

# Looking Forward In HVACR



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## Introduction

The heating, ventilating, air conditioning, and refrigeration (HVACR) industry is facing two dramatic events, imposed by regulatory fiat. These are a 30% increase in the minimum efficiency of unitary air conditioners produced after 2005 (from a “seasonal energy efficiency ratio,” or SEER of 10 to 13) and a change in refrigerants for production of air conditioners from R-22 to R-410a. Both events offer the potential to profoundly impact the industry for several years.

Few would disagree that the events will have an impact on the industry. How much of an impact, and for how long, is much more open to speculation. In truth, no one really knows the depth, breadth, and possible manifestations of 13 SEER and 410a. Any who claim they do are either self-deceptive or disseminating.

Thus, 13 SEER and 410a, especially when combined with other impending industry events and trends, make the future uncertain. How can one prepare? The answer, of course, is to analyze the trends, speculate on the impact of the events, and make the best possible hypotheses of the outcomes. This white paper is my attempt to look forward, so that others might better prepare.

A number of people provided their assistance in the preparation of this paper and their insight was invaluable. Aspects of this analysis that are on the mark are likely due to the insight of others. Where the analysis is wrong, the errors are mine. The following people assisted in the preparation of this paper:

- Rex Boynton – President, North American Technician Excellence (NATE)
- Alex Carney – *Appliance Magazine*
- Mitch Cropp – President, Cropp Metcalfe
- Mike Hajduk – President, Callahan-Roach Products & Publications
- Paul Hobaica – President, Hobaica Refrigeration
- Tom Morton – Vice President of Sales & Marketing, Texas Furnace Co.
- Matt Prazenka – President, American Weathermakers
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- John Riley – Vice President of Sales, Trion
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- Ron Smith – Ron Smith Consulting and Coaching
- Joe Stevens – Air-Conditioning & Refrigeration Institute (ARI)
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- Randy Tice – President, Heating Airconditioning, & Refrigeration Distribution International (HARDI)
- Garry Upton – Senior Vice President, Decision Analyst
- Chandler von Schrader – EPA Energy Star Home Improvement Program
- Mike Weil – Editor-in-Chief, *Contracting Business Magazine*

It should be noted that not all will agree with the analysis and some preferred to remain anonymous.

For those unfamiliar with the HVACR industry, some background may be in order. This includes an overview of the construction and components of an air conditioner and the structure of the industry's distribution channel(s). This information can be found in the Appendix.

The key events and trends examined in this paper include...

- **13 SEER** – Beginning in January, the minimum air conditioner efficiency is raised 30%. Reviewed are the impact of 13 SEER on:
  - Channel Pricing
  - Consumer Pricing
  - Market Share Shifts
  - Component Manufacturers
  - The Replacement Market
  - Parts
  - Compressor Failures
  - Mold
  - Maintenance
- **Energy Star** – EPA Energy Star is beginning to shift its focus from equipment to installations and everything downstream of the equipment.
- **New Construction** – The growing dominance of a handful of homebuilders is likely to exacerbate the already intense new construction pricing pressure.
- **Pacific Rim Competition** – Long feared Pacific Rim competitors are finally entering the U.S. market with U.S. style split systems, but 13 SEER mitigates most of their pricing advantages.
- **Residential Indoor Air Quality** – IAQ continues to be a missed opportunity for the HVAC industry. There is not reason to believe the situation will change.
- **Commercial Indoor Air Quality** – In the commercial sector, IAQ is already incorporated into the air side of the market.
- **Skilled Labor Shortage** – The shortage of technicians is creating opportunities for manufacturers to increase brand preference by incorporating diagnostic intelligence into their products, allowing less experienced technicians to perform more effectively and efficiently.
- **R410a** – In 2010, the production of R22 air conditioners will cease and all residential air conditioners will be manufactured with R410a.
- **Chillers** – 33 thousand of the original 80 thousand R11 and R12 chillers installed in the U.S. are still awaiting replacement.
- **Commercial Refrigeration Standards** – A federal energy standard for self-contained commercial refrigeration is on the way.

- **World Refrigeration Market** – A growing middle class in several developing world nations is stimulating demand for cold chains for food and medicine.
- **Contractor Consolidation** – The first round of contractor consolidation failed and another may be starting.
- **Distributor Consolidation** – Distributor consolidation may lead to a shift of power in the channel of distribution.
- **Contractor Affiliation** – Contractors are seeking affiliations in record numbers with uncertain implications.

## Looking Forward in HVACR

Central air conditioners are remarkably well designed and manufactured. The products are designed with wide tolerance, which has unfortunately permitted sloppy field design and installation practices to occur with little consequence.

Air conditioners also operate for years without maintenance. Though empirical research has shown that annual maintenance saves homeowners more than it costs through returning efficiency to factory fresh performance, preventing breakdowns, extending equipment life, and restoring lost capacity, most homeowners do not get their systems maintained annually. Yet, the air conditioners still operate.

With the changes coming from 13 SEER and 410a, tolerances will get tighter. Sloppy field design and installation is likely to be revealed. Air conditioners will be less likely to operate for years without maintenance.

### 13 SEER

The seminal event facing the HVAC industry is the 30% increase in efficiency mandated by the federal government. Beginning in January, 2006, it will no longer be possible to manufacture air conditioners with an efficiency level of less than 13 SEER (seasonal energy efficiency ratio). This is an increase from today's 10 SEER minimum, which was imposed in 1992. The increase from 10 to 13 SEER will have a significant impact on the short term performance of the industry.

### Channel Pricing

We are anticipating an increase of 30% to 40% in the cost of equipment from unitary manufacturers. Attempts will be made to stick with this increase and pass it down the channel. Given excess industry capacity, it is entirely possible that some manufacturers may reduce margins to gain share, causing the increase to eventually settle in the 25% to 35% range.

Higher efficiency products have traditionally carried better margins than standard efficiency. In essence, higher efficiency subsidized competitive pricing for minimum efficiency products.

Today, one third of air conditioners carry efficiencies above the 10 SEER minimum. Less than 10% are 13 SEER or higher. Since there will be less opportunity to subsidize minimum efficiency products with higher efficiency products, manufacturers will either need to raise margins on minimum efficiency products or see a reduction in their overall, blended gross margins.

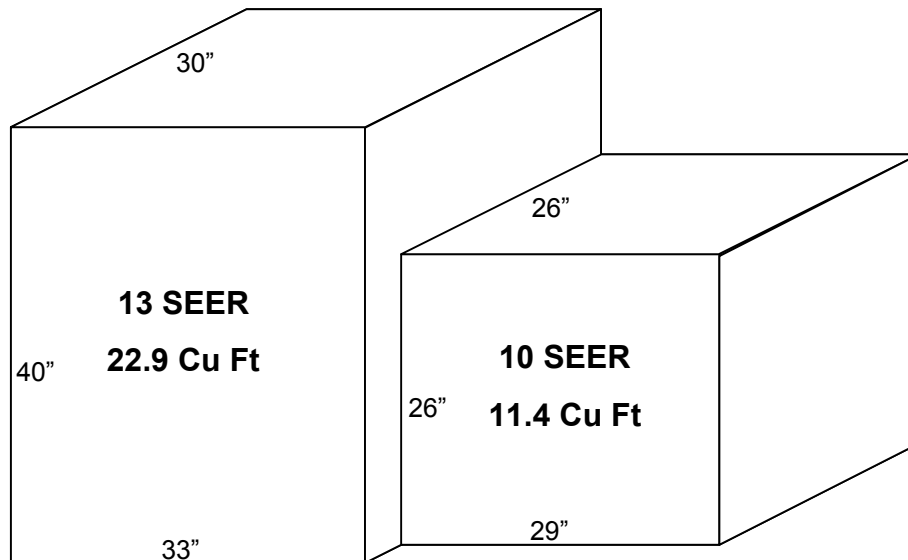
Distributors have little option but to pass along the costs they receive. Their margins are already thin. Top contractors will maintain their margins. Low price contractors will not.

Some low price contractors are in the habit of adding \$500 to \$1000 to the cost of a system replacement, representing their total gross profit. There is no reason to expect them to discontinue the practice, reducing their margins.

In time, manufacturers should be able to value engineer 13 SEER equipment. It is possible that they will find ways to shave another 5% from the cost.

## Consumer Pricing

13 SEER equipment will be physically larger. Potentially, this could lead to even higher installation costs. Condensing units may need to be relocated. Air handlers may not fit through some attic scuttle holes for horizontal or downflow applications, requiring contractors to remove the casing and reassemble it in the attic. In some closet or basement upflow applications, additional duct fabrication or even carpentry may be necessary. Or, a furnace replacement with a low profile unit may be required.



While new designs will be introduced, current 13 SEER equipment for one leading manufacturer is more than twice as large as 10 SEER equipment.

All of this is speculation until the final evaporator configurations are introduced. The unitary manufacturers will do their best to keep the impact minimal. Yet, it is possible that costs will increase for some installations, bumping the price to the consumer another 5% or so.



An example of an attic scuttle hole that requires evaporator disassembly.



A typical attic pull down ladder for recent new construction that is inadequate for many of today's high efficiency air handler assemblies.

## Market Share Shifts

Many top contractors have already shifted to 12 SEER as their base offering. While they will be able to handle the higher pricing from 13 SEER in stride, most contractors will not. They will feel price pressure from their customers and pass it up the channel. It is likely that lower cost, fighting brands will pick up market share.

The market share gains for the fighting brands are likely to come from mid-tier brands more than premier brands, though both may lose share. Premier brands are sold by more than their share of top contractors, who will be able to sell value and hold prices. This will somewhat mute the potential for penetration losses. Mid-tier brands are likely to suffer the most market penetration losses.

## Component Manufacturers

The component manufacturers will be largely exempt from the channel price pressure. They are too few in number. They enjoy economies of scale unitary manufacturers would be hard pressed to replicate. They are also protected by significant barriers in the form of engineering costs, tooling, and manufacturing infrastructure.

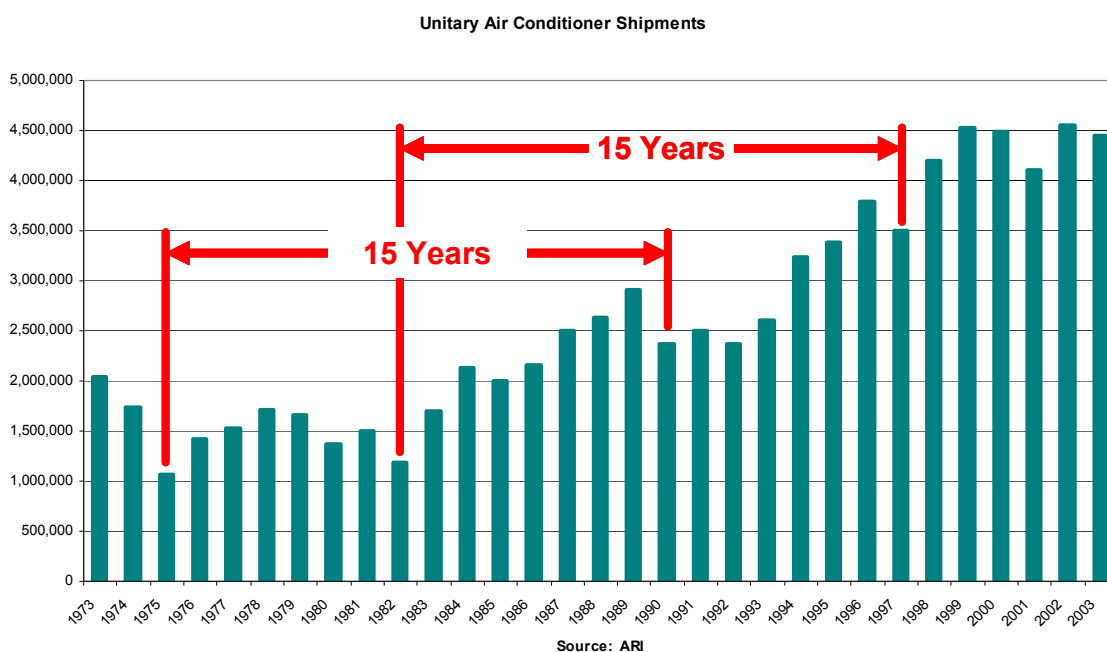
Within limits, component manufacturers can charge what they want. They only need to keep their pricing below the point where it becomes economically advantageous for unitary manufacturers to begin making components in-house.

Expansion valve manufacturers are likely to be the greatest beneficiary from the 13 SEER minimum. To meet the minimum efficiencies, orifices will be phased out and expansion valves are expected to triple in volume.

Compressor and fractional horsepower motor manufacturers will also benefit. They will ship more expensive, higher margin products to the industry and also see increased sales from parts (see “Parts” below).

## The Replacement Market

The air conditioner market benefits from a fairly stable 15 year replacement cycle. This cycle will shift forward for a particularly hot summer (causing air conditioners to fail early) or back if the weather is mild (and air conditioners that would have failed, make it through another summer).



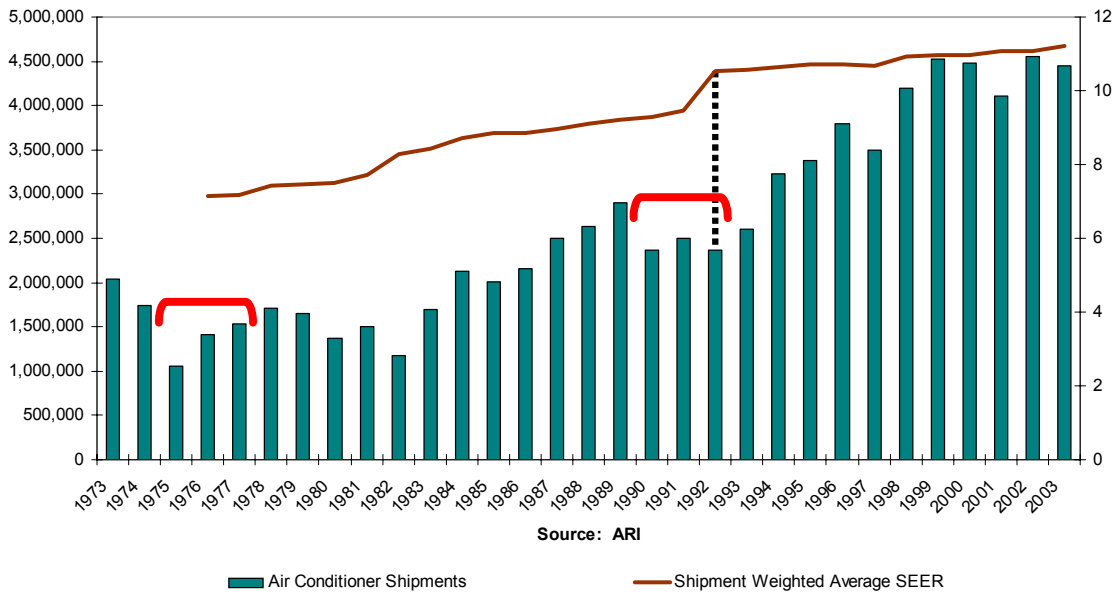
Air conditioning shipments show a fairly consistent 15 year replacement cycle.

In 1990, the industry showed a one year drop in shipments that paralleled a drop in 1975, 15 years earlier. In 1991, shipments increased, consistent with 1976. Yet, in 1992 shipments declined, when they did not 15 years earlier. It was not until 1994 that air conditioner shipments returned to trend.

The drop in 1992 was related to the introduction of the 10 SEER minimum. Confronted with higher prices and a mild recession, homeowners delayed replacements. Of course, unitary air conditioner replacements cannot be deferred indefinitely. The industry eventually returned to course, setting new records for shipments.



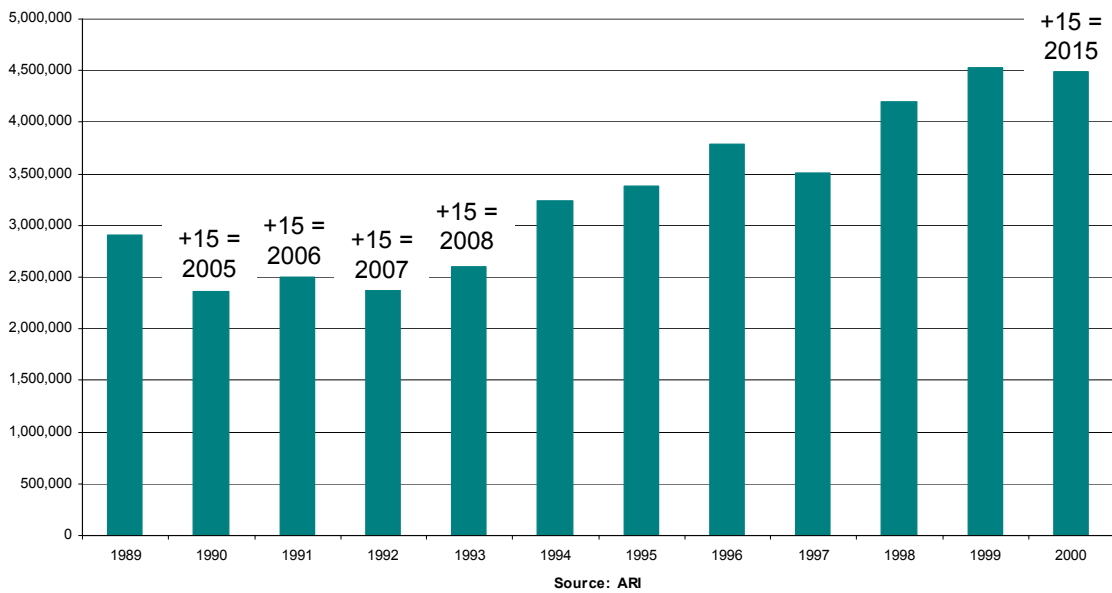
Air Conditioner Shipments Vs. Weighted Average SEER



In 1992, when the 10 SEER minimum took effect, consumers delayed replacements aborting an industry recovery.

The impact of 13 SEER is far greater than the impact of 10 SEER. The incremental pricing is higher and the necessity of replacing the evaporator more acute. Thus, 13 SEER is likely to have a more significant impact on near term industry performance. Plus, 13 SEER strikes 15 years after an industry flat period that resulted from 10 SEER. The timing could not be worse.

Unitary Air Conditioner Shipments 15 Years Ago



Even without 13 SEER, the industry is facing a flat period in the replacement cycle.

Central air conditioning's penetration of new homes reached 87% in 2002.<sup>1</sup> The strong housing market will help shipments (if not margins). Nevertheless, it is likely that industry shipments will be flat in 2006 to 2008 and may decline.

Whether the decline will be greater than the anticipated price increases remains uncertain. If the decline is less than 25% to 35%, revenues will increase despite the reduction in shipments.

By 2009, the industry should be poised for another sustained period of record shipments and growth.

**Parts**

While shipments are expected to be flat or decline, parts shipments will increase. When consumers delay replacements, the parts and service side of the industry is the beneficiary.

Compressor replacements will help offset the reduction in industry shipments for compressor manufacturers. Failed compressors are a leading cause of demand replacements. With the higher costs of 13 SEER, a significant number of consumers can be expected to replace compressors to avoid the expense of a 13 SEER system.

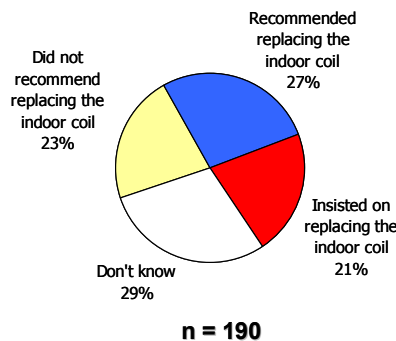
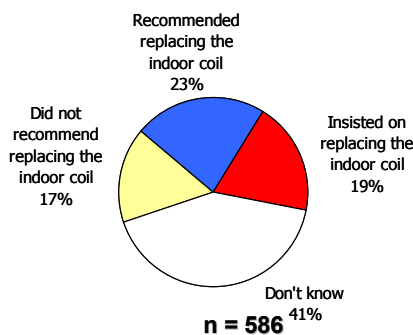
**Compressor Failures**

Despite continuous industry education efforts, the evaporator is left in place for three out of ten condensing unit replacements. If the evaporator is not matched to the condensing unit, the air conditioner will not attain the design efficiency. Yet, it will operate. It will cool. The wide tolerances designed into air conditioners permit the operation of mismatched systems, even if the stated efficiencies are never attained.

**Contractors leave the old evaporator in place for about one third of replacements.**

**Air Conditioners**

**Heat Pumps**



Question: "Did the contractor recommend replace the outside unit and indoor coil or just the outside unit?"  
 Source: Statistical Table 60, American Comfort Report 2002

<sup>1</sup> Characteristics of New Housing, Bureau of the Census

With 13 SEER condensing units, the consequences of leaving the evaporator coil in place increase. The operating pressure differences between older evaporator coils and 13 SEER condensing coils and compressors will lead directly to compressor failures according to industry engineers. In many, if not most cases, the failure will occur within two years.

With 13 SEER, manufacturers and distributors will no longer be able to look the other way about matched condensing unit/evaporator coil combinations. They will enforce existing warranty requirements that condensing units are matched with ARI Certified Combination evaporators. If the warranty requirement is absent, it will be added.

If contractors continue to change out condensing units without replacing the evaporator, the industry faces the potential of widespread compressor failures among units nominally under warranty. Condensing unit only change outs usually occur in price sales. Given the price pressure of 13 SEER, the practice may increase.

It is possible that not tens of thousands, but hundreds of thousands of compressors may fail in condensing units purportedly under warranty. Manufacturers will void the warranties. The installing contractors will either disappear or refuse responsibility. Homeowners will be left out in the cold (or rather, left out in the heat).

At best, this would tarnish the industry's image. The worst case scenarios involve the presence of class action litigation or government intervention.

It will take a concerted industry education effort with the full support of distribution to reduce the practice of leaving the evaporator in place and avert a potential industry disaster. At the very least, distributors and manufacturers would be well served to insist contractors sign waivers at the point of sale or equipment delivery acknowledging their understanding and acceptance of the fact that the warranty will be invalid if the condensing units are installed without ARI Certified Combination evaporators.

## **Mold**

There is an increased awareness and fear of mold among homeowners today. One of the best defenses against mold is maintaining proper levels of humidity. This also saves energy since lower humidity levels allow most people to feel comfortable when the thermostat setpoint is raised several degrees. A small change in the setpoint can have a major impact on homeowners' utility expense.

Higher efficiency equipment presents greater challenges for moisture removal (i.e., latent load). If oversized, which is a common problem, moisture removal may be inadequate, affecting comfort, utility expense, and creating conditions where mold is more likely to propagate.

## **Maintenance**

With 13 SEER, maintenance becomes more important. The correct refrigerant charge is more important. Tighter fin spacing and thinner, rifled tubing make performance degradation from dirty coils more severe.

While the final configurations are unknown, it is possible that manufacturers could introduce double wall coils and other configurations to address space constraints. These could raise maintenance costs.

Consumers, as a rule, are not accustomed to having their air conditioners serviced annually. Inadequate maintenance will have greater consequences for 13 SEER.

HVAC equipment is incredibly reliable. Older 8 SEER and even 10 SEER equipment would operate for years without maintenance. With minimal maintenance, it's not unusual for older systems to operate for 20 to 25 years, which is about 10 years beyond its economic life.

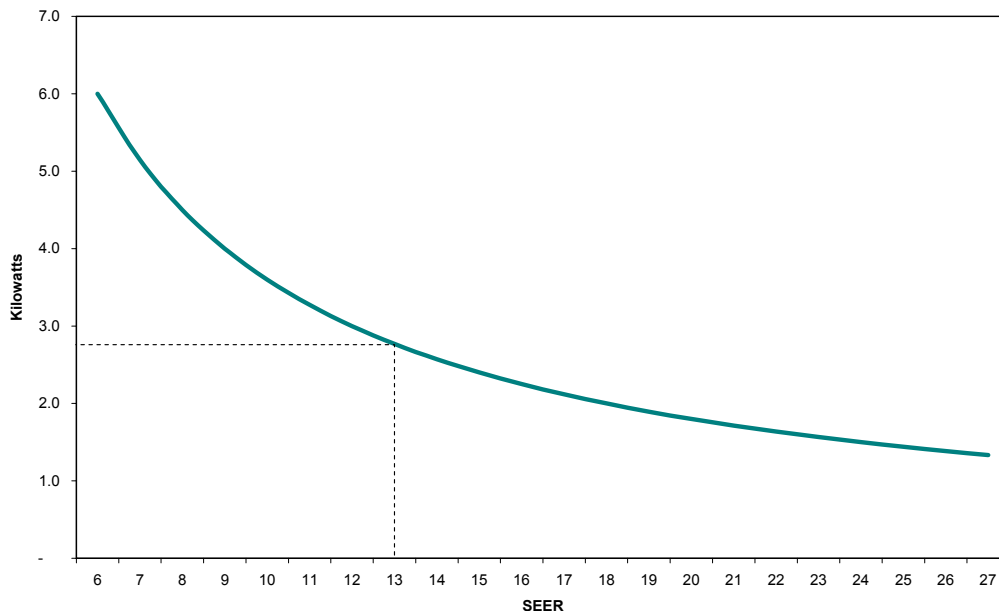
It would not be surprising if 13 SEER equipment fails to achieve a similar performance due to tighter tolerances. In fact, it is entirely possible that the replacement cycle may shorten to 10 years from an average of 15 years if homeowners fail to have equipment serviced.

## Energy Star

HVAC equipment has reached a point of diminishing marginal returns on energy. For a 3 ton air conditioner operating for 1000 hours annually (e.g., central Kansas), increasing from 13 SEER to 16 SEER will save a homeowner \$42 annually with electric rates at \$0.08/kWh.

### **There are diminishing marginal returns from additional improvements in equipment efficiency.**

kW Usage by SEER for a 3-Ton Air Conditioner



For the dollar, the greatest opportunities to save energy are no longer found in boosting equipment efficiencies. The opportunity lies downstream of the equipment, in the duct system and in building science. This is where Energy Star will focus its efforts.

Energy Star is preparing to certify installations. The agency's objectives are to verify sizing, air flow, and refrigerant charge. Energy Star is taking a practical approach, working with utilities and seeking ways to use remote measuring. Sometime after 2006 the agency plans to roll out an installation certification program. As it grows, it is likely to be integrated into the permitting process of many states and localities.

Energy Star will help draw attention to critical areas of energy efficiency that are often overlooked by homeowners. This will benefit everyone. Homeowners are more likely to receive comfortable systems and field efficiency that matches lab efficiency. Certified installations will be embraced by quality contractors who can use them as another means of differentiating. Distribution will likely benefit from higher quality material (e.g., better quality duct board). Manufacturers and distributors will face lower warranty costs.

## **New Construction**

Residential new construction is already characterized by intense price pressures with production home builders. With increased prices from 13 SEER, the pressure will intensify.

The top five builders each have goals of building more than 50 thousand homes in 2005. Before the end of the decade, the top five should account for one quarter to one third of all homes built.

The builders are demanding supply chain transparency. Along each step of the supply chain, companies interested in serving these builders must find a way to make money as the low cost provider.

Manufacturers who chase the production home business, should not expect much in the way of margins. The builders offer volume, not margin. Volume does offer advantages. It gives manufacturers purchasing power, market share, and plant and distribution load and efficiency.

Today, manufacturers are offering rebates to builders (among other practices). It is not beyond the realm of possibility to expect direct purchases of equipment along the lines of appliance package purchases. The equipment would be installed by specialty national contractors who are largely captive of the builders, labor only subcontractors, or the builder's own installation crews. The winning approach is likely to be the lowest cost, most efficient approach.

## **Pacific Rim Competition**

Competition from the Pacific Rim will impact domestic manufacturers, but will not be devastating. The competition has arrived and is producing North American style split systems. The most aggressive Chinese manufacturer is taking the expected price position and successfully acquiring distributors who carry low price fighting brands made by U.S. manufacturers. So far, contractors show few inhibitions about buying and selling Chinese air conditioners.

The Pacific Rim's primary advantage is lower cost labor and fewer government work rules and interference in the production of equipment. Its disadvantage is freight. The larger, more material intensive 13 SEER products reduces the former and increases the latter, largely negating any price

advantages enjoyed today (delivered pricing from one Pacific Rim manufacturer is currently around 11% below the low cost domestic producer). In fact, at 14 SEER and higher efficiencies, it becomes more economical to manufacture air conditioners in the U.S. At least one Pacific Rim manufacturer intends to manufacturer 14 SEER air conditioners in the U.S.

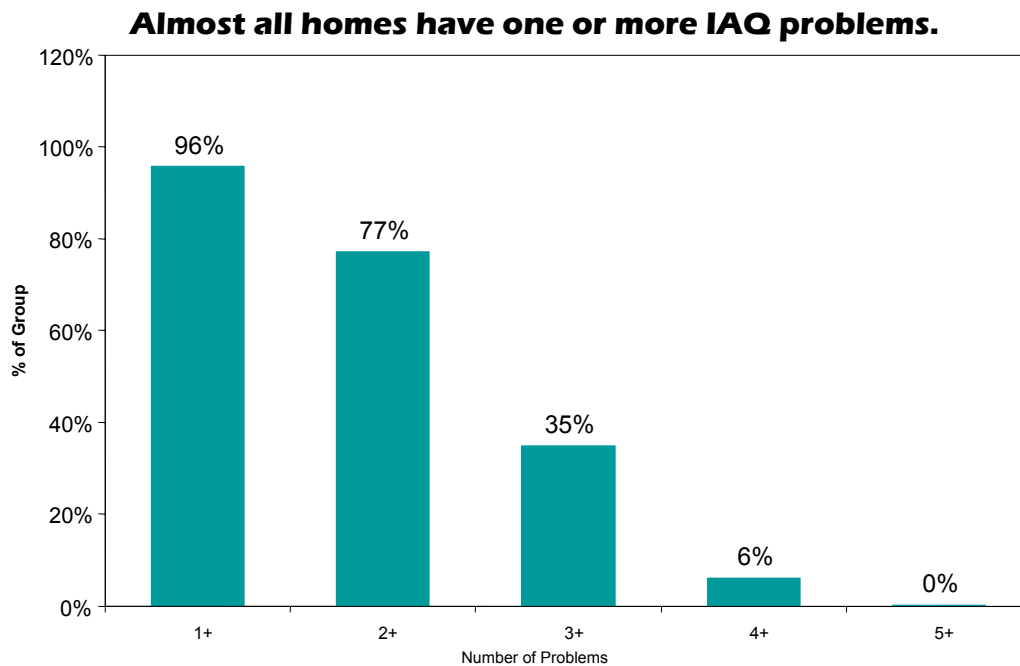
The primary impact of the Pacific Rim competition in the near term is the addition of significant capacity from well-financed, new competitors. Two of the three known Pacific Rim competitors are positioning towards the bottom of the market. The third is positioning itself against the premier brands.

The HVAC industry already suffers from excess capacity and is facing the likelihood of stable to decreasing unit demand through 2008. The Pacific Rim competition will further erode margins.

## Residential Indoor Air Quality

With 50 million allergy sufferers and another 20 million asthmatics, the U.S. has significant demand for indoor air quality (IAQ) products and solutions. This is a natural fit for the HVAC industry, but continues to be a missed opportunity.

IAQ does sell when marketed well. Table top air cleaners, which do little at best and may even be harmful according to reports from Consumer’s Union, sell. Electrostatic filters, which carry extremely high pressure drops (reducing fan speed, air across the evaporator, evaporator dehumidification, and the delivery of air to the end of the longest duct runs), sell.



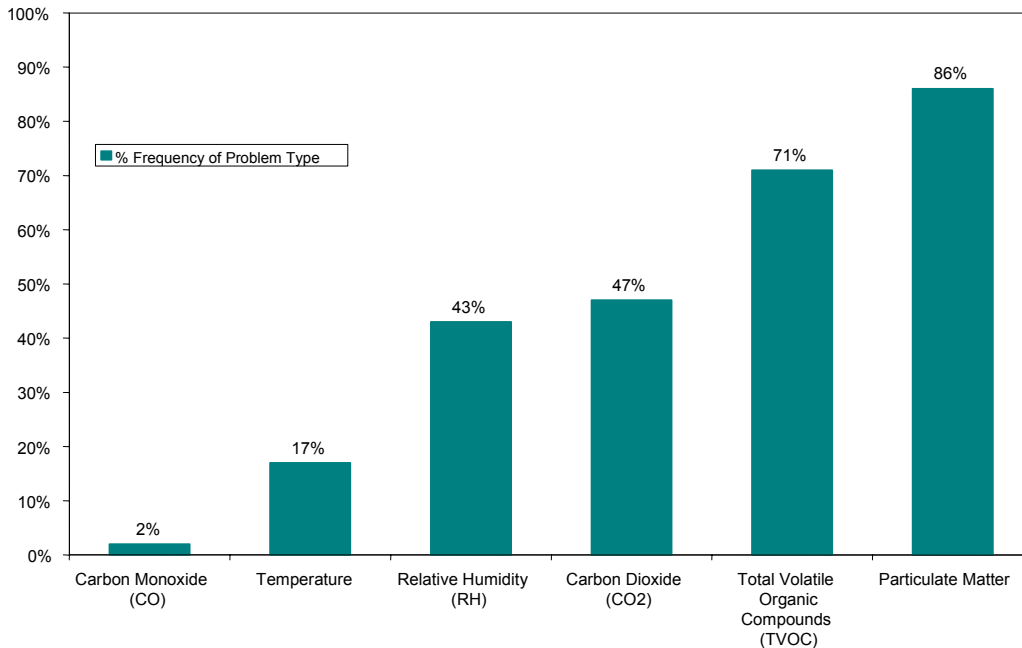
Source: AirAdvice 2004, Dec 2004, based on 11,000 IAQ reports

Table top air cleaners and electrostatic filters sell because they are marketed aggressively, are relatively low priced, and easy for homeowners to purchase and use. True IAQ solutions are not

marketed well. In fact, most of the time, they are not even offered. The average true IAQ solution is \$2,640 according to IAQ monitoring company, AirAdvice. Homeowners must buy IAQ solutions through an installing contractor.

AirAdvice has instrumented more than 11 thousand homes and found that 96% has at least one IAQ problem. Three out of four had two or more.

### Particulate matter and VOCs are the most frequent IAQ problems



Source: AirAdvice 2004, Dec 2004, based on 11,000 IAQ reports

Twenty to thirty percent of homeowners express a desire for better humidity control and air purification.<sup>2</sup> When presented to homeowners during an HVAC replacement, IAQ products are purchased roughly one third of the time.<sup>3</sup> The average IAQ sale is \$2,640.

The need is present. The industry has solutions, yet growth is flat (estimated to be growing around 10% annually for humidifiers and declining slightly for electronic air cleaners). The natural question is why?

IAQ is mature in the HVAC industry. Most of the products have been around for two decades. Industry IAQ growth will be incremental at best without an increase in manufacturer marketing. Unfortunately, the IAQ manufacturers lack the means or incentive to invest significant funds in consumer marketing.

Manufacturers may believe aggressive marketing will be counterproductive. Because IAQ products are very profitable to manufacture, but also relatively simple to copy, they might believe their efforts will simply encourage new competitors who will cut margins.

<sup>2</sup> Source American Comfort Report, 2002

<sup>3</sup> Ibid.

## Commercial Indoor Air Quality

IAQ is well integrated into the air side of the commercial market. This has occurred over a period of years due to ASHRAE Standard 62 (requiring fresh air introduction) and fears of litigation relating to sick building syndrome, Legionnaire's Disease, and so on.

## Skilled Labor Shortage

According to the Bureau of Labor Statistics, the industry will need 32% more technicians in 2012 over the 2002 level. The industry has difficulty recruiting because pay is poor, benefits are largely absent, and the trade has a negative perception among high school guidance counselors and many in the public. While efforts are ongoing to improve recruiting, the technician shortage is not expected to abate anytime soon.

The shortage of skilled labor has created an opportunity for manufacturers who can build intelligence into equipment. This must be more than flashing LEDs. It should help a relatively inexperienced technician to perform at the level of a senior technician. Solid diagnostics integrated into equipment will be well received by contractors.

## R410a

In 2010, the production of R22 air conditioners will end. R410a is the replacement refrigerant. As R410a pricing drops and R22 pricing increases, it is expected that there will be little manufacturing cost difference.

The principle impact of R410a lies in installations. Because of the refrigerant oils, the evacuation and cleansing of existing line sets, which connect the outside condensing unit with the indoor evaporator, will be *critical*. The best practice will be to replace the line sets. However, since line sets are often embedded in walls, replacing them will be a labor intensive process. Many contractors may attempt to clean the line sets. It is inevitable that the cleansing will occur with mixed results. If the old refrigerant oil is not thoroughly removed, it will act as a time bomb, leading to future compressor failures.

Some contractors will insist on replacing line sets. When they do, homeowners may opt to have the new line sets run up external walls to avoid the potential for damage and to save money.

In addition, R410a operates at pressures 50% above R22. More care must be taken in production and installation to ensure that the brazing holds.

Finally, with R410a, refrigeration charge and maintenance becomes even more critical. This increases the possibility that air conditioner life cycle will fall to 10 years without annual maintenance.



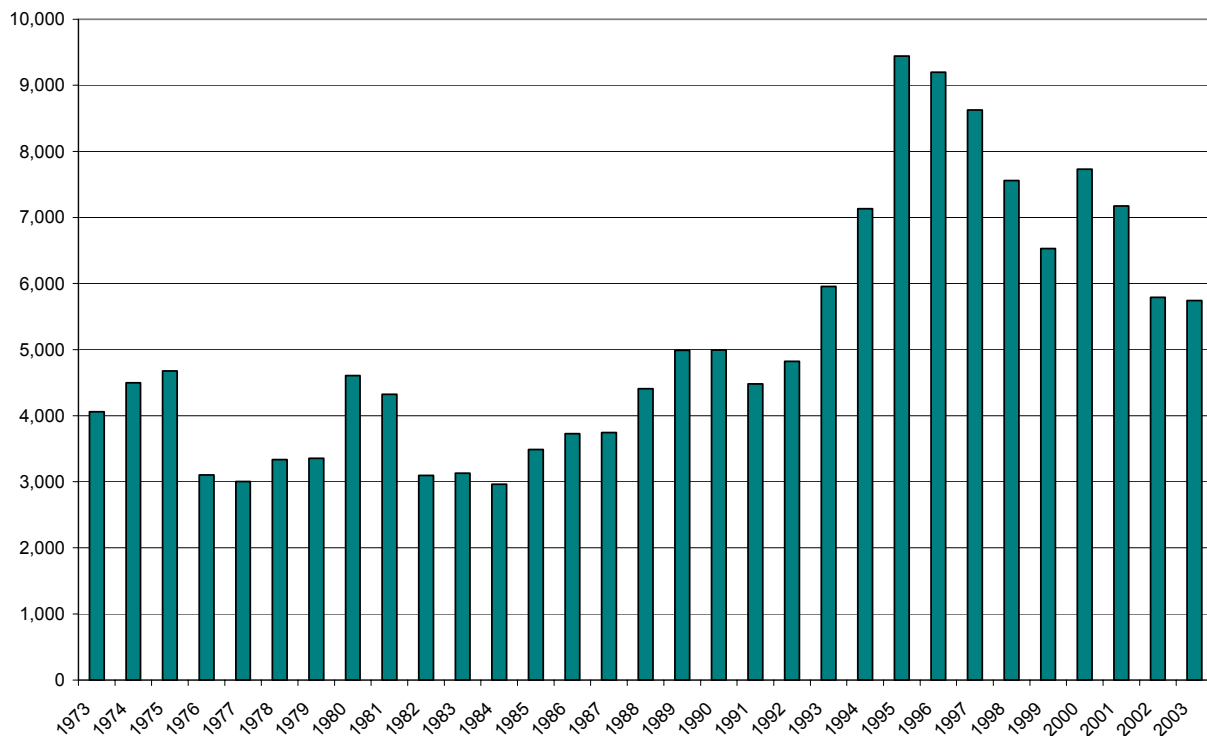
## Chillers

On the heavy commercial front, 33,000 chillers using R11 and R12 are awaiting replacement. The replacements have lagged expectations. These chillers account for 45% of the original 80,000 chillers installed in the U.S.

These chillers were built to last forever, with only parts replacement required. They are difficult or impossible to remove from buildings and simply do not leak. Thus, building owners have had little incentive to remove the chillers despite the 40% efficiency improvement.

With strong lobbying by ARI, H.R. 1241, the “Cool and Efficient Buildings Act” is making its way through Congress. Sponsored by Rep. Peter Hoekstra (R-MI), the bill shortens depreciation for commercial mechanical systems from 39 to 20 years. The eventual passage of the bill appears favorable.

Large Tonnage Chiller Shipments



Source: ARI

## Commercial Refrigeration Standards

The first efficiency standards are expected for self-contained commercial refrigeration equipment (i.e., commercial refrigerators, freezers, and refrigerator freezers used in commercial buildings). The terms have been agreed upon by ARI, the American Council for an Energy Efficient Economy, and more than a dozen other associations, manufacturers, and consumer groups. According to the agreement,

manufacturers will be allowed to develop new models for 2010 that meet the new standards and adhere to EPA requirements for refrigerant phase outs.

The agreement also calls for the DOE to develop efficiency standards for ice-cream freezers, self-contained cabinets without doors, and remote condensing products.

As with 13 SEER, the new standards can be expected to drive up equipment prices. Because the commercial market tends to be better informed than consumers, this may spur an acceleration of early refrigeration replacements in 2009. Once in place, the new standards are unlikely to cause commercial owners to defer replacements more than current practices.

## **World Refrigeration Market**

The third world lacks the refrigeration cold chain for food and medicine that is found in the developed world. As countries like India and China develop middle classes, the cold chain will be demanded. This represents a huge opportunity for commercial refrigeration manufacturers participating in the global economy.

## **Contractor Consolidation**

Contractor consolidation largely failed. Consolidation was driven by Wall Street. It was not performed for operational reasons. The expected economies did not manifest.

Today, contractor consolidation is occurring quietly on a private regional basis. Driven by a quest for operational efficiencies, these regional consolidators are taking a different approach, with industry personnel in key management positions. So far, these regional efforts appear to be successful.

Rumors abound about a new public consolidation effort. The shape of this effort is expected to differ from past attempts, though few details are known.

While not consolidation, per se, utilities continue to operate within the commercial arena. Three of the top 10 mechanicals in *Contractor Magazine's* "Giants" list are owned by utilities.

## **Distributor Consolidation**

Distributor consolidation continues to occur on a steady, aggressive pace. This is significant. While consolidation offers greater distribution efficiencies including better communication, training and personnel, the most significant impact might come from a shift in channel power.

Distributors are starting to private label equipment. While distributor brands are not likely to be heavily promoted to consumers, they will serve to add further clutter to an industry littered with brand names (e.g., the ARI Unitary Directory of Certified Products currently lists 79 discrete air conditioner brands). Strong distributors may be in a position to dictate terms to manufacturers, carrying multiple brands in the same locations.

Distributor consolidation also raises the barriers to entry for unitary manufacturers. It is more difficult for new and regional lines of equipment to attain adequate distribution. An excess of brands further enhances distributors' ability to dictate terms.

The primary risk with distributor consolidation is when distributors acquire too much, too fast.

## Contractor Affiliation

More than ever before, contractors appear to be seeking affiliations. Franchising has re-emerged in the industry and is growing. Private alliances are greater in number and stronger than ever. Trade associations appear to be growing after bleeding members for years.

Contractor affiliation may be driven by fear among mid-size contractors of large contractors, channel conflict, or simply a need for information and training. The implications are uncertain.

## Outlook

	Event Trend		Segment			36 Month Impact				>36 Month Impact			
			Residential New	Residential Replacement	Commercial/Industrial	Component Manufacturers	Product Manufacturers	Distributors	Contractors	Component Manufacturers	Product Manufacturers	Distributors	Contractors
13 SEER	●		●	●		○	↓	↓	↓	↑	↑	↑	↑
Chiller Replacement	●	●			●	↑	↑	○	↑	↑	↑	○	↑
Contractor Affiliation		●	●	●	●	?	?	?	↑	?	?	?	↑
Contractor Consolidation	●		●	●	●	○	↓	○	?	○	↓	○	?
Distributor Consolidation		●	●	●	●	○	○	↑	↑	○	↓	↑	↑
Energy Star		●	●	●		○	○	↑	↑	○	○	↑	↑
IAQ		●	●	●	●	?	?	?	?	?	?	?	?
Pacific Rim Competition	●	●	●	●		○	↓	↑	↑	○	↓	↑	↑
R410a	●		●	●		○	○	○	○	↑	○	○	↑
Refrigeration Standards	●	.	.	.	●	○	○	○	○	↑	↑	↑	↑
Residential New Construction		●	●			○	↓	?	↓	○	↓	?	↓
Skilled Labor Shortage		●	●	●	●	○	○	○	↓	?	?	○	↓
World Market for Commercial Refrigeration		●			●	○	↑	○	○	○	↑	○	○

For 2006 through 2008, the outlook is positive for commercial and industrial HVACR manufacturers and for component manufacturers. It will be neutral to negative for everyone else. Starting in or after 2008, the industry outlook is strongly positive for everyone.

Individual companies, of course, will deviate from the industry trends. Some will win when the majority lose and vice versa. The preceding table shows what segments the various events and trends facing the industry will impact and how they will affect the different levels of the channel.

## **Appendix**

Components of a Residential Air Conditioner

Residential Channels of Distribution

About the Author

About the Service Roundtable

Feedback

# Components of a Residential Air Conditioner

An air conditioner consists of four main components:



## Evaporator

The evaporator pulls heat from air that is delivered to the conditioned space. The evaporator is typically a fin-tube heat exchanger. Liquid refrigerant is sprayed inside the evaporator. The refrigerant, released into low pressure, evaporates. The change of state from a liquid to a vapor draws heat from air blown across the evaporator, creating cooling.



## Compressor

The compressor pulls or “sucks” the low pressure, high temperature refrigerant vapor from the evaporator and pressurizes it. The compressor is the single most expensive component of an air conditioning system and is often referred to as the “heart” of the system.



## Condenser

The condenser releases heat from the high pressure, high temperature vapor to the outside ambient air, causing the refrigerant to condense, changing state from a vapor to a liquid. Typically, condensers are also fin-type heat exchangers.



## Metering Device

The metering device releases cold, liquid refrigerant into the evaporator. Today, most metering devices are pre-set orifices, sized to spray refrigerant at a steady rate. The other common metering device is an expansion valve, which meters refrigerant in response to the temperature of the evaporator coil. To attain the 13 SEER minimum efficiency, it is expected that expansion valves will completely displace orifices.

The compressor and condenser are combined in a single unit with a motor and fan for drawing air across the condenser coil. This is called a condensing unit. It is the outside component of an air conditioner that most homeowners think of as an air conditioner.

The evaporator and metering device are also combined in a single unit, found inside the home. If the house utilizes a gas or electric furnace, the furnace’s blower is used to move air across the evaporator and down the duct system to the occupied space. If the blower is part of the evaporator assembly, it is often referred to as an air handler.

## Heat Pumps

Heat pumps are similar to air conditioners, but contain slightly different refrigerant circuitry and a reversing valve, that switches operation of the evaporator and condenser coils. In heating mode, a heat pump draws heat from the outside air and pumps it to the indoor coil, similar to the way an air conditioner pumps heat from the air passing over the evaporator and releases it outside through the condenser.

Because there is heat in the outdoor ambient air, heat pumps use less energy to heat than furnaces above a balance point (typically in the low 30s). They are usually used in moderate climates where the temperature rarely falls below freezing.

## **Systems**

Condensing units and evaporators ship from the factory as finished assemblies, yet they do not constitute an air conditioning “system.” The system is designed and field assembled by the contractor. In addition to the condensing unit and evaporator, an air conditioning system also requires refrigerant tubing between the evaporator and condensing unit (i.e., a line for liquid refrigerant and a line for refrigerant vapor, called the suction line). The two refrigerant lines are commonly referred to as a “line set.”

Manufacturers also make combination units where the evaporator and condenser are contained in a single unit, often with a gas heating system. These combination units are called “packaged units.” They constitute the bulk of light commercial equipment found on one to three story buildings. They are also frequently applied residentially in certain parts of the country, such as the desert southwest.

Air conditioning systems usually include an air distribution system, which includes duct work, grilles, registers, and diffusers to supply air to the occupied space of a building and to return it to evaporator. The air distribution system is designed, fabricated, and installed by contractors.

## **Commercial**

The commercial market, sometimes referred to as “heavy commercial,” is distinctive from the residential and light commercial market. Residential and light commercial (i.e., one to three story buildings) utilize the air conditioning systems described above, known as unitary systems.

The heavy commercial market utilizes field applied systems, typically chilled water systems. Large tonnage chillers and water towers provide efficient cooling for large scale commercial systems. Large air handlers are also used with chilled water systems.

## **Refrigeration**

Refrigeration uses similar technologies as air conditioning, but is distinct due to the low temperature requirement. The refrigeration side of the industry includes a home appliance component, a small commercial refrigeration component (e.g., refrigerated display cases, small ice machines, and walk-in coolers), mobile refrigeration for transportation, and large, industrial ice machines and refrigeration.

## **Other Subsets**

Other subsets of the industry include room air conditioners, automotive air conditioners, marine air conditioners, and so on. They are not included in this analysis.

## Residential Channels of Distribution

The basic channel of distribution for the residential side of the industry involves component manufacturers, product manufacturers, distributors, contractors, and consumers.

- Component manufacturers produce the key components of air conditioners, such as compressors, expansion valves, and motors.
- Unitary product manufacturers take these components, fabricate other raw materials, and assemble condensing units, evaporators, furnaces, and boilers.
- Distributors supply contractors with product and parts.
- Contractors take condensing units, evaporators, furnaces, boilers, other raw materials, and assemble the finished product in the field.

There are, of course, many variations. One manufacturer provides its own distribution, selling direct to contractors. Others have purchased many of their distributors to attain supply chain efficiencies. Some distributors are dedicated to a single line. Others carry multiple lines across a number of locations. However, as a rule, most distributors are dedicated to a single line of equipment in each location.

### Channel Roles & Strengths

#### Component Manufacturers

At one time, unitary product manufacturers built most of their key components. Over time, the manufacture of components in the residential and light commercial markets has fallen to a limited number of component manufacturers who can produce the components at a lower cost due to specialization and economies of scale. Today, there are few manufacturers of key components.

Product manufacturers often continue to make many components for heavy commercial and industrial refrigeration.

Because of their importance and limited numbers, component manufacturers hold the strongest position in the HVAC industry. While product manufacturers have the potential to re-enter the component manufacturing arena, the barriers to entry are substantial and the economies of scale absent. The component manufacturers appear well aware of this fact and are careful to price their products at a level that allows them good returns, but precludes re-entry considerations by the product manufacturers.

#### Unitary Product Manufacturers

The unitary product manufacturers have traditionally played the role of channel captain in the industry. They produce the products that distribution sells to contractors. They are the companies with the greatest resources and strongest brand recognition within the industry and with the end users.



Over the past two decades, considerable consolidation of the product manufacturers has occurred. At the same time, the number of brands has increased in attempts to gain additional market share through product positioning.

In general, unitary brands can be classified into three broad categories. These are 1. Premier brands that are well known and regarded in the industry, 2. Fighting brands that compete primarily on price, and 3. Mid-level brands that fall in between the other classifications.

Manufacturers of premier brands all offer a mid-level and/or fighting brand to supplement their premier lines. As a brand increases in price, the accompanying bundle offered by the manufacturer increases as well. This bundle consists of dealer identity programs, training, incentives, and so on that are designed to attract and support contractors. Because these non-product offerings are easily imitated, most mid-level brands and even many fighting brands offer similar programs.

### **Distribution**

It is the job of distribution to work with the contractors, providing them with parts and product inventory, offering training, local technical and sales support, and so on. Distributors efficiently buy in bulk, break up the orders, and get the right pieces to the right places at the right time. They are the front line of contractor support, market the manufacturers' programs, and develop many of their own programs. The distributor has the direct relationships with the contractors.

Distributors usually align with a single brand of equipment and have an exclusive territory. When they carry more than one, the second is usually the fighting brand or mid-level brand of the same manufacturer as their main equipment. The sole source is not necessarily by choice. Manufacturers with strong positions are able to impose sole sourcing of equipment. With large scale consolidation, it is no longer unusual for distributors to carry multiple brands, though not at the same branch locations.

Some manufacturers have been purchasing key distributors in recent years. This is largely an attempt to gain supply chain efficiencies.

As distributors have consolidated, purchasing has become centralized. Branches place orders with the central offices in some cases, who see to the fulfillment of branch needs. While distributor consolidation has improved economic efficiencies, it has effectively added a step in the channel. Manufacturer sales representatives call on the central offices and visit the branch locations far less often. As a result, some communication from the manufacturer is filtered before it is passed along to the branches.

Manufacturer and distributor relationships are fairly strong with significant switching costs. Distributors are hesitant to change lines.

### **Contractors**

Contractors design, sell, install, and service comfort systems. The contractor is the final assembler of the comfort "system."

The contractor step of the channel is extremely fragmented. According to Census statistics, there are approximately 200,000 contractors operating in the plumbing, heating, and air conditioning NAICS classification (the Census does not bother to split plumbing from HVAC due to the high degree of cross over). Slightly more than half operate as sole proprietorships or partnerships without a payroll.

Nine out of ten have fewer than five employees. One in five closes annually, only to be replaced by a slightly larger number of starts.

While many contractors are very large, highly sophisticated operations, the typical contractor can be characterized as a technician who suffered an entrepreneurial seizure and opened a business. He is a technician with little business training.

Larger contractors associate with one or more brands of unitary equipment as “dealers” for those brands. Typically, the lead brand represents 80% to 90% of sales with the second line making up the majority of the balance. Ninety-two percent express loyalty to their primary brand. Sixty-eight percent are loyal to their secondary brand.<sup>4</sup>

Contractors determine the brand sold. Sixty-two percent of homeowners cited the contractor’s recommendation when asked why they selected the brand of equipment purchased.<sup>5</sup> Because of the contractor’s role in brand selection, the manufacturers with the strongest dealer bases are the most successful.

## **Retail**

The retail channel is small but growing. One large, national retailer sells its own brand and other brands using its own sales force and a mix of employees and subcontractors to perform the installations. Another big box retailer offers HVAC through its stores in partnership with the manufacturer’s dealers.

Retail sales are small today, but remain a threat to the traditional channel. To date, retailers appear to have focused very little on HVAC.

## **Internet**

Several companies offer HVAC equipment direct to the homeowner via the Internet. Because homeowners must install the equipment themselves or locate a contractor to perform the work for them (something established contractors are reluctant to do), Internet sales are negligible.

## **Commercial**

In the commercial market, there are a number of variations on the channel. Manufacturers sell direct to national accounts as well as operating their own service and installation arms.

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<sup>4</sup> Comfortech Report on the American Contractor, 2001

<sup>5</sup> American Comfort Report, 2002

**Channel Conflict**

The HVAC industry has a fairly normal amount of channel conflict. More exists in the commercial arena due to manufacturer competition, yet it is also present at each step of the traditional residential and light commercial channel.

## About the Author

Matt Michel is CEO and President of the Service Roundtable, the world's largest private contractor group. He began his career in 1983 and has held engineering, marketing, and senior management positions with such leading organizations as:

### **The Turbo Refrigerating Company**

**A leading manufacturer of industrial ice harvesters & thermal storage systems**

Matt joined Turbo out of college and held design and manufacturing engineering positions.

### **Lennox Industries**

**A Fortune 500 air conditioning manufacturer**

Matt worked for Lennox from 1985 to 1990. He joined as head of corporate factory automation, moved into corporate marketing research, and was the head of marketing west of the Rocky Mountains when he left Lennox.

### **Titus**

**The world leader in air distribution systems; subsidiary of Tomkins Industries – owner of Murray bicycles & mowers, Smith & Wesson, Lasco, etc.**

Matt turned around the company's VAV terminal and DDC controls business units, generating the first profit for DDC controls and gaining more than nine points of VAV terminal market share in 24 months, leaving Titus as the world leader in this product area.

### **Aire Serv Heating & Air Conditioning**

**The oldest continuous air conditioning franchise system**

Aire Serv was started by Matt in 1993. He grew the company from a clean sheet start to 65 locations, and achieved a #233 ranking in *Entrepreneur Magazine's* "Franchise 500" within 24 months, before being given marketing responsibilities for the Dwyer Group Trade Services (Aire Serv, Mr Electric, and Mr Rooter).

### **Decision Analyst**

**One of the world's leading private marketing research and marketing consulting firms**

Matt was Vice President of the Advanced Technology Group, serving such clients as:

- A.O. Smith
- Alabama Power
- Amana
- Amtrak
- Armstrong
- Carrier Corporation
- Citgo
- Contractors 2000
- Department of Energy
- Dibold
- Earthlink
- Environmental Protection Agency
- Ericsson
- Excellence Alliance
- Front Range Solutions (Goldmine software)
- Glovia,
- GroupMAC/Encompass
- Guadalupe Valley Telephone Cooperative
- Honeywell
- HylsaMex
- Invensys (Maple Chase)
- Lennox Industries
- Moen

- The Museum Company
- The National Association of Realtors
- The National Cutting Horse Association
- Nippon Telephone & Telegraph
- Nokia
- North American Technician Excellence
- Oklahoma Natural Gas
- Penton Media
- Overhead Door Corporation
- Peregrine Systems
- Portland General Electric
- PPG Industries
- Primedia
- Ryobi
- Sage Telecommunications
- Sears
- Sprint
- Time/Life
- Trane
- York

## **The Service Roundtable**

### **The nation's largest private contractor group**

Matt is currently CEO & President of the Service Roundtable, a group dedicated to providing contractors with the information they need to improve their sales, profitability, and business performance. Matt founded the Service Roundtable in 2002 with funding by angel investors, including professional angel investors and a number of leading air conditioning industry professionals, such as four past chairman of the industry's leading trade association, one of three living industry hall of fame members, several past national contractors of the year, and so on. Within six months of its launch, the Service Roundtable became the largest private contractor group in the heating, ventilating, and air conditioning industry. In 2003, the company added plumbing. The organization's member companies represent more than \$2 billion in sales.

## **Engineering**

While Matt has made his mark in marketing, his background is engineering. As an engineer, Matt developed the first solid state control system for a thermal energy storage system. He was also named as a Tomkins Industries' "Innovator" for his contributions to the development of Titus' cold air distribution technology.

## **Industry Contributions**

Matt has/currently serves on a number of air conditioning industry advisory boards including:

- The Air Control & Distribution Devices Section for the Air-conditioning & Refrigeration Institute
- The Air-conditioning & Refrigeration Institute's Industry Awareness Task Force
- The Curriculum Advisory board for Universal Technical Institute
- The Editorial Advisory Board for *Contracting Business* magazine.
- The NATE (North American Technician Excellence) Board of Trustees
- The National Advisory Board for the National Comfort Institute
- The National Advisory Council for the Thermal Storage Applications Research Center
- The Standard 885 Engineering Committee for the Air-conditioning & Refrigeration Institute

## **Publications**

An award winning writer, Matt has published a vast number of technical papers and trade journal articles. He writes "The Rant," a bi-monthly featured column for *Contracting Business* magazine.

He is a contributing writer for a number of publications. Matt has written for *Contracting Canada*, *Plumbing & Mechanical*, *Reeves Journal*, *The PHC Profit Report*, the *CASRO Journal*, *Quirk's Marketing Research Review*, and a variety of other leading trade publications.

Matt is the publisher of Comanche Marketing, a leading Internet based marketing publication for small, service businesses. His articles have been reprinted in numerous newsletters, magazines, and websites.

Matt developed *Results Driven Marketing*, the primary consumer marketing system employed by four contractor franchise organizations.

He is the author of the book, *Never Lose A Customer: 10 Steps To Building an Outstanding Customer Retention Program* and the forthcoming book, *The Power of Positive Pricing: Pricing Strategies To Grow The Top Line While Building The Bottom Line*.

A popular speaker, Matt has had formal speaking engagements that include individual manufacturers, utilities, trade associations, university groups, and civic organizations.

## **Education**

- Bachelor of science degree from Texas A&M University (1983)
- Master of business administration degree from the University of North Texas (1987)

## **Personal**

Married since 1984 (Pam), Matt has two daughters (Mackenzie and Madison). He is very active in his church, coaches youth soccer, and has served on a variety of civic boards. An accomplished heavyweight runner, Matt has earned over three dozen middle distance running awards. Matt lives in Flower Mound, Texas.

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## About the Service Roundtable

With members in 46 of the lower 48 states, Europe, and Australia, the Service Roundtable is the nation's largest private contractor group. The Service Roundtable is dedicated to help small business owner improve their business and financial performance, leading to a profitable exit strategy.



The company fulfills its mission by using the Internet to deliver a stream of sales, marketing, and business tools to its members. The company also encourages member dialogue through online “roundtables.” The extensive use of the Internet reduces the marginal cost of adding members, allowing the organization to charge nominal rates for membership.

The Service Roundtable was launched in 2002 in the HVAC industry. The plumbing vertical market was added in 2003. The company's business model is simple in concept, yet difficult to execute. To date, it has attracted few imitators within a single trade and they have been unable to gain traction.

The business model was designed to be replicated across two dozen vertical markets, all characterized by in-home service. While each vertical contains its own nuances, the Service Roundtable's basic model should translate. Within each vertical, the company will serve small businesses, while working with manufacturers, distributors, trade associations, government agencies, utilities, and other organizations with an interest in helping small business owners succeed.

For more information, visit the company's website at [www.ServiceRoundtable.com](http://www.ServiceRoundtable.com).

## **Feedback**

Your comments, thoughts, and feedback about this white paper would be welcome. This includes those who agree, those who disagree, and those who think key points were missed entirely (and they very well might have been).

Send your feedback to [matt.michel@serviceroundtable.com](mailto:matt.michel@serviceroundtable.com).