.7 WORK PLAN AND TIMELINE FOR PROGRAM IMPLEMENTATION

Listed below are the timelines for program implementation for CCAP2 programs in all three utility service areas. The majority of the outreach activities are completed in 1Q-2004. There are a number of companies already interested in getting CCAP2 audits. Therefore, there are plans to complete audits and leak surveys in PG&E and SCE service territories in 1Q-2004.

In each of the utility service areas, design assistance is scheduled to follow the audit by two quarters, with project coordination and incentive calculation occurring in the following quarter, and site inspection occurring two quarters later. It was found in CCAP, that while many companies were willing to commit to completing their project, many companies had to delay the start of installation subject to funding availability during the current economic downturn.

### Timeline for Program Implementation: SCE and PG&E Service Areas (Accomplishments per Service Area)

CCAP2 Activity	2004				2005				Total
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	
Outreach	*								
Audits	2	5	5	5	5	3			25
Leak Survey	2	5	5	5	5	3			25
Design Assistance			2	4	4	4	1		15
Project Coordination				2	4	4	4	1	15
Incentive Calculation				3	5	5	5	2	20
Site Inspection				1		2	10	7	20
Incentive Processing							10	20	20
Evaluation, Measurement, and Verification	Bid	Plan		Test				Final	

**Timeline for Program Implementation: SDG&E Service Area**

CCAP2 Activity	2004				2005				Total
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	
Outreach	*								
Audits			2	3					5
Leak Survey			2	3					5
Design Assistance					2	1			3
Project Coordination						2	1		3
Incentive Calculation						2	2		4
Site Inspection							2	2	4
Incentive Processing								4	4
Evaluation, Measurement, and Verification	Bid	Plan						Final	

### **3.1 CUSTOMER DESCRIPTION**

Large and medium industrial customers are the primary targets of the CCAP2 program. There are no specific industry segments that are being targeted, but the mix of customers participating in the CCAP2 program will generally parallel the industry mix of the service area. Opportunities for compressed air system improvement are typically found in every industry segment and in every customer size that uses compressed air.

The primary market actors targeted in the CCAP2 program are plant engineers or maintenance managers. Initial customer targeting will be assisted by local air service vendors. Corporate management may be targeted for certain plants to help recruit customers or to obtain implementation commitments.

There are no hard-to-reach customer categories that are targeted within this program, although some of the industrial sites may be located in rural areas.

### **3.2 CUSTOMER ELIGIBILITY**

Large and medium industrial customers will be targeted for this program, because of the need to average 1,000 MWh in savings per site to meet the CCAP2 program metrics. KEMA-XENERGY will work with other industrial customers, even though their ultimate savings levels may not contribute significantly to the overall CCAP2 program savings goal, as long as they have a committed interest to improving their air system.

KEMA-XENERGY reserves the right to pre-qualify customers before committing resources associated with performing an audit. KEMA-XENERGY also reserves the right to limit the level of customer incentives to reflect an appropriate payback period for the customer – e.g., customer incentives cannot exceed the cost of the measure.

Because opportunities for reducing energy use in compressed air systems are found in every industry, the key is to get to the “right” customer quickly -- i.e., customers who:

- Have good potential savings projects
- Are willing to move forward and pay for measures once reasonable ones have been identified.

In the previous CCAP Programs, we have successfully used service vendors, utility reps, and trade organizations to identify and qualify these customers. These groups are the “trade allies” of the audit professional and are in the best position to know the status of individual customers.

### 3.3 CUSTOMER COMPLAINT RESOLUTION

Dispute resolution between KEMA-XENERGY and participating customers will be handled at four levels listed below:

1. **Prevention** – The two CCAP2 customer M-O-Us (Access Agreement and Incentive Agreement) provide a clear understanding of the role and responsibilities of KEMA-XENERGY and the customer. A Statement of CCAP2 Program and audit purpose and scope is included in the CCAP2 Program Description, which is provided to the customer at the time of its application.
2. **Discussion** – All disagreements should be resolved at the lowest levels possible within each organization. In this Program, there is a hierarchy of three tiers: KEMA-XENERGY staff member/Customer staff member at the source of the dispute; KEMA-XENERGY Program Manager (John Skelton)/Customer Project Leader; and KEMA-XENERGY Program Officer (Rich Barnes)/Customer Management.
3. **Mediation** – It is standard KEMA-XENERGY contractual policy to take any unresolved disputes to binding arbitration.
4. **Protection** – KEMA-XENERGY carries standard policies for both General Liability Insurance and Professional Liability Insurance.

There have been no complaint resolution activities to date in the current CCAP program.

### 3.4 GEOGRAPHIC AREA

The CCAP2 program is being offered on a statewide basis to include the SCE, SDG&E, and PG&E service areas. Plant audit locations may or may not include sites in the transmission-constrained area as identified by the California Independent System Operator.

# 4

## MEASURE AND ACTIVITY DESCRIPTIONS

### 4.1 ENERGY SAVINGS ASSUMPTIONS

Audit recommendations associated with a comprehensive review of a compressed air system are highly specific or customized to the individual site. Such reviews incorporate assessments of both the demand-side (i.e., the use of compressed air) and supply-side (i.e., the generation of compressed air), as well as their interaction.

A typical air system audit might include 5-10 specific recommendations to reduce energy costs of the air system or otherwise improve air system quality or productivity. For the most part, recommended measures are drawn from the pool of 39 measures included on the next page.

Electric savings in compressed air systems are usually indicated by a lower electric usage by the compressor units generating the compressed air. This is accomplished by either reducing the amount of air needed from the system or by improving the efficiency of generating the compressed air. However, in some instances, the energy savings is equal to the reduction in direct power usage. In the case of an unneeded dryer with a power draw of 4 kW and continuous operation, removing the unit from the system would save 4 kW x 8760 hours per year or 35,040 kWh annually.

Energy savings levels (kWh) of individual measures are usually derived by comparing the spec sheets supplied by OEMs for the current and proposed equipment. The aggregate savings level for most measures is determined by comparing the electric use level of the compressors and ancillary equipment “before” the recommended measures are implemented with the electric use level “after” they are implemented. The energy savings levels of the individual measures are then reconciled to this aggregate total.

In most cases, the air system is operating over a predictable time period – 8,000 to 8,760 hours per year for many of the customers that will participate in CCAP2. In most cases, the energy savings measures will also operate during the same timeframe. This means the level of demand reduction (kW) can be estimated by dividing the total annual energy savings (kWh) calculated above by the number of operating hours.

Measures that do not follow the general operating hour pattern of the overall air system are treated on a case-by-case basis. An example of such a measure would be operating a smaller compressor just at night, when air requirements might be lower than it would be when operating the larger compressors to supply day-time loads.

The list of compressed air measures appearing on the next page is organized into two groups:

1. Operational/Maintenance Measures – measures associated with changing compressor system operations (e.g., Project #5: Reducing compressor discharge pressure) or maintenance activities (e.g., Project #25: Implementing an ongoing leak management program)

2. Hardware Measures – measures generally involving new equipment, hardware, controls, or piping.

### List of Potential Compressed Air Efficiency Measures

Meas #	COMPRESSED AIR MEASURES	Hardware (H) or Operational (O)
<b>AIR COMPRESSOR SUPPLY MEASURES</b>		
1	Replace current compressors or add new efficient units	H
2	Add trim or small compressor	H
3	Add or run small compressor during non-production times	H
4	Combine multiple systems into a single system	H
5	Reduce compressor discharge pressure	O
<b>CAPACITY CONTROL MEASURES</b>		
6a	Add or replace capacity control	H
6b	Correct or adjust capacity control operation or selection	O
7	Establish effective storage with more receiver capacity	H
8	Eliminate excess pressure loss between compressor discharge and distribution sys	H
9	Add central master control system	H
<b>AIR TREATMENT MEASURES</b>		
10	Add more effective or efficient compressed air dryer	H
11	Add dew point demand purge controller	H
12	Reconfigure or modify aftercooler to correct performance	H
13	Correct or replace pre- and after-filters with loose-packed deep-bed filters	O
14	Replace timer-activated drains with level-activated drains	H
15	Correct ventilation system	H
<b>TRADITIONAL CONSERVATION MEASURES</b>		
16	Set up heat recovery system using heated cooling air or water	H
17	Replace existing motors with high-efficiency units	H
<b>DISTRIBUTION SYSTEM MEASURES</b>		
18	Correct main distribution header piping	H
19	Install demand-side control system with receiver or pressure/flow controller	H
20	Install air receiver to maintain system pressure during auxiliary compressor startup	H
21	Install air receiver and regulator to address surge air demands	H
22	Install air receiver and regulator to hold steady, lowest effective pressure	H
23a	Add or replace regulators and regulated flow at the point of use	H
23b	Modify or adjust regulators and regulated flow at the point of use	O
24a	Replace dust collector or controls	H
24b	Modify or adjust dust collectors or controls	O
25	Implement an ongoing leak management program	O
26	Install automatic shut-offs on equipment	H
<b>POTENTIALLY INAPPROPRIATE AIR USE MEASURES</b>		
27	Reconfigure cabinet coolers	H
28	Replace open blows with Venturi amplifiers	H
29	Replace single-stage vacuum generator with multi-stage unit	H
30	Replace Venturi vacuum generator with a central system	H
31	Add automatic controls to Venturi vacuum generator	H
32	Replace air-operated diaphragm pump with electric units	H
33	Modify regulation of air-operated diaphragm pump to improve energy efficiency	O
34	Replace air motors or air hoists with electric units	H
35	Replace air vibrators with electric units	H
36	Install low-pressure air to replace or reduce high-pressure air	H

One of the advantages CCAP2 has in designing its program and in establishing its assumptions is the fact that it can utilize the results that have been obtained from CCAP. The table below summarizes some of those key results, which are based on more detailed figures presented in the spreadsheet on the next page. This spreadsheet reflects the costs and the savings (kWh and dollars) for each of the 45 CCAP audits that have been entered into the database.

**CCAP Measure Cost and Savings Results**

<b>Audit Group</b>	<b>Measure Cost</b>	<b>Measure Savings</b>
All Audits (45 audits)	Hardware – 9.8¢ /kWh Leaks – 4.0¢ /kWh	82% 18%
Large Customer Audits (5 audits)	Hardware – 5.3¢ /kWh Leaks – 1.7¢ /kWh	82% 18%
CCAP2 Assumptions	Hardware -- 9¢ /kWh Leaks -- 2¢ /kWh	75% 25%

Measure costs and savings have been tabulated into two groups: hardware and leak-related measures. This is not the precise categorization that will be used in CCAP2, because we have expanded the list of operational and maintenance measures to include six other measures from the list provided previously (i.e., Measures #5, #6b, #13, #23b, #24b, and #33b).

Because leaks represent the majority of savings associated with operational and maintenance-related measures, it is instructive to look at the findings from CCAP. Results from the 45 audits completed to date have indicated that the average cost of hardware measures is 9.8 cents per kWh of savings, while the average cost of leak measures total 4 cents per kWh of savings.

A second cut of the database was made using audits from larger plants, which might better reflect what will be encountered by CCAP2. For the subset of plant audits, the average hardware cost was 5.3 cents per kWh, while the cost of leak repairs was 1.7 cents per kWh. The main reason that the cost of leak repair was lower for the larger plants was that almost every audit, even audits at small plants, included a recommendation for the customer to acquire a \$2,800 leak detector and implement an ongoing leak management program. This would raise the average cost for leaks for smaller customers with a few leaks more so than for larger customers with many leaks.

Based on these results, the workbook for CCAP2 has been developed based on an average hardware measure cost of 9 cents per kWh saved and on an average operational and maintenance measure cost of 2 cents per kWh saved.

It is interesting to note that the proportion of savings made up by leak and non-leak measures did not vary by plant size. For both audit groups, leaks were 18% of total savings, while non-leak measures accounted for the other 82%. For CCAP2, 25% was used to characterize the portion of total savings attributable to operational or maintenance savings. This figure includes 18% for the leaks and 7% for non-leak operational and maintenance measures.

## Total CCAP Measure Cost and Savings Estimates (to date)

AUDIT #	Savings (\$)		Savings (kWhr)		Project Cost (\$)	
	leaks only	non-leaks	leaks only	non-leaks	leaks only	non-leaks
1	\$78,190	\$328,127	878,539	3,686,824	\$9,800	\$84,362
2	\$0	\$12,595	0	96,886	\$0	\$0
3	\$1,956	\$54,833	12,538	351,173	\$3,073	\$54,291
4	\$2,676	\$6,839	16,728	42,757	\$5,800	\$2,000
5	\$31,050	\$98,765	221,786	705,469	\$7,800	\$39,000
6	\$9,281	\$39,598	70,846	302,277	\$4,750	\$93,859
7	\$6,742	\$25,263	46,497	174,227	\$4,500	\$45,200
8	\$8,289	\$157,254	51,487	976,732	\$6,550	\$80,655
9	\$0	\$37,161	0	169,684	\$0	\$0
10	\$30,157	\$106,628	199,715	686,522	\$6,250	\$59,415
11	\$25,483	\$28,720	208,873	235,413	\$5,500	\$65,404
12	\$2,968	\$105,296	19,786	592,736	\$3,350	\$106,271
13	\$18,854	\$10,751	134,668	76,802	\$2,500	\$86,912
14	\$143	\$18,579	1,018	132,710	\$1,250	\$58,079
15	\$4,483	\$31,580	40,754	291,656	\$6,100	\$83,900
16	\$4,605	\$47,318	46,050	473,180	\$6,400	\$81,635
17	\$14,935	\$118,449	106,679	846,064	\$4,950	\$76,800
18	\$5,088	\$10,550	32,615	67,628	\$4,000	\$53,246
19	\$11,510	\$21,601	77,770	145,953	\$5,200	\$29,400
20	\$34,790	\$47,767	243,287	334,034	\$5,400	\$62,100
21	\$66,161	\$267,464	601,464	2,431,890	\$7,550	\$182,145
23	\$10,068	\$28,991	91,527	263,549	\$3,850	\$24,814
24	\$4,669	\$24,976	31,547	168,756	\$4,052	\$900
25	\$5,363	\$39,986	29,794	222,144	\$4,150	\$31,006
26	\$11,365	\$87,193	94,708	726,609	\$4,400	\$48,300
27	\$3,201	\$19,391	29,749	180,213	\$4,200	\$25,352
28	\$624	\$39,949	7,656	490,171	\$3,450	\$32,500
30	\$12,997	\$9,682	92,836	69,156	\$4,000	\$22,900
31	\$6,183	\$82,499	53,786	717,321	\$4,650	\$74,000
32	\$2,674	\$1,811	20,569	13,930	\$3,400	\$3,400
33	\$5,606	\$16,478	46,717	137,316	\$4,700	\$4,500
34	\$6,567	\$11,812	54,725	98,434	\$4,150	\$11,200
35	\$20,374	\$71,423	203,740	714,230	\$4,400	\$6,525
36	\$9,059	\$80,799	90,590	807,990	\$4,000	\$48,000
40	\$3,694	\$8,101	28,415	62,312	\$250	\$17,900
41	\$308	\$22,903	2,567	190,858	\$50	\$24,300
42	\$590	\$8,827	5,900	88,271	\$600	\$19,500
43	\$0	\$1,691	0	16,910	\$0	\$700
44	\$1,613	\$11,334	13,445	108,256	\$3,500	\$14,900
46	\$33,812	\$19,760	98,024	164,423	\$2,800	\$1,900
47	\$295	\$4,203	2,458	35,025	\$50	\$15,000
<b>Total</b>	<b>\$496,423</b>	<b>\$2,166,947</b>	<b>4,009,853</b>	<b>18,096,490</b>	<b>\$161,375</b>	<b>\$1,772,271</b>



## 4.2 DEVIATIONS IN STANDARD COST-EFFECTIVENESS VALUES

There are no deviations in standard cost-effectiveness values prescribed in the Energy Efficiency Policy Manual and the CEC's DEER database:

- Net-to-Gross Ratio – 80 percent is used in both CCAP and CCAP2
- Estimated Useful Life – in CCAP2 12 years is used for hardware measures and 3 years is used for operational or maintenance measures; these assumptions are appropriate relative to the standard measure life in DEER for hardware (motors and control systems) of 15 years and for audits of 3 years.
- Incremental Measure Cost – Measure costs are based on vendor estimates and invoices for both CCAP and CCAP2.

## 4.3 REBATE AMOUNTS

The “Rebates” area reflects one of the few differences between CCAP and CCAP2. In CCAP, the customer incentive was set at 2 cents per kWh of projected energy savings plus a customer benefit of 2 cents per kWh for additional post-audit technical services. There was a cap equal to 100 percent of the cost of the measure. The CCAP2 customer incentive is based on at least matching the Standard Performance Contracting program (SPC), which is 8 cents per gross kWh with a cap of 50 percent of measure cost.

The reason for matching the SPC incentive increase is to pre-empt any potential concerns that customers might have in CCAP2 program participation once they have signed an Access Agreement. Such agreement excludes their participation in other programs for the same set of measures; i.e., “double dipping” is not permitted in any program.

## 4.4 ACTIVITIES DESCRIPTIONS

The major CCAP2 activities are listed on the next page. The Step # notation refers to the figure in the “Program Implementation” (Section 2-1), where each activity was briefly discussed.

Service	Key Activities	Value
Customer Screening (Step #1)	Telephone Interview Review Energy Usage	<ul style="list-style-type: none"> <li>• Ensures that customer time and program resources are not wasted</li> </ul>
Site Audit & Benchmarking (Steps #2-#4)	Pre-visit Data Collection 3-5 Day Site Visit Short-term Monitoring Analysis and Report Development	<ul style="list-style-type: none"> <li>• Establishes credibility of CCAP2 team</li> <li>• Provides customer with assessment of current system and recommendations for energy savings</li> <li>• Develops baseline for savings verification</li> </ul>
Post Audit Support (Step #5)	Audit Review & Follow-up Design Assistance Procurement Support Vendor Coordination	<ul style="list-style-type: none"> <li>• Reduces customer's hassle and transaction costs associated with pursuing the project</li> <li>• Encourages customer to implement</li> <li>• Reduces barriers</li> <li>• Increases implementation rate</li> </ul>
Implementation (Step #6)	Technical Advice Construction Management (paid fully by the customer)	<ul style="list-style-type: none"> <li>• Assesses implementation issues that arise</li> <li>• Provides solutions</li> </ul>
Post-Implementation (Steps #7-#8)	Post-Project Inspection Savings Verification Incentive Processing	<ul style="list-style-type: none"> <li>• Ensures that savings were achieved</li> <li>• Builds customer satisfaction</li> <li>• Develops case study for further marketing</li> </ul>

Savings and performance goals for each utility service area are provided below. Number of customer sites audited total 55 for the group of three utility service areas. It is expected that 60 percent of the sites will install hardware measures, while 80 percent of the sites will install operational or maintenance measures.

Electric savings on a net basis totals 28,600 MWh across all three utility service areas, while demand reductions on a net basis total 3.575 MW.

Project budget totals \$3,633,015 for all three utility service areas. Of this amount, customer incentives represent 44 percent.

The TRC ratio for each of the three utilities is on the order of 3.25. The levelized program costs range from \$21.60 per MWh to \$21.90 per MWh.

<b>Program Characteristics</b>	<b>SCE</b>	<b>SDG&amp;E</b>	<b>PG&amp;E</b>	<b>Total</b>
Audits	25	5	25	55
Sites Completing Hardware Projects (60% close rate)	15	3	15	33
Sites Completing Operation or Maintenance Projects (80% close rate)	20	4	20	44
Electric Savings (net)	13,000 MWh	2,600 MWh	13,000 MWh	28,600 MWh
Demand Reduction (net)	1.625 MW	0.325 MW	1.625 MW	3.575 MW
Program Budget	\$1,649,575	\$333,865	\$1,649,575	\$3,633,015
Customer Incentives	\$725,000	\$145,000	\$725,000	\$1,595,000
TRC Ratio	3.27	3.24	3.27	3.26
Levelized Program Cost	\$21.60 /MWh	\$21.90 /MWh	\$21.60 /MWh	\$21.63 /MWh



# 6

## PROGRAM EVALUATION, MEASUREMENT AND VERIFICATION (EM&V)

Evaluation of programs is critical to ensuring accomplishments and improving programs over time. Evaluation should also be tailored to the specific characteristics of the programs and strike a balance between the value of information generated by the EM&V activity and cost.

The evaluation approach for this program will include verifying installation of the measures, determining the actual level of energy savings, and measuring participant satisfaction with the CCAP2 experience.

**Verification of Installation.** One of the advantages of CCAP2 having direct involvement with the local service and installation vendors is the ability to closely track project implementation progress. As part of the incentive processing step, KEMA-XENERGY staff will conduct a verification survey on all system installations. The independent EM&V contractor will follow-up with verification of a random sample of participants near the end of the program period.

**Energy Savings.** Estimation of actual energy savings is relatively straightforward, because CCAP2 will develop trended data of electric demand or air flow for most program participants on a “pre-project” and “post-project” basis. KEMA-XENERGY staff will establish the pre-project baseline as part of the audit visit and report, while the “post-project” baseline will be established as part of our post-project follow-up activity. KEMA-XENERGY staff will compile these data into a savings verification write-up for each customer participant, along with a discussion of any differences between the post-project data and what was projected as part of the original site audit. The independent EM&V contractor will review the pre-project and post-project data along with the savings verification write-up for each customer. In addition, the independent contractor will visit and measure a sample of customer participants.

**Process Evaluation/Customer Satisfaction.** The independent contractor will develop a simple approach for surveying customer satisfaction and process evaluation. This approach may take the form of a mail-in and/or phone follow-up. The survey will generally focus on their satisfaction with the program process and measures installed.

A budget of \$87,700 has been set aside for the independent contractor to conduct the EM&V activity. Of this amount, \$70,000 is earmarked for the subcontractor, with the remainder for KEMA-XENERGY labor and overheads to coordinate its savings verifications/baseline measurement, coordinate scheduling, and technical support with the EM&V subcontractor.

Quantum Consulting and Quantec are two examples of firms we feel are qualified to provide an independent review of the program.



## 7.1 PRIMARY IMPLEMENTER

The four CCA-type projects that KEMA-XENERGY has previously developed for other clients are the most relevant qualifications for the proposed CCAP2 Program. Each of these efforts is meeting or has exceeded program goals by a significant margin and contributed greatly to the development of approaches and individual staff included in this CCAP2 proposal. Key characteristics of these four prior CCAP-type Programs efforts include:

### *Central Vermont Public Service (1999-2000)*

- 6200 MWh in savings or 100% more than goal
- \$158 in program costs per MWh saved during first year
- 54% close rate (where the “close rate” is the percentage of sites that implemented a major portion of the recommended package of improvements)

### *NYSERDA (1999-2001)*

- 4000 MWh in savings implemented – 25% more than goal
- \$80-110 of program cost per MWh of savings in first year
- 63% close rate

### *PG&E (2000-2001)*

- 1000 kW in demand reduction or 80% more than goal
- \$480 per kW reduced
- 80% close rate

### *CPUC (2002--Current)*

- 50 audits to produce 16,000 MWh in savings (net)
- Levelized Program Cost = \$16.20 per MWh
- 70% of audits conducted at sites with a total demand < 800 kW.

In addition to these “CCAP programs”, the members of KEMA-XENERGY’s CCAP team have collectively performed over 600 additional audits of compressed air systems. The range of clients for whom these audits have been conducted is depicted on the next page.

Audit team members average more than 20 years of experience working with compressed air systems and are active with the US DOE Compressed Air Challenge (CAC) Program. Hank van Ormer and Henry Kemp are regarded as being industry leaders in terms of conducting plant assessments and making air systems work. Each is certified as a CAC Level I/II instructor.

Each of the four previous CCAP-type programs are described and the completed audits listed in the program profiles that follow.

### List of Previous Compressed Air Audit Clients

#### **BUILDING PRODUCTS**

Allied Mineral Allied  
Signal Conway Lumber  
Kentile  
Malta Windows Norco  
Windows  
\*Owens Corning  
\*PPG Industries Shamrock  
Conduit  
\*Sherwin Williams  
\*Superior Hardwood  
Weathershield

#### **CHEMICAL AND PHARMACEUTICAL**

\*Bayer  
BP Amoco  
Cerl  
Crossfield Chemical  
\*Dupont Georgia Pacific, ISP  
Fine Chemicals Jamalco,  
Jamaica Johnson & Johnson  
Kodak Noramco  
Pharmacia Upjohn PPG  
Roche Vitamin

#### **COMMUNICATIONS/**

##### **ELECTRONICS**

Applied Materials  
CompuServe Foxboro  
LAM Research  
\*Lucent Technology

##### **ELECTRIC POWER PLANTS**

\*American Electric Power American  
Generating Company British Virgin  
Islands Electric Corp.  
Lansing Board of Water and Light,  
Lansing, Michigan Southern Illinois  
Power Virginia Power  
\*Wisconsin Power and Light

#### **FOOD AND FOOD PROCESSING**

\*American Bottling Associated Milk  
Producers Berry Callebaut U.S.A.,  
Inc. Bloomer Candy  
\*Bob Evans Cerestar  
USA, Inc. Christopher  
Ranch Dole  
\*Donatos  
The Garlic Company Hillshire  
Farm and Kahn's Jones Potato  
Chips Joy Cone Lipton Luigianos  
Miller Brewing Company Nestle  
\*Pepsi Cola  
\*Ralston Foods  
\*Ralston Purina  
\*Ross Products, Division of Abbott Labs  
Sargento Foods St. Albans  
Creamery Coop. Stroh's Brewery  
Sunsweet Growers Tamarack  
Dairies  
\*Worthington Foods  
Wyeth Nutritionals

#### **FURNITURE**

Ethan Allen Vermont  
Tubbs

#### **GAS TRANSMISSION**

Columbia Gas Transmission  
\*Consolidated National Gas  
Lancaster Gas  
National Energy  
\*Tennessee Gas  
Texas Eastern Gas Transmission

#### **GLASS**

\*Anchor Hocking Ball  
Foster Glass Cardinal  
Glass Constar  
\*Holophane Corporation  
Hordis Brothers Lancaster  
Glass

Libby Owen Ford  
Oasis Mfg \*Pilkington  
Premiere Auto Glass \*Saint Gobain  
Container  
Tech nlg las

#### **HEAVY EQUIPMENT MANUFACTURING / AUTOMOTIVE**

Flexible Corporation  
\*Ford Motor Company  
\*General Motors Corporation  
\*Honda of America IGM, SA,  
Mexico International Case John  
Deere Johnstown industries  
\*Subaru - Isuzu Automotive  
\*Union Tank Car

#### **HOSPITALS / MEDICAL PRODUCTS**

AHegence Health Products  
\*Bethesda Hospital Cardinal Health  
Childrens Hospital Ethicon - Endo  
Surgery Fairfield Hospital Grant Medical  
Lancaster Hospital Licking Memorial  
Hospital Oral Roberts Hospital St.  
Ann's Hospital

#### **INDUSTRIAL / CONSUME? PRODUCTS**

Amatek Lamb  
Avery Dennison  
Bodine Electric  
Bronz Shoe  
Cannondale Manufacturing  
DAL-Tile  
Ebco Oasis  
\*Ethan Alien  
\*Eveready Battery Fiberglass  
Industries G.E. Aircraft  
\*G.E. Lighting G.E. Turbine Geka Brush

\*Refers to audits at multiple sites of the client.



## List of Previous Compressed Air Audit Clients (Cont'd)

Glen wood Range	Ohio Steel	'FarmaPet - Mexico City, Mexico
Golden Cat	Ormet	Johnson Controls Oasis Mfg.
Himolene	Pang born	Owens Brockway Plastipak
Hoover Company	Republic Steel	Packaging Schmalbach-Lubeca
Interstate Envelope	Ross Castings	Sewell Plastics
Johnson & Johnson	Shield Alloy	
Kodak 'Lancaster Electro	Slater Steel	
Plating	Stolle Products	<b><u>PRINTING</u></b>
Land is Plastics	TFOTech, Inc.	Columbus Dispatch
Mirro Aluminum	Timkin Manufacturing	Communicolor Cyril
National Manufacturer	U.S. Steel	Scot Mansfield Printing
'Nestaway 'Paragon	Vermont Castings	Morrow-Macke Newark
Industries	Vestshell	Advocate One Write
Parker Hannifin	Wheeling Corrugated Steel	Quebecor Vermont
Radiant Color	'Wheeling Pittsburg Steel	
Ralston Purina	*Worthington Machine Technology	<b><u>PULP AND PAPER</u></b>
Reynolds Aluminum		Fibermark Fraser
Rutland Marble and Granite	<b><u>PACKAGING</u></b>	Paper
Sherwin Williams	'American National Can	*Georgia Pacific Irving
Silgan Plastics	*Fabri - Form	Tissue Jefferson Smurfit
Sony	*Grief Brothers	Lake Superior Paper
Superior Plating	'Packaging Corporation of America	Meade Paper Ohio
Sweetheart Cup	*Silgan Container	Paper Board
Syracuse China	*Tennecco Packaging	
Thermodisc		<b><u>REFINERIES</u></b>
Thomson Consumer Electronics	<b><u>PARTS</u></b>	Champlin Refinery City
Ultra motive	<b><u>MANUFACTURING</u></b>	Service Texaco
Whirlpool	AY Manufacturing	<b><u>REFRIGERATION</u></b>
	'Bailey	<b><u>PRODUCTS</u></b>
<b><u>METALS (MILLS,</u></b>	Daifuku 'Delphi	Lennox
<b><u>FOUNDRIES, ETC.)</u></b>	Automotive	LJebert
*ALCOA	Federal Mogul	Oasis
*ARMCO Steel	Fremont Plastics	Showa Aluminum
Bethlehem Steel	Glacier Vandervel I	
Buckeye Steel Casting	Glacier Clevite	<b><u>SKI SLOPES</u></b>
Capstan Atlantic	ITT Heat Exchanger	Bromley Mountain
Cast Master	ITT Pneumotive	Stratton Mountain
Central Aluminum	ITWIMPro	<b><u>TEXTILES</u></b>
Colfor Manufacturing	*ITW Shakeproof	Amoco Fabrics and Fibers
Dietrich Industries	Kelsey Hayes	•Beaumont Mills
El kern Metals	Lempco Nastech	BP Amoco Queen
'General Castings	Nisco	Carpet Shaw
Hayes Lamerz	Oxford Automotive Randall	Industries
Kobe Steel	Textron Tiger Poly	
LTV Steel	Manufacturing Tomasco TRW	
Mansfield Foundry	Automotive	
Marion Steel	*TSTrim	
Metatloy		
Met-Tech	<b><u>PET</u></b>	
Motor Castings	Constar	
*North Star Steel		
Ohio Aluminum		

\*Refers to audits at multiple sites of the client.

## California Public Utilities Commission: Compressed Air Program

Michael Lo (SCE, Program Administrator) – (626) 302-3818

**Program Description:** CCAP-type program with 50 audits of which 35 are earmarked for smaller customers with a maximum overall electric demand of leads 800 kW. The program combines the information value of an audit program with the implementation focus of a standard performance contract effort, to form a single, integrated program. This approach simplifies participation for smaller companies and eliminates double counting. The program offers incentives of \$20 per MWh saved to industrial sites in the Southern California Edison and San Diego Gas and Electric service areas. The program leverages trade allies, such as compressed air service vendors and industry trade groups, to identify qualified customers. The overall goal of the program is to generate savings of 20,000 MWh and 3.0 MW at a cost of \$1.6 million.

**Program Results:** More than 40 audits have been completed and generated savings levels appear to be greater than the original program goals

**KEMA-XENERGY's Role:** Principal contractor

**Type of Equipment:** Standard set of compressed air measures

**Marketing Methods:** Leverage local vendor customer contacts and KEMA-XENERGY corporate accounts

**Close Rate:** At least 65 percent of customers appear to be moving forward with implementing at least some of the audit recommendations

**Lessons Learned:** “Make it quick” — Compressing the time frame between competing the audit and implementing the project has a major impact on the chances the measures will be ever installed. Suggestions for accelerating the process include the need to streamline and routinize all steps in the process, use the post-site visit briefing to gain staff commitment and identify potential project pitfalls, make all players aware of roles and obligations, and allow only 4-6 weeks from the time of the site audit visit and a signed written agreement.

Company Type	City	kW Saved	kWh Saved	Annual \$ Saved	Project \$ Cost	Payback
<i>Southern California Project Summary (2002)</i>						
Medical Products	Irvine	13	105,920	14,000		0
Transportation Products	Garden Grove	61	270,093	41,000	19,000	5 months
Transportation Products	Riverside	40	211,470	30,000	112,000	3.8 years
Transportation Products	Riverside	43	133,729	19,000	61,000	3 years
Paper Products	Buena Park	76	519,200	52,000	88,000	1.7 years
Plastics	Irvine	43	373,123	49,000	99,000	2 years
Transportation Products	Lancaster	24	63,518	64,000		0
Electronics	Long Beach	137	1,028,220	166,000	79,000	6 months
Glass Products	El Monte	521	4,566,300	406,000	94,000	4 months
Plastics	City of Industry	147	927,254	130,000	47,000	< 5 months
Transportation Products	Mira Loma	82	169,684	37,000		0
Subtotal CPUC Projects		1,187	8,368,511	\$1,008,000	\$599,000	7 months

## Pacific Gas & Electric Compressed Air Program

Betsy Krieg —(415) 973-0016

**Program Description:** CCAP-type program with comprehensive audits at 10 industrial sites in PG&E service territory

**Program Results:** 550 kW in reduced electric demand (original goal) – 2,000 kW (actual savings) (see below)

**KEMA-XENERGY's Role:** Principal contractor

**Type of Equipment:** Standard set of air system measures

**Marketing Methods:** Leveraged local compressed air vendors and KEMA-XENERGY corporate accounts

**Close Rate:** 80 percent of customers moved forward with at least some of the audit recommendations

**Lessons Learned:** “Focus on the Post-Audit” — Simply conducting a good audit and expecting a customer to implement reasonable recommendations will not work. Instead, the customer needs to be surrounded with technical support and frequent contact. Incorporate at least some level of incentive to keep customer interest focused. Use simple pre- and post-project measurement approaches. Isolate and communicate productivity benefits and air quality improvements.

Company	City	kW Saved	kWh Saved	Annual \$ Saved	Project \$ Cost	Payback
<i>PG&amp;E California Project Summary (2001)</i>						
Food Products	Gilroy	129	925,400	238,000	148,600	6 months
Food Products	Soledad	150	1,897,700	142,300	167,900	1.2 years
Food Products	Bakersfield	150	311,100	23,900	30,000	< 2 years
Paper Products	San Francisco	55	573,180	43,000	13,100	3 months
Electronics	Fremont	78				
Chemicals	Richmond	158	980,000	161,400	80,600	< 6 months
Food Products	Maricopa	527	227,700	27,000	28,000	1 year
Glass Products	Madera	489	4,288,700	321,000	189,000	< 6 months
Mechanical Products	Fairfield	138	1,213,000	121,000	97,000	< 1 year
Food Products	Yuba City	271	1,000,800	121,100	< 121,100	< 1 year
Subtotal PG&E Projects		2,145	11,417,580	\$1,198,700	\$754,200	8 months

## NYSERDA Compressed Air Program

Miriam Pye (518) 862-1090 – ext 3370

**Program Description:** A CCAP-type program in which the goal was to train local service vendors to take the lead in identifying and marketing compressed air system efficiency measures—13 audits were completed (1999-2001).

**Program Results:** Electric demand reduction of 0.7 MW

**KEMA-XENERGY's Role:** Principal contractor

**Type of Equipment:** Standard set of compressed air measures

**Marketing Methods:** Local compressed air vendor contacts and customers

**Close Rate:** 60 percent of customers moved forward with at least some audit measures

**Lessons Learned:** “Make it right” – Improving the accuracy of the audit phase begins with using the right auditors, preferably those who are literally walking encyclopedias of compressed air systems and who can gain instant credibility with customers. Other aids include applying a consistent analytical approach, providing a clear snapshot of “before” and “after” air system energy use, balancing the “level of measurement detail” with its “value,” and producing a professional report that can be quickly generated.

Company	City	kW Saved	kWh Saved	Annual \$ Saved	Project \$ Cost	Payback
<i>New York Project Summary (2000)</i>						
Consumer Products	Bohemia	28	161,800	17,800	58,300	3+ years
Electronics	Farmingdale	71	452,100	40,600	40,800	1 year
Consumer Products	Farmingdale	30	250,000	20,000	25,000	1.2 years
Building Products	Amsterdam	74	762,300	62,400	69,200	13 months
Electronics	Schenectady	111	970,600	60,200	27,050	6 months
Building Products	Glen Falls	147	1,285,000	77,100	75,000	1 year
Paper Products	Maspeth	30	185,400	35,000	28,400	10 months
Paper Products	Ft. Edwards	70	597,700	47,800	44,900	12 months
Industrial Products	Buffalo	13	61,200	4,000	65,000	1.6 years
Chemicals	Rochester	213	2,088,000	104,400	60,000	7 months
Industrial Products	Port Jervis	187	856,500	81,200	36,400	< 6 months
Rubber Products	Pawling	62	482,800	45,700	23,000	< 1 year
Industrial Products	Watervliet	136	1,192,000	107,300	100,000	1 year
Subtotal NYSERDA Projects		1,172	9,345,400	\$703,500	\$653,050	11 months

## Central Vermont Public Service Compressed Air Program

Bruce Bentley (802) 747-5520

**Program Description:** A customer program to provide compressed air audits was used to generate energy savings to assist the utility in meeting overall energy goals established by regulatory staff. The program included 11 compressed air audits, as well as technical support for other end-uses.

**Program Results:** 0.5 in MW savings were generated

**KEMA-XENERGY's Role:** Principal contractor

**Type of Equipment:** Standard set of compressed air measures

**Marketing Methods:** Contacts made by utility key account managers

**Close Rate:** 50 percent of customers moved forward with at least some of the audit recommendations

**Lessons Learned:** “Make it easy.” If the customer won’t participate in a program because the sign-up or other processes are too complicated or time-consuming, savings goals will not be met. Focus on getting the audit team “into the plant” – once there, the technical and relationship management skills of the lead auditor can win the customer over. Incorporate easy sign-up forms and agreements. Do not include any upfront payments.

Company	City	kW Saved	kWh Saved	Annual \$ Saved	Project \$ Cost	Payback
<i>Vermont Project Summary (1999)</i>						
Food Products	St. Albans	52	444,714	106,433	35,060	.33 years
Print Processing	Brattleboro	175	1,091,548	88,265	52,355	.59 years
Furniture Products			186,152	20,599	33,000	1.6 years
Chemical Products	St. Albans	91	566,000	40,301	27,560	8 months
Construction Materials	Brattleboro		566,730	37,913	55,000	1.45 years
Consumer Products	Brattleboro	227	1,418,529	91,951	56,700	8 months
Paper Products	Brattleboro	240	2,061,398	139,856	198,630	1.42 years
Electronics	Bennington	100	392,079	29,417	21,300	9 months
Food Products	St. Albans	23	202,969	14,513	20,446	1.41 years
Construction Materials	Rutland	76	465,524	38,720	36,700	.95 years
Industrial Products	St. Albans	97	285,559	42,319	34,500	10 months
Subtotal CVPS Projects		1,080	7,681,202	650,287	571,251	.88 years

**7.2 SUBCONTRACTORS**

No subcontractors are proposed at this time. The subcontractor completing the independent EM&V activities will be selected during the first part of 2004.

**7.3 RESUMES OR DESCRIPTION OF EXPERIENCE**

Project Manager – John Skelton

Senior Audit Directors – Hank van Ormer, Henry Kemp

Project Information Manager – Ron Koch

**JOHN C. SKELTON****SUMMARY**

John Skelton has more than 20 years of experience developing and delivering technical services to help industrial customers reduce operating costs and improve productivity. These services have included: compressed air system efficiency, manufacturing process assessments, fuel supply management, energy project development, and facility outsourcing.

His experience spans the full range of functions associated with an energy services business: sales lead generation and screening; plant assessments; project specification, contracting, and implementation; and savings verification. He is currently working on several major initiatives to identify and implement compressed air projects on a state-wide basis. Over 30 sites have been evaluated with an average energy cost reduction of more than 30% via projects reflecting an 18-month payback or less. More than 70% of the recommended projects will be implemented by customers.

**EDUCATION**

Cornell University: Master of Engineering

Cornell University: Master of Business Administration

Cornell University: B.S. in Industrial Engineering/Operations Research

**EXPERIENCE HIGHLIGHTS****KEMA-XENERGY Inc., Columbus, Ohio, 1995-Present.**

Director, Industrial Services. Responsible for compressed air system projects and other industrial energy services, customer program implementation, and non-regulated utility business venture development.

**Resource Dynamics Corporation, Columbus, Ohio, 1990-1995.**

Director, Utility Services. Responsible for energy market assessment and technology evaluation.

**Battelle - Columbus Division, Columbus, Ohio, 1978-1990.**

Manager, Industrial Programs. Responsible for technical service program development, industrial DSM, industrial energy market assessments, and energy program implementation.

**FIELDS OF SPECIAL COMPETENCE**

- Compressed Air Programs
- Industrial Technical Services
- Productivity and Environmental Strategies
- Energy Program Design and Implementation
- Vendor and Utility Alliances
- C&I Technology Assessments
- End-Use Energy Analysis
- Market Segmentation

## MAJOR PROJECTS AND PRODUCTS

### Compressed Air Systems

- Designed and implemented compressed air program targeted on manufacturers in three states - ongoing program has reached over 30 customers and identified savings averaging 30% based on projects with less than a 18-months payback - over 70% of the projects are expected to be implemented using local vendors
- Designed and implemented major contract for Department of Defense to upgrade compressed air systems at six military-operated manufacturing sites. Project includes the design and installation of gas engine systems to enhance existing systems at two sites.
- Designed and implemented state-wide program to identify and implement compressed air programs in New York - program involves working with 12 local vendors and 24 customers to save over 4,000 MWh as a first step in a market transformation program.
- Designed and implemented program to identify and implement compressed air programs in Ohio - program worked with industrial customers through the local power company.

### Energy and Technical Services Programs

- Designed and implemented comprehensive energy and technical service program offering chiller retrofits, lighting retrofits, motor assessments, process heating improvements, power quality assessments, environmental studies, and capacity expansions.
- Designed and implemented statewide industrial productivity improvement program linking business firms of all sizes with engineering resources in the state.
- Managed energy audit program for major utility--program focused on lighting and motor retrofits to accelerate implementation of conservation measures.

### Technology and Market Assessments

- Developed screening tools ("20 QUESTIONS") to help staff qualify customer leads-- separate screening tools were developed for compressed air systems, adjustable speed drives, heat pumps and heat recovery systems, wastewater treatment, and process heating technologies.
- Conducted economic and market assessment of 15 conservation technologies -- evaluations were then extrapolated to develop state and national estimates of energy impacts.
- Established clearinghouse and centralized database of industry-wide estimates of technology performance, energy impacts, and market potential and penetration rates.



**HENRY P. VAN ORMER, JR.****EDUCATION**

BA Business Administration, Gettysburg College, 1959

Graduate Studies, American University

Graduate Studies, Kent State University

Graduate Studies, Akron University

**EXPERIENCE HIGHLIGHTS****KEMA-XENERGY, Inc., Worthington, Ohio, 1999 - Present**

Technical Director. Responsible for technical quality on all compressed air system reviews. Served as lead auditor on projects for PG&E, Central Vermont, NYSERDA, and CERL. Lead author on NYSERDA guidebook on conducting plant assessments and collecting data.

**AirPower USA, Inc., Pickerington, Ohio, 1986 - Present**

President. Responsibilities include conducting compressed air system audits at various plant facilities throughout the country. During walkthrough audit, compile and analyze data on compressed air systems, troubleshoot problem areas, and recommend improvements and upgrades to current compressed air systems. Upon completion of audits, prepare compressed air reports for plant manager including equipment specifications and cost data.

**Compair Kellogg, Inc., Kingston, New Hampshire, 1983-1986**

Marketing Manager. Supervised 35 people including field sales force/product service group/application engineers & product managers/customer service & order entry/marketing/advertising, and print shop. Helped in turnaround situation as company was changing from a petroleum equipment supplier (gas station) to a significant industrial compressed air supplier in the U.S. for all Compair Products. Developed business plans, action plans, and significant interface among five other plants in Canada, United Kingdom, and Mexico that supplied over 50 percent of the business.

Oversaw complete restructuring during which sales climbed from \$15 million to \$22 million by improving margins through selective account sales and product mix and bring the company from a significant loss to a break even or small profit level.

**Ingersoll-Rand Air Center, Tulsa, Oklahoma, 1982-1983**

Manager. Supervised the start up of a full service air center in Tulsa to back up all Ingersoll-Rand industrial and construction sales and work closely the I-R gas compression group. Facility was fully operational within four months of start up, including locating a facility site, and hiring and training all personnel for sales, parts, service, and custom fabrication. Operation exceeded all sales goal and was profitable within the first year.

**Finnell Compressor Company, Tulsa, Oklahoma, 1978-1982**

Marketing/Sales Manager. Responsible for developing marketing and business plans and supervision of sales and product engineering groups; product lines included air compressors

(engine and electrical motor driven), air tools (industrial and construction), hoist and winches, air starters, boosters, and special packaged air systems for the oil and gas market.

**Ingersoll-Rand Corporation, Davidson, North Carolina, 1973-1978**

Marketing Manager, Air Power Division. Responsibilities covered Air Power Division products, including electric motor-driven rotary screws, single and double acting reciprocating units, booster compressors, etc. and included overseeing marketing, order entry, forecasting, field autonomous company pricing, writing market plans, competitive analysis, and new products.

**Worthington Compressor & Engine International, Holyoke, Massachusetts, 1968-1973**

Product Manager. Reported to Marketing Manager, Construction Equipment. Prepared quotes, pricing, market plans, sales literature, advertising, forecasts, and job cost estimates. Coordinated all drill demonstrations and conducted drill and blast seminars for rock contractors.

**MAJOR PROJECTS**

- Compressed Air System Assessments:
- Eveready Battery
- Vermont Castings
- Vermont Tubbs
- Harbour Industries
- Vestshell
- Start up of full-service industrial air center
- Oil analysis program for screw compressors
- Special ski and snowmaking unit
- High pressure units for underground mining market
- Development and promotion of "Wrangler" rock drill

**FIELDS OF SPECIAL COMPETENCE**

Compressed Air System Analysis	Sales and Marketing
Equipment Specification and Cost Estimating Environment	Troubleshooting in Corporate Environment

**REPORTS, PUBLICATIONS, AND PRESENTATIONS**

Author of numerous technical articles on rock drills, rock drilling, blasting, engine compressors, electric motor compressors and rotary screw compressors in numerous industrial publications.

**PROFESSIONAL AFFILIATIONS**

International Society of Explosive Engineers	Southern Gas Association
Association of Mechanical Engineers	

**HENRY L. KEMP, JR.****EDUCATION**

University of Detroit, Mechanical Engineering Studies

**PROJECT EXPERIENCE****KEMA-XENERGY, Inc. (2000 - Present) - Senior auditor on compressed air assessments.**

Responsible for audits and leak surveys for NYSERDA, CERL, and PG&E programs. Conducted workshops for compressed air training for NYSERDA.

**Compressed Air Challenge (1997 - Present) - Member, Training Core Group.**

Pilot instructor for U.S. Department of Energy's collaborative for energy conservation in industrial compressed air systems. Qualified as Level I and Level II instructor.

**Strategic Air Concepts (1995 - Present) - Owner/President.**

Specialists in survey, audit, and design of industrial compressed air systems. Emphasis on energy conservation and substantial cost operating dollar and energy savings on large industrial compressed air systems.

**Ingersoll Rand (1957-1993)- Area Manager for State of Florida, Air Compressor Group.**

Responsible for all sales, service, rentals, distributor training, and all financial aspects for compressed air systems and accessories up to 5,000 horsepower.

- Southeast Distributor Sales and Service Development. Worked to reconfigure distributor operations in North Carolina, South Carolina, and Tennessee
- Northeast Regional Manager for Distributor Sales
- National Account Manager for T-30 Products
- Product Manager, Michigan, Responsible for sales of centrifugal pumps, pneumatic tools, and compressed air systems.

**FIELDS OF SPECIAL COMPETENCE**

Energy Audits

Equipment Surveys and Inventories

Energy Analyses and Conservation

Conservation Project Evaluation

**KEY CLIENTS**

Gladding-McBean Company

Lockheed Martin

Tampa Tribune

Commonwealth Edison

Union Electric Company

Didion & Sons Foundry

Chrysler Corporation Assembly Plants

Sun Main Raisin Company

AT&T Automotive

Georgia Power Company

Ralston Purina Company

FSC Paper Company

Lone Star Industries

Cheeseborough-Ponds, USA

Van Hoffman Press

Pacific Gas & Electric

**RONALD J. KOCH, P.E., J.D., C.E.M.****CERTIFICATION**

Licensed Professional Engineer (P.E.), Ohio, Reg. #E60503  
 Licensed Attorney. Ohio Supreme Court Reg. #0075860  
 Certified Energy Manager (C.E.M.), Association of Energy Engineers.

**EDUCATION**

The Ohio State University, BS, Electrical Engineering, 1989  
 Capital University, J.D., law, 2002

**EXPERIENCE HIGHLIGHTS**

KEMA-XENERGY, Inc., Columbus, Ohio, 1995-Present  
 Energy Auditor. Conducts facility energy audits on industrial, commercial, and multifamily buildings. Emphasis on conservation measures, demand-side management, building operation profiles, fuel use analysis. Delivers reports to customer and provides technical and program assistance. Provides utilities with additional technical assistance and marketing.

STARTEC ENVIRONMENTAL, Inc., Dublin, Ohio, 1993-1995  
 Energy Engineer. Conducted energy audits of electrical equipment and HVAC and performed detailed analyses of energy usage. Specified energy reduction strategies utilizing state-of-the-art energy-efficient equipment. Oversaw installation and start up of energy reduction measures.

ARTHUR N. ULRICH COMPANY. Columbus, Ohio. 1992 to 1993  
 Technical support for manufacturer's representative specializing in transfer switches, uninterruptible power supplies, chargers, inverters, and battery backup systems.

AMERICAN ELECTRIC POWER, Columbus, Ohio, 1989-1992  
 Construction Engineer. Provided project management for electrical systems for power plant construction.

**FIELDS OF SPECIAL COMPETENCE**

- Energy Field Auditing
- Electrical Engineering
- Legal Research and Analysis
- Construction Management
- Automated Energy Auditing Systems

A summary budget table is provided below for each of the utility service areas and for the CCAP2 Program overall. The table below summarizes project costs in a manner that reflects the workbook structure. Overhead and Benefits and Travel costs are included with Administrative costs, unless they are associated with EM&V, in which case, they are reported with EM&V activity.

	<b>SCE</b>	<b>SDG&amp;E</b>	<b>PG&amp;E</b>	<b>Total</b>
<b>ADMINISTRATIVE COSTS</b>				
Managerial and Clerical Labor	\$45,000	\$9,000	\$45,000	\$99,000
HR Support and Development (Benefits, Payroll Tax, Human Resources)	\$119,700	\$24,396	\$119,700	\$263,796
Travel Direct Implementation	\$62,500	\$12,500	\$62,500	\$270,000
Overhead	\$392,175	\$79,929	\$392,175	\$144,000
Subtotal Administrative Cost	\$619,375	\$126,825	\$619,375	\$1,365,575
<b>OUTREACH COSTS</b>				
Labor	\$5,000	\$1,000	\$5,000	\$11,000
<b>DIRECT IMPLEMENTATION COSTS</b>				
Customer Incentives	\$725,000	\$145,000	\$725,000	\$1,595,000
Labor	<u>212,500</u>	<u>42,500</u>	<u>212,500</u>	<u>467,500</u>
Subtotal Direct Implementation Cost	\$937,500	\$187,500	\$937,500	\$2,062,500
<b>EM&amp;V</b>				
Labor	\$6,000	\$1,200	\$6,000	\$13,200
Materials (Evaluation Report)	70,000	15,000	70,000	155,000
Overhead	<u>11,700</u>	<u>2,340</u>	<u>11,700</u>	<u>25,740</u>
Subtotal EM&V Cost	\$87,000	\$18,540	\$87,700	\$193,940
<b>POTENTIAL PERFORMANCE AWARD</b>	\$115,420	\$23,371	\$115,470	\$254,211
<b>CCAP2 PROGRAM TOTAL</b>	<b>\$1,649,575</b>	<b>\$333,865</b>	<b>\$1,649,575</b>	<b>\$3,633,015</b>