FAQs About Home Weatherization Contracting (HWC)

FAQ #1 Q:) How can I figure out if Home Weatherization Contracting (HWC) might make sense for my house?

A:) If your annual utility bills total less than about $0.80 per square foot of finished floor space per year, you're already using less energy than the typical home. To save more it will cost you quite a bit of money compared to the potential savings. On the other hand, if your annual bills total more than about $1.50 per square foot per year, there's definitely a potential for significant savings with an HWC retrofit. Between those values, "it depends," as they say. Your HWC contractor will help you figure out the economics. But keep in mind that in addition to energy savings, HWC retrofits always improve comfort and reduce noise. These benefits may be just as important to you as energy savings, or perhaps even more so.

FAQ #2) Q:) How does HWC differ from other home energy retrofit programs?

A:) The really critical differences are HWC's reliance on: A. Measured results of the work, and B. In-process instrument readings taken by the workers themselves, providing them the real-time feedback they need to achieve superior results. Programs which measure results after the project is complete have not been as effective as HWC, because after completion it's too late to fix (at reasonable cost) the inevitable installation problems that happen when installation crews are "flying blind." 3rd-party testing before and after a retrofit project is not as effective as requiring the crews themselves to take responsibility for and to record and report the measured results. HWC does not preclude 3rd-party testing. It can serve as a periodic audit of the effectiveness of a given contractor's crews and the integrity of their reported results. But by itself 3rd-party testing has not been shown to ensure favorable results

For example, since 2005 California's Title 24 energy regulations have required air conditioning contractors to measure and validate the refrigerant charge in all new construction AC systems, as they run under load, after the installation is complete. However, Title 24 has also allowed contractors to avoid this reporting requirement if they install AC systems which have thermostatic expansion valves (TX valves) instead of systems with other types of refrigerant distribution. TX valves are certainly an improvement in technology. But the results of this exception, popular among many contractors, are nothing to be proud of. In a field study of 80 homes built under Title 24 between 2007 and 2009, less than 20% of the AC systems were measured as being properly charged. For that reason and others, losses in capacity (and therefore energy

waste) from the 80 tested systems were between 30 and 60%. The average loss in capacity was 45%. All testing is good. But testing performed by the crews as they work is much better. That's the foundation of an HWC project.

FAQ #3) Q:) Why does a home weatherization contractor have to inspect and test so many different aspects of the home?

A:) Because the comfort, annual energy consumption, safety and indoor air quality of the home are all important. And each of those affects the others in complex ways that demand a clear understanding of: A. What energy features are in the house, B. Where they are located and C. How they are interacting. That clear understanding cannot be achieved by just looking at the bills, or by strolling around outside the home. Clear understanding demands measurements. It also requires peering into all sorts of nooks and crannies that normal people don't have time to think about. If safety, comfort and energy efficiency are not all addressed in a comprehensive way, bad things happen. Unexpected costs can arise after the fact. And occupant health can be compromised if the house is tightened without ensuring combustion safety and efficiency. So as much as one would like to have a simpler fix for energy, safety and comfort, a house is just too complex for simple, quick solutions, when you need all three of those features.

FAQ #4) Q:) Why do I have to replace my high-SEER (High Efficiency) cooling unit just because it's oversized? That unit's nearly new! Isn't it a good thing to have spare capacity?

A:) You'd certainly think so. But unfortunately, oversized units create major problems for both comfort and energy cost. SEER stands for "Seasonal Energy Efficiency Ratio." The rating number is based on tests under a carefully controlled set of conditions which do not reflect the realities of installation, nor the variability of daily operation. Equipment which has too much capacity is like a suit which is too big for it's owner. It doesn't fit right, so it's clumsy and does not perform well. When cooling units are too big, they deliver intermittent blasts of large amounts of cold air. Then because they are so big, an oversized unit satisfies the thermostat quickly and turns off. As a result, for much of the day the occupants are either too warm or too cool. The larger the oversizing, the worse is the comfort. Also, the bigger the unit, the more energy it uses while creating that discomfort and the more noise it makes in the process. To deliver energy efficiency and comfort in real homes (rather than in the carefully constrained SEER testing lab) the AC unit and all its system components must be sized and

installed the way a fine tailor makes a suit fitted perfectly to its purpose, and crafted with careful attention to the critical details which vary from house to house

FAQ #5 Q:) Can't you just replace my old air conditioner with a modern high-efficiency unit? The difference in SEER ratings tells me a new unit should save about 30% of my cooling costs, for not nearly as much money as replacing the entire system.

A:) The SEER is not as important as how the system is designed and installed. Temperature uniformity the evenness of temperature throughout a space is critical to comfort and therefore to energy consumption. If the temperature is comfortable in one part of the room but not in another, people in the second location will want to adjust the thermostat to deliver more cooling. That takes extra energy. The air distribution system is not changed when only the AC unit is replaced, and that's a problem. The air distribution system must be included in most projects because of the critical importance of installation quality. For example, if duct connections leak air (as do most duct systems installed without measurements of leakage) then any increased efficiency of the new unit is wasted by that air leakage, and savings don't occur. Likewise, if parts of the duct system is "kinked" or makes hairpin turns, the system fan must work too hard as it forces air through the system and into the rooms. There's no reduction in fan energy use when a high efficiency unit is mated to a kinky duct system. A third reason for disappointing results with unit replacement alone is duct design and return air fl ow. If the current duct system delivers air at too low a velocity, little mixing occurs as the air leaves the duct. The cold air just "falls out" of the diffuser and you end up with a pool of cold air at the fl oor and hot air at about eye level. So you turn down the thermostat to get more cooling. Also, if air is "dead-ended" because there is no return air path which allows air to get back to the system, the occupant of that room will not get an adequate amount of cooling air. That will make the occupant want to turn down the thermostat to improve comfort, using still more energy. For all of these reasons, neither comfort nor energy savings happen automatically by simply replacing an old unit with a new unit which has a higher SEER rating. To achieve better comfort and energy

savings at the same time, you need both a new, smaller AC unit, and a duct system which ensures nearly zero air or thermal leakage, and a return air system which allows air to flow smoothly through the rooms and back to the system.

FAQ #6 Q:) Why can't air sealing, insulation and HVAC be done over a longer time, as money becomes available, instead of all at once?

A:) Unfortunately, unless the air sealing, insulation and HVAC system are all installed at the same time, you're more likely to generate problems instead of improvements. For example, the foundation of energy savings is air tightness and effective insulation of both the building's enclosure and its HVAC system. But if you tighten the enclosure without making sure that combustion appliances can operate safely in a tight building, that's a health risk. And if insulation is added in the attic before it's sealed off from the fl oors below, mold can grow because humid air from indoors will rise up through cracks, gaps and holes and moisture will collect in that attic. So to ensure favorable results and to avoid major problems, everything must be designed as a system and installed at the same time not over months or years.

FAQ #7 Q:) Why do I have to replace a perfectly good furnace with a 90+ efficiency rating just because it's larger than the load? Aren't you guys just running up the bill?

A:) Oversized heating units generate the same discomfort and energy waste as do oversized cooling units. It's just that the symptoms of that failure are different. Instead of intermittent blasts of cold air, the furnace produces blasts of hot air. When the furnace is too big, it runs for very short periods, satisfying the thermostat quickly. But unless everything else about the house and the duct system is well fitted and air-tight, the house is too cold (or much too hot) in the spaces where the thermostat is not located. With short run-times, the system can't mix the air evenly throughout the home, to provide comfort in all spaces. So occupants without enough heating are complaining. They turn up the thermostat so the home uses more energy than it should. The oversized unit and the poor duct system combine to produce an inefficient system, even though the lab tested efficiency rating on the furnace was impressive. So once again, like the man who gets sold a suit which is "the next size up," a home with an oversized heating system is less comfortable, not more so. And oversized equipment costs more to run, no matter how high its lab tested combustion efficiency might be. All in all, comfort and heating costs are not controlled by combustion efficiency. The cost of comfort is controlled by how efficiently the total system can maintain temperature in the occupied spaces. And furnace efficiency is only a small part of that process.

FAQ #8 Q:) Instead of all that redesign and reinstallation of the whole system, can't I just replace my crummy old furnace and AC unit with a ground-source heat pump and save energy?

A:) It would be so pleasant if that were true. But it's not. Ground source heat pumps are a wonderful technology provided that they can be correctly sized for both the heating and cooling loads, and provided that they are coupled to an equally efficient heating and cooling distribution system. However, the problems begin with the idea of only replacing the existing equipment. Simple replacement of the units alone does not result in energy savings, for all the reasons discussed in answers to earlier questions in this FAQ list. One must also replace or fix the distribution system and reduce heating & cooling loads to achieve savings. Then there are issues of both operating and installed costs. Ground source heat pumps are not automatically more efficient, but they are definitely more expensive. As an example, consider two identical homes located in Redding CA. As measured over a year by researchers working for the US Department of Energy, the home with the ground source heat pump used more than twice the energy used by the other home, which had a conventional "hot water furnace" with air conditioning. (A hot water furnace is an air handler which has a conventional cooling coil, plus a hot water coil connected to the domestic hot water heater.) Also, the installed conventional equipment cost less than 50% of the installed cost of the system with the ground source heat pump (U.S. DOE, 2006). This is not to say that ground source heat pumps cannot be made to work well. It's just that at present, they cost quite a bit to install. It's true that their electrical compressors pump heating and cooling from the ground. But that capability does not automatically by itself produce energy cost savings.

FAQ #9 Q:) My kids have asthma. Will HPC improve indoor air quality?

A:) Definitely. When outdoor air is filtered through the HVAC system rather than dragged through the walls, attic or crawl space, the quality of the ventilation air is much improved. It will have fewer particles, and it will carry fewer of the allergens which can trigger asthma attacks. To be clear on this point, however, an HWC retrofit is not a cure for asthma, nor is it a guarantee that your loved ones won't develop asthma. But an HWC retrofit will improve indoor air quality.

FAQ #10 Q:) My wife is sensitive to mold. Will HWC fix my mold problems?

A:) If mold is a concern, HWC contractors are usually well qualified to eliminate the cause of mold growth, which is always some form of excess moisture accumulation. The contractor may or may not be qualified to remove mold. Sometimes that requires a

subcontractor. But HWC contractors will certainly be capable of making the repairs necessary to avoid a repeat problem.

Typical repairs include adding rain gutters, replacing windows with properly flashed units, regrading the earth which surrounds the house so water does not collect at the foundation or in the crawl space. If you want to know more about reducing mold risk and what it takes to accomplish that goal, consult the California Builder's Guide to Reducing Mold Risk, which is available in PDF format at no cost at http://masongrant.com/pdf_2008/California_Builders_Guide.pdf

FAQ #11 Q:) Why can't I just seal the attic & duct work and add insulation to save energy? Why do I have to replace the entire HVAC system and the can lights that penetrate the attic? Aren't you inflating the project?

A:) Sealing the building and duct work and adding insulation would certainly save some energy. The key things to keep in mind are the safety and comfort issues. Safety first. It's OK to add insulation to the attic but only after the assembly that separates the attic from the living space has been air sealed, and after the lighting which penetrates that attic has been made safe. You don't want moisture accumulating in the attic, and you don't want the lighting fixtures to overheat and start a fire in that attic. And it's OK to seal up the building, but after doing that, it's critical to also check the safe operation of combustion appliances and make any necessary changes to ensure safety. You don't want the water heater to "backdraft" (flames coming out of the unit and/or toxic carbon monoxide gas flooding backwards into the house). Provided you can also accommodate those safety measures in the budget, the weatherization contractor can certainly just air seal the attic and duct work and add insulation. Next, comfort. After the loads are reduced by insulation and air sealing, then the existing AC and heating equipment is going to be really oversized. Some rooms will be way too hot and others way too cool. Resetting the air flows to the correct values probably won't be possible because the system and its duct work is still problematic and is simply much too big. (It's difficult to modify a bulldozer and turn it into a sports car) The home probably won't be comfortable. For these reasons, air sealing and insulation are usually not proposed alone. By replacing the HVAC system with one which fits the new, reduced loads, comfort is assured and the total energy savings are more substantial usually enough to actually lower your net monthly costs, even after paying the loan to fund the larger project.

FAQ #12 Q:) Why do I have to mess with electrical system rework and lighting replacement before I put insulation in the attic?

A:) It's a matter of air sealing, safety, code compliance and resale value. Electricians (and plumbers) drill holes in the 2" X 4" wood framing at the top of each wall where there is a wall just under the attic. Electricians run wires through those holes; however, they don't plug the open space between the wire and the side of each hole. When you add up all of those open spaces between wires and edge of hole it adds up to a very large hole or opening into the attic. Those unsealed or unplugged holes then let cold or hot attic air into the wall cavities and also into the air your breath.

Here's the safety issue. If either substandard wiring or old can lights (recessed lights) are covered with insulation, they can overheat and start a fire. The additional insulation keeps the heat generated by the lights or poor wiring from being released into the attic air. On hot days, that heat under the insulation may be enough to ignite nearby combustible materials.

Then there's the matter of code compliance. It's not OK to connect new equipment or new lighting fixtures to wiring which is defective or substandard. Ultimately, that's also a safety issue. In addition code compliance issues can be a problem which will prevent the resale of the house until corrected.

FAQ #13 Q:) What if I don't want to fund a full home weatherization retrofit right away? Can't I do a project in stages?

A:) Certainly. There's a lot that can be done with a small investment of money and mental energy before getting to the larger expenses. Here's a logical sequence for a "staged" program of energy reduction, beginning with small expenditures and building towards larger projects and bigger benefits, as your funds allow.

(Stage 1) Light bulb replacement, smart power strips and education. About 60% of the energy used in most homes is "baseline" energy that has little to do with the HVAC system. Begin with replacing all your incandescent light bulbs with compact fluorescent or LED bulbs. That small but significant change will make a noticeable dent in your monthly electrical bills. Compact fluorescent bulbs cost less than $2.00 each when bought in packages of five. LED bulbs cost more but they use less electricity. Then add "smart power strips" to all your TV's and other entertainment appliances like game consoles, stereo gear, powered speakers, computers, computer screens and printers. A smart strip costs less than $50. One of its outlets controls the others. For

example, when you turn off the computer, the smart strip will turn off any other accessories plugged into the same power strip. The electrical loads from “sleeping” TV’s, game consoles and computers are surprisingly high, and they are constant. Next, make sure that any ceiling fans or portable fans are turned off if nobody’s actually in the rooms they serve. Fans circulate air to make people comfortable. But the electrical power drawn by the fan is released into the space as heat. If people are in the room, the breeze from the fan promotes comfort, so it’s worth adding the heat load of the motor to the room. But if nobody’s in the room to enjoy the breeze, the fan’s just wasting energy and adding heat without providing any comfort benefit. The dishwasher may also be using more energy than necessary. The “heated drying” cycle is meant to dry dishes quickly, in cases of heavy use and multiple loads. But if the dishes are just going to sit in the dishwasher overnight anyway, use the “economizer” setting to turn off the supplemental heaters. This saves energy by letting the dishes dry at a slightly slower rate, without electrical power. Finally, keep in mind the obvious but often-forgotten reminder to everybody in the home: turn off the lights whenever you don’t need them to be on.

(Stage 2) - Lighting fixture and appliance replacement. For the next stage, replace any can lights that penetrate the ceilings with air-tight fixtures rated for full insulation contact. New fixtures will allow the use of even more efficient pin base compact fluorescent bulbs or LEDs, and they are a necessary first step for any later insulation. Also in stage 2, consider replacing appliances. Specifically, replace any older gas water heater with a high efficiency, sealed combustion unit. This will save gas costs in the short run, and will simplify and reduce the cost of safety measures which will be necessary when the home is sealed up during a stage 3 project. Also note that the older, conventional natural draft hot water heaters don’t usually last more than 7 to 10 years in any case. So chances are good that by replacing the unit now, you’ll avoid the disruption of a broken water heater that has to be replaced on an emergency basis later. (See note 3)The clothes washer and drier are also excellent candidates for replacement if they are not already modern models. Front-loading washers spin clothes at very high speeds to remove much more rinse water before the clothes go into the dryer. Removing water by spinning is far more energy efficient than heating that same water to evaporate it in the drier. So you’ll save major amounts of dryer energy when you wash the clothes with a front-loading washer. Replacing the dryer itself is also a good idea, if it does not already have a clothing moisture sensor which terminates the drying based on moisture content rather than by an arbitrary (and usually excessive) time clock setting. The hot water heater and washer-drier use energy in big amounts over short periods. But the long-term, low-draw appliances often use just as much energy over the long term. In particular, getting rid of any old freezers or second

refrigerators is an excellent way to reduce energy at little or now cost. Then consider replacing television sets which have either cathode ray tubes or plasma displays instead of LCD or LED flat panels. LCD displays typically use less than 30% of the energy of a plasma display or an old cathode ray tube TV or computer screen. Also, if the refrigerator is more than 20 years old, chances are good that a new unit will use less than half of the power consumed by that older unit. These appliance replacements (and getting rid of any plugged-in appliances not actually in use) is an excellent way to make modest reductions in energy consumption with relatively little expense. The next stage will take more time and money, but it will produce larger energy savings and also improve comfort.

(Stage 3) - HVAC (Heating, Ventilating & Air Conditioning) replacement, insulation and air sealing. The stage 3 project is where the comfort benefits begin. It's also where the biggest reduction in energy consumption is accomplished when the project is located in the warmer parts of the State. But, keep in mind that, for all the reasons described earlier in this series of questions, all three of these must be done at the same time to achieve the benefits without creating problems. So the stage 3 project will be more expensive and take more time than just appliance replacement. These guidelines are focused primarily on getting to and through Stage 1, Sage 2, and Stage 3 type projects in as short a period of time -as possible.

(Stage 4) - Window replacement or renewable energy generation The most expensive projects involve either window replacement or renewable energy systems like solar hot water heaters, or photovoltaic panels or wind turbines. These projects will save energy, and window replacement with modern triple-glazed, low E coated, insulated frame units will certainly improve comfort. But at current energy costs and installation costs, these projects are not likely to save enough energy to provide an attractive return on investment. So if your budget is limited, you probably want to delay these projects until your finances allow for a low return on the relatively high installation costs of improvements.

FAQ #14 Q:) Can an HWC contractor also install a solar hot water or solar PV or wind energy?

A:) Certainly. A Home Weatherization Contracting project is an excellent time to add those features to the home. After the heating and cooling loads have been reduced, you won't need as large a solar heater or PV array. So you'll save money on that side

of the project. Many weatherization contractors are also fully qualified to design and install those features. Like window replacement, the added costs of renewable energy generation are seldom paid back by energy cost savings in a short period. But as long as that's not a problem for your budget, by all means install renewable energy features at the same time.