American Multi-Family Conservation in Kraków

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This report, prepared by one of the participating crew chiefs, outlines the training and implementation phase of an unusual conservation effort sponsored by the U.S. State Department to test the effectiveness of American multi-family conservation efforts under East European conditions, specifically in Kraków, Poland.

Poland's plan to reduce subsidies and introduce metered heating, combined with the need to conserve energy and reduce the high pollution impacts of Poland's soft-coal fired power stations, makes conservation extremely important for that nation's future.

Starting in late 1992, two private American contractors provided experienced installation crew chiefs/field supervisors to train local installers in cost-effective techniques and to develop installation strategies. Poland's use of low quality concrete block construction, poor ventilation systems, and its cold damp climate, combined with that nation's lack of capital resources, caused the team to concentrate on low-tech, labor intensive measures easily accommodated by that nation.

By the second week of installations, the immediate improvements in occupant comfort levels resulted in a word-of-mouth surge of volunteers greater than the training program was designed to handle.

This report also describes the differences in work styles, language barriers, availability (and lack) of basic tools and materials, and the experience of a woman crew chief in what is an overwhelmingly male occupation in Poland.

The first year savings results show that the building treated with the team's conservation strategies experienced a 21% savings level, highest of the four buildings used in the pilot.

Introduction

During its Communist period, Poland and other Iron Curtain neighbors did not even meter energy for residential heating use. Almost all of Poland's electricity and most of its urban heating is provided by central station units fueled by soft coal-an especially dirty fuel when not used in conjunction with tight emissions controls. Poland's is not. However, with the coal mines, the power plants, the utilities and the apartment building all owned and run by the state, there was no need and little concern over the energy use at each building—nor was there much attention to the environmental implications.

During the past several years Poland has made a commitment to market pricing of energy and heating through a metering system and has made a concerted effort to reduce the high pollution from Poland's coal fired power stations. Residential energy conservation, largely ignored for the past forty years, became extremely important, but still largely unknown.

Poland's Housing Stock and Energy Practices

The predominant housing throughout Poland's cities are large scale apartments complexes, often comprising scores of large buildings at one site. After the wholesale destruction of World War II, the prime concern to was to replace housing as quickly and cheaply as possible, which meant doing so on a mass production basis, with the emphasis on production, not quality. That nation's chronic housing shortage, which continues today, encouraged the government to continue building in this fashion, and discouraged the tenants from complaining or refusing long-awaited housing, even if it was substandard by most standards.

(I make no comment on the potential viability of expressing any public complaint at the time.)

The apartment buildings, normally either long, sprawling 3 to 5 story buildings, or the taller 10 to 12 story units, almost always are of concrete panel construction, referred to as Zeran construction. The smaller buildings contain about 60 to 70 apartments and the larger buildings containing 300 or more apartments. The apartment buildings were usually clustered into various "coop" complexes of 10 to 50 buildings, which were constructed and are now managed as a single unit. This was the typical housing we found in most of Krak6w, Poland.

The concrete panels used to construct the complexes are mass produced and are transported to construction sites, where they are assembled without interior or exterior insulation. The panels are highly subject to damage during transit and construction, and they have suffered significant damage in place from water and ice, and from the pitting, corrosion, and blackening due to air pollution.

Windows in the apartments are wood framed, are often badly warped from water damage, and are frequently ill positioned in the wall cavity as the buildings have settled. Gaps around the window framing itself are often visible, and the air infiltration is sometimes so obvious as to billow curtains and to blow interior doors shut.

To offset the drafts, a prevalent Polish custom is to hang floor-length white sheer curtains in front of windows and to draw very heavy, floor-length curtains across the windows at night. However, this blocks the heat from the radiators, which are placed beneath windows, and therefore behind the heavy curtains. This problem was explained frequently to tenants; however, old customs are slow to change.

The windows also are typically installed so as to rest on a 2" thick concrete shelf which extends out of the wall and into the room about eight to ten inches over the radiator; this shelf continues outside the window where it forms an exterior shelf of six to eight inches. The radiator is placed directly under this "through-the-wall" shelf. When the radiator is hot, the concrete shelf becomes very warm inside the apartment (especially when trapped behind the heavy curtains) and this heat travels along the shelf, through the wall and outside. Conversely, when the radiator is not hot, the concrete shelf very effectively brings the cold into the house and is quite cold to the touch.

Heat is provided to the apartment building and then to the apartments by a city government owned central district heating system in which a municipal authority sets the water temperature—for the entire city. The apartments have radiators in each room, but no thermostats. The radiators theoretically can be adjusted somewhat by a valve, but, in reality, most valves are stuck in place, and many radiators do not have even a valve. And even if available, tenants are very reluctant to try to turn the valves for fear of breaking them or causing a major leak.

Therefore, the tenants have no option should the temperature be too cold and when it gets too hot, tenants use open windows as their thermostat to control the interior temperature. In fact, on a windy, 20° day in Warsaw, tall, modern, glass office buildings were noted for open windows. Since the tenants pay a flat fee in their rent for heat, which is government subsidized, the cost of such "wasted" energy has not yet become an issue for the tenant.

In fact, wasted energy is not a concern for the apartment complex either since the "billing" for energy from the district heating system is calculated on the basis of square footage of living space and of the number of radiators. Only a very few coops have even a master meter to check what the complex as a whole is using, let alone any one building or apartment. Thus, energy conservation has not been rewarded, nor has energy prolificacy been penalized.

The Project and Measures

To help the newly democratic Polish government reduce its air pollution problems, the U.S. government, primarily through the Federal Department of Energy, proposed to test several different strategies in Kraków, Poland. (This effort is now known throughout Eastern Europe energy circles as the "Kraków Project"). The two largest DOE efforts were devoted to reducing emissions at the district heating facilities and at small coal burners. One small effort was to test the ability to use energy conservation to reduce the load on the district heating system, thereby reducing the polluting emissions. Since these were to be pilot efforts, there was a requirement that the planned results could be replicated throughout the nation. The pilot called for testing four duplicate buildings: one would be a control, receiving no attention, one would be fully weatherized, and the other two receive other types of attention.

While neither I nor my company were part of the original strategy discussions, the housing stock and the emphasis on replicability eliminated many potential alternatives. As one of the analysts told me later: "When you see snow blowing in around the window frame, we don't need infra red cameras to show there is a problem. " And when a nation is trying desperately to catch up from five decades of economic stagnation, new windows and cutting edge equipment were recognized as idealistic extravagances.

The predominance of the housing construction described above, combined with the long, cold and very damp winters, exacerbated by strong winds across the plains of Poland encouraged the team to look at the conservation opportunities in residential housing. The nation's lack of capital resources caused the team to concentrate on low-cost, low-tech, labor intensive measures. The project team decided to concentrate on infiltration reduction, which would provide major energy savings, would improve living conditions for the tenants, and could be readily taught and continued in the future. The major vehicle for its implementation would be a Polish, for-profit weatherization company which could continue and expand the effort in the future. The Polish Foundation for Energy Efficiency, FEWE, is currently in the process of forming such a company.

To train the individual Polish installers, the project team asked two American firms experienced in securing significant energy savings through weatherization, to provide training materials and assistance. Those firms provided the training materials and also two experienced crew chiefs and supervisors for several weeks to oversee the field training. Starting in late 1992, the two of us conducted on-site training for newly hired Polish technicians to teach the installation procedures appropriate for the local conditions and the particular housing stock. We also learned that we had more to teach than installation procedures. And we had a lot to learn ourselves.

It is essential to keep local economics in perspective when dealing with conservation programs outside of the United States. I have already discussed the practical fact that no one close to the energy end-use (apartment, building, or even the complex) has any responsibility for reducing energy use. It is also important to keep general economics in consideration. For example, we had to recognize that, while evaluating the use of materials and equipment, remember that a trained weatherization installer will earn about $2,000 to $3,000 per year in Poland.

The major lesson that we, as teachers, had to learn was that equipment that we consider common in the United States, such as insulation blowers or infra red equipment, are extremely rare and or non-existent for Polish use. Even what we consider low cost materials, such as weatherstripping, was considered precious and was hoarded and protected. What was low cost was labor.

A second, but more complicated, lesson we had to learn was the difference between mass produced products and services which were uniformly of poor quality and the high quality of the individual worker. When given the opportunity, the local workers were both hard working and inventive. More on that later.

Materials and Applications Used

Of the measures and materials we evaluated and used, the most important by far were weatherstripping and caulking, which produced an immediate and obvious increase in comfort. A surprising third place went to the installation of reflective insulation behind and over each of the radiators.

The infiltration reduction of windows within the apartments took a great deal of experimentation. Each window was approximately three feet wide and four feet high, with a double lateral design similar to double atrium doors. These windows are hinged on the sides and open into the apartment. Usually a smaller awning type window which is hinged along the top is placed above the larger windows and the balcony door. The windows are constructed with two separately framed panes of glass screwed together. The panes can be separated with a screwdriver for cleaning.

A highly visible reminder of the problem were the particles and even piles of soot collected between the panes, carried there by the air infiltration. And many customers commented on the rattling of the window panes in high winds. Fortunately, we had brought many different types of products with us. (Fortunately, we had been forewarned that local products were very limited.) An American product called EDPM, which is a rubberized 1/4" wide strip that comes in large rolls with adhesive backing for installation, was found to be very effective in sealing between the two framed components. The EDPM compresses and quite effectively fills the gaps where winds had been rattling the panes. The down-side to the product, i.e., that it does not accept sheering, side-to-side stresses well, is eliminated in this application. We now understand that FEWE is using this product in many similar applications.

Weatherstripping around the windows was made difficult by the presence of numerous coats of hard, often chipped paint around the frame, requiring that the surface be sanded or smoothed down before applying weatherstripping. In all circumstances, it was especially necessary to carefully clean the surfaces and use a spray adhesive to assure a good contact.

The most common weatherstripping available for door and window frames is poly-vee. This is a flexible plastic strip creased so as to fold closed when compressed, and is usually applied using its adhesive backing. The surface area conditions required additional spray adhesives and staples for proper adherence. The same product was used on the entrance doorway from the cold, common area hallway and on the balcony access doors. There was no

availability (other than the limited number that we brought) of more durable specialized weatherstripping materials we commonly used in the United States. However, the poly-v, which is also very commonly used in the United States, was a major improvement for the apartments treated.

In the United States, we use a single strip to cover an entire side of the door or window, generally discarding any below size pieces. This saves labor time and makes it less likely that a fault occurs at the joining or two pieces. This was one of the few lessons we could not teach. To the local people, the materials were so valuable and hard to come by that all scraps were saved and reused. As a compromise, we showed them how to cut the end pieces on angles and notches to more tightly fit the pieces together and taught them to avoid likely stress points for such joints.

The exterior doors often benefitted from the use of a flexible triple flanged doorsweeps and new bumper thresholds. Doorsweeps and bumper thresholds were received by the residents more favorably in Poland than has been our experience in the United States, where a number of homeowners refuse them on the basis of their appearance not matching the pre-existing flooring or door. In Poland, thresholds, which are common on even some interior doors, are often square-edged one by four inch strips of wood. The rounded edge thresholds and the color coordinated or clear door sweeps we provided were considered an aesthetic improvement.

A siliconized latex caulking compound was applied along the interior framing of all windows and doors and on all cracks visible along exterior walls. This product dries to a transparent, paintable finish and is quite effective in sealing all of the joints where the frames of the windows and doors meet the walls. Such caulking is highly effective in blocking drafts and has an expected life of at least twenty five years. All pipe bypasses, which were quite prevalent due to the building design, were filled as well.

The typical weatherization treatment consisted of the installation of radiator reflectors on the concrete walls behind each radiator and along the underside of the concrete shelf extending over the radiator. A radiator reflector is a very thin, pliable, foil-faced insulation which is installed behind the large cast iron radiators commonly in place in each room. The reflective surface directs the heat from the radiator back into the rooms rather than allowing it to heat the concrete wall and window shelf.

While these measures and materials are very common in the United States, they were a revelation to the people of Poland. We received more than one offer to form a “joint venture” to sell these products within the coop and even outside to other buildings and coops.

What was a revelation to us was the low level of conservation background. We had expected to have to import the insulation blowing machine. However, we also found that it was impossible to get such simple items as a quality caulk gun, or staple gun, or retractable knives. Recognizing the need for such items, the Polish government has now waived import duties and restrictions for many such conservation products. Nevertheless, anytime one of us returns to Poland, a gift of some tool or equipment is always very appreciated.

Interfacing

Initially, the most difficult aspect of training the Polish technicians was the language barrier, but this was not a major problem once we were in the field. The training consisted of a combination of class room explanations followed by on-site field work. From our stand-point, the class room effort was not very useful, nor in retrospect was it very necessary. The language barrier was to be overcome by the use of an interpreter, but explaining it in the class room without a demonstration before them was difficult. Since the interpreter was at least as unfamiliar with the techniques and materials as the trainees, we suspect there were some mistakes in the translation.

However, once in the field, the need for a translator was less. Most of the workers knew at least some English and we quickly picked up some key Polish words and phrases. And once we had done our first apartment, they became very interested and animated. Within a few days, primarily through pantomime, examples and good natured grunts, the technicians were capable of doing all of the tasks necessary to treat the complexes. In hindsight, we should have started with the field work training and then gone to class room. This would have given them a sense of perspective, provided the trainers with greater credibility, and allowed all of us to talk in a looser, friendlier manner.

Impressive to us was that once freed from the requirement to do the installations “by the book”, the technicians were very inventive in finding different approaches and adapting their materials and tools to do the tasks for which we rely upon specialized tools.

This ability seemed to contradict the poor materials and workmanship we saw around us. What was later explained to me was that the “by the book” process was the common procedure for most jobs, with no opportunity for individual thought or initiative. However, the generally poor workmanship required the population to be resourceful, in

both work and private life, to keep the equipment running or to make do with alternatives.

In the United States where trained labor is the most significant cost of weatherization and where materials are readily accessible, speed of installation is often stressed and remnants of weatherstripping are discarded if they are too short or if the adhesive is defective. In sharp contrast, the Polish technicians worked very carefully not to waste even the smallest length of weatherstripping or radiator reflector and were difficult to dissuade from exerting efforts towards repair of hinges or resetting of latches where replacement would have been much faster and more cost-effective.

Also new to the technicians was the concept of customer service and customer satisfaction. In fact, the only time we felt any resentment was related to customer service, when we explained that it might be necessary to work on Saturdays. While this difficulty passed, they were astounded to learn that my own firm worked a Tuesday-to-Saturday schedule every week just to accommodate customer service.

Prior to the training, the technicians felt that their job was to do a good installation and it was the tenants' job to like it. For example, it took us a while to convince the technicians to talk to the tenants to explain what they were doing and why, providing conservation education along with the installation. The need to be personable and friendly when in another's home was also a learned experience. The need to be clean, to carefully return the apartment furnishings to the same place as when we found them, the need to go back to an apartment if the tenant was not there as scheduled were unexpected parts of the training. And the concept of asking the tenant for their opinion and feedback was a totally alien idea—at first the trainees looked upon it as though we were looking for problems.

They should never have been concerned. The response from the community was overwhelmingly positive—once they saw what we were doing. It had been difficult for the building management to get many volunteers for us to treat during training, except for some personal friends that did it as a favor. Because of a lack of volunteers, we spent most of one day treating a day-care area and related common area.

Fortunately, the benefits from weatherstripping, caulking, doorsweeps, and radiator reflectors were immediately obvious since the initial field training was conducted in February. And it was cold and very windy. Many residents watched very closely as the work was done and even without translation, it was clear that they were pleased with the reduction of drafts and the much higher comfort levels.

It was also impossible to dissuade many appreciative apartment residents from serving refreshments, such as hot tea, thick coffee, sodas, beer or vodka with cakes and cookies.

By the end of the week, tenants were following crews around the building trying to get us to treat their apartment next. There were soon far more volunteers than we could possibly use during the training period. Eventually, the project had to place the remainder on a waiting list which were later treated by the trained crews.

The group of technicians I initially helped train consisted of six Polish men, whom I found, on a professional basis, to be perfectionists in their work, and to devote time to fine details. They also showed a hunger to learn "the American, capitalist ways" and accepted much of what we recommended on faith, even if it seemed very strange to them, such as the importance of customer service and satisfaction.

On a more personal level, I found them to be quite shy and perhaps embarrassed to be instructed by an American female. (It may be that this is happening in my U.S. training efforts, but I have not noticed it.) Outside of the hands-on guidance and training sessions, the Polish technicians were much more cordial and polite towards me than I am accustomed to in the United States. It seemed to be insulting to the men if I opened a door ahead of them or carried materials. At first I took these traits as being somewhat chauvinistic, but with a little patience and a little flexibility, I adjusted to the cultural differences and grew to like and respect it, along with the greetings—which were usually polite kisses on the cheek.

Conclusions

This project was an exciting opportunity for me personally to travel and experience directly some of the global changes. I was especially pleased to bring to a new culture some of the conservation techniques and customer service practices that I have so taken for granted in my own career.

However, what has been most satisfying is learning what has happened both to the project on which we worked and to the technicians that we trained.

Follow-up visits by the project team has shown that the tenants are, if possible, even more pleased with the work than when we were conducting the training. Poland, as a nation, has made wonderful strides in its economic well

being and in its quest to establish free market strategies, including energy and energy conservation. The six technicians we trained have become the nucleus of a successful conservation company, which recently moved into new headquarters in downtown Kraków. And most important of all, the project has been a success.

When compared to the building in which nothing was done, the weatherized building we treated reduced its usage by 21%. This was far in excess of the other two buildings, which received other conservation treatments, but no weatherization. These achieved savings of only 3% and 12% each. The project has clearly demonstrated that American multi-family weatherization techniques can be cost-effectively adopted in Eastern Europe to improve the comfort levels of the tenants, to conserve on energy and to reduce pollution.