CITY OF COLLEGE STATION'S THERMOGRAPHIC MOBILE SCAN

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ABSTRACT

During the first quarter of 1986, the City of College Station conducted a thermographic mobile scan of the entire city. A thermographic mobile scan is a process by which heat loss/heat gain data is accumulated by a vehicle traveling the city with thermographic equipment mounted on it. College Station residents were given the opportunity to view a thermogram of their home which showed where heat is escaping in the winter and gained in the summer. A computer run of this data was provided to the citizen with recommendations and exact paybacks on various energy conservation improvements.

INTRODUCTION

College Station's thermographic mobile scan collected a tremendous amount of information on the energy efficiency of heated buildings. The challenge of the program was in the distribution of this information. Distribution was attacked through two programs. The first program allowed residents to view their thermograms and receive a computer analysis of their home through a Neighborhood Open House Program. This segment was conducted from March 24, 1986 through May 14, 1986. Over 800 citizens participated. The second program was directed towards apartment complexes. Thermograms were taken directly to apartment owners and managers along with an indepth energy analysis of their facilities. Completion of this segment is expected in the spring of 1987. It is estimated that 6,000 apartment units will participate out of a possible 8,000 units.

Due to the time frame of both distribution programs, this paper is directed mainly towards the thermographic mobile scan as it relates to neighborhood open houses.

BACKGROUND

In the fall of 1984, the premise of an energy conservation program with the aid of aerial thermographic information was investigated. There was hope that such a program would increase public awareness of energy conservation.

Aerial thermographic scans came into prominence around 1976. Cities used them as an attractive tool in setting up an energy conservation program. Aerial thermography had been used to define heat loss levels from building roofs to within 0.8°C accuracy; however, several problems arose. Data collection had to be taken under proper conditions, such as clear skies, calm winds, dry roofs and large temperature differences between interior and exterior surfaces. Also, the heat loss detection was primarily concerned with the roof and little data could be derived of the heat loss through exterior walls.

Around 1982, thermographic scans were enhanced by mounting the equipment on the back of a truck at eleven feet above ground level. This type of scanning offered numerous advantages:

1. More information could be derived on a home.
2. This information could be placed into a computer. The print out would give specific recommendations and paybacks on various energy related improvements.
3. Citizens could identify their homes more readily and are more apt to perform necessary changes.
4. Weather conditions are not as critical.
5. Publicity could be generated easier.
6. It is less expensive.

In February 1985, funding was approved for a thermographic mobile scan project. The proposal was to take ground level thermograms of all the heated buildings in College Station. Data would be distributed at various locations during a three month period. Volunteers would be used to man the booths with staff over-seeing the operation. Weatherization packages were to be handed out to help citizens get started on weatherization improvements.

The amount of money requested was $88,825.00. A break down of the costs are as follows:

Thermograms, software and training	$ 55,000.00
Weatherization packages	20,000.00
Equipment	6,325.00
Advertising	7,500.00
TOTAL	$ 88,825.00

SCANNING

Scanning began on January 14, 1986 and was completed on March 5, 1986. It was estimated that scanning would take from ten to fourteen days. However, due to an unseasonably warm winter, scanning took much longer to complete.

Scanning times had to meet the following criteria:

1. Buildings suspected of housing Texas A&M students could only be scanned while TAMU

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was in session.
2. Outside temperatures had to be below 43°F.
3. Wind speeds had to be below 15 MPH.
4. Buildings had to be relatively dry.
5. Solar radiation gain had to dissipate out of the buildings' exterior siding.

Thermograms were produced on a ½" VHS tape while driving at 5 MPH. They were then "still framed" onto a laser disc. Efforts were made to make a home's thermogram a corner shot showing all of the front and right side of the home. However, in many instances this was not possible. Two thermograms were transcribed in these situations. For the sake of brevity, only representative thermograms were required to be transcribed on each apartment complex.

A total of 12,886 thermograms were transcribed. This covered 163 linear miles. Specifications allowed for a 1% loss of homes. It is unknown how many homes were missed; however, it is believed that this qualification was met.

THERMOGRAMS

Thermograms are infrared pictures that show heat loss/heat gain of a building. Thermograms can be scaled in almost any color desired. However, College Station used a black and white scale because it was felt that a resident would be more apt to identify his or her home. The scale was set up to show lighter shades where heat was escaping and darker shades where less heat was lost.

Thermograms were stored on a laser disc. This enabled a home to be seen within seconds after accessing it. It also allowed a still shot that could be viewed for long periods of time.

Thermograms were very detailed and accurate. They were able to show heat differentials to within one-half of a degree centigrade. Common light areas included air loss underneath the sole plate, air leakage around windows and doors, duct leakage, uninsulated attic accesses, insulation deterioration, insulation voids and air infiltration up chimneys.

COMPUTER ANALYSIS

The computer analysis was based on visual scaling of the thermogram's heat loss and information provided by the home owner. Thermogram scaling components included the ceiling, walls, windows, corners, roof valleys, doors and foundation. Participants were questioned as to seasonal thermostat settings, orientation, number and sizes of windows, type of heat, etc. Analysis provided excessive loss figures (Btu's and dollars) concerning conductance, solar gain and air infiltration.

The cost benefit analysis was based on College Station weather data, occupant's life style, the home's components, orientation and thermogram scaling. A computer print out gave the home owner recomendations on energy efficient improvements. It included approximate costs, estimation of savings and simple payback on each improvement. It also produced a generic list of energy conservation tips.

INFORMATION DISTRIBUTION

The general public was able to view their thermograms through a series of neighborhood open houses. The objective of distribution was to make the open houses highly accessible and personable. For this reason, they were held at various locations, dates and times. Neighborhood open houses were set up during daytime and evening hours, on weekdays and Saturdays. Locations included the City Hall, the Community Center, schools, churches, neighborhood meeting places and citizen's homes.

Volunteers were used to man the open houses with staff overseeing the operation. Three volunteer job positions were utilized: 1) host/map reader, 2) computer operator, and 3) interpreter. The host/map reader greeted the home owner at the door and helped the participant register. The registrant's home was then located on a map and the laser disc frame number was assigned. The computer operator would show and discuss the thermogram with the home owner. They would then type in citizen responses and thermogram scaling. The interpreter would discuss the generated print out. Before leaving, the home owner was given appropriate literature and a weatherization kit. Literature included information on air leakage, programmable thermostats, windows, air conditioner maintenance, electrical appliance usage, general energy conservation and a directory/coupon book pertaining to local "energy businesses". The weatherization kit included door weatherstripping, caulking and wall plate insulation pads.

Approximately 75 volunteers were enlisted. A training session was held two weeks before the first neighborhood open house. Instruction included a general knowledge of energy conservation and the thermographic mobile scan along with personal direction into specific job duties. Each volunteer was given a manual with their job responsibilities and goals.

After the neighborhood open houses were completed, residents were able to view their thermogram by scheduling an appointment with the Energy Department at City Hall.

CONCLUSION

College Station's thermographic mobile scan was an innovative project that brought together the latest in high technology. Citizens were able to view their thermogram and receive a concentrated short course in energy conservation during a half hour visit. Information was personable, highly accessible and specific to their needs.

It is estimated that 7,000 electrical customers out of a possible 14,000 will be effected by this project. All initial comments were very positive and supportive. Individuals were very appreciative of the city's effort to help keep utility bills down.