Ventilating Existing Homes in the US
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In the U.S. the focus of the current administration is on reducing energy use in homes. The US Federal government is providing substantial financial support for energy savings in existing homes over the next two years: low income weatherization programs will have $5 billion with an additional $3.5 billion in grants for states to administer. There are also significant utility program efforts – including almost $1 billion in California alone. Finally, there is a proposed program to develop a home energy conservation industry with potential funding of more than $20 billion. With that level of financial support we expect to see millions of homes subject to air tightening and subsequently requiring mechanical ventilation.

For many years the focus was on new construction where the mantra of "build tight and ventilate right" was followed, at least by progressive builders and designers (including the US DOE Building America efforts (http://www1.eere.energy.gov/buildings/building_america/)). In these new homes it was relatively simple to include air retarders in walls, floors or ceilings and to seal the major envelope leaks at sill plates and around plumbing and electrical penetrations. To do this in existing homes, however, presents a significantly tougher challenge.

Air sealing has historically (e.g., in US DOE weatherization programs: http://apps1.eere.energy.gov/weatherization/wxtech_air_sealing.cfm) confined itself to weather-stripping windows and doors and using foam seals on electrical outlets – with dubious results. More extensive work has involved inspecting attics, crawlspaces, around internal building service stacks, heating/cooling duct systems and other locations where surprisingly large holes can be found on a regular basis. Most successful air sealing contractors focus their efforts in this second category of air tightening and achieve significant results, with typical reductions of 20-30% (Measured air leakage of buildings. ASTM. 1986. Eds: Heinz R. Treschel, Peter Lagus).

However, there is a limit to air tightening. Below a certain level we can no longer rely on natural infiltration to provide sufficient ventilation. In which case, whole house mechanical ventilation systems are required. In the US, most retrofit programs refer to ASHRAE Standard 62.2 – or its predecessor 62-89 (www.ashrae.org). These standards provide algorithms for sizing whole house mechanical ventilation systems by specifying a minimum air flow requirement based on the floor area of the home and the number of bedrooms (or occupants). A credit can be obtained for downsizing the whole house fan if the air leakage of the envelope is measured and the natural infiltration rate estimated based on the local

climate. ASHRAE 62.2 refers to the weather factors in ASHRAE Standard 136 to make this estimate of natural infiltration that relates the measured envelope air leakage to an annual average infiltration rate. To allow for the temporal variability in natural infiltration in a very simple way, the credit obtained is only half of the annual average natural infiltration.

Most air leakage reduction in existing US homes is done as part of Federal and Local Government sponsored weatherization programs that operate under tight budget limits for each house (historically $2500/home but now increased to $6500/home (http://www.energy.gov/news2009/7015.htm)), where the expense of adding a whole house mechanical ventilation fan leads to reductions in other measures, such as adding insulation. This has led to the practice of tightening to a limit such there is just enough estimated natural infiltration to avoid installing a whole house fan - the usual target is 0.35 ACH. This is not quite what was intended by the writers of the standard and leads to lost opportunities for energy saving.

However, this is not the major difficulty in complying with ASHRAE 62.2. ASHRAE 62.2 also includes provisions for local exhaust ventilation of kitchens and bathrooms. This has proven to be difficult to comply with in cost-limited weatherization programs. Particularly if these rooms or the cooking appliances are not adjacent to an outside wall. In an attempt to encourage adoption of ASHRAE 62.2 in existing homes the standard committee has written an alternative compliance path for existing homes that allows for an increase in the whole house system air flow rate if exhausts are not installed in kitchens and bathrooms. This compliance path includes credit for openable windows. These changes have been enthusiastically embraced by the weatherization community and will allow much more flexibility (as well as compliance with codes and standards) in existing homes.

The US DOE is also beginning work to provide energy use labels on all homes - like those that already exist in Europe and some other countries. These labels will require that building air tightness be measured in order to estimate energy use. They will also include estimates of energy savings for different retrofit measures, including air tightening. Proposed new US Federal Government programs (http://www.efficiencyfirst.org/home-star/) that are just starting are aimed at middle-income occupants are going to include air tightening as one of the first things done to a retrofitted home.

So we are about to start a whole new world of air tightening in US homes, and with it comes the challenge to ensure that energy savings predictions from tightening are delivered and that the homes are comfortable and healthy after the retrofit by complying with the newly revised ASHRAE 62.2.