NCEMBT-041215

FINAL REPORT

NATIONAL CENTER FOR ENERGY MANAGEMENT AND BUILDING TECHNOLOGIES TASK 5: THE HOSPITALITY INDUSTRY INTERACTIVE SEMINAR ON ENERGY MANAGEMENT AND INDOOR ENVIRONMENTAL QUALITY

Prepared By:

David Mallino, Ph.D.
Mallino Government Relations

Davor Novosel
National Center for Energy Management and Building Technologies

Prepared For:

U.S. Department of Energy
Terry Logee
Contract Manager

This report was prepared for the U.S. Department of Energy
Under Cooperative Agreement DE-FC36-03GO13072

National Center for Energy Management and Building Technologies

601 North Fairfax Street
Suite 250
Alexandria, VA 22314
703.299.5633
www.ncembt.org

NOTICE

NATIONAL CENTER FOR ENERGY MANAGEMENT AND BUILDING TECHNOLOGIES CONTACT

Davor Novosel
Chief Technology Officer
National Center for Energy Management and Building Technologies
601 North Fairfax Street, Suite 250
Alexandria VA 22314
703-299-5633
dnovosel@ncembt.org

TABLE OF CONTENTS

1. INTRODUCTION & BACKGROUND

The Hospitality Industry Interactive Seminar on Energy Management and Indoor Environmental Quality was held as a part of the National Center on Energy Management and Building Technologies (NCEMBT) Year 2004 research agenda. It is one of NCEMBT's five major tasks supported by the U.S. Department of Energy. Hospitality facilities make-up a significant portion of the building stock in the United States, they represent a leading segment of the economy, and are major consumers of energy. Therefore, this seminar was conducted to address the physical and environmental status of the industry.

The seminar was attended by a cross section of professionals including: building engineers, architects, laborers and industry and government officials. (See Appendix A for a list of participants) The seminar was conducted over a period of a day and a half and focused on energy management and indoor environmental quality (IEQ) and its impact on hospitality operations. Within this topic a number of related issues were discussed.

The discussion process was initiated by presentations by one of the participants followed by a period of questions, answers and statements (See Appendix B for the seminar agenda). Presentations were made by Erik Emblem (NEMI), John Wimer (NCEMBT), Davor Novosel (NCEMBT), Chad Dorgan (Farnsworth Group) George Benda (Chelsea Group), Steven Grover (National Restaurant Association), Gary Marx (Center for Public Outreach) and Frank Powell (consultant).

Each participant was requested to keep notes throughout the seminar and to make them available to the seminar organizers at the conclusion of the seminar. These notes were further supplemented by a questionnaire completed by each participant. Some of the participants submitted additional written comments to NCEMBT following the conclusion of the seminar. These comments are reflected in this report (See Appendix C for seminar notes and questionnaire). Also, those who made presentations prepared power-point outlines of their presentations and made them available to the other participants (See Appendix D). A full transcript of the proceedings was also made and it is available.

2. PURPOSE & FOCUS

The primary purpose of the seminar was to review and analyze what is known about the state of energy use and management and indoor environmental quality (IEQ) and its economic importance to hospitality operations. An effort was made to identify opportunities for reduced energy consumption and improved indoor environmental conditions, review a variety of proposed remedies, and distill significant research and technology gaps. The seminar focused on defining and discussing three major problem areas and addressing a series of related questions:

- What is the importance of energy management and IEQ to the financial success of various hospitality segments?
- What is the impact of IEQ in day-to-day operations (i.e., does it impact customer service and satisfaction? If so, to what degree?)
- What is the status of the current HVAC technologies withthe potential to meet the demands of various hospitality segments with regard to energy, IEQ and operational performance? What are the gaps?

3. GENERAL THEMES

The seminar participants largely accepted the assumption that energy efficiency and IEQ are issues of growing importance to the hospitality industry. According to George Benda, for most hospitality venues, energy remains a relatively small element (4% - 6%) in operating budgets, which are dominated by labor costs. However, the hospitality industry, especially the restaurant sector, is particularly sensitive to energy demands due to recent energy price increases. IEQ impacts the hospitality industry in two key areas, top line revenues and labor productivity. IEQ influences how comfortable customers are in a hospitality venue, which directly impacts customer retention and sales. IEQ also influences how employees perceive their working conditions. Participants from the restaurant industry identified employee retention as the most significant opportunity for cost control in the operating budgets of their facilities. Employee turnover leads to productivity losses and increased training costs. One of the goals of the seminar was to address the means by which to improve IEQ and energy efficiency within the whole hospitality industry

There were five general themes that reoccurred throughout the seminar and discussions including:

1. There is very little research documenting the scope and nature of some of the most critical problems confronting the hospitality industry especially on the adverse impact of poor environmental quality on customer satisfaction and employee productivity.
2. The dominant consideration of owners and managers is the upfront, short-term economic costs of hospitality facility repair, renovation and replacement.
3. Energy consumption and conservation considerations have become integral and preeminent factors in the cost equation for the industry and often outweigh other considerations such as IEQ. Energy management is now a key design parameter for new facilities and major retrofits, but it is often poorly executed and remains dependent on operations capabilities that largely do not exist in the hospitality industry.
4. The technological state of the art in equipment, design, architecture and professional education and training is such that many if not most of the problems confronting the industry can be remedied and controlled.
5. The key to addressing and resolving the problems confronting the industry is effective education and communication between the technical professionals and the owners on the need and long term benefits of improvements in energy management and IEQ.

4. CHARACTERISTICS AND TRENDS OF THE HOSPITALITY INDUSTRY

4.1 CHARACTERISTICS OF THE HOSPITALITY INDUSTRY

The hospitality industry includes food services, entertainment, gaming operations and lodging. This is a highly segmented business sector and exhibits great diversity with regard to buildings, building systems and occupancies. Common to all is the highly transient nature of occupancy.

The food service segment is characterized typically by comparatively small facilities with unitary equipment. The internal loads (equipment and occupants) are generally higher than the external ones. The ventilation requirements often exceed the capabilities of what standard unitary equipment can deliver.

Entertainment and gaming operations tend to be extensive in size and often include lodging as part of their service offering. The HVAC equipment employed in this segment of the industry tends to be custom and field-build, although some smaller gaming operations may use packaged equipment, particularly for their lodging facilities. Ventilation requirements are generally very high.

The budget and mid-priced segments of the lodging industry generally tends to employ packaged HVAC equipment. In the higher-end segments, central, built-up HVAC systems dominate. The highly transient occupancy patterns challenge the HVAC controls particularly when it comes to moisture control.

The business models of various hospitality segments have significant different investment horizons which in turn drive the type of HVAC and related IEQ equipment being used. Generally, the industry is interested in relatively rapid return on investment compared to other types of facilities such as health care.

Availability of skilled labor and higher turnover rates coupled with business focus on customer service relegate the installation and maintenance of HVAC equipment and building systems to a low priority.

There are a variety of characteristics that define the hospitality industry.

- By sector, the number of buildings within the hospitality industry are:
  - Casinos: 651
  - Bars: 52,825
  - Lodging: 158,000
  - Restaurants: 434,081 (including institutional food service)
- Energy consumption by hospitality sector expressed in trillion BTUs are:
  - Casinos: 0.5
  - Bars: 62.0
  - Lodging: 461.0
  - Restaurants: 506.0
- Current restaurant sales total $440.1 billion at some 645,000 individual locations, serving more than 70 billion meal and snack occasions. Sales growth is projected to reach 53% of the total food dollar spent in restaurants by 2010.
- The restaurant industry employs an estimated 12 million people, making it the nation's largest private-sector employer.
- Some 75-80% of restaurant establishments are single-location, small businesses.

- The restaurant industry includes institutional food service such as hospitals, schools, prisons and the military.
- The state of "wellness" for hospitality facilities is thought to be slightly worse than the general building population because of poorer quality IEQ equipment and operations. A review of various studies focused on U.S. buildings categorized hospitality facilities as 20% healthy, 40% generally healthy, 20% unhealthy (source unknown), 10% unhealthy (sources known), and 10% Sick Building Syndrome (SBS) or Building-Related Illness (BRI).
- For most of the hospitality industry, investments in capital improvements with payback of longer than one year are difficult to make and longer than two years are nearly non-existent. The major feature of the restaurant industry is that it is highly competitive with very small profit margins. Only one in five restaurants achieve the golden 5-year survival mark in business. The competition within the industry focuses on (1) providing a dining experience that retains customers and (2) attracting and retaining productive employees.
- There is a serious disconnect between life cycle design, duration of franchise and property leases. The conceptual and structural life cycle for a restaurant is 13 years compared to franchise licenses that can be as long as 20 years, while leases on the property are usually only about 5 years. This disconnect impacts on the fact that minor restaurant facility upgrades are required about every 5 years and major ones every 10 years. All of this further complicates the business investment decision-making process.

4.2 HOSPITALITY INDUSTRY TRENDS

Among the major trends affecting the hospitality industry include:

- The "graying of employees" which is witnessing older Americans joining the workforce for supplemental income;
- New dietary directions aimed at obesity and other diet-related diseases including low carbohydrate and high fiber diets. These new directions may generate increased pressure for more government regulatory actions.
- Recreational shopping will likely include new shopping destination convergence with the increased clustering of restaurants in and around shopping malls.
- The increased diversity of the population will be reflected in a similar diversity of menus, foods and customers. Additionally such diversity will also result in increased expectations on the part of customers and employees for new dietary requirements and indoor environmental quality. In this respect, the aging "baby boomers" will have a profound affect on the industry.
- Energy requirements are reemerging as a critical issue within the industry as a direct result of recent increases in the price of oil, natural gas, electric utilities and gasoline. These pressures are compounded by the conflicts in the Middle East and the spectacular growth in energy demands from the Chinese, Indian and other Asian economies.
- Industrial globalization has begun to impact the hospitality industry and it will only increase. While the exact impact is unknown, there are already signs of increased interest in international performance standards and standardization of equipment and technology, food preparation and delivery, IEQ regulations.
- New technology that will impact the industry include increased automation and control system improvement such as infrared controls, nanotechnology and improved demand control ventilation.

5. SUMMARY AND ANALYSIS

There was a consensus among the seminar participants that hospitality-related building facilities, especially restaurant facilities, were generally less "healthy" from an IEQ perspective than other types of buildings and facilities. This is due largely to the nexus between the competitive economics of the industry and the relatively high up-front costs of installing and maintaining effective HVAC and related IEQ equipment and technologies. In this respect the seminar addressed a number of inter-related problems and issues including IEQ, energy utilization and management, and the economic costs associated with IEQ and energy management.

A primary issue throughout seminar discussion was the current status of energy and environmental systems and the perceived market potential for such systems, including novel applications. There was a consensus on the lack of convincing available data that could move the industry to change its current practices with respect to energy efficiency or IEQ. The seminar also identified and discussed a number of policy related issues, raised a number of "outstanding questions that should be addressed by the industry and concluded by suggesting a set of recommendations.

5.1 IEQ PROBLEMS

There was a general agreement with George Benda's observation that many of the IEQ problems confronting the industry were "hidden" and "behind the walls" because the HVAC and related IEQ infrastructure is "invisible" unless a problem develops. Thus, IEQ infrastructure often does not receive the kind of investment needed.

There is a general acceptance within the industry that the maintenance of outward appearances and comfort is of more immediate concern than "behind the walls" investments. These types of business decisions create and exacerbate HVAC operating and maintenance problems and lead to poor IEQ. As a result, the IEQ of hospitality facilities is generally worse than the general building stock because of poorer quality HVAC and other IEQ systems. This approach is very shortsighted because, according to Chad Dorgan, confidential restaurant industry data indicate that adjustments of temperature, humidity, air quality, and lighting can add from 10% to 15% to the overall the sales of the establishment.

Environmental Tobacco Smoke (ETS) is a major issue with the hospitality industry and according to Steven Grover of the National Restaurant Association:

- Some 80% of the public approves of restrictions on smoking in public places
- Some 65% of restaurants have eliminated smoking;
- Regulation of ETS has occurred largely at the state and local levels;
- Owners are split over whether to ban smoking in their establishment;
- The investment pay-back on improved ventilation systems to control ETS is not certain;
- Worker and customer environmental health issues related to ETS is an increasing concern.

Among the other IEQ related conclusions arrived at by the seminar participants were:

- While owners have a good understanding of customers, employees and food, they lack a full appreciation for the underlying operational and technical issues affecting their facilities.
- Employee retention is a key economic driver that could be enhanced by improved IEQ in hospitality venues, but the data currently available are insufficient to convince owners
- Data on increasing customer retention and therefore revenues by investment in IEQ are not currently persuasive to the hospitality industry, but may not become a driver regardless of research because the hospitality industry prides itself on understanding customer needs.

- On-site personnel have little or no understanding or training about IEQ issues and solutions, and they often exacerbate a problem by, for example, closing outside air dampers on rooftop units, manually control thermostats, and take other actions that compound IEQ problems within the facility.
- Mold in hospitality facilities (particularly in hot damp climates) is becoming an greater problem especially because it is increasingly linked to the exacerbation of asthma.
- ETS (environmental tobacco smoking) will not be a driver for business investment decisions on ventilation equipment in the future. however, what will drive these decisions is the competition to improve employee working conditions (to increase productivity and reduce turnover) and customer comfort and retention.
- It was generally agreed that the quality of outdoor air can have a significant impact on IEQ within hospitality facilities and while there is technology available to monitors outdoor air quality it needs to be employed with smart basic interior design to minimize impact of unhealthy outdoor air.
- The issue of accessing outdoor air for use indoors must also take into consideration building security and anti-terrorist measures.
- Although it was generally agreed that lighting and sound have impact on IEQ, it was also noted that there are very little data available to empirically demonstrate the linkage.
- According to Erik Emblem, LEED (Leadership in Energy and Environmental Design) has a widely accepted set of standards which award building owners for good design concepts based on energy efficiency and integration of sustainable building products. LEED is a building rating and certification program offered by the US Green Buildings Council (USGBC). LEED was developed primarily for commercial and institutional construction and something similar should be considered for the hospitality industry. Short of that some of the factors in the existing LEED assessment approach might be considered for this industry.
- There was a consensus that the hospitality the industry has suffered from a lack of access to qualified IEQ and energy consultants and advisors and as a result has been victimized by far too many failed schemes. Finding the right technical IEQ, HVAC and energy management advisors is a difficult issue for owners and managers.

5.2 Economic Costs

The capital investment aspects of the hospitality industry depend not only on owner business confidence, expressed in increasing sales, but also on a stable political economy expressed in economic growth, interest rates and unemployment rates, international balance of trade, and, of course, world energy supply, demand and price. While, a stable political economy is important to other businesses as well, the hospitality industry is particularly sensitive to economic forces that impact on consumer disposable income. This is especially true when owners confront the costs associated with IEQ improvements.

According to Chad Dorgan, the initial capital costs to improve the hospitality industry's IEQ to acceptable standards is about $20 billion, with and additional $1 billion annually for proper maintenance. The benefits can amount to some $20 billion annually in increased employee productivity and customer satisfaction and sales.

It was generally agreed among the seminar participants that the primary issue is motivating owners and decision makers to choose among other competing demands to make upfront investments in improving indoor environmental quality equipment and systems.

Among the other competing demands are the energy costs of utilities which represent 4 to 6 percent of the total restaurant costs. According to the Farnsworth Group handout, annual energy costs by hospitality sector include:

- Casinos: ..... $ 0.070 billion
- Bars: ..... $ 0.893 billion
- Lodging: ..... $ 5.114 billion
- Restaurants: ..... $ 7.337 billion

It was generally agreed that there is little correlation in the industry between investments made in improving the quality of construction or retrofit of the building and the cost or quality of its operation. In new construction, the designer is typically charged with achieving low cost construction, and the owner or operator either is not consulted on the consequences or does not have the knowledge to rationally consider the comparative merits of first cost outlays compared to longer term operating costs. Energy efficiency and IEQ are often not the highest priority. New construction decisions, on the other hand, are a relatively small part of the problem since some 80% of the facilities have existing installed infrastructure that is in various stages of repair and not likely to be upgraded. Thus, in most cases investment decisions are made (or not made) with respect to retrofitting and renovation.

5.3 Productivity / Employee Turnover

There was a general consensus among the participants with Steven Grover's assertion that one of the key competitive factors within the hospitality industry is attracting and keeping productive employees. It was acknowledged that in addition to wages and benefits, acceptable working conditions measured in IEQ often is a determining factor in retaining good employees. Given the fact that the hospitality industry suffers from a 200 percent employee turnover rate, among the questions raised were:

- What portion of this turnover can be attributed to the casual labor aspect of the market?
- What portion can be attributed to IEQ?
- What is the impact of the "graying of employees" on employee turnover?

The restaurant industry employs an estimated 12 million people, making it the nation's largest private-sector employer. Thus, the industry provides work for nearly 9% of those employed in the United States. More than four out of 10 adults have worked in the restaurant industry at some time during their lives. The typical employee in a foodservice occupation is:

- Female (55 percent)
- Under 30 years of age (52 percent)
- Single (67 percent)
- Working part-time (averaging 25.3 hours a week)
- Living in a household with two or more wage earners (79 percent).

Although not specific to the hospitality industry, the National Institute for Energy Management (NEMI) made available to the seminar its comprehensive study on "Productivity Benefits Due to Improved Indoor Air Quality." This study was an effort designed to quantify the relationship between improved indoor air quality and worker productivity. Among its findings, the study concluded that improved indoor air quality (IAQ) resulted in approximately $130 billion annually in increased worker productivity and sales, and savings in lost time and medical costs associated with workers exposures to poor IAQ.

It was generally agreed that there was a lack of research and empirical data on productivity and employee turnover within the hospitality industry. One of the problems, according to Dorgan is the need for an empirical definition of productivity for the industry. Steven Grover noted that while the turnover rate was unsustainable in the long-term, the industry itself is not sure of the exact reasons for the high turnover,

largely because current measures to reduce the rate have not been successful. In this respect, one of the key research questions that needed to be addressed was how to correlate productivity data to the asset value of the facility, especially the IEQ infrastructure. Indeed, there was near unanimous agreement that there were very little hard data available on the link between productivity and IEQ.

It was suggested that a research initiative be undertaken to develop an industry specific index quantifying the various factors that impact employee turnover including management practices, employee compensation and benefits, workload, and indoor environmental quality. In addition to employment and turnover questions, it was noted that other factors affecting productivity within the industry were energy use and consumption, and the introduction of new technologies and practices, especially in the food preparation services.

5.4 ENERGY MANAGEMENT

There was a general consensus among the seminar participants that energy consumption and costs to the hospitality industry is and will remain a "front burner" issue largely because of international competition for energy resources from the exploding energy consumption demands of the Chinese and Indian economies. As indicated above, the total hospitality industry energy costs are in excess of $13.3 billion annually.

According to Steven Grover, the industry is approaching an "educable moment" on energy management when owners will be motivated to act on improving the energy performance of their facilities. Whether or not this "moment" will pass or be sustained will largely depend on energy price stabilization and its impact on other competing energy demands on disposable income. Indeed, it was agreed that large gasoline price increases could seriously impact the industry because of the direct competition with restaurant food dollars.

The issue is further complicated when the nexus between improved energy efficiency is linked with IEQ, especially indoor air quality. In this respect, the over-riding question is: must one be traded-off for the other, or can both be achieved at acceptable costs?

In addressing some of these questions, Frank Powell made a presentation to the seminar which outlined 10 areas which he termed "top efficiency measures for hospitality facilities" which included:

1. Installation of high efficiency lighting fixtures that could result in as much as a 30% lighting cost savings
2. Improved heating and cooling energy recovery systems which would permit higher air exchange rates with lower energy peak loads and therefore achieve better IAQ with less energy;
3. The use of heat pumps to heat water in large restaurants or hotels with large hot water demands while at the same time cooling the air (or water) for refrigeration and air conditioning demands;
4. The use of "demand-controlled ventilation" where the ventilation rate is individually regulated according to occupancy indicators in offices, conference rooms, lounges and gaming facilities.
5. The use of balanced air supply and exhaust ventilation systems;
6. The use of "variable speed drives" which allow both ventilation fans and air pumps to monitor loads and make necessary adjustments according to the loads;
7. The adoption of " economizer cycles" which permit the use of outside air for cooling when the temperature is lower than the return air; and the transfer of heat from the building to a cooling tower loop via a heat exchanger;
8. The 're-commissioning" of buildings which, among other requirements, includes a complete tune-up of the building control systems;
9. The use of solar energy under certain conditions and climates;

10. Other miscellaneous energy options including cogeneration, fuel switching, replacing air-cooled equipment with water cooled, and the use of high-efficiency boilers.

According to Mr. Powell, Mr. Benda and others, the expertise to achieve energy efficiency improvements does not exist within most segments of the hospitality industry, particularly the small business sector. Overall, the industry requires solid, independent research as well as qualified contractors, technicians, consultants and vendors who can provide full service and defend owners against "snake oil" remedies.

5.5 POLICY ISSUES

Throughout the seminar discussion, a number of policy issues arose, most of which related to business policy decisions on the part of the owners. There was some debate over what factors may motivate owners to make the necessary investments in IEQ and energy efficiency systems, technology and equipment. Dorgan offered the notion that ultimately the fear of government regulation and litigation will force increased investment decisions. This was supported by the fact that there are an increasing number of environmental lawsuits (especially for second-hand tobacco smoke and mold exposure) being filed on behalf of patrons and, in some cases, workers against the hospitality industry. Also, it was noted that while most government regulation of the hospitality indoor environment has occurred at the state and local levels, there are increasing pressures of such federal agencies as OSHA and EPA to regulate indoor exposures to environmental pollutants, particularly tobacco smoke.

There was general agreement, however, that increased government regulation and litigation were not the most preferable motivators. Most believed that the economics of the issue are more effective motivators especially if the owners can be educated to the positive economic impacts on energy costs, employee productivity and turnover, and increased sales. The problem, according to Dorgan, is that it generally takes about ten years for that kind of transformation in thinking to actually take hold throughout the industry.

6. OUTSTANDING QUESTIONS

As the seminar concluded there occurred a general discussion of "outstanding questions" that should be addressed by the hospitality industry and/or NCEMBT which included the following:

- How directly is employee retention or turnover related to energy and indoor air quality?
- Is basic customer satisfaction the essential key and how is that related to energy and indoor air quality?
- What are the requirements of any technology before it can be adopted by the restaurant industry?
- How realistic are such "outside the box" methodologies as biowaste, fuel cells and other alternative fuel technologies?
- How should the restaurant industry address the prequalification of experts in the field to make it easier for owners to know who is reliable?
- What are the best methods for educating owners and managers on the key technical IEQ and energy management.

7. RECOMMENDATIONS

While the seminar did not include a specific agenda item for "recommendations " over the course of the discussion, a number of suggestions were made on what the industry might wish to consider in addressing the twin problems of improved IEQ and energy efficiency. In order to provide some sense of conformity to what follows, a draft of this report was sent to all the participants with a request for comments, especially on the recommendations. The feedback we received resulted in a general consensus on the following set of recommendations:

There was a consensus among the participants on the overwhelming need for an education and research program for hospitality owners and managers on various aspects of the costs and benefits of improved IEQ and energy management.

7. 1 EDUCATION AND OUTREACH

The proposed educational program should include:

1. The development and provision of two distinct education programs; one for the small, independent operators and one for the large chains. Each would include distinct messages and communications tailored for the respective audiences. Such a program would be most effective if undertaken by the National Restaurant Association (NRA) and similar trade associations with support and assistance from the HVAC and related professions, including NCEMBT.
2. The development and provision of a working understanding at the operational level of the relationship between mechanical equipment and facilities, which is often the key to the performance of a facility. Owners and operators are concerned primarily with food and other services, and not with equipment operation. Therefore, simple, non-technical instructions should be created and widely disseminated. These instructions and messages should be similar in nature to those developed for the widely successful food safety program and should include such items as equipment and maintenance check lists.
3. The program should also include:
    a. An easily understandable explanation and analysis of the costs and benefits of IEQ and energy control equipment and its maintenance
    b. The development and provision of a directory of qualified and certified IEQ and energy management contractors, designers, engineers, and other advisors.

7.2 RESEARCH AND TECHNOLOGY TRANSFER

While the instructional and educational material should be non-technical and simple to understand, it must also be supported by sound technical research and analysis so as to be creditable with owners and managers. In this respect, it was agreed that the following issues required additional research and analysis:

- Productivity information and data should be gathered from companies that view such data as proprietary. An analysis of the data should be conducted "blind" by a reputable research group so as to protect the proprietary nature of the data.
- From such an analysis, an index should be developed that quantifies those factors that impact employee turnover including management practices, employee compensation, benefits, workload, and indoor environmental quality.
- Comparative research and analysis on the costs and benefits of smoking and non-smoking areas of hospitality facilities.

- Examination of the use and application of bio-waste technology and its relation to disposal costs, labor requirements, time, and energy saving. There exist several systems that recover energy from food and water ("grey water") wastes. The recovered energy from this food and "grey water" waste is then reused in conditioning the air or preheating water for domestic use.
- Encouraging the transformation of buildings by supporting and upgrading the USGBC/LEED certification process to incorporate more critical indoor environmental aspects including regular maintenance.
- Examination of climate-specific construction and IEQ/HVAC equipment.
- Examination of ASHRAE and LEED standards that might have important implications for the hospitality industry with respect to both new and retrofit design, energy efficiency and IEQ.
- Review of standardization of equipment needed for global hospitality markets.
- Examination of miniaturization technology for IEQ and energy control systems.
- Analysis of the effects of outdoor air and the technology to minimize the impacts of poor outdoor air quality.
- Analysis of the effects of outdoor air and the technology to minimize the impacts of poor outdoor air quality.
- Analysis and examination of building security issues.
- Although it was generally agreed that lighting and sound have impact on IEQ, it was also noted that there are very little data available to empirically demonstrate the linkage.

APPENDIX A – LIST OF SEMINAR PARTICIPANTS

NAME	TITLE	COMPANY
Christine Andrew	Manager, Health and Safety Regulatory Affairs	National Restaurant Association
Rick A. Bagwell	President	Halton Company
George Benda	Chairman/CEO	Chelsea Group Ltd.
William Blazvick		Royal Metal Works
Yi-Tung Chen		University of Nevada Las Vegas
Jerald Delventhal		Restaurant Developers Corporation
Chad B. Dorgan	Director, Facilities Science & Technology	Farnsworth Group, Inc.
Erik S. Emblem	Executive Director	NCEMBT
Don Fisher	President/CEO	Fisher-Nickel, Inc.
Eric Gill		
Steven Grover	Vice President, Health and Safety Regulatory Affairs	National Restaurant Association
Glenn Harvey		J.D. Higgins Company
Douglas Kosar	Principal Research Engineer	University of Illinois at Chicago
Ted Kuczynski	Executive Administrator	International Training Institute
Terry Logee	Technology Development Manager	U.S. Department of Energy
Jim Long	Business Manager	SMWIA Local 88
Gary Marx	President	Center For Public Outreach
Judith C. Nagle	Chapter Executive	SMACNA of Southern Nevada, Inc.
Davor Novosel	Chief Technology Officer	NCEMBT
Vince A. Panvini	Director of Government Affairs	SMWIA
Seth Pike		Quality Mechanical
Frank Powell	Mechanical Engineer	Frank Powell Consulting
David C. Rader		Max & Erma's Restaurant, Inc.
Douglas Reynolds	Professor	University of Nevada Las Vegas
Tony Spata	Director	WD Partners
Dr. Linda Stetzenbach	Director, Microbiology Division	University of Nevada Las Vegas
Rich Sweetser	Partner	Exergy Corporation
John C. Wimer	Chief Operations Officer	NCEMBT

APPENDIX B – SEMINAR AGENDA

Tuesday, September 7		
5:00 pm	Board Shuttle to Training Facility	
6:00 pm	Meet and Greet	
6:30 pm	Opening Remarks ▪ Welcome ▪ Introductions ▪ Purpose of Conference	 Erik Emblem John Wimer John Wimer
	Tour of the Joint Apprentice Training Center ▪ Introductory Remarks ▪ Tour	 Jim Long Dan Rose
7:30 pm	Working Dinner ▪ Overview/Objectives of Agenda ▪ What is NCEMBT? ▪ NCEMBT Overview of Tasks	 Gary Marx John Wimer` Davor Novosel
9:00 pm	Board Shuttle to Return to the New York New York Hotel	
Wednesday, September 8		
7:30 am	Buffet Breakfast ▪ Welcoming Remarks ▪ Program Introduction	 John Wimer Gary Marx
9:00 am	Presentation & Topic Discussion	
	▪ Productivity in The Workplace	Chad Dorgan
10:00 am	Break	
10:30 am	Continuation of Topic Discussion – Productivity in the Workplace	
12:00 pm	Working Lunch	
1:00 pm	Presentation ▪ IAQ and Energy in Tropical Settings	 George Benda
2:30 pm	Break	
3:00 pm	Presentation ▪ Utilities Perspective	 Frank Powell
4:00 pm	End of Presentation	
6:00 pm	Working Dinner	
8:00 pm	Program Wrap-up	Gary Marx
Thursday, September 9		
7:30 am	Buffet Breakfast & Welcoming Remarks	John Wimer
8:30 am	Presentation	
	Policy Issues Related to IAQ & Energy	Stephen Grover
10:30 am	Break	
11:00 am	Wrap-up and Outcomes	Gary Marx, Davor Novosel
12:00 pm	Thank you and Have a Safe trip	John Wimer

APPENDIX C – CHAD DORGAN PRESENTATION

Slide 1

Productivity of the Hospitality Industry

Chad B. Dorgan, P.E., Ph.D., CxAP
Farnsworth Group, Inc.
Corona, California

Charles E. Dorgan, P.E., Ph.D., CxAP
Farnsworth Group, Inc.
Madison, Wisconsin

Dr. Marty S. Kanarek
University of Wisconsin – Department of Epidemiology
Madison, Wisconsin

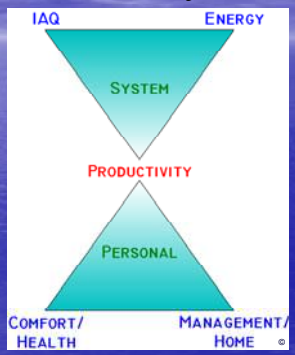
Slide 2

Hospitality Industry Unique Indoor Air Quality Challenges

- High density of people
- Beyond design conditions
- Contact changes
- Higher opportunity for moisture
- Pollutant generating activities
- High number of HVAC units
- Others?

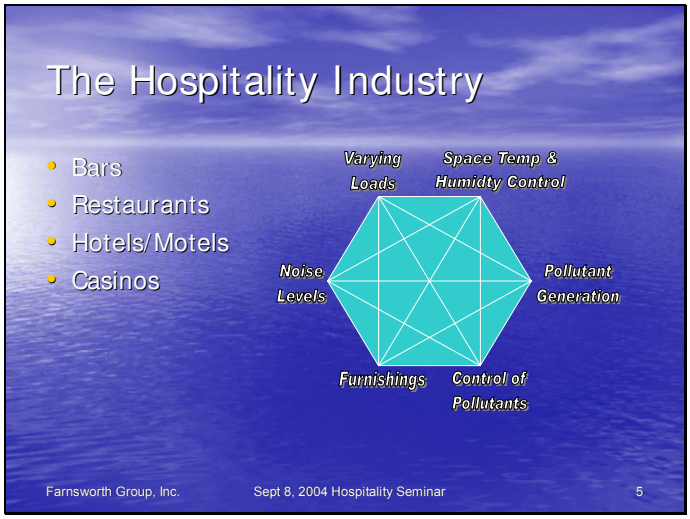
Slide 3

What is Productivity?

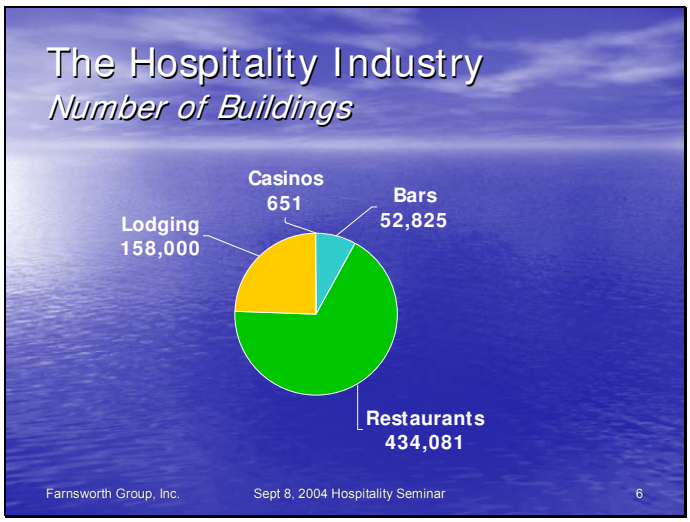


Slide 4

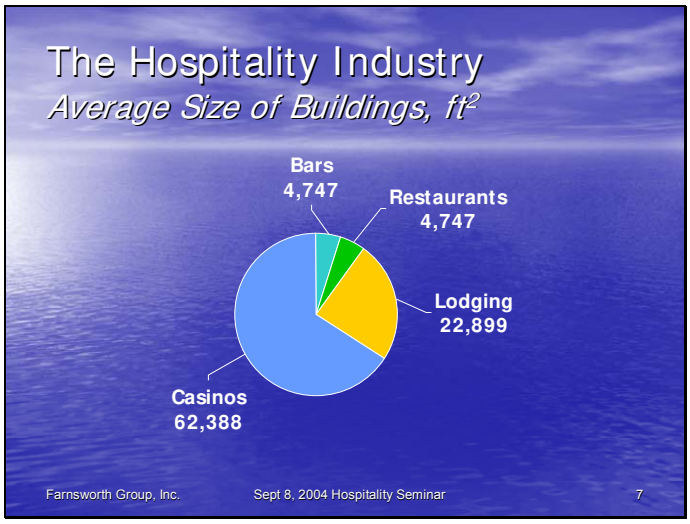
Slide 5



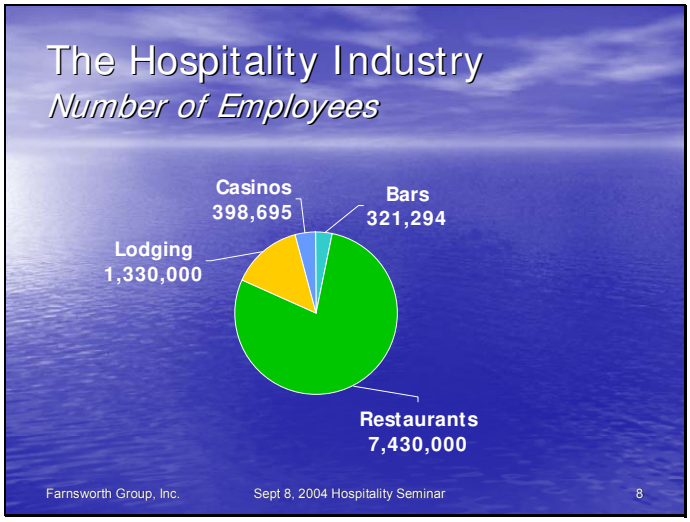
Slide 6



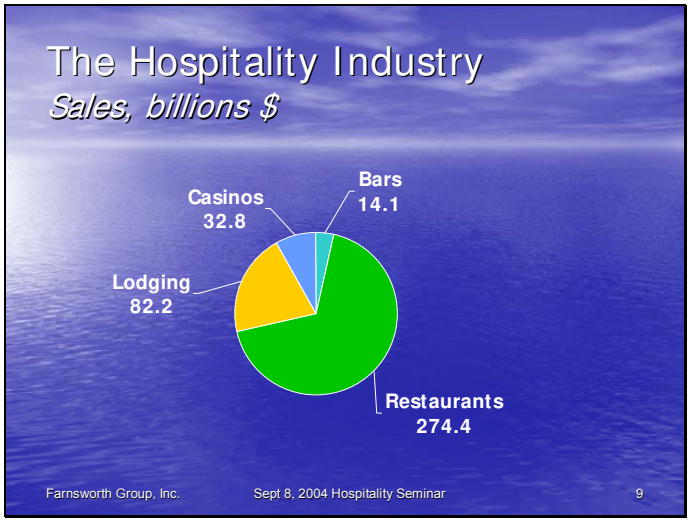
Slide 7



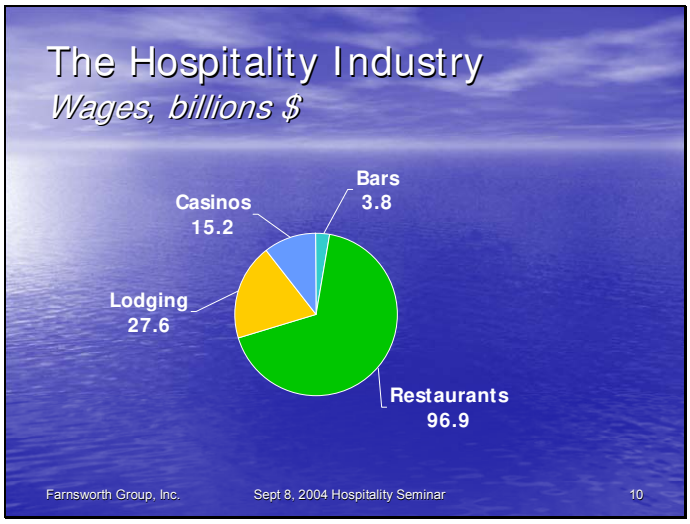
Slide 8



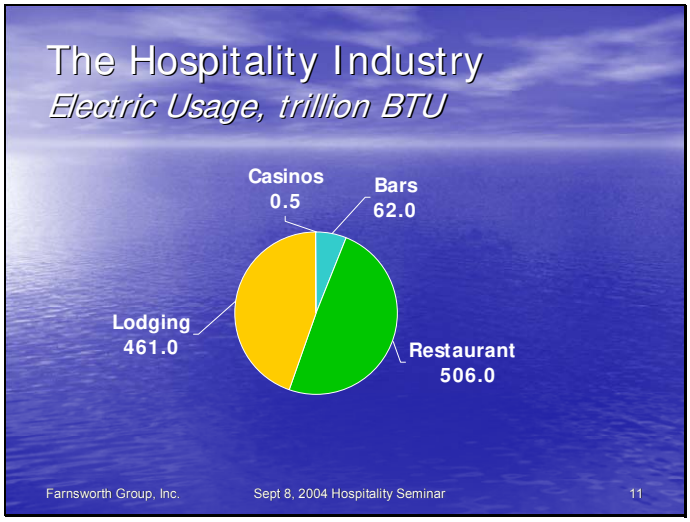
Slide 9



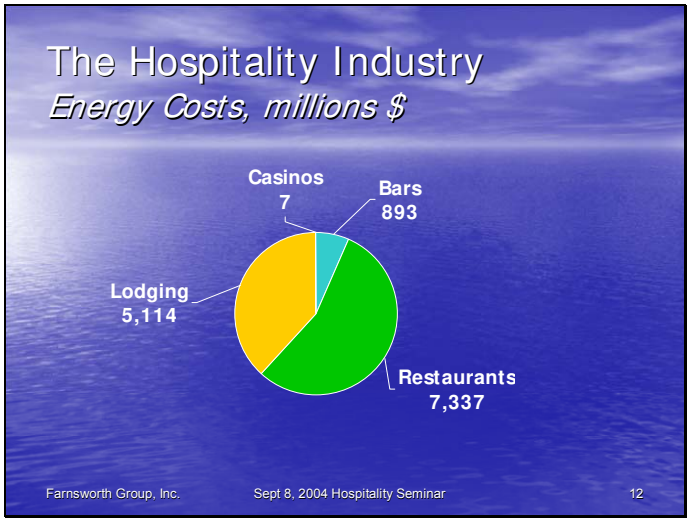
Slide 10



Slide 11



Slide 12



Slide 13

What is Indoor Air Quality?

- Quality of the space air
- Comfort of the occupants
- Avoidance of illness
  - Sick building syndrome
  - Building related illness

IAQ is both subjective and objective

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 13

Slide 14

Categorizing Buildings

- Wellness Categories
  - Healthy
  - Generally Healthy
  - Unhealthy, Source Unknown
  - Unhealthy, Source Known
  - SBS and BRI

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 14

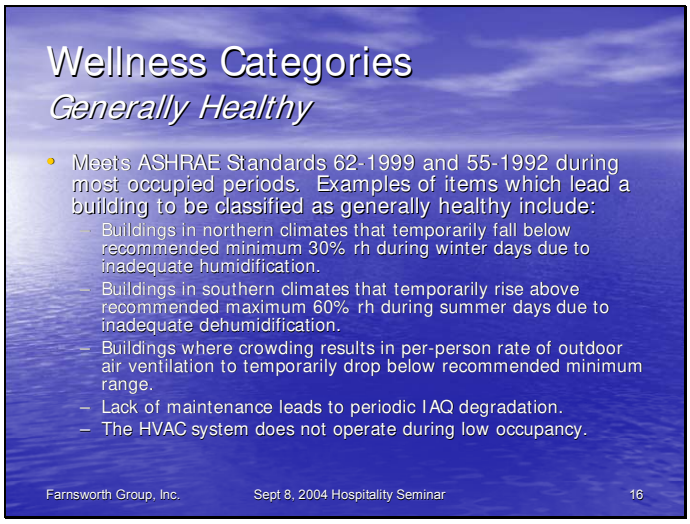
Slide 15

Wellness Categories
Healthy

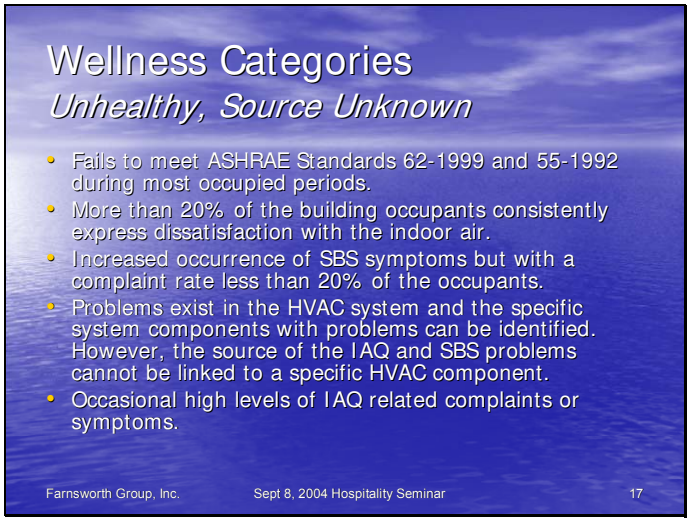
- Always meets ASHRAE Standards 62-1999 and 55-1992 during occupied periods
- 80% or more of the occupants do not express dissatisfaction with indoor air
- Building systems are well maintained
- Building health management practices exists

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 15

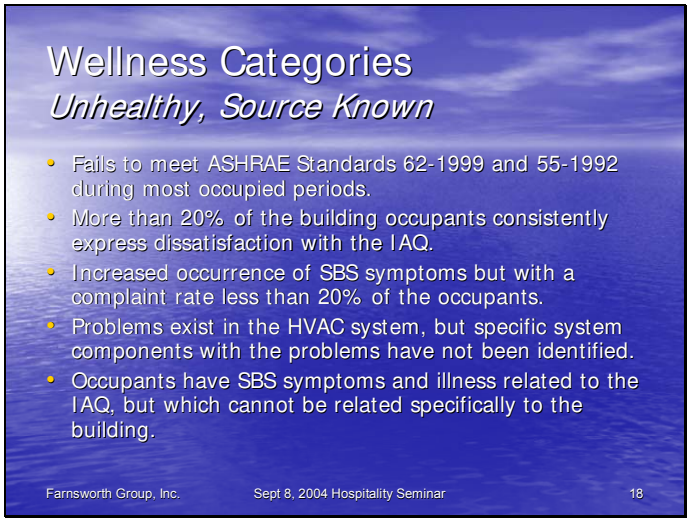
Slide 16



Slide 17



Slide 18



Slide 19

Example Unhealthy Buildings

- Buildings designed/operated using out-of-date ventilation rate standards
- Inadequate maintenance leading to dirty coils, dirty ducts, moisture, and mold growth
- Cross-contamination between occupied zones and sources of chemical pollution
- Poorly sized or inoperable HVAC equipment
- Uncontrolled contaminant generation and containment

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 19

Slide 20

Wellness Categories

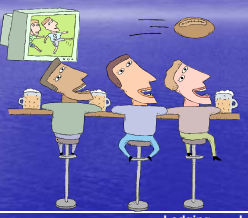
SBS and BRI

- More than 20% of the building occupants complain of SBS symptoms
- One or more cases of BRI have been documented
- Occupants report daily symptoms of IAQ related illness while in the building

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 20

Slide 21

Hospitality Industry Wellness Percentage Distribution



Building Wellness Category	National Building Wellness	Restaurants	Bars	Lodging (humid climate)	Lodging (non-humid climate)	Casinos
Healthy Buildings	20	15	10	12	15	15
Generally Healthy	40	35	10	18	30	25
Unhealthy, Source Unknown	20	30	25	40	35	20
Unhealthy, Source Known	10	12	45	15	10	30
SBS and BRI Building	10	8	10	15	10	10

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 21

Slide 22

Upgrade Opportunities

1. Meet or exceed the requirements of ASHRAE Standard 62-1999
   a) Change the rate of outdoor air
   b) Install demand control
   c) Develop smoke and odor control and separation systems
   d) Monitor outdoor air quantity to meet ventilation requirements
   e) Install local exhaust
   f) Increase ventilation effectiveness
   g) Maximize economizer cycle
   h) Relocate air vents
   i) Change the air filtration method
   j) Reduce unwanted infiltration/exfiltration

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 22

Slide 23

Upgrade Opportunities

2. Improve space control to meet the health needs of Standard 62-1999 and meet or exceed the generally accepted requirements of ASHRAE Standard 55-1992
   a) Improve space temperature control
   b) Improve control or provide positive control of humidity (dehumidification)
   c) Install humidification, self-contained steam humidifiers

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 23

Slide 24

Cost to Implement

IAQ Improvement	Total Potential Economics ($ millions) Labor	Materials	Combined
Meet ventilation standards (ASHRAE 62-1999)			
Change the rate of outdoor air to 20 cfm or more	$655.9	$1,881.6	$2,537.5
Monitor outdoor air quality to meet ventilation requirements	$353.6	$1,020.1	$1,373.7
Install local exhaust	$0.9	$4.3	$5.2
Increase ventilation effectiveness	$36.0	$136.3	$172.3
Maximize economizer cycle	$132.9	$0.0	$132.9
Relocate air vents	$196.2	$62.9	$259.1
Change air filtration method	$689.4	$1,979.7	$2,669.1
Reduce unwanted infiltration/or exfiltration	$145.4	$27.0	$172.4
Total for meeting ASHRAE 62-1999	$2,210.2	$5,111.9	$7,322.1
Improve space control (ASHRAE 55-1992)			
Improve space temperature control	$1,641.4	$4,734.9	$6,376.3
Improve control or provide positive control of humidity (dehumidification)	$1,154.0	$5,368.3	$6,522.3
Install humidification, self generated steam humidifiers	$0.8	$12.4	$13.2
Total for meeting ASHRAE 55-1992	$2,796.2	$10,115.6	$12,911.8
TOTAL	**$5,006.4**	**$15,227.5**	**$20,233.9**
Maintenance/on-going costs			$1,112.87

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 24

Slide 25

Benefits of Improved IAQ

- Reduced health and medical costs
- Reduced classical absenteeism
- Reduced turnover costs
- Increased productivity
- Reduced sick leave costs
- Increased sales
- Improved sales
- Reduced complaint resolution

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 25

Slide 26

Savings due to Improve IAQ

	Bars	Restaurants	Lodging (humid)	Lodging (non-humid)	Casinos	Total
Demographics						
Number of buildings	52,825	434,081	105,148	52,852	651	645,557
Total space (million ft²)	252	1,101	2,408	1,210	40.6	5,012
Number of employees	321,294	7,430,000	885,108	444,892	398,695	9,479,989
Annual payroll (million)	$3,552	$90,739	$17,179	$8,635	$11,053	$131,158
Total sales (million)	$13,187	$257,020	$51,252	$25,762	$31,629	$378,850
Benefits of Improved IAQ						
Reduced health and medical cost (million)	$56	$1,296	$154	$78	$70	$1,654
Reduced classical absenteeism (million)	$98	$1,738	$454	$181	$246	$2,717
Reduced turnover costs (million)	$20	$307	$42	$17	$20	$ 406
Increased productivity (million)	$50	$948	$234	$97	$130	$1,459
Reduced sick leave costs (million)	$17	$343	$81	$35	$46	$ 522
Increased sales (million)	$132	$2,570	$513	$258	$316	$3,789
Improved sales (million)	$264	$5,140	$1,025	$515	$633	$7,577
Reduced complaint resolution (million)	$201	$881	$241	$121	$32	$1,476
Annual total benefits (million)	$837	$13,223	$2,744	$1,302	$1,492	$19,598
Annual total benefits (per employee)	$2,605	$1,780	$3,100	$2,927	$3,742	$2,067
Annual total benefits (per ft²)	$3.33	$12.01	$1.14	$1.08	$36.73	$3.91
Cost to Implement						
Implement all identified IAQ improvements (million)	$631	$13,860	$4,096	$1,536	$111	$20,234
Average cost per square foot (per ft²)	$2.51	$12.58	$1.70	$1.27	$2.73	$4.04
Average cost per worker (per employee)	$1,964	$1,865	$4,628	$3,452	$278	$2,134
Initial average economic simple payback (yrs)	0.75	1.05	1.49	1.18	0.07	1.03
Annual cost to sustain all improvements (million)	$35	$762	$225	$84	$6	$1,112
Net 20-year present value of benefits less cost*						
For all improvements	$11,307	$171,526	$33,370	$16,578	$21,993	$254,774
Per ft² for all improvements	$44.93	$155.74	$13.86	$13.70	$541.50	$789.73
Per worker for all improvements	$35,191	$23,086	$37,702	$37,263	$55,163	$188,405

Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 26

Slide 27

Questions?

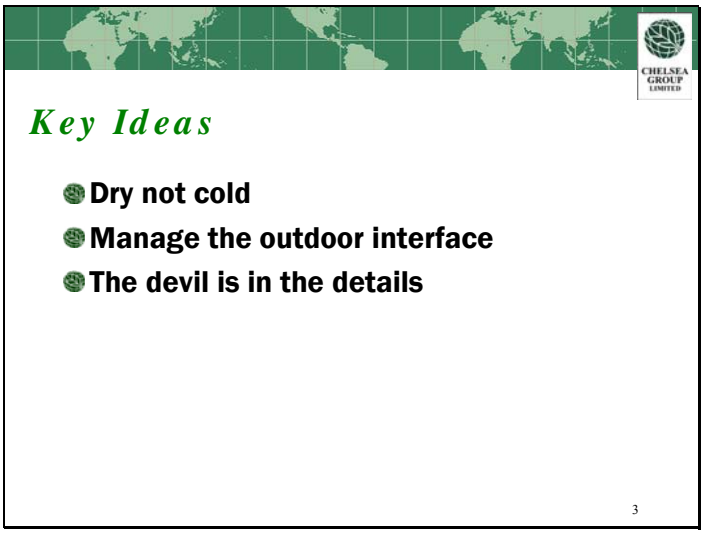
Farnsworth Group, Inc. Sept 8, 2004 Hospitality Seminar 27

APPENDIX D – GEORGE BENDA PRESENTATION

Slide 1

Slide 2

Slide 3



Slide 4

Case Study: Hilton Hawaiian Village

- Kalia Tower, with more than 400 rooms, completed in 2001
- $95 million building
- Mold remediation history
  - Mold found early 2002
  - Tower closed June 2002
  - Tower reopened September 2003
- More than $55 million in cost to Hilton

4

Slide 5

IAQ Challenges in the Tropics

- Moderate temperatures, high humidity
- Multiple climates in close proximity
- Major storm events
- Salt spray
- Wind, wind, wind

5

Slide 6

Energy Advantages in the Tropics

- Sun, sun, sun
- Wind, wind, wind

Slide 7

IAQ Problems

- Moisture and mold
- Allergens
- Ventilation in mechanically conditioned spaces
- Pest control chemicals
- Deterioration of equipment

7

Slide 8

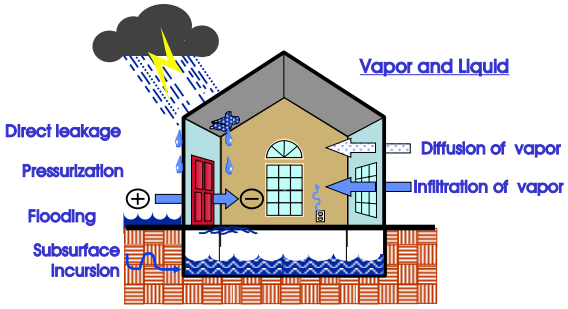
Mold Needs…

- **Moisture**
  - Damp
  - Frequently wetted
  - Humid
- **Food**
  - Species preferences
  - Organic material
  - Many building materials
- **Dim light or dark**
  - Low UV
- **Temperature**
  - Species preferences
  - If you're happy, mold is happy

8

Slide 9

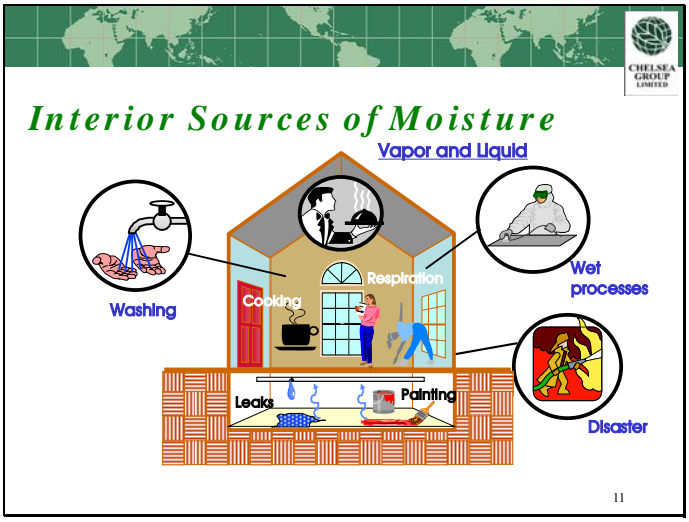
Exterior Sources of Moisture



9

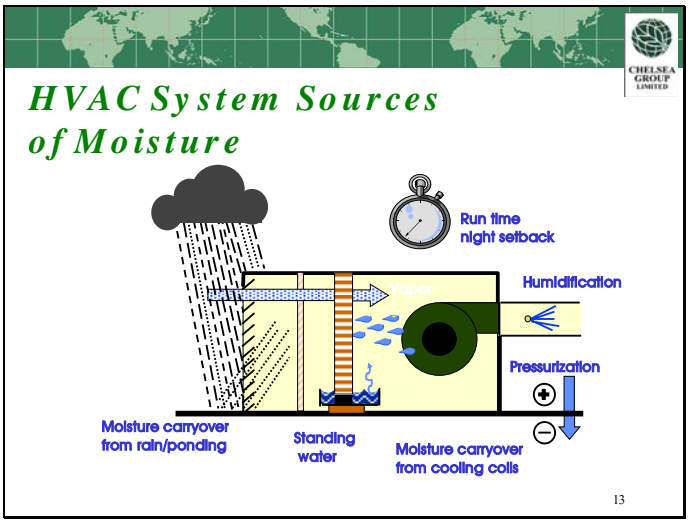
Slide 10

Slide 11

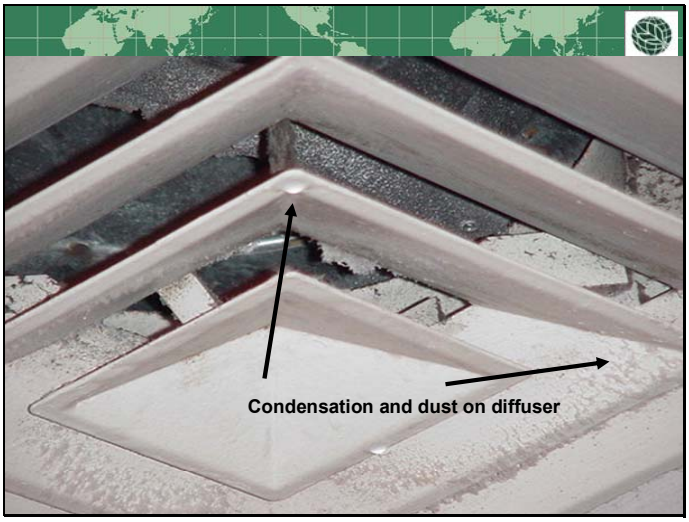


Slide 12

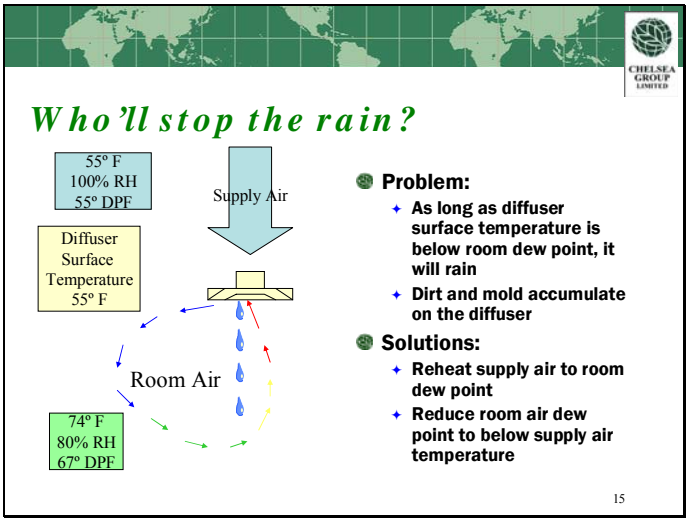
Slide 13



Slide 14



Slide 15



Slide 16

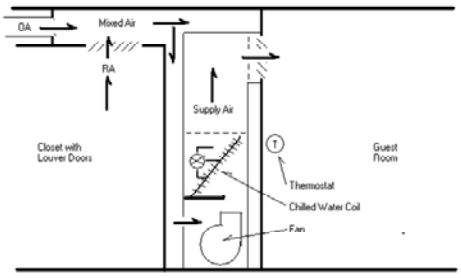
Devil in the Details

- Construction details often weak in tropical locale
- Doing it how it's always been done is usually wrong
- Unintended airflows and moisture intrusion the result

16

Slide 17

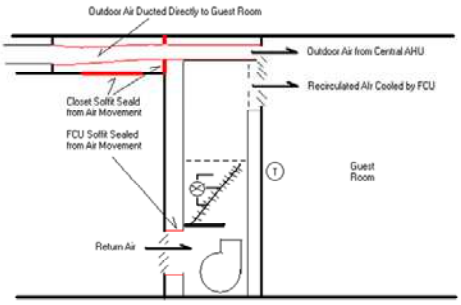
Wrong



17

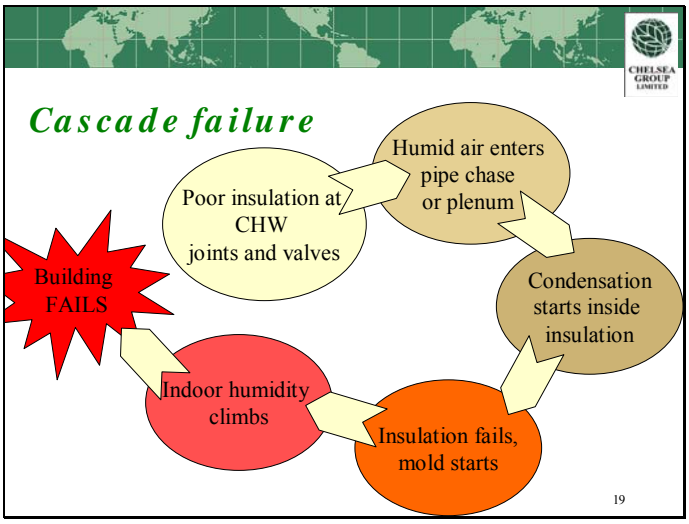
Slide 18

Right

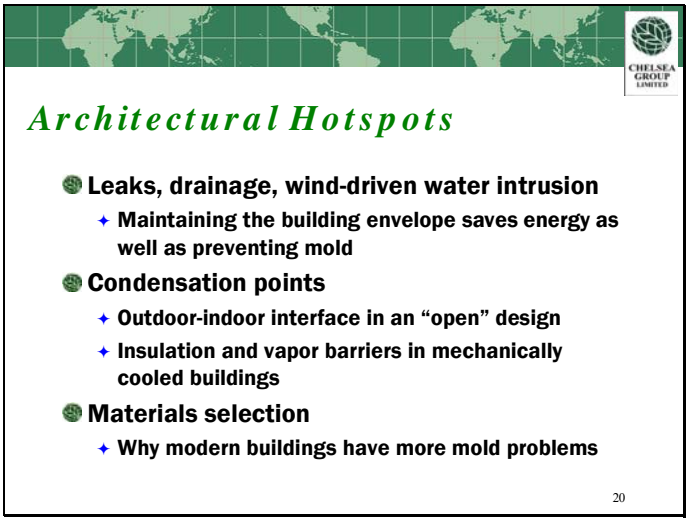


18

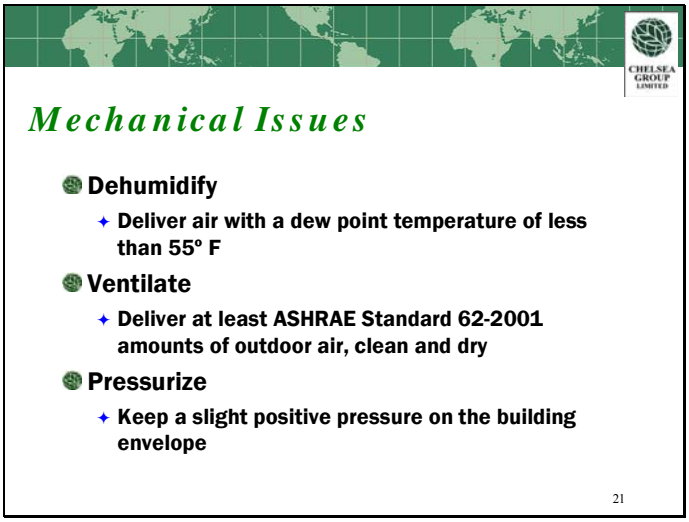
Slide 19



Slide 20



Slide 21



Slide 22

Easy to say…hard to do…

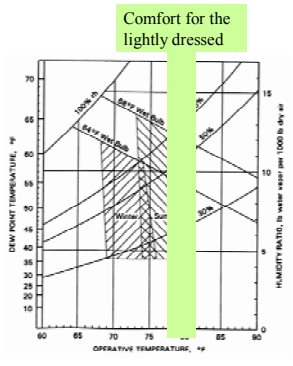
- **How can I ventilate, pressurize *and* meet dew point temperature of less than 55° F and not bust the energy budget?**
- **How can I control the outdoor interface and meet occupant expectations?**
- **How can I attend to any more details in building operations?**

22

Slide 23

Solution Set #1

- **Deliver dry air rather than cold air**
  - **Reheat or desiccant dehumidification in central systems**
  - **Apply to mixed natural and mechanical**
  - **Shoot for 78° - 82° F, 30 – 60% RH, or 50° - 55° F dew point**



23

Slide 24

Active Dehumidification

- **Control to dew point rather than relative humidity**
- **Separate latent load (humidity) from sensible load (temperature) for control**
- **Use desiccants for energy efficiency**
- **Can be integrated or stand alone**

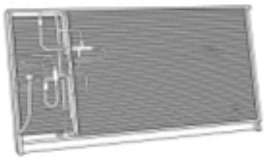
Modular Dehumidification Unit

24

Slide 25

Package Rooftop Dehumidifier Option

- Uses refrigerant cycle to subcool and reheat
- Control on interior space humidity or dew point
- Sustains energy efficiency



25

Slide 26

Non-fossil Reheat Energy

- Use solar hot water to reheat
  - Central ventilation air supply
  - Locally for room fan coil units

26

Slide 27

Solution Set #2

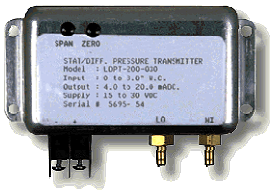
- Manage the outdoor interface to minimize dew point conditions
  - Deliver dry, ambient temperature air to interface areas
  - Choose stone and non-porous surfaces at interface
  - Avoid vapor barrier creation on adjacent interior surfaces

27

Slide 28

Pressure Management

- Reduce moisture intrusion
- Control cross-zone contamination
- More flexible space use



28

Slide 29

Solution Set #3

- Set minimum credentialing standards for vendors
  - Establish a schedule to require construction and service contractor teams to include an **MLP** certification from IAQA
- Build understanding and skill through training
  - **CIAQP** from AEE or **CIE** from IAQA for engineering team
  - **MLP** for technicians and in-house construction teams

29

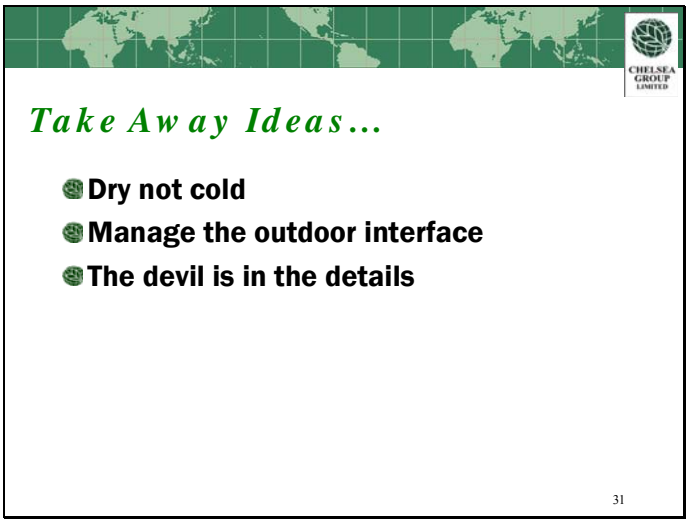
Slide 30

IAQ Instant Winners – Energy Losers?

- Keep coil face velocity below 550 fpm
- Keep chilled water at design temp
- Do not set up CHW temperature
- Do not duty cycle
- Operate systems 24/7

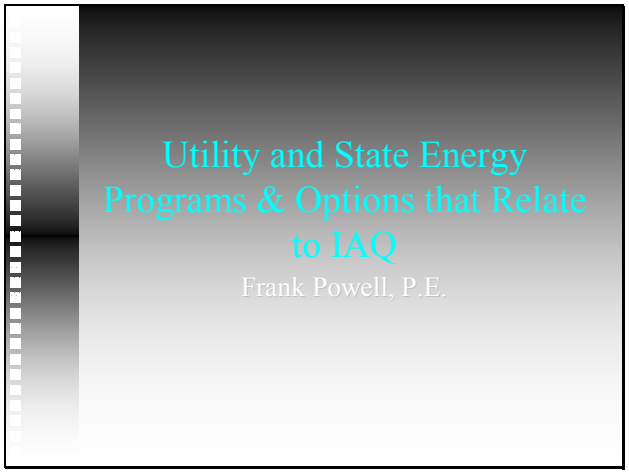
30

Slide 31

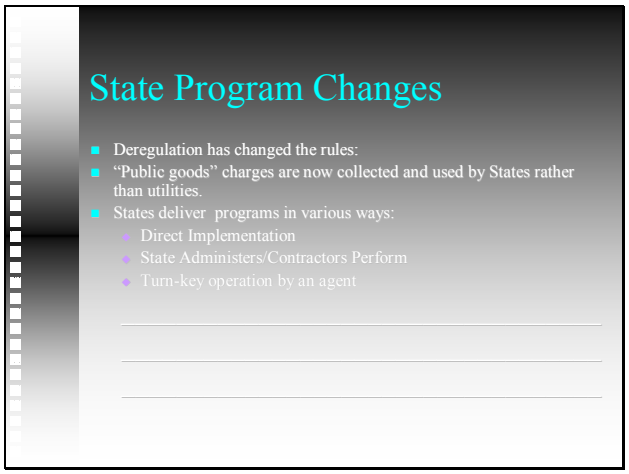

CHELSEA GROUP LIMITED
Take Away Ideas…
Dry not cold
Manage the outdoor interface
The devil is in the details
31

APPENDIX E – FRANK POWELL PRESENTATION

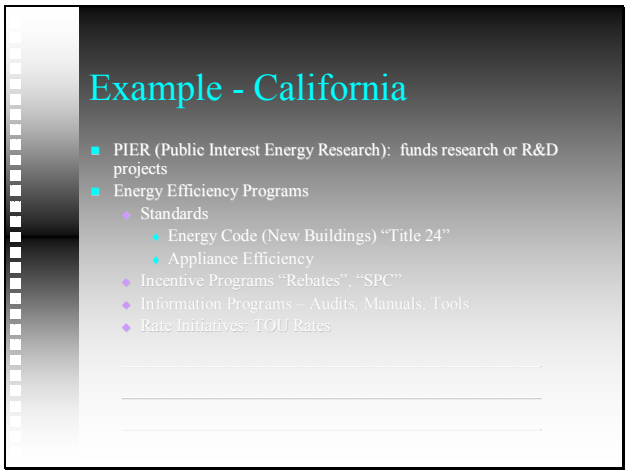
Slide 1



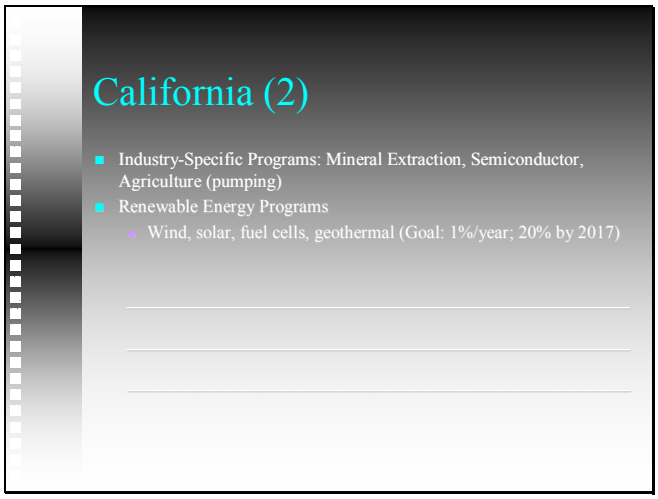
Slide 2



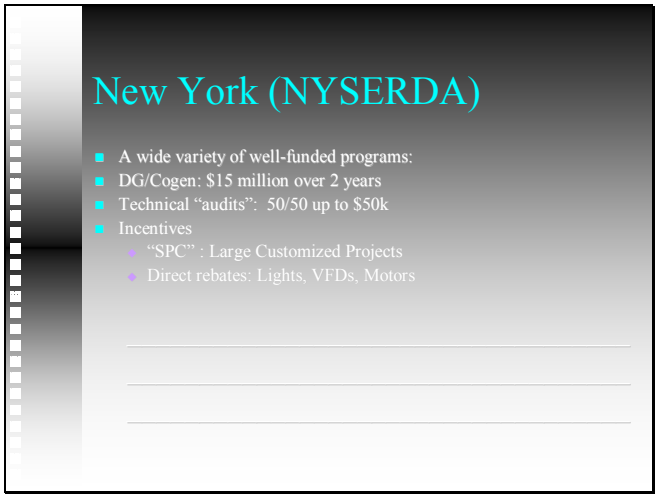
Slide 3



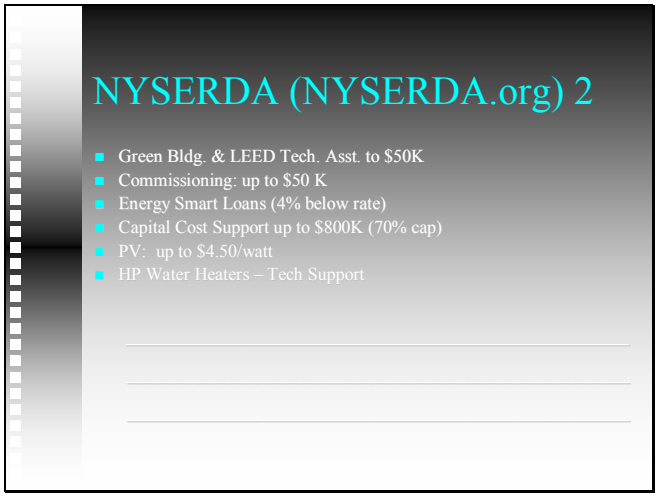
Slide 4



Slide 5



Slide 6



Slide 7

NEVADA (NP.com)

- Sure Bet Program
  - Incentives up to ($10K/yr) for prescribed efficiency measures: lighting, AC, window shades/film, etc.
  - Demonstration retro-commissioning & energy studies
  - Solar (PV) Installations

Slide 8

Top Efficiency Measures for Hospitality Facilities

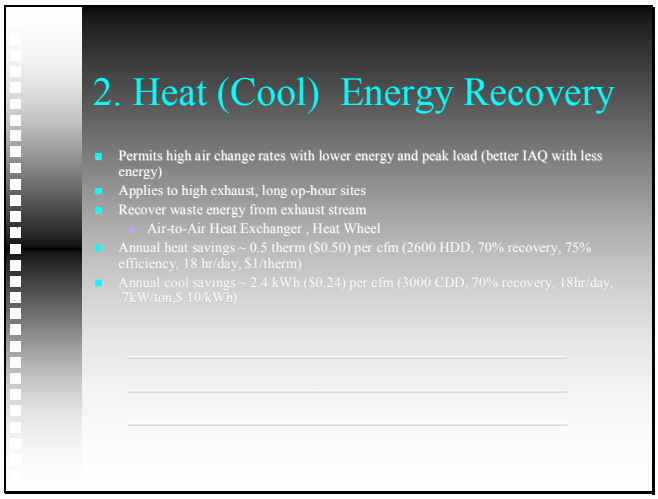
- Lighting
- Ventilation
- Air Conditioning
- Heating
- Water Heating

Slide 9

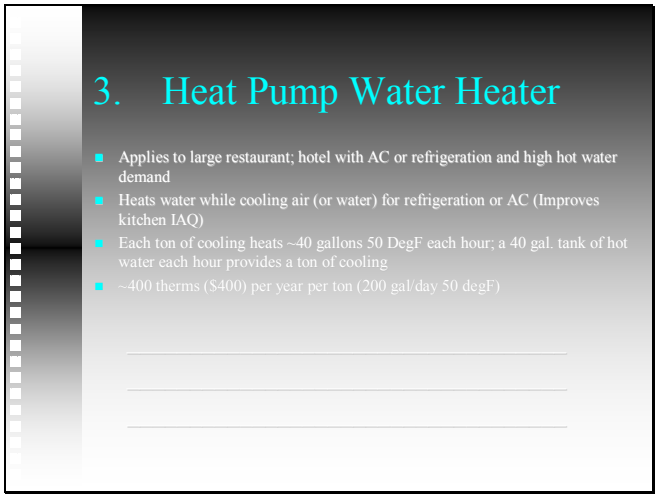
1. Lighting

- High Efficiency Fixtures in halls, back-of-house, kitchen and storage (30% Savings)
- Compact fluorescents in sconces, etc.
- Dimmers on Dining Area Lighting
- HID Exterior Lights
- Retrofit - Typical payback 1-3 years
- Most states/utilities offer incentives

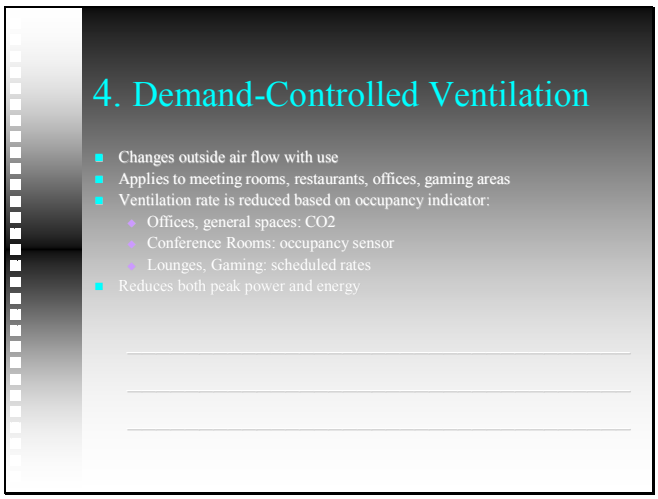
Slide 10



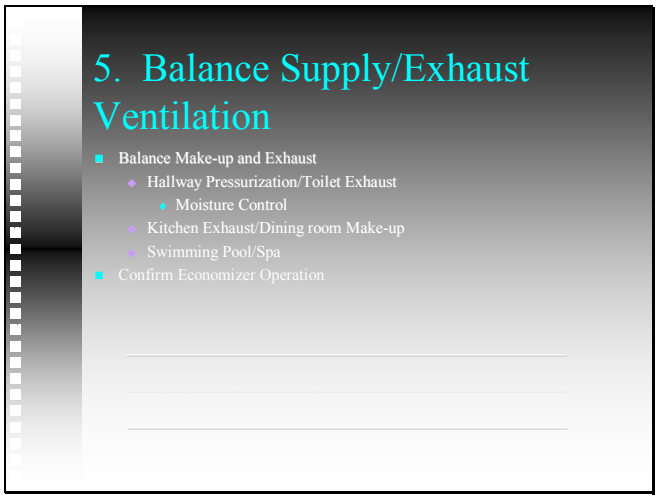
Slide 11



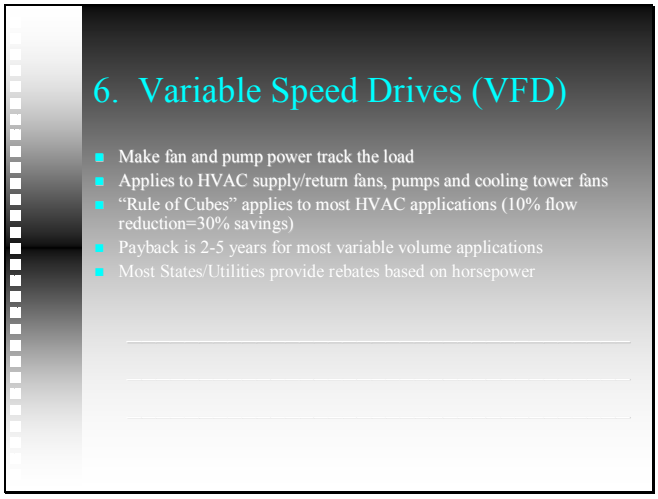
Slide 12



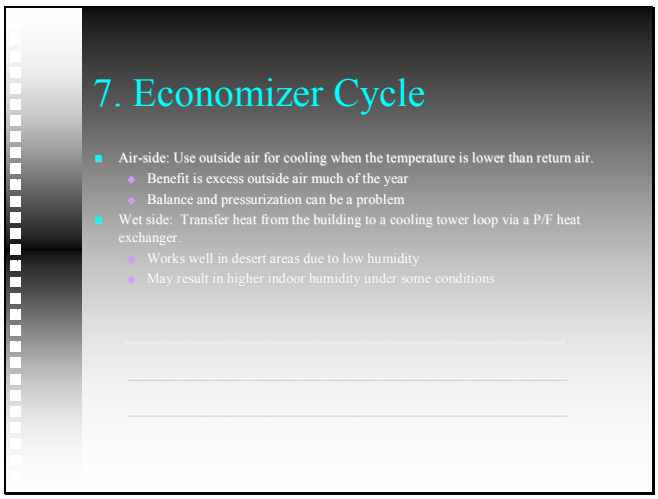
Slide 13



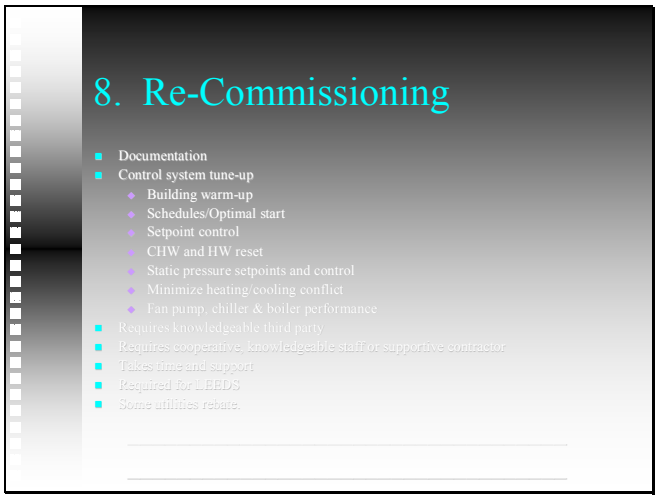
Slide 14



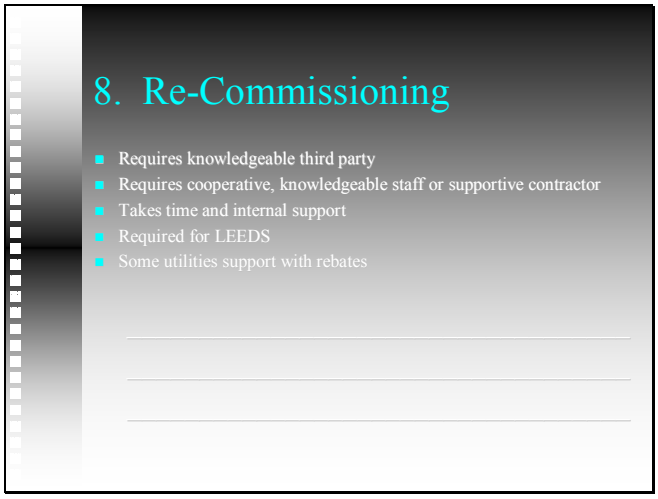
Slide 15



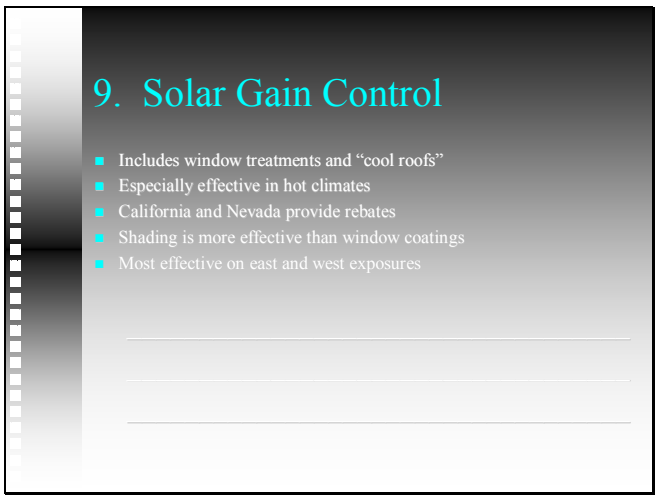
Slide 16



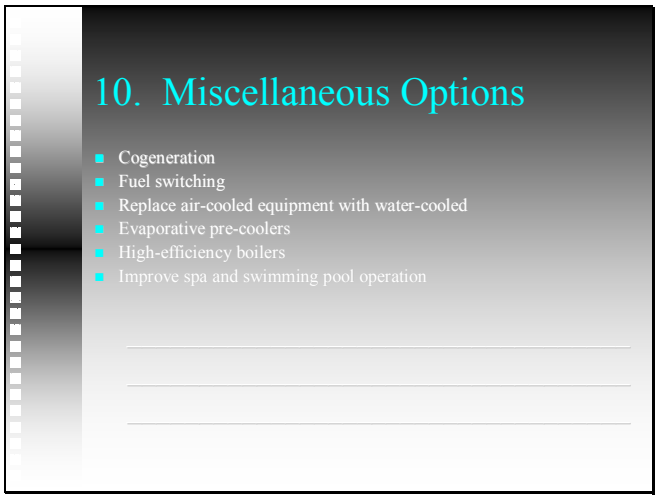
Slide 17



Slide 18

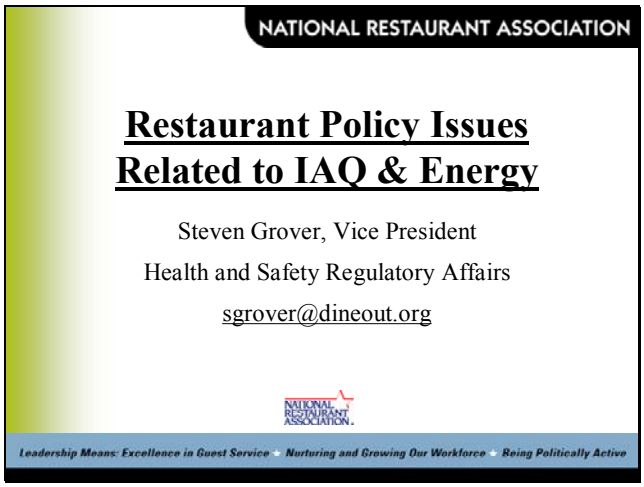


Slide 19

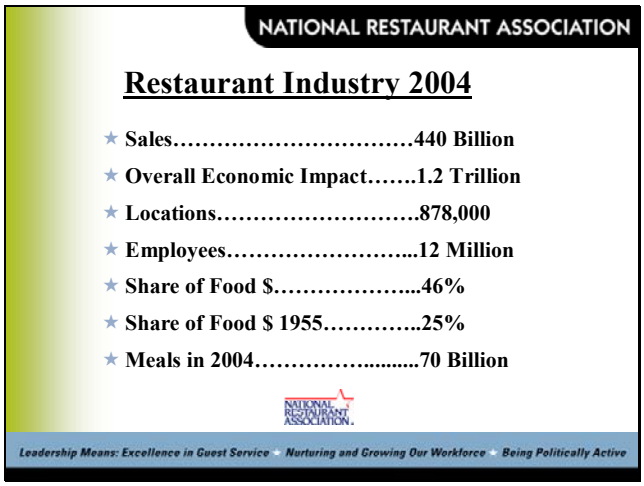

10. Miscellaneous Options
Cogeneration
Fuel switching
Replace air-cooled equipment with water-cooled
Evaporative pre-coolers
High-efficiency boilers
Improve spa and swimming pool operation

APPENDIX F – STEVEN GROVER PRESENTATION

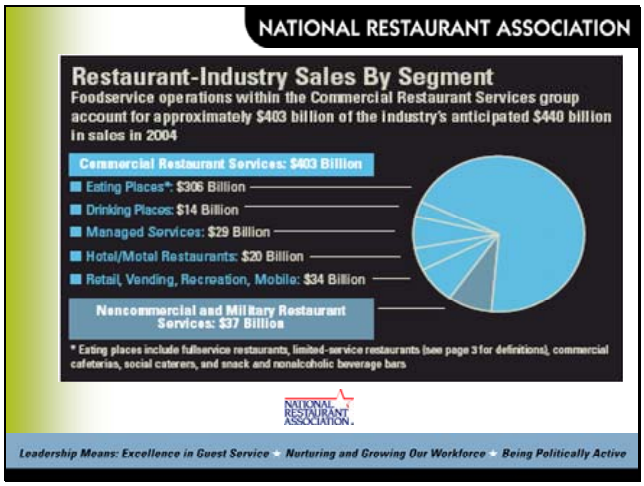
Slide 1



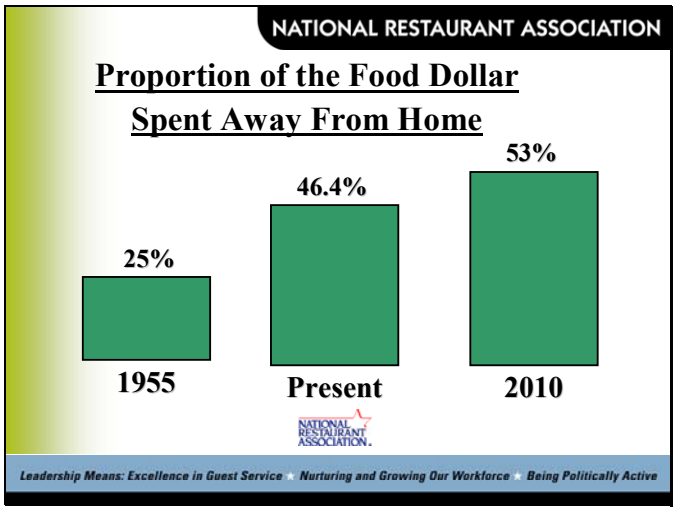
Slide 2



Slide 3



Slide 4



Slide 5

Slide 6

Slide 7

NATIONAL RESTAURANT ASSOCIATION

Equipment Sales Forecast--2004

- Chain restaurants and independents continue to struggle with restricted growth, however there is the beginning of a turnaround this year
- Funding for capital goods remains difficult for many operators and may become tighter in the near term
- Operator outlook improving slightly, rate of growth should accelerate slowly
- Growth is expected to slowly improve through 2005, however caution is the word for the foreseeable future

Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

Slide 8

NATIONAL RESTAURANT ASSOCIATION

Energy on Front Burner in 2004

- New concerns about international oil supplies
- Rising energy cost across the board
- The impact of oil price spikes on the economy
- Awareness of recent events in the West
- The Summer concerns regarding gas supplies
- Impact of energy fluctuations
  - Consumer spending
  - Transportation costs
  - Operations costs

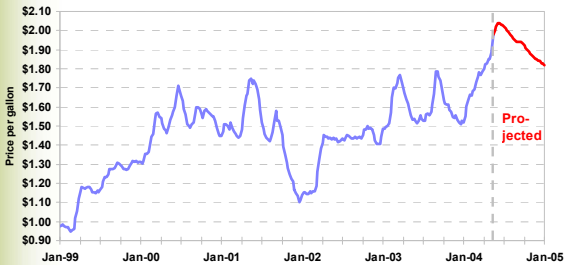
Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

Slide 9

NATIONAL RESTAURANT ASSOCIATION

Average Price for a Gallon of Gasoline

Weekly average for all grades, including taxes



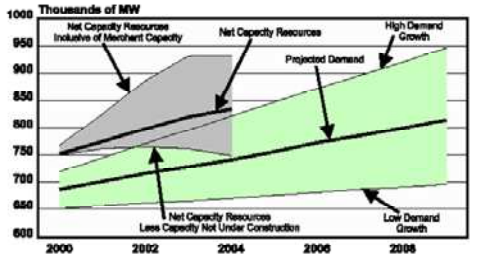
Source: Energy Information Administration

Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

Slide 10

NATIONAL RESTAURANT ASSOCIATION

United States
Capacity vs Demand – Summer



Source: NERC 2001

Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

Slide 11

NATIONAL RESTAURANT ASSOCIATION

Restaurant Energy Outlook 2004

- Controlling utility costs is important, increased energy costs over the last decade has elevated the need for restaurant energy management
- Significant factors in reducing energy use in restaurants
  - Commitment of management
  - Energy use data collection and review
  - Selection of energy efficient facilities & equipment
- Controllable restaurant costs
  1. Payroll
  2. Food
  3. Facilities
  4. Utility

Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

Slide 12

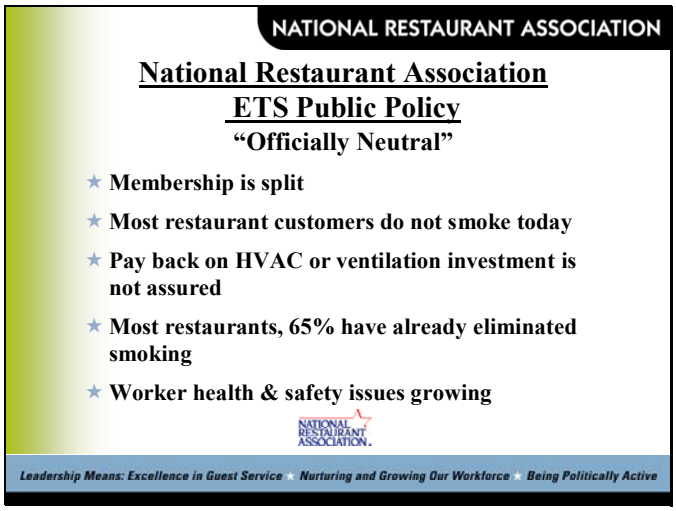
NATIONAL RESTAURANT ASSOCIATION

Restaurant ETS Issues in 2004

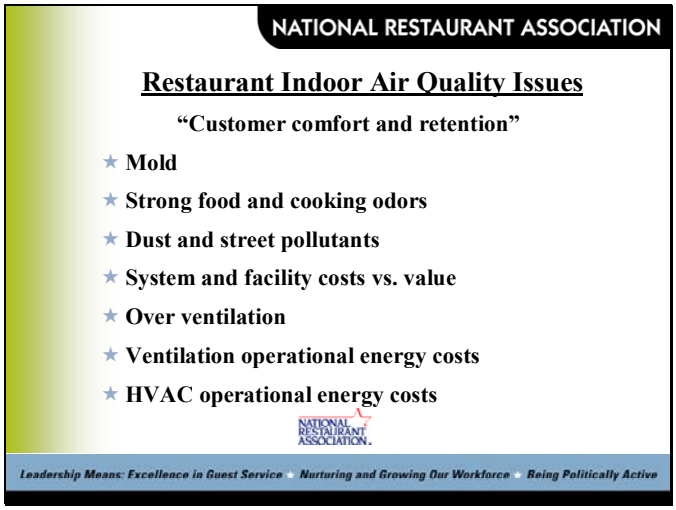
- **"Business owners right to choose"**
- **ETS or customers may not be the real issue**
- **80% of the public approves restrictions on smoking in public establishments**
- **EPA and OSHA have not taken actions to restrict workplace smoking at the federal level**
- **States and cities will continue to take action to ban or severely restrict smoking in restaurants**
- **Anti-smoking activist are well funded**

Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active

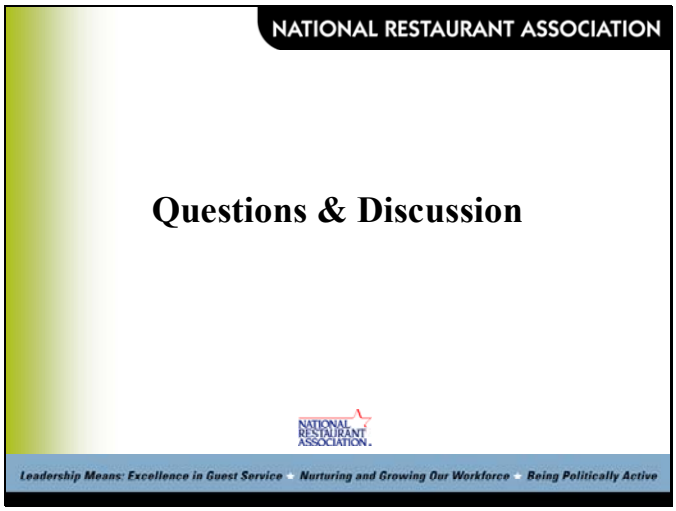
Slide 13



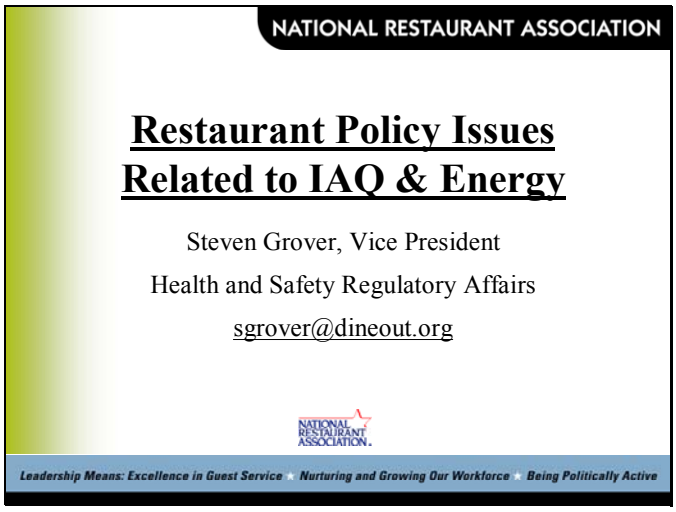
Slide 14



Slide 15



Slide 16


NATIONAL RESTAURANT ASSOCIATION
Restaurant Policy Issues
Related to IAQ & Energy
Steven Grover, Vice President
Health and Safety Regulatory Affairs
sgrover@dineout.org
NATIONAL RESTAURANT ASSOCIATION
Leadership Means: Excellence in Guest Service ★ Nurturing and Growing Our Workforce ★ Being Politically Active