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THE CALIFORNIA EXPERIENCE WITH ENERGY CONSERVATION STANDARDS FOR BUILDINGS

Robert Feinbaum

May 1981

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THE CALIFORNIA EXPERIENCE WITH ENERGY CONSERVATION STANDARDS FOR BUILDINGS

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ON READING THIS REPORT

In order to assist policy makers and to inform all the various actors in the housing industry, this report is arranged so that it can be read on several levels:

1. Taken in their entirety, the first chapter and the last chapter convey the general sense of this report in the shortest time.

2. The core research and data analysis underlying the conclusions are summarized in bold-type at the beginning of each section.

3. Supporting data, background, direct quotes from representatives of all sectors are presented in the body of the report. Key sentences are emphasized, to facilitate skimming sections not read in detail.

Earlier drafts of this report were received by Ted K. Bradshaw, Patrick McLafferty, Earl Ruby and Mark Levine. The author wishes to express his appreciation for their comments, as well as to Howard Rheingold for editorial work, and Tom Wagner for typing the manuscript.

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INTRODUCTION:

ENERGY CONSERVATION STANDARDS FOR BUILDINGS -- RELEVANCE OF THE CALIFORNIA EXPERIENCE FOR NATIONAL ENERGY POLICY

BEPS and Title 24 -- Parallels

RELEVANCE OF CALIFORNIA'S STANDARDS TO PROPOSED FEDERAL POLICY

California's experience with implementation of Title 24 standards has much to offer federal policy makers who are concerned with increasing the energy efficiency of new buildings.

SIMILAR COMPLIANCE MECHANISIMS

The Building Energy Performance Standards (BEPS) program outlined in the Notice of Proposed Rulemaking (November, 1979), depends on the same kind of enforcement mechanisms as those used in the California program. BEPS standards would be put into effect at the state or local level through building codes certified to meet or exceed federal requirements. Codes would be enforced by local building departments presumably by demanding a showing of compliance by applicants, and witholding permits from those who failed to comply. The Department of Energy would assist in establishing code equivalency by prequalifying codes that localities could adopt whole or modify to suit their individual needs. An alternative approval process, based on a determination by a local code official, or

CODE ENFORCEMENT BY LOCAL BUILDING DEPARTMENTS

ROLE OF DOE IN ESTABLISHING CODE EQUIVALENCY

design professional, that a building design met or exceeded the requirements established in the standards, would also be part of the process.

BEPS and Title 24 -- Disjunction between Development and Enforcement

DISJUNCTIONS BETWEEN THOSE WHO DEVELOP STANDARDS AND THOSE WHO ENFORCE THEM

BEPS programs face the same primary problem which emerged from the California experience -- a disjunction between those who developed, and those who will enforce the regulations. Work on BEPS was done at the national laboratories, and by consultants, while California's standards were produced by the Energy Commission staff with advice from technical committees. Both sets of standards depend for enforcement on local officials who had no hand in writing them.

SHARED DEPENDENCE ON ENERGY AGENCIES

The success of both California's Title 24 and BEPS depends on the energy agency (CEC or DOE) to provide training and technical assisance, design manuals, and certify computer programs meant to aid compliance.

Mandatory Standards or Voluntary Guidelines?

CALIFORNIA STANDARDS ARE MANDATORY

Title 24 standards are mandatory. BEPS standards covering all new building activity in the nation were originally proposed as mandatory

snadards. In the present political climate, the BEPS regulatory approach is likely to give way to voluntary guidelines, if the national effort to save energy in new buildings continues at all.

REGULATORY APPROACH LIKELY TO BE REPLACED BY VOLUNTARY GUIDELINES ON FEDERAL LEVEL

Some problems are inherent in this shift of emphasis from regulation to guidelines. States and localities throughout the country may each adopt somewhat different approaches. This lack of uniformity may hit the manufactured housing industry (which provides much of the nation's low cost housing) especially hard. The industry claims that it will be costly to adapt to different standards in neighboring jurisdictions.

PROBLEMS IN SHIFTING EMPHASIS TO GUIDELINES

LACK OF UNIFORMITY MAY HINDER MANUFACTURED HOUSING INDUSTRY

A guidelines approach also opens the field to "cost cutters" who may entirely eliminate energy conservation features from their projects in order to allow them to undersell competitors. Without standards enforced by either building officials, utilities, insurance companies, or state or local energy offices, housing may be built with few cost effective energy conservations features included.

DANGER OF OPENING THE FIELD TO COST CUTTERS

The voluntary approach is not likely to save as much energy, as quickly, as the original BEPS program. Energy conservation would be left

DRAWBACKS OF LEAVING ENERGY CONSERVATION TO MARKET PRESSURES

almost entirely to the marketplace, with the driving force being the rising price of energy to consumers. However, as the Ford Foundation Energy Policy project pointed out, market imperfections might lead consumers to choose less energy conservation than would be warranted. Since distortions in the market are likely to occur, serious future problems may emerge due to "incorrect" economic decisions by current builders and buyers.

Problems from the California Expericence which are Relevant to National Energy Policy

LIKELY PROBLEM AREAS IN VOLUNTARY GUIDELINE PROGRAMS

1. Consultation

The California Energy Commission brought some implementation problems on itself by not paying closer attention to industry concerns. Consultation with all actors in the building game becomes even more critical with a voluntary program. Compliance then depends on the industry's perceptions that the guidelines are relevant, easy to use, and drawn with the needs of the private sector in mind.

NEED FOR CONSULTING ALL ACTORS BEFORE INITIATING THE PROGRAM

2. Simplicity

MANUALS MUST BE UNDERSTANDABLE AND WORKABLE

The CEC's manuals were criticized for being too technical, and not oriented toward field applications. A guidelines program cannot afford to make a similar mistake. Specifications should be clearly stated, and the techniques for fulfillment carefully worked out before issuing guidelines. Manuals and other information should be readily available, and written in a language easily assimilated by an "average" member of the industry.

USE OF LANGUAGE APPROPRIATE TO END USERS

3. Training

CENTRAL ROLE OF PROPER TRAINING PROGRAM

Training is vitally important to the success of a guidelines approach. California's training programs were developed too hastily, with too little regard for implementation concerns. A "train the trainers" strategy, such as that proposed by the CEC, might be considerably more productive than a massive federal training effort. The bulk of the work could be done by industry people, with financial backing and curriculum development from a central agency.

"TRAIN THE TRAINERS" STRATEGY MORE LIKELY TO SUCCEED

4. Innovation

Some designers feel that Title 24 now hampers them from following new energy conservation approaches. Standards seem to focus attention on bringing the worst performers up to a minimal level of competence rather than on encouraging the best possible results. A guidelines approach ought to follow a different line of reasoning; it should point builders toward attaining the highest level of cost effective energy conservation possible. That might mean special emphasis on passive solar design and on making energy considerations integral to the building process rather than something to be "tacked on" afterwards.

EMPHASIS ON REGULATING WORST PERFORMERS MAY DISCOURAGE NEW WAYS OF ACHIEVING ENERGY CONSERVING DESIGN

5. Information-flow

INDUSTRY PROBLEMS WITH CEC COMMUNICATION APPARATUS

The industry faulted the CEC's efforts at information dissemination for a variety of reasons: inconsistent interpretations, lengthy response times on complex matters, and difficulty in reaching portions of the industry outside the orbit of professional or trade groups or located in outlying areas.

A voluntary program needs adequate staffing to provide information and to monitor the effec-

ENHANCING COMMUNICATIONS IN VOLUNTARY PROGRAMS

tiveness of the effort in a way that will allow additional resources to be put into areas where the message doesn't seem to be taking hold. Close coordination with private sector organizations can keep direct costs down and allow staff in those groups to carry their share of the burden.

COORDINATION WITH PRIVATE SECTOR CAN KEEP COSTS DOWN

6. Reactions of Building Officials

VARIATION IN LEVEL OF LOCAL ENFORCEMENT

California's building deparments varied in their level of enforcement of Title 24 regulations, and officials varied in their commitment to the idea of state energy standards. Even though code officials will have no enforcement responsibilities under a voluntary program, their assistance will be vital to its success. Officials need to be aware of energy design principles in order to interpret the Uniform Building Code for the purpose of promoting energy savings as well as for their historic purposes of protecting public health and safety.

IMPORTANCE OF INVOLVING BUILDING OFFICIALS IN A VOLUNTARY PROGRAM

Many small builders look to building departments for information and assistance in meeting codes. The continuing relationships between building officials, contractors, and design professionals puts local officials in a position to reinforce the impact of the communications that

ROLE OF BUILDING OFFICIALS IN DISSEMINATING, EXPLAINING, AND REINFORCING GUIDELINES

the industry receives from trade and professional sources. Training for local officials ought to be included in the guidelines approach. At the very least, officials should be able to answer questions about good building practice for energy conservation purposes and to interpret existing codes to facilitate energy efficient designs.

IMPORTANCE OF TRAINING LOCAL OFFICIALS

7. Regional Differences

URBAN AND RURAL ATTITUDES TOWARD ENERGY STANDARDS MAY DIFFER

California's rural regions appear to be less favorably inclined toward state energy regulations than other parts of the state. Construction practices outside the main metropolitan areas differ from the rest of the state; guidelines should recognize regional differences in practices and should include appropriate sections pertaining to low cost energy-saving features that owner builders can incorporate into their own projects.

8. Calculations

CALCULATIONS ARE UNPOPULAR FOR SHOWING COMPLIANCE

Building officials and industry representatives dislike using calculations to show compliance with energy regulations; they prefer trade-offs to achieve energy efficient buildings. California builders seem to favor a point

BUILDING OFFICIALS AND INDUSTRY REPRESENTATIVES PREFER A FLEXIBLE TRADE-OFF APPROACH

system which is easy to comprehend, simple to administer, and flexible in interpretation. A voluntary program ought to tie into those concerns. Calculations should be done by the energy agency, not by the user, and should be presented in a form that can be applied quickly and easily. Trade-offs should be built into the guidelines through charts and tables that indicate the relative value of various energy saving measures.

9. Products

INITIAL SHORTAGES OF ENERGY EFFICIENT PRODUCTS

California builders reported shortages of products, such as insulation and small HVAC systems, after the state standards went into effect; they were also concerned about deficiencies in other materials such as double glazed windows. Many builders were reluctant to adopt new technologies like solar water heating because of questions about reliability. As part of a voluntary program, an independent testing laboratory or equivalent agency should certify new energy efficient products so that builders can use them with confidence. In addition, more efficient communication with manufacturers of established energy conservation products (such as insulation) could insure that adequate sup-

STIMULATING EFFECT OF CERTIFYING ENERGY EFFICIENT PRODUCTS

MAKING SURE SUPPLIERS HAVE ADEQUATE INFORMATION TO MEET DEMAND

plies of materials and equipment will be available to meet demand anticipated from builders.

10. Research

It is understandable that construction firms spend little if any of their earnings on research. Federal support thus becomes necessary to stimulate new developments in energy efficient building practices. This is especially important in preventing wasteful fragmentation of effort. Collection and dissemination of results from demonstration projects can be helpful to builders as well as policy makers.

FEDERAL RESEARCH SUPPORT NEEDED TO STIMULATE NEW DEVELOPMENTS

DISSEMINATING RESEARCH RESULTS CAN FACILITATE ENERGY CONSCIOUSNESS

11. Financing

California builders worry about added costs from energy conservation features influencing the affordability of their product. Financial institutions ought to consider energy costs in qualifying buyers for new homes. As part of a voluntary program, the authorities regulating banks and savings institutions, together with the energy agency, should develop a formula to alow credit for extra first costs incurred in energy efficient construction.

FINANCIAL INSTITUTIONS MUST CONSIDER ENERGY EFFICIENCY IN GRANTING LOANS

12. Coordination

COORDINATION WITH UTILITIES' CONSERVATION PROGRAMS

Utilities in California and other states are embarking on programs to increase energy conservation in new and existing homes. Standards arising from utility efforts should not conflict with guidelines for new construction. In order to prevent confusion to builders and buyers, national policy makers and state utility commissions should coordinate their efforts. Utility personnel in marketing as well as technical divisions need to understand and be able to use energy conservation guidelines in order to better assist builders who look to them for guidance in or incentives.

EDUCATE UTILITY PERSONNEL TO ASSIST BUILDERS WITH GUIDELINES

RESEARCH APPROACH

THE STATE OF CALIFORNIA HAS PROVIDED THE LEGISLATIVE AND REGULATORY UNDERPINNINGS FOR A SUBSTANTIAL EFFORT TO SAVE ENERGY IN NEWLY CONSTRUCTED BUILDINGS. LAWRENCE BERKELEY LABORATORY INITIATED A STUDY OF CALIFORNIA'S DEVELOPMENT AND IMPLEMENTATION OF ITS TITLE 24 ENERGY CONSERVATION STANDARDS.

SEVERAL QUESTIONS EXPLORED IN THIS STUDY ARE OF INTEREST TO NATIONAL POLICY MAKERS:

* HOW WERE THE STANDARDS DEVELOPED?
* HOW WELL IS THE IMPLEMENTATION EFFORT SUCCEEDING?
* WHAT TYPES OF PROBLEMS HAVE SURFACED?
* HOW HAS THE LEAD AGENCY, THE ENERGY COMMISSION, DEALT WITH THOSE DIFFICULTIES?
* HOW MUCH ENERGY ARE THE STANDARDS LIKELY TO SAVE?
* WHAT IMPLICATIONS DOES THE CALIFORNIA EXPERIENCE HOLD FOR A NATIONAL EFFORT TO IMPLEMENT BEPS?

Broadly Defined Study Population

The study population was defined broadly enough to include all the major actors directly or indirectly involved in energy saving efforts. The actions of the Energy Commission, and the enforcement efforts at the local level provided obvious areas of interest. In order to understand the way the entire system was being affected by regulations, we also investigated reactions from the private sector -- the builders and building designers who have to comply with the regulations, and "supporting actors" (realtors, financial institutions, uilities, and insurers) who play important roles in the state's building industry.

Looking at the Standards Setting Process

Two separate techniques were used to study the CEC's standards setting process and the enforcement activities of local building departments. AT the CEC, key staff and Commissioners were interviewed, relevant documents reviewed, and meetings of the Task Force investigating compliance with Title 24 monitored. For building officials, a questionnaire was designed to tap experiences with and attitudes towards energy standards; it was sent to all 482 departments in the state. The response rate of approximately 60% was quite accepable in light of the length and complexity of the form (an estimated thirty minuites to complete). Selected local officials were also interviewed to gain an understanding of the role energy considerations play in building department activities.

Research into the Private Sector

Similar techniques were used to explore reactions in the private sector. Key figures in the building, architecture, utility, and banking fields were interviewed. Pilot studies of architects and builders were completed. A questionnaire comparable to the one sent to building officials was administered at a conference on Energy Conserving Design sponsored by the California Council of the American Institute of Architects (CCAIA) in September, 1980. Slightly more than half of the 103 registered California architects responded. The second study involved lengthy, semi-structured interviews with representatives of 15 building firms in the San Francisco Bay Area. The interviews were spread among various types of builders -- large and small, custom and tract, innovative and conventional -- to give a full picture of the industry's response to standards. Magazines and newsletters read by builders and architects were also surveyed for the two years that California's Title 24 requirements have been effect.

THE DEVELOPMENT OF STANDARDS

THE CALIFORNIA LEGISLATURE CREATED THE CEC AND CHARGED IT WITH DEVELOPING CONSERVATION STANDARDS.

THE PROCESS OF DEVELOPING STANDARDS WAS HINDERED BY CONFUSION, AND IMPLEMENTATION OF SOME PARTS OF THE STANDARDS WAS DELAYED BY LEGAL CHALLENGES.

ALTHOUGH THE CEC WAS EVENTUALLY VINDICATED BY THE STATE COURT OF APPEALS, THE LENGTHY LEGAL BATTTLE FURTHER COMPLICATED ENFORCEMENT OF TITLE 24.

Legislative History of Energy Conservation Standards

During the past several years, California has established a reputation as a leader in efforts to promote energy conservation. In particular, the state has been deeply involved in programs to save energy in buildings.

In 1972, the legislature passed a bill requiring the Commission on Housing and Community Development to adopt regulations for minimum standards of insulation in new residential buildings. After lengthy consultation with building officials and industry representatives, the Commission adopted a set of requirements which went into effect on February 22, 1975. Housing and Community Development (HCD) laid down prescriptive requirements for new housing construction: Ceilings were to be insulated to R-20, walls to R-12.5, and in colder areas (degree days over 4500), floors to specified levels; window area was restricted to 20% of gross floor area, and in the colder places, special glazing was required; doors and windows were to be weatherstripped and pipes in unheated spaces were to be insulated.

Creation of CEC

Shortly before the HCD standards were to go ino effect, the legislaure passed a far-ranging bill creating a new state commission to deal with energy matters -- the California Energy Resources Conservation and Development Commission (herein referred to as the CEC). The Warren-Alquist Act transferred responsibility for reducing "wasteful, uneconomic, inefficient or unnecessary consumption of energy" in buildings to the new Commission, and it charged the CEC with going beyond insulation standards to prescribe requirements for lighting, climate control systems, and design features for both residential and non-residential buildings. All standards were to be "cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared to historic practice."[1]

The Commission's first action was to review the insulation standards, and to adopt requirements that were esentially the same as HCD's. Then CEC staff began to identify potential energy savings and to evaluate their cost effectiveness. The Commission appointed committees to advise staff on development of the residential and the non-residential standards. The residential effort generated friction on both sides: staff felt that committee members engaged more in posturing than constructive input, while some committee members felt that staff was being too cautious, and others regarded saff as insensitive to their views.

Starting from the existing insulation code, and using the newly developed ASHRAE 90 model, the Energy Commission staff worked out standards for the State. In passing the standards, the Commission changed several of the staff's ideas: it dropped a requirement for local building departments to inspect buildings for compliance, and adopted more stringent degree day and glazing requirements than those recommended by the staff.

During the nine month period prior to adoption in March of 1977, "there were four hearings conducted by the full Commission, five hearings conducted by a committee of two Commissioners . . . (and) a number of Advisory Committee meetings and public workshops which dealt with the regulations under study."[2]

The Commission set January 1, 1978, for implementation of the regulations. Building officials and industry representatives argued that such a short deadline would be impossible to meet. In response, the effective data was set back by six months, to July 1.

Title 24 Added New Dimensions to the Existing Standards:

* additions to existing residential structures were required to comply.

* Design heating loads were established. Heat inputs for buildings were based on geographic conditions and building insulation.

* Insulation requirements were modified to take account of the heating load. In colder climates, Title 24 required higher levels of insulation than the HCD standards (which were uniform throughout the state).

* Allowable glazing was decreased to 16% of gross floor area, and special glazing was required in areas with 2600 degree days or more of heating. Buildings in cities such as San Francisco, Oakland, Sacramento and Fresno were required to have double glazing. Additional windows were allowed on the south face, subject to a passive solar credit analysis.

* Heating and cooling system efficiencies were required to meet standards established by the CEC. Rated capacity of the heating equipment was not allowed to exceed the design load by more than 30%.

* Electric resistance heating was limited to 10% of the annual heating load unless a life cycle cost analysis showed it to be cost effective. Electric resistance water heating was prohibited unless it was cost justified.

* Fossil fuel heaters for swimming pools had to be compared with solar heating; they were only allowed in conjunction with pool covers.[3]

Legal Challenges to CEC Standards

In 1976, Building Code Action (BCA), a group funded by the construction industry, took the Commission to court, challenging the nonresidential code on the grounds that the state legislature had mandated a performance code, and the one to be adopted was effectively a prescriptive code. The Alameda County Superior Court "ordered the state to rewrite the code to include performance 'energy budgets' and to provide a computer program to calculate energy budgets." Those changes set

adoption back almost a year.

In 1978, BCA challenged the residential portion of the code; it "alleged that the code's cost calculations were incorrect and that it had been deprived of adequate opportunity to analyze and rebut those calculations."[4] The Marin County Superior Court concluded that "the Commission's failure to provide the public in general and the BCA in particular with 'reasonable access' to the contracted computer studies and a 'reasoable opportunity' to analyze and criticise the report's cost-effectiveness conclusions constituted a failure to provide a full and fair hearing." Furthermore, it found that "the Commission's adoption of the 2600 degree day double glazing standards raised a 'distinct possibility' of environmental impact . . . and that an EIR was required." The Commission was ordered to set aside certain wall and ceiling insulation regulations, the double glazing and glazing area standards, and a definition of "special glazing". Other regulations were allowed to stand.[5]

The Energy Commission immediately appealed. Although it took nearly two years for the case to be decided the CEC was ultimately vindicated on nearly all counts. The state's Court of Appeals determined that the Commission had provided a fair hearing process, and that the regulations had been adoped according to lawful procedure. However, the court upheld the finding on the double glazing requirements, citing the Commission for failure to consider all the appropriate evidence in making its determination. The suspended portions of the standards became effective on September 1, 1980. Only one change occurred from those originally adopted: special glazing was required in areas of 3500 degree days, rather that 2600. The Commission regarded the outcome as a significant victory, not only because the full standards would save greater amounts of energy over the coming decades, but also because its authority over energy regulations for buldings had been effectively reinforced.

While the BCA suit was going through the courts, it created a great deal of confusion for everyone involved in the state's building industry. Local code officials remained unclear about applicable regulations, and for the better part of a year many seem to have given short shrift to enforcement. The manual which CEC published to help designers was geared to the original regulations; consequently, several sections were incorrect for most of the time the regulations have been in effect. Despite the Commission's best efforts to get information out, many participants in the building field seemed to have difficulty complying with the standards for some period of time.

IMPLEMENTING THE STANDARDS

ACTIONS BY THE CALIFORNIA ENERGY COMMISSION

THE FIRST IMPLEMENTATION PROBLEMS STEMMED FROM FLAWS IN THE DEVELOPMENT PHASE. ALTHOUGH LEFISLATIVE INTENT WAS CLEAR, THE CEC METHOD OF IMPLEMENTING STANDARDS RAN COUNTER TO THE USUAL PROCESS FOR CHANGING BUILDING CODES, CONTRIBUTING TO ENFORCEMENT PROBLEMS.

LACK OF PRIOR INPUT BY THE PEOPLE WHO WERE TO BE TRAINED, THE HASTY NATURE OF THE TRAINING EFFORT, AND CONCENTRATED TRAINING SESSIONS CREATED OBSTACLES TO SUCCESSFULLY FAMILIARIZING OFFICIALS WITH PROCEDURES REQUIRED FOR COMPLIANCE.

CEC'S INFORMATION DISSEMINATION EFFORT WAS TROUBLED BY A LACK OF KNOWLEDGE ABOUT ITS AUDIENCE. IN ATTEMPTING TO FUNCTION AS BOTH A COMPLIANCE TOOL AND A DESIGN AID, THE COMMISSION'S MANUAL APPEARS TO SERVE NEITHER PURPOSE VERY WELL. APPLICANTS ALSO COMPLAINED ABOUT THE COMPLEXITY OF COMPLIANCE FORMS.

THE COMMISION'S NEWSLETTER, "THE BLUEPRINT", WAS RATED HIGHLY BY ALL ACTORS IN THE BUILDING FIELD, BUT ANOTHER EXPERIMENT, THE TELEPHONE HOTLINE, SEEMS TO HAVE CREATED CONFUSION UNTIL IT STARTED TAKING CALLS FROM BUILDING OFFICIALS ONLY.

IN THE EARLY PHASES, BUILDING INDUSTRY REPRESENTATIVES COMPLAINED THAT CEC ENGINEERS KNEW LITTLE ABOUT BUILDINGS AND NOTHING ABOUT CONSTRUCTION PRACTICES. CONSTANT TIME PRESSURE, AND A HEAVY WORKLOAD HAMPERED CEC STAFF. STAFF HAS SUBSEQUENTLY INCREASED, AND CAREFUL IMPLEMENATION PLANNING HAS BEEN RECOGNIZED AS A MAJOR RESPONSIBILITY BY THE COMMISSION.

Problems Stemming from the Development Process

The Warren-Alquist Act mandated the CEC to draft and implement energy standards for buildings, and required "the rules and regulations of the commission . . . (to) be enforced by the building department of every city, county, or city and county." Although legislative intent was clear, it ran counter to the usual process for changing building codes. Alan Wicks, former technical director of California Sheet Metal, Air Conditioning National Association told the Energy Commission Task Force on Compliance: "Uniform Building Code changes are publicized years in advance. The go to all members; then through a sub-committee of the code writing organization, to a code change committee, and then to the conference of the entire membership. There is full opportunity to input." The Model Code, or professional organization works through a consensus process, which takes time. It attempts to iron out differences among constituent groups of officials and product suppliers before final proposals are adopted.

Development of energy standards short-circuited the normal code change process. As Wicks commented: "The energy regulations were passed in a short time. They were never published in neat, clean language that building officials could understand. The input portion didn't begin to correspond to other codes." Not only was quick action demanded, but, of more importance, the process was taken out of the hands of the professional societies, material suppliers, and code officials who normally controlled code revisions. These "quasi-legislative authorities"[1] found themselves on the outside, looking in, as the Energy Commission staff, with assistance from consultants, wrote the Title 24 standards.

Wicks saw a "backlash of non-compliance" with the regulations. No other person interviewed for this study would go quite that far, but the fact that energy regulations came from outside the normal channels, with what building officials unanimously felt was insufficient opportunity to comment,and the fact that the regulations were issued in an unfamiliar form, undoubtedly contributed to enforcement problems.

Training Programs

The Energy Commission recognized the need to train building officials to understand, and to be able to enforce, the new regulations. As one CEC staffer invloved in the effort remarked: "going in, the level of understanding was minimal; few officials had any expertise (in energy)". Another was blunter: "most building officials wouldn't have known a BTU from a brick."

Starting in February, 1978, the Commission set up a series of seminars throughout the state; all building departments in each area were invited to attend. These ten seminars involved a "whirlwind cruise through the state from Redding all the way south." After that, the CEC co-sponsored sessions with interested groups, such as the California Building Industries Association (CBIA), American Institute of Architects (CCAIA), Professional Engineers Association (NSPE), the Electrical Industries Association (EIA), and their local affiliates. A CEC team

typically did the training, setting times after hours or on weekends for the convenience of the participants. Altogether, the CEC estimates that 10,000 people atended the 100 or so training sessions which took place during 1978.

Shortly after the regulations went into effect, a team of four CEC staffers visited local building departments to check for compliance and to answer technical or administrative questions. Team members selected 111 city and 36 county building departments "on the basis of their size and accessibility. Some departments were met in group meetings, some were contacted by telephone, but most were contacted individually. Sessions lasted from 1 to 7 hours, depending on the needs of the local officials." A variety of aids to enforcement were distributed -- procedures developed by other building departments, fact sheets summarizing the CEC's regulatory activities, examples of properly completed forms for typical plans, a summary of amendments to the regulations, and the impact of the BCA suit upon the standards. The team found these materials to be "very well received".[2]

CEC training sessions had two objectives -- to communicate some of the concepts on which the standards were built, and to familiarize officials with calculations required for compliance. Trainers thought they might be trying to cover too much material too fast: "Unless it's entertaining or personal growth", one staffer felt, "you can't keep people for over 2 or 3 hours and expect them to understand." He suggested that "trainers must be able to stay over for consecutive days or come back."

Given the hasty nature of the training effort, it proved impossible to send out materials in advance. CEC staff rarely knew who would be in attendance at any session. Both deficiencies created problems. "The most effective way is to give material to them a week ahead of time." By doing so, participants could ask questions "going in . . . and point out issues we weren't aware of." Had the backgrounds of attendees been known in advance, seminars could have been tailored more closely to the needs of participants. Specialized sessions broken into two segments of two hours -- such as later workshops on lighting -- were felt to be more effective than other sessions.

One CEC staff member esimates that training may have been provided for roughly half of the state's building departments. However, "mainly plan checkers" attended: "We felt that plan checking was the most significant part of enforcement. All the inspector has to do is see if the card is posted for insulation."

The CEC had no way to force building departments to send representatives for training. Some of the smaller departments would have had to close up shop to have someone attend. One CEC staffer suggested giving "some inducement (e.g., a certificate) which might convince officials to come after hours or on weekends, or compensate building departments for lost time." However, the Commission had neither the budget for release

time, nor a curriculum which could have led to a meaningful certificate.

Information Dissemination

The Warren-Alquist Act required the Commission to "establish a continuing program of technical assistance to local building departments . . ." In response, the Commission: developed a design manual to supplement the building standards; provided compliance forms to local building departments; contracted with the California State University and Colleges System Energy Consortium to develop educational materials to simplify compliance by the building industry; prepared a monthly newsletter with articles about the standards, staff interpretations, and answers to common questions; and established a toll-free telephone line to provide immediate answers to official's questions.[3]

The Act required the Commission to "produce, no later than 180 days afer the adoption of standards, an energy conservation manual for the use of designers, builders, and contractors . . ." By the end of 1977, CEC staff had completed two manuals -- one for residential, and the other for non-residential construction. Those manuals were "furnished upon request at a price sufficient to cover the costs of production" to interested parties in the private sector, and "distributed at no cost to all affected local agencies". However, a number of building departments reported that they had trouble obtaining copies, and private parties sometimes experienced delays because the CEC Publications Office was out of stock.

The residential manual is more than an inch and a half thick. It contains sections dealing with: calculating heat loss through the building envelope, meeting prescriptive standards for residential construction, guidelines for trade-offs for alternative designs, life-cycle cost methodology and how it is applied to analyzing HVAC systems (required when electric resistance heating is proposed), calculating exemptions for passive solar and for buildings with excess glazing area, life-cycle costing for water heating (electric), and for fossil fuel swimming pool heating, insulation and weather stripping materials, and appliance efficiency standards. Appendices contain tables and graphs useful to the designer, degree day maps of the state, detailed weather data for selected areas and copies of the compliance forms developed by the CEC, togeher with common examples of residential wall, ceiling, and floor construction practices.

The manual proposes to "assist those who must comply with the regulations, and to encourage the design, construction, and operation of energy efficient buildings in California."[4] In attempting to function as both a compliance tool and a design aid, the manual serves neither purpose very well. It lacks the specific examples, tied to a variety of common situations, that building officials need. It lacks cost data that builders find essential in making decisions about features to include in their developments, and it provides only a sketchy discussion of options beyond the prescriptive standards (which, after all, contain the minimum level of conservation that should be provided). The sections for "performance standards" and "recommendations beyond the

standards" remain empty. In fact, the manual seems to be tied to filling out compliance forms rather than to stimulating design alternatives.

The Commission has developed a set of forms to aid building departmens with enforcement of residential standards. Form 1 asks for a summary of the entire project. Forms 2 and 3 involve heat loss calculations. Form 4 applies to alternative designs. Forms 5 and 6 deal with life-cycle costing for space and water heaing systems (required only for electric resistance space heating or electric water heating), and form 7 involves life-cycle costing for swimming pools. The Commission's forms are not mandatory; building departments can, and do, devise their own. This lack of uniformity may lead to some difficulty in monitoring enforcement should the Commission decide to follow through wih such an effort.

Building departments vary in the importance they attach to proper completion of energy forms. Some departments check all calculations, and return forms to applicants who make mistakes. Others seem to rely more on compliance statements than on calculations to verify that Title 24 standards have been met. The problem is particularly acute in considerations of electric heating systems. Even building officials in more scrupulous jurisdictions admit that they lack the time and expertise to check reams of computer printout, or to verify assumptions that enter into life-cycle costing.

Although applicants complain about the complexity of compliance forms, difficulties attributed to the forms are more likely to stem from the regulations themselves -- especially in those parts pertaining to life cycle costing and standards for lighting design, which are probably not well understood by most building departments.

The Energy Commission contracted with the Consortium of California Colleges and Universities to produce guidebooks to supplement the design manual. The guides were intended to provide step-by-step instructions for demonstrating compliance with each division of the code. Unfortunately, the project lagged considerably behind schedule; the first guides to sections of the non-residential standards only became available at the beginning of December, 1980.[5]

All reports from participants in the building field rate the Commission's newsletter, the Blueprint, highly as a source of information. One section is usually devoted to CEC staff answers to common questions coming from building officials and designers. Such interpretations have been cited as the most helpful part of the Blueprint, since they reach the level of specificity that concerns building officials and most designers in their daily work.

Even this information source has some shortcomings. Although the CEC distributes about 11,000 copies of each issue, smaller building departments claim they have not received regular mailings. The Blueprint's format presents a more serious problem. The newsletter cannot be easily integrated with the manual and the regulations; consequently, building departments have to refer to separate sources of

information about the state's energy regulations. A number of officials expressed the hope that all material pertaining to Title 24 standards could be incorporated into a loose-leaf format which could be regularly updated to reflect changes and interpretations.

CEC staff answers, whether published in the Blueprint or given orally, are not official interpretations of the regulations. Only the full Energy Commission makes official interpretations. Those have to be requested in writing, given due notice, and usually held for hearing. The process takes time, and has been used mainly by industries (swimming pool installers, HVAC suppliers) to challenge portions of the regulations which could adversely affect their businesses. However, building officials are caught in a dilemma -- they usually need immediate answers to questions posed by applicants, but interpretations lacking the Commission's official seal are viewed with suspicion.

In the early fall of 1978, the Energy Commission announced a toll-free number to handle questions concerning the energy regulations. However, as one staffer remembers: "The hotline was getting over 100 calls per day. It paralyzed us. 60% of this office was doing nothing but answering phones." After several months, the public hotline was discontinued and applicants were urged to call local building departments for information about the regulations.

The public hotline caused problems for local building officials. One CEC staffer recalled: "We answered every question that came in off the top of our heads. We didn't want to slow construction. Rather than being purists, we sometimes gave contradictory advice." When the Commission limited its responses to building officials, it reinforced the authority of the local departments and prevented "end runs" around local building departments on the part of applicants. It probably also created a greater need for local officials to know about the regulations in order to give informed answers.

Commenting on the hotline experience a CEC staffer noted: "Building officials have to have confidence in their own ability to evaluate an application; otherwise, it's a disaster. Building officials have life-long relations with contractors. They would like to be able to explain regulations. If they can't, they're in a bad position. We now take calls from building officials only. We save their face as authoritative officials who know the code."

Advisory Committees

The Commission appointed two committtees to advise staff in drafting the standards -- one for the residential, and the other for the non-residential portion. An industry group provided input for the development of the non-residential portion. The residential advisory committee, composed of a wide spectrum of participants (including consumer and environmental represenatives, builders, architects, a banker, and a code official) met frequently for the better part of a year. Staff came to view this committee as non-productive: "It became a sounding board. We got no product from them; no constructive criticism." Commitee members saw the situation differently. They felt they had been effective in getting the Commission to reject staff's degree day standard (3000) and adopt a lower standard (2600), as well as in making other modifications. In 1978, afer the standards went into effect, the residential committee was disbanded.

In July, 1979, The Commission started a new advisory committee, made up of CALBO (California Building Officials) members. "These people were more attuned to problems in enforcement. We wanted credibility and needed their support." The Committee usually meets every two or three months, and takes up ideas for changes in the standards as well as problems that arise in the field.

Current members of the advisory committee include representatives from some of the largest building departments in the state; the chairman is the Superintendent of Buildings for the County of Los Angeles. Advisory committee members are appointed at CALBO's annual meeting, after screening by a selection committee. The Committee appears to be attractive to active CALBO members; CALBO's current president was the former chair of the Energy Commission's Advisory Committee, and other officers of the organization served on the Committee. This situation is likely to prove helpful to both building officials and the CEC; it helps to get direct feedback from the field to CEC officials, and it provides an opportuniy for building officials to comment upon, and perhaps influence changes in regulations.

Energy Commission Staffing for Implementation

When the standards went into effect, 15 staff members, most with degrees in engineering, were involved in the building energy program. However, few of those engineers had previous experience in the private sector; the majority came to the Energy Commission from CALTRANS. In the mid-70's, the state's highway boom suddenly deflated, leaving hundreds of engineers out of work. Some of those with seniority in state service were able to move over to the newly created energy agency. Building industry people commonly complained that CEC engineers knew little about buildings and nothing about construction practices. According to the industry, the resultant regulations turned out to be needlessly confusing.

CEC staff rushed from one phase of the program to another, always working under time pressure. An evaluation conducted for HUD in August 1978 noted: "Until recently, the staff was almost totally preoccupied in working with consultants and advisory groups in developing the residential and non-residential standards and the design manuals. With the promulgation of the standards and the manuals, staff acivities shifted to participation in . . . training programs held throughout the state . . . to explain the sandards and compliance requirements. Since July 1, 1978 -- the effective date for local implementation of the program -- the staff has been redireced to addressing the 'avalanche' of questions from building officials and contractors."[6] Under the circumstances, planning for implementation of the standards was necessarily hasty, and oversight of enforcement efforts at the local level was almost non-existant.

Recently, several organizational changes have occurred in the building standards program. It now forms a separate unit -- the Office of Buildings and Appliances -- within the Conservation Division, indicating greater importance attached to the program by the Commission. Staffing has been increased to about 20 professionals. Implementation has been recognized as a major responsibility stemming from the Energy Commission's 1979 Biennial Report to the legislature. The Commission appointed a Task Force on Code Enforcement and a staff implementation unit was formed at about the same time. The staff group is loosely divided into three sections -- one planning a program to implement the standards, a second concerned with training and education for building officials and the building industry, and a third considering ways to develop a continuing monitoring and evaluation effort.

The aim of the new measures is to shore up a major slippage in the standards program. Although the Commission has been projecting energy savings attributable to the Title 24 standards, it lacked hard data to validate its assumptions. Information filtering in from the field via the CALBO commitee and industry sources indicated uneven enforcement of the regulations. The Commission also realized that updated residential standards, based on a performance concept, will provide a much tougher enforcement job for local officials. The increased staff effort is directed toward anticipating and eliminaing future problems created by lack of implementation planning.

EVALUATIONS OF IMPLEMENTATION

IN 1978, A CEC TEAM AND A GROUP OF HUD CONSULTANTS CONDUCTED SEPARATE EVALUATIONS OF IMPLEMENTATION EFFORTS IN CALIFORNIA. THE CEC STUDY WAS MORE OPTIMISTIC THAN THE HUD REPORT REGARDING EFFECTIVENESS OF INFORMATION DISSEMINATION AND LOCAL ENFORCEMENT.

THE CEC TEAM SAW BUILDING DEPARTMENTS MAKING A GOOD FAITH EFFORT TO ENFORCE REGULATIONS, ALTHOUGH THEY NOTED THAT ENFORCEMENT TENDED TO BE BETTER IN URBAN THAN OUTLYING AREAS. THE HUD TEAM, LOOKING AT CALIFORNIA'S EXPERIENCE WITH AN EYE TO IMPLEMENTATION OF BEPS, WAS CONSIDERABLY MORE CRITICAL. IT POINTED AT CONFUSING AND COMPLEX STANDARDS, INEFFECTIVE MANUALS, POORLY CONCEIVED AND EXECUTED TRAINING, AND INADEQUATE STAFFING. LOCAL ENFORCEMENT PROBLEMS WERE FOUND.

HOWEVER, METHODOLOGICAL FLAWS IN BOTH STUDIES ARE SERIOUS ENOUGH TO TREAT THEIR CONCLUSIONS WITH CAUTION.

IN 1980, THE CEC APPOINTED A TASK FORCE ON CODE ENFORCEMENT AND CONTRACTED WITH HCD TO MONITOR ENFORCEMENT IN 29 LOCAL JURISDICTIONS. THE TASK FORCE CONCLUDED THAT COMPLIANCE WITH BOTH RESIDENTIAL AND NONRESIDENTIAL STANDARDS EQUALLED OR EXCEEDED ESTIMATES BY COMMISSION STAFF. DATA ANALYSIS AND SAMPLING PROBLEMS RAISE CONCERNS ABOUT THE ACCURACY OF THAT CONCLUSION. INDEPENDENTLY COLLECTED EVIDENCE CASTS SOME FURTHER DOUBT ON THE ACCURACY OF TASK FORCES'S REPORTED COMPLIANCE LEVELS.

THE TASK FORCE ALSO IDENTIFIED A NUMBER OF BARRIERS TO EFFECTIVE ENFORCEMENT: ALTHOUGH REGULATIONS REQUIRE DEPARTMENTS TO CHECK PLANS, THEY DO NO MANDATE INSPECTION; TRAINING HAS NOT BEEN PROPERLY FOCUSED ON NEEDS OF PARTICIPANTS; BUILDING DEPARTMENT FEES HAVE BECOME A SOURCE OF REVENUE FOR OTHER DEPARTMENTS; APPLIANCE STANDARDS HAVE BEEN DIFFICULT TO ENFORCE AT THE CONSTRUCTION SITE. STRUCTURAL PROBLEMS WITHIN BUILDING DEPARTMENTS WERE REGARDED AS KEY BLOCKAGES TO EFFECIVE ENFORCEMENT.

1978 Evaluations

Shortly after the standards went into effect, two separate evaluatins took place. One was conducted by a Building Official Liason team assembled by the Energy Commission, and the other by a group of consultants under contract to the Department of Housing and Urban Development (HUD). Each report pointed to implementation problems, but the Commission's study was considerably more optimistic than the HUD report regarding the effectiveness of information dissemination and local enforcement efforts.

The CEC team's efforts had several purposes: to promote enforcement in areas where it was lacking, to answer technical and administrative questions about the standards, as well as to monitor compliance. The four members of the evaluating group received training about the standards, and then, after telephone contact, visited local building departments.

Their general impression was that "building departments were making a good faith effort to enforce the regulations". The team reported that most departments were "ensuring compliance with the energy regulations through plan checking and field inspection." However, in one area of the state -- the slice taking in the Sierra foothills and the Central Valley -- "nearly half of the building departments had not implemented the regulations. After working with them, only two departments continued to refuse to comply." Enforcement in urban areas seemed to be generally better than in outlying areas. One official told the CEC that his staff "takes additional heat from builders who can evade the regulations in nearby rural and suburban" areas.

Although CEC staff noticed specific enforcement problems, particularly with slab-edge insulation, equipment oversizing, and life-cycle costing calculations, the evaluation team's optimistic assessment led the Commission to believe that enforcement of the standards could reach predicted levels, with better education and improved access to expert staff.

At about the same time, HUD sponsored a study of the California experience as a means of anticipating problems that might be encountered in implementing a national Building Energy Performance Standard (BEPS). The study was conducted by Harbridge House and Public Technology, and its conclusions were based on interviews with "more than 25 state and local officials who are involved in the implementation" of energy conservation regulations. The tone of the HUD study was considerably more critical than the CEC's own evaluation. It pointed to confusing standards, design manuals which were too complex, lack of opportunity for building officials to participate in the development of standards, as well as "poorly conceived and poorly executed" training programs for building officials.

At the state level, the HUD consultants found that "the staff of the Conservation Division has never been large enough to perform all of the critical functions called for." As a result, inquiries "about the standards and regulations have not been answered in a timely and responsive

manner."

Local enforcement problems abounded. Small furnaces were often unavailable. Product labeling was not always correct and was difficult to check in the field. Code conflicts, especially with respect to foundation ventilation, were difficult to resolve. Degree day figures for some communities were inaccurate. Documentation requirements were regarded as too severe. The standards also caused real economic problems. Builders and owners were faced with increased costs. The HUD team found little market for energy conservation among the buying public, primarily because life-cycle savings "may either not be recognized by, or be meaningless to an affected party." They also found that commercial relocations were sometimes caused by enforcement of standards "when neighboring jurisdictions are not enforcing the standards at all."

The HUD study team concluded that "local enforcement of the standards was spotty: some jurisdictions were enforcing the code strictly, some in a lax manner, and some not at all." Most local officials relied "almost completely on architects, builders, and contractors to certify that the plans and construction comply with the standards. This is especially true on non-residential building permits, inasmuch as these standards are new, technically very complex, and involve detailed compliance requirements."

The HUD report indicated that "the ultimate effectiveness of the energy standard relies upon the ability of designers and builders to use it . . . but many of them are not aware of the standard or do not know how to use it . . . Much of the building design in California is done by professionals who do not have the advanced engineering background necessary for working with the energy standards."

However, both studies have serious enough methodological flaws that their conclusions should be treated with caution. The CEC study, combined as it was with an effort to train officials to use the regulations, might have inhibited accurate reporting in several ways. For one, some building officials might have been less candid with staff members of the agency which had imposed Title 24 on them than they would have been with outside evaluators. Moreover, the natural tendency of staffers to regard their training efforts as successful might have led them to accept intentions to enforce as actual enforcement. The team did not do any plan checking or field inspection, nor did it return to visit building departments to check on how well its training had been absorbed. Since the effort was limited to building officials, the private sector's perspective was completely eliminated from consideration.

The HUD study had different, but equally serious flaws: Its sample was much too small to allow meaningful generalizations about implementation throughout the state. The study questions appear to have been formulated with little more than the sections of regulations in mind. The team appears to have flown in and flown out again too quickly to gather more than surface impressions. Although it sought to attribute attitudes to the private sector, no interviews seem to have been held with builders, or building designers, to find out what was actually happening

from their perspective.

1980 Evaluation of Compliance

In April, 1980, the CEC appointed a Task Force on Code Enforcement to "determine the current level of compliance with the energy conservation standards, identify institutional barriers to full compliance with the standards, and recommend actions to remove the institutional barriers . . ." The Commission contracted with the State Department of Housing and Community Development (HCD) to monitor enforcement practices in 29 local jurisdictions. HCD engineers interviewed building department personnel, reviewed plans for completeness, and inspected both residential and non-residential buildings for compliance with approved plans.[1]

From the data provided by HCD, the Task Force concluded that compliance with the residential building standards equalled or exceeded that estimated for each utility service area by Commission staff. "Statewide, approximately 22% more energy is being saved than was forecasted to be saved in the Commission staff's Biennial Report." For non-residential buildings, energy savings were also found to be greater than the Commission had predicted. The analysis focused on two utilities -- Pacific Gas and Electric, and Southern California Edison, which together account for 75% of the state's electric use. From the sample of 22 inspected buildings the Task Force inferred a level of compliance of 62% (PG&E) and 70% (SCE), compared to the 50% estimated by staff for the Biennial Report.

This finding of a high degree of compliance with the energy conservation standards must be taken cautiously. HCD's sample of buildings was clearly too small to allow meaningful statistical generalizations. (For the SMUD service area, three houses were inspected; For L.A. Water and Power -- two houses; for PG&E. -- 28 houses.) Furthermore, the sample was not drawn randomly; HCD engineers looked at buildings that were called for inspection on the day they visited local jurisdictions.

The probability of drawing inaccurate conclusions increases when an unsophisticated technique for data reduction is added to the serious sampling problems. HCD inspectors used a checklist to determine conservation features present in the house, and analysts compared that to the characterisics of pre-1975 houses. After that, the percentage of buildings in full compliance with the envelope requirements was multiplied by the energy savings resulting from satisfying Title 24 standards. According to the CEC enforcement task force: "Those products were added together to arrive at the estimated level of compliance with the residential building standards".

Such a procedure fails to credit partial compliance (which saves some energy over pre-1975 practice). It recognizes one of the sampling problems, but a fixed correcion factor cannot rectify the biases involved. The comparison imposes a degree of rigor on the HCD field reports that may not have been present in the originals. Inspections were usually done quickly, and could not always include every

conservation feature. The data analysis raises concerns beyond those presented in the sampling.

Independently collected evidence casts further doubt on the accuracy of the CEC Task Force's reported compliance levels. PG&E has conducted home energy audits for the past two years. Pulling out the data collected from recently built homes, the company "found that approximately 32% of the audited homes built in 1975 or later have less than R-19 attic insulation. This percentage ranges between 12% and 41% throughout the PG&E. service area." Since at least R-19 ceiling insulation has been required to meet Title 24 standards, this suggests "significant violation of the Residential Building Standards."[2]

Of course, the PG&E sample is highly selective, consisting only of homes for which audits have been voluntarily requested. The study deals only with insulation, and not with other energy conservation measures, but it does temper the Task Force's optimism about compliance and suggests that enforcement may be spottier than the HCD survey indicated.

In addition to taking the first quantitative stab a estimating compliance levels, the Task Force also identified a number of barriers to effective enforcement:

* Although current regulations require building departments to check plans for energy, they do not mandate inspection.

* Training has not been "focused to the specific needs of the participants", manuals have not been current, and forms to facilitate compliance have been "too complex".

* Building department fees have become "a source of revenue for other departments of local government in the post-Proposition 13 era". As a result, few local departments have been able to increase staff to deal with energy matters.

* Appliance efficiency standards have been "difficult to enforce at the construction site because of outdated compliance directories . . . (and) last-minute substitutions by the contractor"

These problems are not new, but the context in which the Task Force places them is quite different than in previous studies. Barriers to compliance are seen as a function of local jurisdictions' ability to enforce the regulations. Structural problems relating to building departments -- such as their lack of authority to inspect for compliance with energy regulations, budgetary and manpower limitations, and ineffective training, are thus regarded as key blockages to effective enforcement.

ENFORCEMENT BY LOCAL BUILDING OFFICIALS

THE CEC HAS NOT ESTABLISHED CRITERIA FOR INTERVENTION WHEN IT MIGHT SUSPECT LACK OF COMPLIANCE. IT HAS NEVER TRIED TO TAKE OVER ENFORCEMENT RESPONSIBLITIES BECAUSE IT LACKS THE STAFF AND THE CAPACITY TO MONITOR ENFORCEMENT. CONSEQUENTLY, BUILDING OFFICIALS AND INDUSTRY MEMBERS BELIEVED THAT THE CEC HAD LITTLE IDEA OF HOW ITS REGULATIONS WERE BEING TREATED LOCALLY.

BOTH THE BUILDING INDUSTRY AND THE CEC REALIZE THAT LOCAL BUILDING OFFICIALS PLAY A CENTRAL ROLE IN OBTAINING COMPLIANCE, BUT RECOGNIZE A NUMBER OF SERIOUS PROBLEMS AT THE LOCAL LEVEL: BUILDING DEPARTMENS ARE UNDERSTAFFED AND UNDERFUNDED, DUE TO PROPOSITION 13 AND LOCAL POLITICAL FACTORS; THE CEC'S FAILURE TO MANDATE INSPECTION MAKES IT MORE DIFFICULT FOR LOCAL DEPARTMENTS TO SEEK ADDITIONAL STAFF. STAFF CUTS OR FAILURE TO PROVIDE ADDITIONAL STAFF ARE BOTH EXPECTED IN THE NEAR FUTURE, AND MAY HAVE SERIOUS CONSEQUENCES FOR ENFORCEMENT.

STAFF SHORTAGES AND LACK OF ENTHUSIASM FOR STATE REGULATIONS HAVE LED MANY DEPARTMENTS TO RESTRICT THEIR OWN INVOLVEMENT IN CHECKING FOR COMPLIANCE. THE COMMISSION CONTRACTED WITH HCD FOR PLAN REVIEW SERVICES. A FEW JURISDICTIONS REFER MOST NON-RESIDENTIAL PLANS TO HCD FOR REVIEW. MANY SMALL DEPARTMENTS CONTRACT WIH COUNTY AGENCIES OR PRIVATE ENGINEERING FIRMS FOR ASSISTANCE WITH PLAN CHECKING.

INSTEAD OF INSPECTING FOR INSULATION, DEPARTMENTS USUALLY ACCEPT STATEMENTS FROM CONTRACTORS AS EVIDENCE OF COMPLIANCE. COMPLIANCE STATEMENTS SAVE BUILDING OFFICIALS TIME AND EFFORT, BUT THEY HAVE UNDOUBTEDLY BEEN ABUSED. WIDESPREAD USE OF COMPLIANCE STATEMENTS RISKS TURNING ENERGY STANDARDS INTO VOLUNTARY GUIDELINES.

THE PRACTICE OF QUICK APPROVAL OF CONVENTIONAL PROJECTS AND LENGTHY CHECKS FOR UNCONVENTIONAL ONES MAY HAVE THE UNINTENDED CONSEQUENCE OF DISCOURAGING SOME NEW ENERGY CONSERVING DESIGNS FROM BEING PURSUED.

Problems and Procedures in Local Enforcement

The Warren-Alquist Act specifies that building permits for new construction are not to be issued "unless a review by the building department of the plans of the proposed residential or non-residential building contains detailed energy system specifications and confirms that the building satisfies the minimum standards . . . applicable to such building." In cases where the local jurisdiction fails to enforce the regulations "the commission may provide such enforcement after furnishing 10 day's written notice to the local building department."[1]

Lack of staff is certainly one reason the Energy Commission never tried to take over enforcement responsibilities. A more fundamental cause has been the CEC's failure to establish the capability to monitor enforcement. Until the HCD evaluators inquired into compliance, the Commission received only impressionistic evidence about enforcement efforts. Building officials and members of the industry widely believed tha Sacramento had little idea how its regulations were being treated throughout the state. Our LBL survey asked building officials whether they believed that "state officials are aware of the manner in which local communities are enforcing energy standards for buildings." Only 17% said they thought state officials were aware of the way localities were enforcing Title 24, while 45% indicated that they didn't think that state officials knew how local jurisdictions were treating the regulations (37% answered that they didn't know).

Both the Commission and the building industry realize that local officials play a central role in obtaining compliance with the standards. But building departments have had their own problems over the past two years -- problems that have affected their capacity to enforce energy regulations.

California voters passed Proposition 13 shortly before the Title 24 standards were to go into effect. The tax-cutting initiative drastically reduced income for more local governments throughout the state, and building departments were as quick to feel the effects as other city services. The most immediate effects were staff cuts. The CEC's Building Official Liason Team noted in August 1978 that "eighteen building departments reported layoffs ranging from one to eleven employees . . . the impact of these layoffs varies widely, because of variations in level of effort for particular cities. San Diego, for example, has six times the staff that Santa Anna does, but it only processes twice as much valuation annually."[2]

The Warren-Alquist Act gave building departments the authority to prescribe a fee schedule to pay for the costs of enforcement, and allowed the Commission to establish such a fee schedule; the Energy Commision hasn't done so, and most building departments have found it politically impossible to increase fees. Our survey found only about one-third were able to raise fees to cover the added costs of enforcing energy standards.

Even those departments that raised fees may not have been able to use the money they collected for checking Title 24 compliance. Nearly all building departments funnel their fees into their city or county general fund; during the budget process, they have to compee with other local services for allocations to carry out their responsibilities. In many jurisdictions, building departments seem to be close to the bottom of the political pecking order. Other programs often have more appeal to local elected officials. Many building officials grumble about the attention given to housing and social programs while their departments, which bring money into the city or county treasury, remain understaffed.[3]

The political climate within which building departments operate contributes to problems in enforcing the energy regulations. In the post-Proposition 13 era, local departments have been hard-pressed to convince city councils or boards of supervisors to allocate funds to enforce new programs. The situation is compounded by the CEC's failure to mandate inspection for compliance with Title 24 requirements. One CEC staff member commented: "When building departments ask for additional staff to inspect, they're turned down. They can't show the city manager that anything in the regs requires inspection."

Most California localities have not yet felt the full impact of Proposition 13. In the past two years, state surpluses helped bail out local governments. With the state surplus exhausted, building officials are concerned about the implications of future funding cut-backs. Further staff cuts, or failure to provide additional staff in response to increased work loads, may have especially serious consequences for enforcement of energy regulations.

Restricting Involvement in Enforcement

Few building officials look on energy regulations in the same way they regard enforcement of Uniform Building code standards to protect life and safety. "Nobody's going to get killed if we do a rotten job on energy", was a charactaristic comment.

Staff shortages and lack of enthusiasm for state regulations have led many departments to restrict their own involvement in checking for compliance. Some of them refer plans to HCD before processing permit applications. Others contract with larger building departments or with private engineering firms to check plans or inspect buildings. Many accept compliance statements from builders or building designers in lieu of thorough checking by their own staffs. Most officials grant permits for uncomplicated projects that appear to meet the prescriptive requirements without asking for forms or calculations.

The Warren-Alquist Act directed the CEC to "provide, on a contract basis, a review of building plans and specifications submited by a local building department." Rather than establishing such a program itself, the CEC contracted with HCD to provide plan review services since HCD already had contacts with local building officials through its on-going programs. The Commission reasoned that it would be more effective tc

build on those existing relationships than to hire its own staff to review plans.

HCD's two offices -- in Sacramento and Santa Anna -- have reviewed more than 1,700 plans since the regulations went into effectt. One engineer in each office is responsible for energy plan checking, though other engineers help whenever an overload occurs. HCD staff received training from the CEC and maintain contact to help with interpretations; but most interpretation problems are handled independently, with only the stickiest referred to CEC.

Some jurisdictions refer most non-residential plans to HCD for review. Medium-sized cities such as Anaheim, Palm Springs, and Sunnyvale ask permit applicants to have their plans checked by HCD before submission. Our survey indicated that 9% of the building departments sent all non-residential plans for review, and an additional 2% sent between 50% and 90%. A few departments even required residential plans to be reviewed prior to submission.

HCD maintains that its turn-around time is quite short. "A lot of interior improvement jobs can be done in a day. We try to settle major questions right away. If we find mistakes, we contact the applicant and try to take care of it over the phone." HCD staff often find mistakes. Some are simple errors of arithmetic or situations in which insulation is indicated in the calculations but not shown on the plans. Other mistakes take more time to find and fix. Corrected plans must be filed with the local building department.

Quite a few small building departments contract with county agencies or with private engineering firms for assistance with energy plan checks. The huge Los Angeles County building department's district offices provide plan checking and inspection services for a number of smaller cities within its jurisdictions. Our survey found that 48 small cities around the state contracted with county deparments for plan checking, and another 28 departments sent plans out to private engineers for review.

Small California cities often contract with counties for services which they cannot provide. Common arrangement are made for fire and police service, so it should come as no surprise that energy conservation standards for buildings are being treated in a similar fashion. Since large agencies probably provide more effective plan checking that small jurisdictions could offer, these arrangements may lead to somewhat better enforcement of Title 24 regulations than might otherwise occur.

Building departments commonly accept statements from contractors or from building designers licensed by the state, attesting to fulfillment of Title 24 regulations. When statements are filed by reputable firms, officials usually do little checking of their own. Many building departments seem to assume that a professional's stamp insures compliance with energy regulations, and relieves them of responsibility for further investigation.

Instead of inspecting for installation of insulation, building departments usually accept statements from contractors as evidence of compliance. Typically, a signed form, posted at a "conspicuous location" within the building at the time of the final inspection, attests to the type of insulation installed (blown or batt) and to the thickness and R-value of the insulation. This ready acceptance of statements may be one reason behind the PG&E study's finding of substantial non-compliance with the requirements for attic insulation.

Compliance statements save building officials time and effort, but they have undoubtedly been abused. Widespread use of compliance statements risks turning energy standards into voluntary guidelines. Applicants who want to cheat, or who lack knowledge about the regulations, or make mistakes in calculations, have been granted permits on the basis of statements that their buildings were in compliance with Title 24.[4] Building officials say that they don't have the staff, and may lack the expertise, to check all calculations carefully. As an employee of a utility energy conservation program commented, "insulation contractors often pay their workers by the square foot blown in. They haven't necessarily had any training. We've had running battles with contractors." But, inspections for insulation have sometimes even been dropped due to staffing limitations.

Many building departments grant permits for construction which meets the basic component standards, without requiring calculations or forms to be filed. For example, the County of San Diego's standard design statement for conventional housing projects allows a licensed contractor or design professional to indicate that plans conform to the Title 24 energy conservation standards. Other jurisdictions handle the situation even less formally.

This situation cretes difficulties with innovative projects because every building department requires designers of alternative projects to file detailed heat loss calculations and comprehensive summaries of their designs. The practice of quick approval of conventional projects, and lengthy checks for unconventional ones, may have the unintended consequences of discouraging some new energy-conserving designs from being pursued.

THE BUILDING OFFICIALS SURVEY

AS PART OF THE LBL SURVEY OF ENFORCEMENT PRACTICES AND ATTITUDES, A QUESTIONNAIRE WAS SENT TO 482 BUILDING DEPARTMENTS, WITH A 59% RESPONSE RATE. QUESTIONS DEALT WITH CONTACTS WITH CEC, EFFECTIVENESS OF TRAINING PROGRAMS, PROBLEMS IN ENFORCEMENT AND FUNDING, LEVEL OF ENFORCEMENT, AND ATTIUDES TOWARD THE STANDARDS. DEPARTMENTS WERE COMPARED ON DIMENSIONS OF SIZE, TYPE OF AREA, AND WHETHER OR NOT OFFICIALS FELT THEY NEEDED ADDITIONAL STAFF FOR ENFORCEMENT.

IN GENERAL THE MAJORITY OF BUILDING OFFICIALS FROM ALL SIZES OF DEPARTMENT ARE LIKELY TO:

* SEND STAFF TO TRAINING SESSIONS.
* PREFER CALBO TRAINING SESSIONS TO CEC'S
* THINK TRAINING SESSIONS SHOULD BE CONDUCTED IN SMALLER GROUPS, CONTINUED OVER A LONGER PERIOD, AND THAT MORE CLEARLY WORDED AND EXAMPLE-ORIENTED TRAINING AIDS SHOULD BE PROVIDED.
* SPEND MUCH LESS TIME ON INSPECTION THAN ON PLAN CHECKING.
* ARE SUFFERING FROM POLITICALLY GENERATED FUNDING CUTBACKS, AND STAFFING PROBLEMS.
* DISLIKE CALCULATIONS AND WOULD LIKE THE CEC TO DEVELOP A COMPUTER FORMAT FOR MAKING SENSE OF THEM.
* AGREE THAT PERFORMANCE STANDARDS WILL LEAD TO GREATER ENERGY SAVINGS, BUT FEEL THEY WILL MEAN MORE WORK.
* SEEM TO REGARD TITLE 24 REQUIREMENTS AS SAVING ENERGY, BUT NOT AS COST EFFECTIVE.
* FEEL THAT INCREASED STAFF FOR INSPECTION AND PLAN CHECKING IS THE MOST IMPORTANT WAY TO IMPROVE COMPLIANCE.

IN GENERAL, BUILDING OFFICIALS FOUND ENFORCEMENT PROBLEMS REGARDING:

* SPECULATIVELY BUILT COMMERCIAL OR INDUSTRIAL STRUCTURES.
* SIZING HVAC SYSTEMS.
* ENFORCING EFFICIENCY CRITERIA FOR APPLIANCES.
* LIFE-CYCLE COSTING CALCULATIONS, ESPECIALLY WITH REGARD TO ELECTRIC RESISTANCE HEATING.
* CHEATING ON COMPLIANCE STATEMENTS.

* DIFFICULTIES IN EVALUATING ALTERNATIVE DESIGNS.

* INTERPRETAION OF LIGHTING STANDARDS FOR NON-RESIDENTIAL BUILDINGS.

IN GENERAL, LARGE BUILDING DEPARTEMENTS ARE MORE LIKELY TO:

* BE IN TOUCH WITH CEC OFFICIALS, ASK CEC STAFF FOR INTERPRETATIONS, AND HAVE DIFFERENCES WITH THE CEC.

* ADD PERSONNEL TO ENFORCE CONSERVATION REGULATIONS, BUT ALSO TO FIND THEIR CURRENT EXPENDITURES SATISFACTORY.

* FAVOR PRESCRIPTIVE STANDARDS OVER PERFORMANCE STANDARDS AND THINK THAT ENFORCEMENT WILL BE MORE DIFFICULT WITH THE LATTER.

* BE CRITICAL OF ASPECTS OF THE STANDARDS.

* FEEL THAT EXISTING STANDARDS SAVE ENERGY AT RELATIVELY SMALL COST.

IN GENERAL, SMALL BUILDING DEPARTMENTS ARE MORE LIKELY:

* NOT TO BE IN CLOSE CONTACT WITH CEC OFFICIALS, OR TO ASK FOR INTERPRETATIONS.

* TO RAISE QUESTIONS ABOUT RESIDENTIAL STANDARDS.

* TO SEND FEWER MEMBERS TO TRAINING SESSIONS.

* NOT TO ADD PERSONNELL TO ENFORCE STANDARDS.

* TO FAVOR PERFORMANCE OVER PRESCRIPTIVE STANDARDS.

* NOT TO FEEL THAT STANDARDS SAVE ENERGY EFFECIVELY.

IN GENERAL, BUILDING DEPARTMENTS IN THE LEAST BUILT UP AREAS OF THE STATE ARE MORE LIKELY TO:

* HAVE NEGATIVE ATTITUDES ABOUT THE ENERGY COMMISSION'S EFFORTS.

* NOT MAKE SPECIAL VISITS FOR INSULATION OR OTHER ENERGY ITEMS.

* FEEL THAT THEIR ENFORCEMENT BUDGETS ARE INADEQUATE AND WANT TO INCREASE STAFF TO ENFORCE STANDARDS.

* REGARD PROBLEMS WITH LEGAL LIABILITY AS IMPORTANT.

IN GENERAL, BUILDING OFFICIALS WHO THOUGHT THEIR DEPARTMENT'S STAFF WAS ADEQUATE WERE MORE LIKELY TO:

* HAVE FEW CONTACTS WITH THE CEC.

* SEND FEW CALCULATIONS TO HCD.

* SPEND A SMALLER PROPORTION OF PLAN CHECK AND INSPECTION TIME ON ENERGY.

* INCREASE FEES.

* OPPOSE LIFE-CYCLE COST CALCULATIONS AND BELIEVE THAT CHEATING COULD BE A PROBLEM.

IN GENERAL, BUILDING OFFICIALS WHO THOUGHT THEIR DEPARTMENT'S STAFFING WAS NOT ADEQUATE WERE MORE LIKELY TO:

* MENTION SPECIAL ENFORCEMENT PROBLEMS, ESPECIALLY WITH SPECULATIVE BUILDINGS AND HVAC SIZING.

* BELIEVE THAT THEIR LEGAL LIABILITY HAD INCREASED AS A RESULT OF TITLE 24

* CRITICIZE CALCULATIONS ON FORMS.

* SEE INCREASES IN FIRST COSTS DUE TO THE STANDARDS.

The Survey

The LBL questionnaire dealing with enforcement practices was sent to every building department appearing on the mailing list maintained by CALBO (California Building Officials). The total list of 482 departments contained both members and non-members of CALBO. The survey tabulations are based on 246 completed questionnaires. Since not every respondent answered every question, the percentage base shifts in the following tables.

A number of small departments indicated that they neither plan checked nor inspected for energy. Since our questionnaire was directed toward departments that were enforcing the Title 24 regulations, these jurisdictions should not be counted as potential respondents. Furthermore, many of the departments which failed to return the survey are small, and not likely to be enforcing the energy conservation standards. Therefore, our response rate certainly understates the true response to the survey.

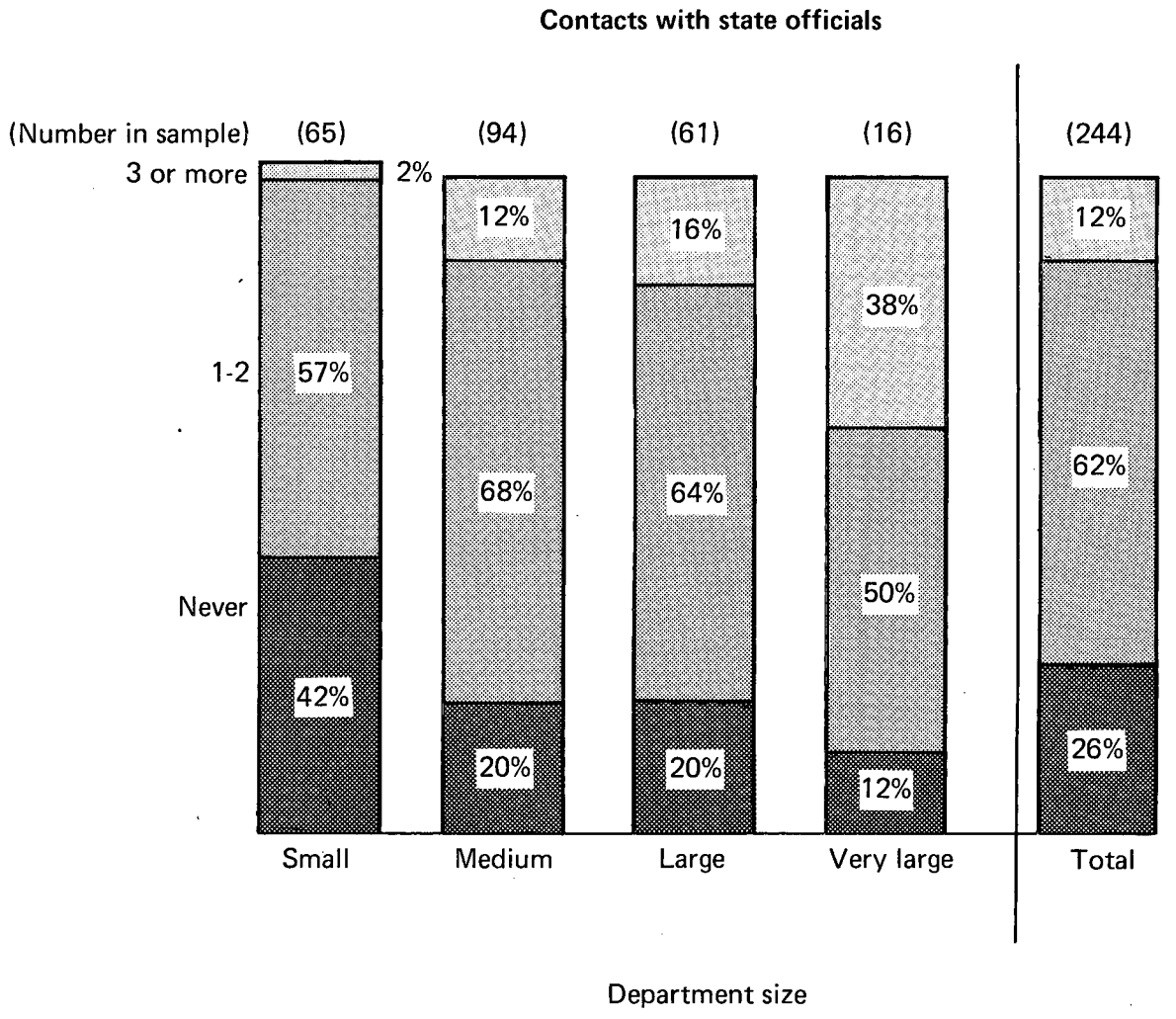
Questions dealt with the quality of contacts which building officials had with the CEC, with the effectiveness of training programs and aids to compliance, with problems in enforcement and funding, with the level of enforcement, as well as with building official's attitudes towards aspects of the standards. In addition, questions were included to allow comparison of various types of departments. Some of the most relevant comparative dimensions were the size of the department (measured by budget level), whether officials felt that they needed additional staff to enforce the energy regulations, and the type of area in which the deparment operated (completely built up, partially built up,or mainly rural).

Contact with the CEC

Few building departments have frequent contact with state officials concerning interpretations of the building energy standards. Over 60% of the departments indicated that they made only one or two efforts in a given month to reach the CEC staff, while slightly over one-fourth of the departments said that they never contacted state officials for interpretations. Very large departments are considerably more likely to be in close touch with sate officials, and the smallest departments are least likely to ask for interpretations. (Figure 1)

Small building departments are considerably more likely to raise questions about the residential standards, while departments in the most built-up areas are likely to have contacts with state officials over the non-residential standards.

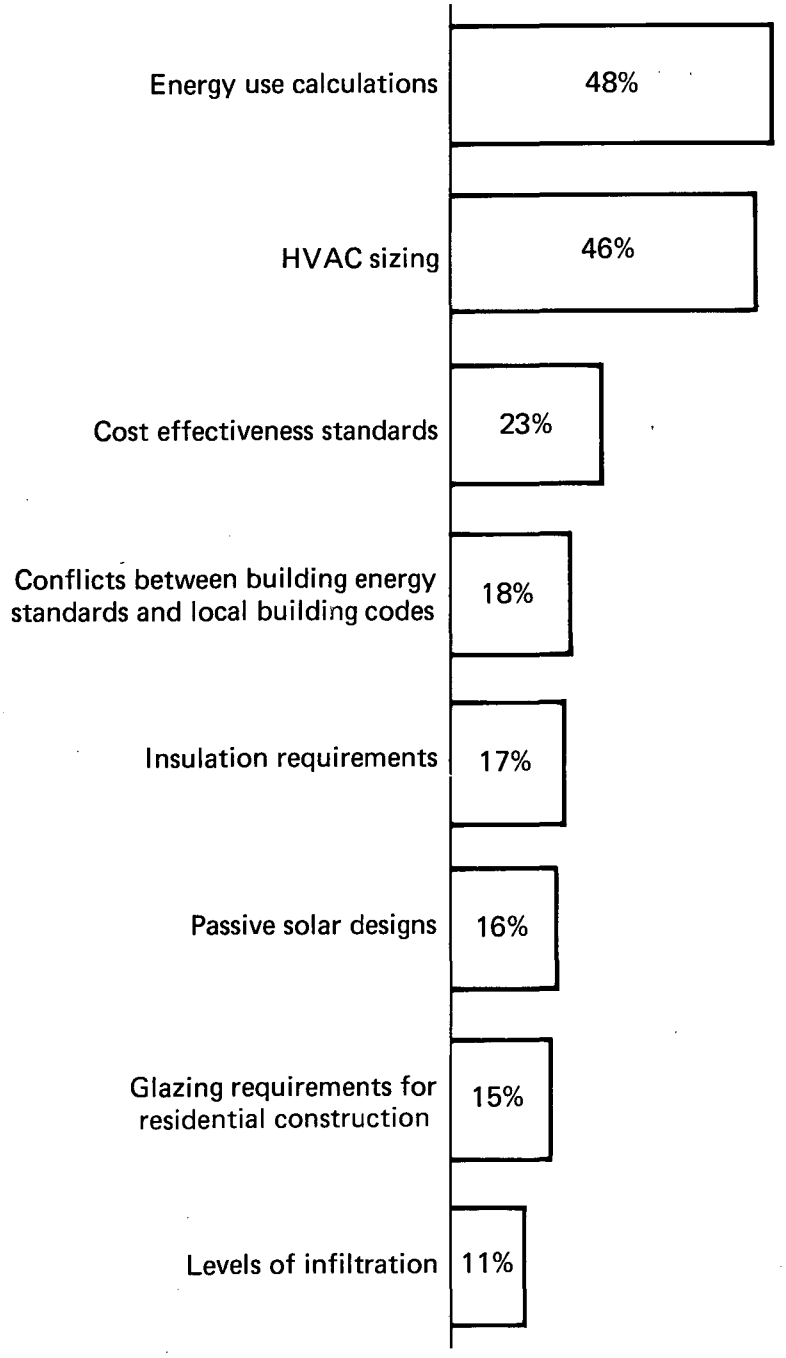
Building officials were likely to take problems involving energy use calculations and HVAC sizing to state officials for interpretation. (Figure 2) For most areas covered in our survey, very large departments were most likely to have asked CEC staff for interpretations. Departments which felt they had enough staff to handle the Title 24 energy standards were considerably less likely to refer calculations to state



XBL 818-1194

- Figure 1 -

Proportion of officials taking various problems to state officials for interpretation



XBL 818-1195

- Figure 2 -

officials than those needing to add staff to enforce the regulations.

Building officials split on whether they could obtain clear interpretations of the energy regulations from state officials. 15% indicated that the "rarely or never" receive useful responses, and another one-fourth claim that they only "sometimes" get clear answers from the state. Altogether, 40% of the building officials say they have experienced difficulty in obtaining helpful interpretations of the standards from CEC staff. (Figure 3)

Most often, responses to officials' questions come in the form of immediate phone replies; however, very large building departments are more likely to wait longer for responses, perhaps because they raise more difficult or more technical questions than other building departments. (Figure 4)

A majority of the state's building departments report "occaisional" differences with state officials over interpretations of the energy standards. Small departments are more likely to "never" differ with state officials, while very large departments have almost all had "occasional" differences with the CEC. (Figure 5)

Training and Information

The vast majority of building departments (84%) sent staff members to training sessions concerned with enforcement of the California building standards. Not surprisingly, the size of the department was strongly related to attendance at training sessions. (Figure 6) All the very large departments sent at least one member (most sent five or more), while nearly 30% of the small departments didn't send anyone for training. One official expressed a major reason for lack of attendance: "Economics prohibit going to Sacramento."

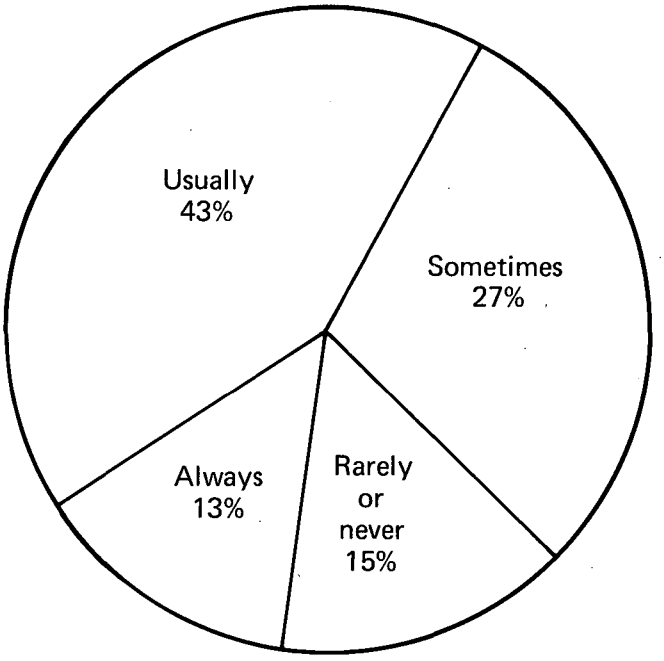
Most sessions were organized by the CEC; others were sponsored by CALBO, by trade or professional groups, or by colleges.[1] Although a majority of the officials indicated that all sessions were "helpful in enforcing the standards", a substantial proportion criticized the training sponsored by the CEC. While only 18% of the officials indicated that CALBO sessions were "unhelpful", fully 42% said that of training under the Commission's auspices. (Figure 7) Interestingly, the smallest departments were most likely to rate the CEC sessions as helpful (67%, compared to 55% for the entire sample).

Building officials offered specific criticisms of the CEC's training efforts. Several asked for training to be conducted in smaller groups. One thought that material should be provided prior to the session. Another complained of "too much material covered in the allotted time." Several more wanted "definite answers to specific questions".

Many of the comments were directed to the need for more "application and enforcement than economics". A number of officials asked for sessions to "make us aware of what to check for on plans and calculation sheets." Another wanted the CEC staff to provide "typical examples of an

Clear answers to interpretation problems?

How often would you say that your office has been able to get clear answers from state officials concerning interpretation of the building energy standards?



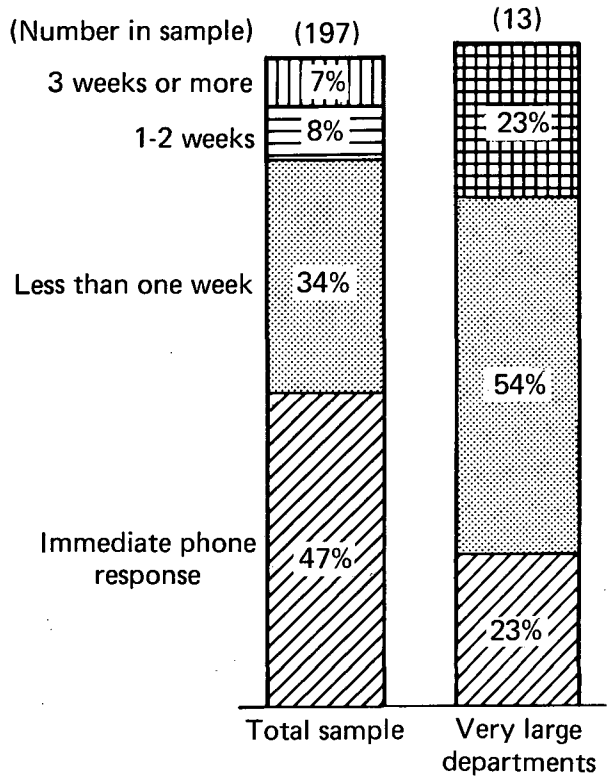
Number in sample: 213

XBL 818-1196

- Figure 3 -

Length of time to receive responses

How long does it usually take for your office to receive helpful responses from state officials to questions concerning plan check of building plans?



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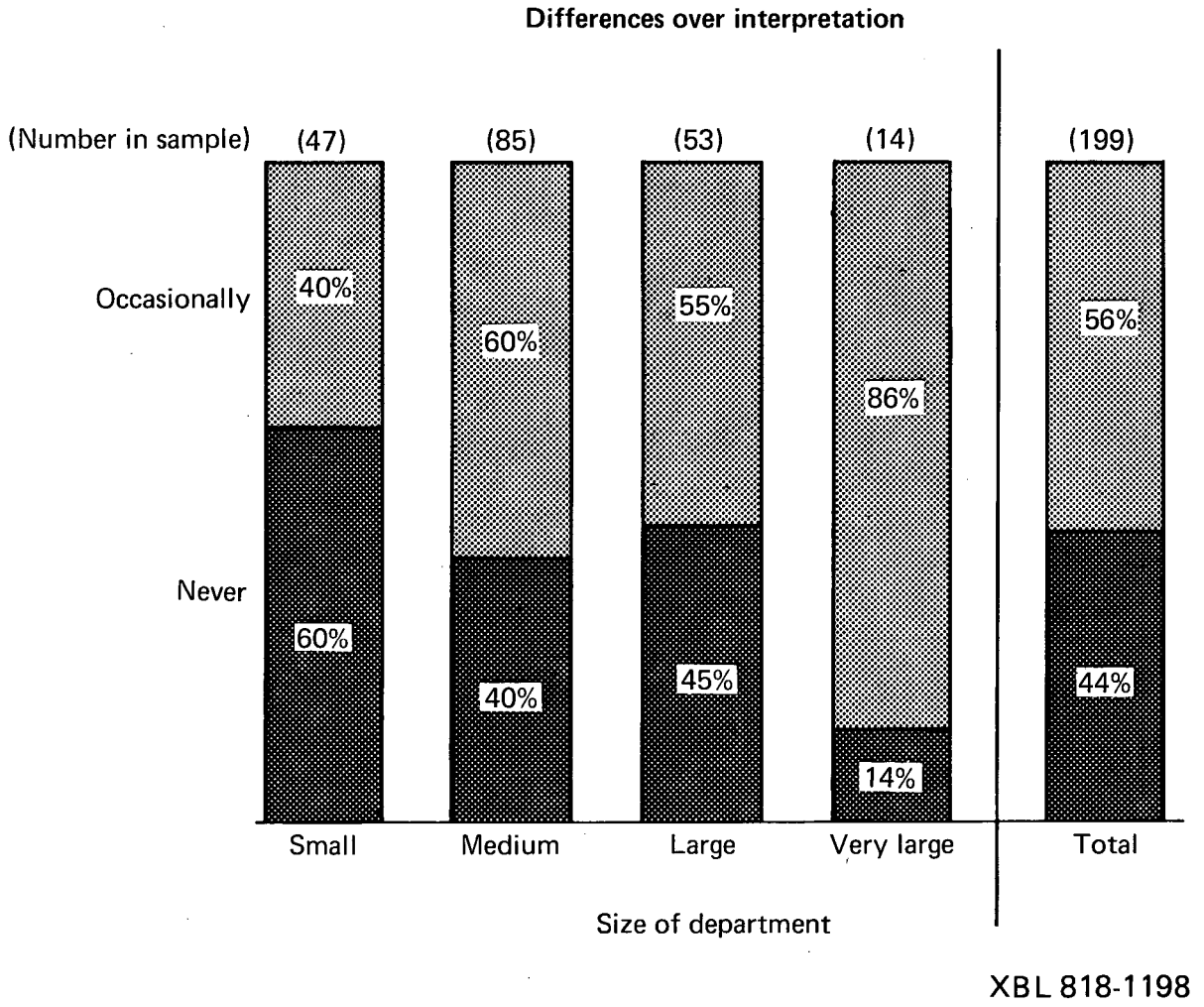
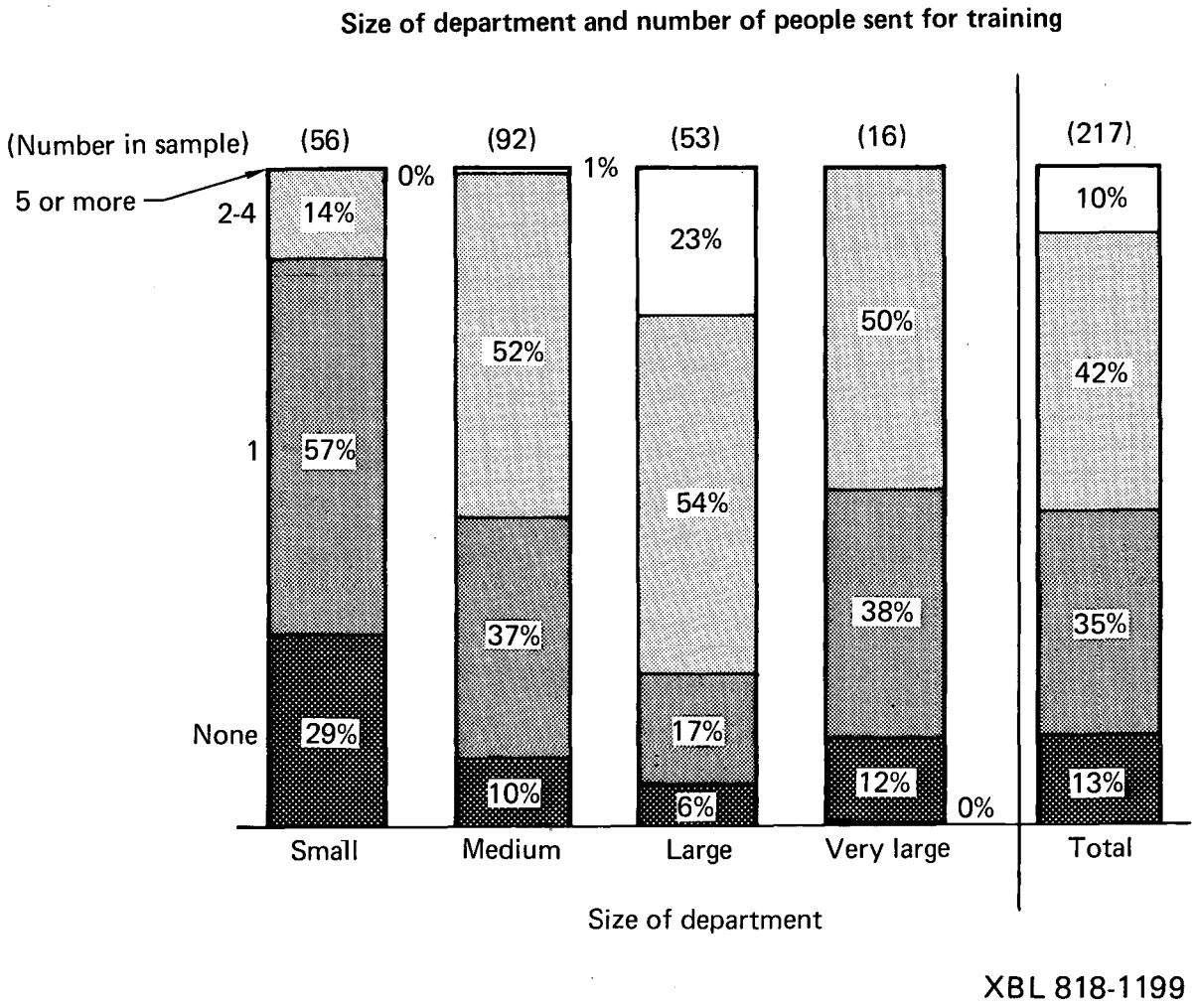
- Figure 4 -


Differences over interpretation
(Number in sample)
(47)
(85)
(53)
(14)
(199)
Occasionally
Never
40%
60%
60%
40%
55%
45%
86%
14%
56%
44%
Small
Medium
Large
Very large
Total
Size of department
XBL 818-1198

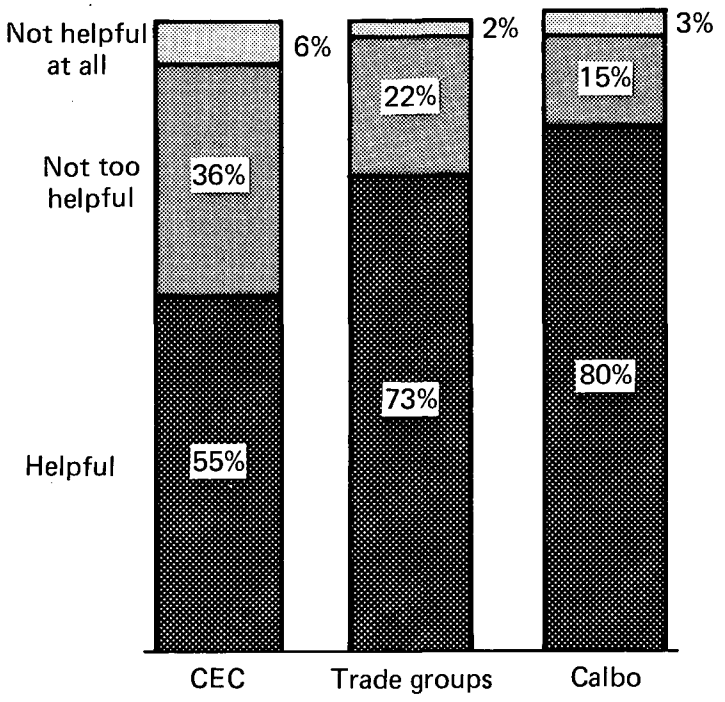
- Figure 5 -


Size of department and number of people sent for training
(Number in sample)
(56)
(92)
(53)
(16)
(217)
5 or more
2-4
1
None
0%
1%
0%
14%
57%
29%
52%
37%
10%
23%
54%
17%
6%
50%
38%
12%
10%
42%
35%
13%
Small
Medium
Large
Very large
Total
Size of department
XBL 818-1199

- Figure 6 -

Was training helpful?

How would you rate the session(s) sponsored by each of those organizations in terms of helpfulness in enforcing the standards?



XBL 818-1200

- Figure 7 -

analysis of single family, multi-family, commercial, and industrial buildings for various climatic areas of the state." Concern was voiced for sessions to be "more practical, less theoretical".

Energy Commission instructors came in for criticism. One building official wanted instructors "familiar with enforcement problems rather than construction or design or political or administrative eggheads." Another asked for emphasis on "how to do, not why we should" from the people running the sessions. Generally, officials expressed a desire to have those "conducting the training sessions (have) experience in code enforcement or field problems on the local level".

Finally, officials noted the need for continuing training. One asked for "follow-up sessions after the standards have been implemented to address shortcomings or clarifications after working with the standards".

Of all the types of assistance provided by the Energy Commission, building officials found the newsletter (the Blueprint) and the manual to be of most use in enforcing the standards. Over 70% of the officials gave those aids "helpful" ratings. Next in order were phone contacts with CEC staff, which half of the officials found helpful (but a third thought of as unhelpful). (Figure 8)

The very largest departments were most likely to find the newsletter and phone conacts to be "not too helpful", but they were somewhat more likely to find the manual to be "helpful". The smallest departments were most likely to find the plan review service to be helpful in enforcement of the regulations.

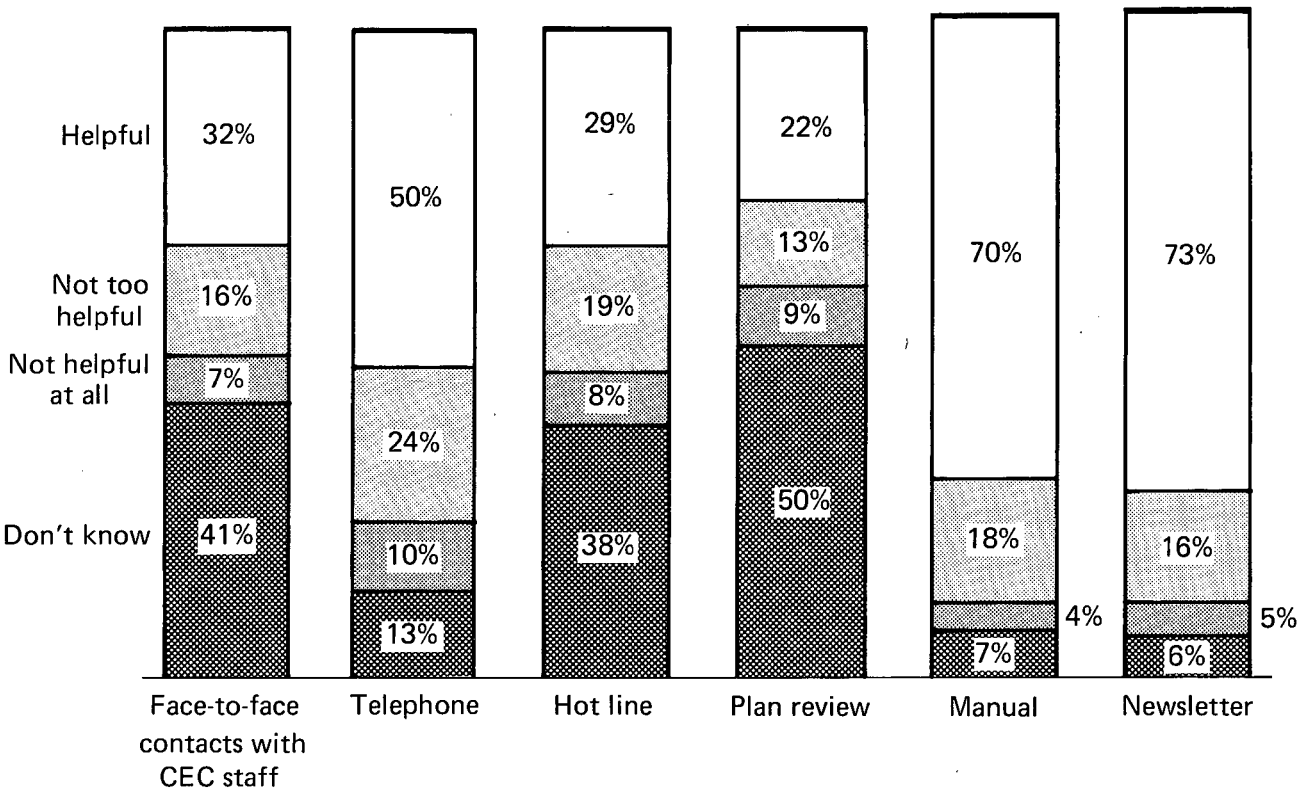
Departments in the least built up areas expressed more negative attitudes toward all of the Energy Commission's attempts to provide assistance than did other departments. More of them thought that personal contacts, the Hot Line, and plan review services were unhelpful rather than helpful. A higher proportion of officials in rural areas also found the manual and phone contacts "not too helpful".

Although officials generally rated the manual highly as an aid to compliance, they also voiced criticism of its format and contents. Several called for clearer examples. Other officials wanted the manual to be more concise, and to be "written in simple words". They expected the manual to be "up to date" and to reflect changes in the standards.

Phone contacts with the Energy Commission staff also came in for criticism. A number of building officials felt they were getting "different answers from different officials" in Sacramento. Others experienced frustration when "too often the one person who can answer the question is not there". Sometimes, officials complained, calls were not reurned within a reasonable time. Building departments find it hard to deal with equivocal answers; one official commented that "we need definite answers for a particular question instead of answers of perhaps or

Were communications and information dissemination helpful?

The Energy Commission has provided certain types of assistance to help jurisdictions enforce building energy standards. How would you rate the following?



XBL 818-1201

- Figure 8 -

maybe".

Level of Enforcement

Commissioner Ron Doctor, until January 1981 the presiding member of the Energy Commission committee dealing with the building standards, estimated that "we're getting between 50% and 75% compliance. That's better than the market would have delivered, but not as good as it should be". The Commission's 1979 Biennial Report takes it for granted that "substantial complinace with the existing building efficiency standards will not be achieved prior to 1982, and even then we assume that compliance will be less than total."[1]

One way of measuring enforcement effort is by the amount of time building departments spend checking plans and inspecting buildings for compliance with Title 24. By this measure, building departments report varying levels of effort in enforcing the energy regulations. The City of Santa Clara told HCD investigators that it spent about 15 minuites reviewing energy measures in a typical residential plan; Riverside County said it took 30 minutes, and Sacramento County thought that energy added 25% to plan check time.

In order to quantify this means of evaluation, we shall assume that departments spending less than 5% of their time plan-checking and inspecting are probably doing only a minimal job of enforcement, while departments that report spending more than 15% of their time are likely to be paying more conscientious attention to the standards.

HOW MUCH TIME DO DEPARTMENTS SPEND CHECKING PLANS FOR ENERGY ENFORCEMENT?

Table #1
Proportion of Plan Check Time Spent on Energy

% of Plan Check Time	Type of Construction				
	Single Family	Multi Family	Non-Residential Small	Non-Residential Large	Non-Residential Very Large
0%	5%	10%	12%	12%	14%
1 - 4%	11%	14%	12%	15%	10%
5 - 9%	23%	20%	21%	14%	16%
10 - 14%	31%	29%	25%	24%	21%
15 - 24%	11%	15%	17%	22%	24%
25% and above	20%	13%	13%	13%	15%
Total number of respondents	100% (208)	100% (197)	100% (196)	100% (186)	100% (185)

Fewer than 20% of the departments made only minimal plan checks on single family residential projects, while for large non-residential projects between 25% and 30% indicated that they spent less than 5% of their time on energy. 30% of the departments said that they spent a

significant proportion of plan check time on the residential energy standards, while about one-third said they spent at least 15% of their time checking non-residential applications for compliance with Title 24.

Building departments report much less time spent on inspection than on plan checking. The average energy plan check took 10% of the total plan check time for both residential and large non-residential projects, but the average field inspection took just 5% of total inspection time for both types of construction.

HOW MUCH TIME DO DEPARTMENTS SPEND ON INSPECTION FOR ENERGY CONSERVATION?

Table #2
Proportion of Inspection Time Spent on Energy

% of Inspection Time	Type of Construction				
	Single Family	Multi Family	Non-Residential Small	Non-Residential Large	Non-Residential Very Large
0%	11%	13%	21%	21%	21%
1 - 4%	16%	17%	16%	16%	16%
5 - 9%	34%	31%	28%	25%	25%
10 - 14%	26%	26%	22%	23%	22%
15 - 24%	10%	11%	11%	12%	13%
25% and above	3%	2%	3%	2%	3%
Total number of respondents	100% (216)	100% (204)	100% (199)	100% (199)	100% (199)

Over one quarter of the building departments indicated that they spent a minimal amount of time in field inspection for compliance on residential projects, while more than 35% of the departments reported spending less than 5% of their time in field checking non-residential projects. The proportions shrink at the up end of the time scale. Less than 15% of the departments spend a substantial proportion of their time on inspections for compliance with Title 24 in either residential or non-residential construction.

These data lead to a very rough estimate that somewhere between 25% and 35% of the building departments in the state may be devoting only minimal attention to the energy standards, while 20% to 25% seem to be spending a subsantial proportion of their time on energy conservation. However, time spent on plan checking and inspection must be treated cautiously as a measure of enforcement effort. One reason is that departments using the services of HCD or outside engineers might cut their own time involvement without reducing their effectiveness. Another reason is that areas with complicated building projects, such as custom residences, may need to spend more time on energy checks than jusridictions with tract developments.

The size of the department is related to the amount of time officials spend plan checking, and to a lesser extent, to the amount of time they spend field inspecting. Small departments are more likely to make minimal plan checks, while the very largest departments are most likely to spend more than 15% of their time plan checking for energy in large non-residential projects. However, for deparments of all sizes, field inspection time for energy matters is less than plan review time.

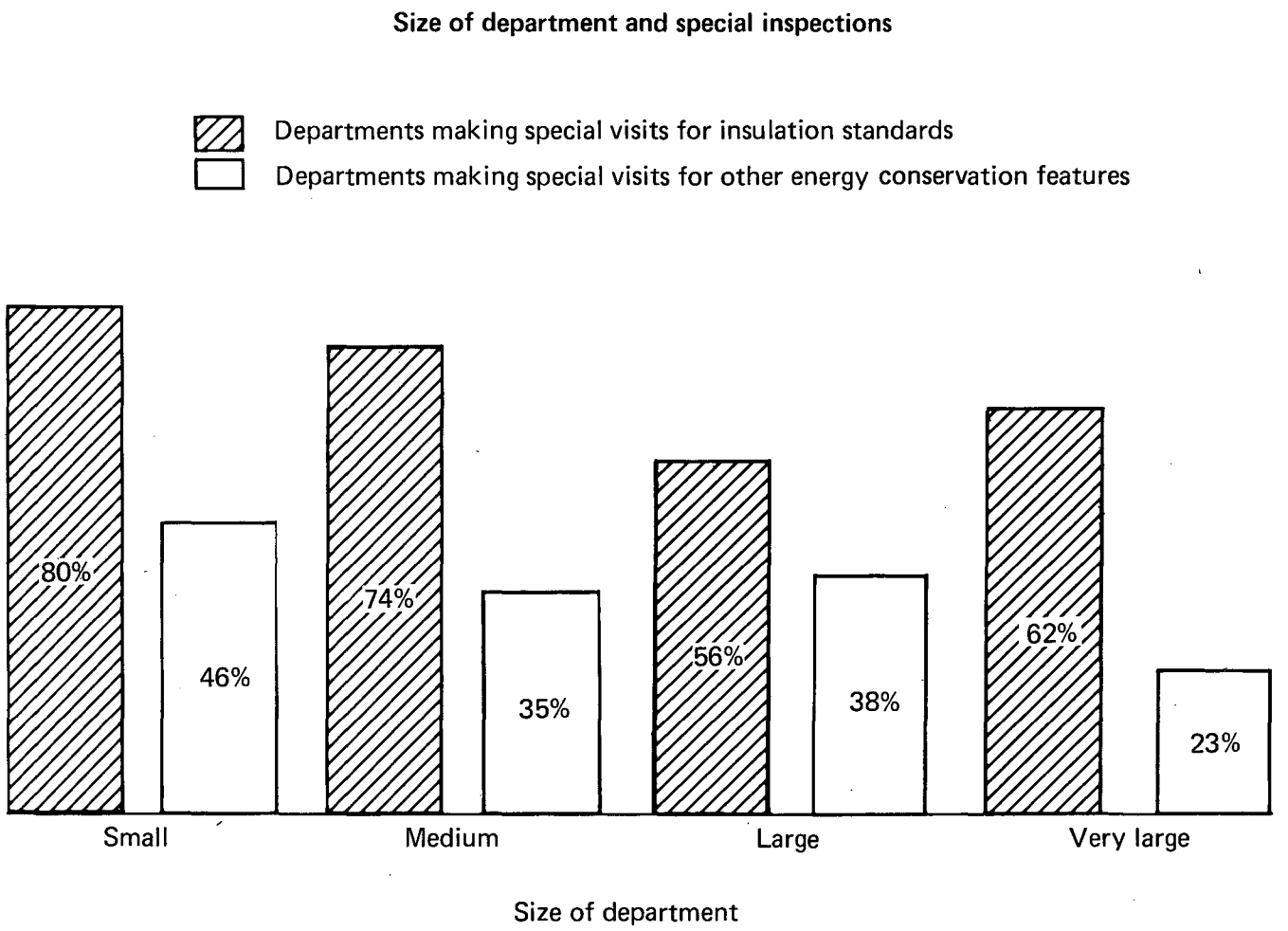
SIZE OF BUILDING DEPARTMENT AND TIME SPENT ON PLAN REVIEW AND INSPECTION

Table #3
Percentage of Plan Review and Inspection time spent by various sized building departments on energy conservation.

	Size of Department							
	SMALL		MEDIUM		LARGE		VERY LARGE	
	Less Than 5%	More Than 15%	Less Than 5%	More Than 15%	Less Than 5%	More Than 15%	Less Than 5%	More Than 15%
Plan Review for:								
Single-Family Residential	22%	36%	12%	26%	14%	30%	12%	38%
Large Non-Residential	38%	32%	27%	36%	21%	34%	25%	44%
Inspection for:								
Single-Family Residential	32%	21%	28%	11%	21%	9%	33%	7%
Large Non-Residential	40%	19%	40%	14%	28%	13%	47%	13%

Officials who maintain that they have enough staff to assure compliance devote a smaller proportion of both their plan check and their inspection time to the energy standards, compared to those departments that indicate they need to add staff. (The relationship holds for residential as well as for non-residential projects.) For residential plan review, the same proportion of departments with "enough" staff made minimal and intensive checks (23%), but about three and a half times as many departments that wanted to add staff spent a large amount of time on plan checking for energy.

Seventy percent of the building departments reported that field inspectors generally made special trips to building sites to check on compliance with the insulation standards. More than one third of the departments also said that they made site visits to enforce other apsects of the energy standards (such as HVAC equipment insallation, glazing, or weatherstripping). The smaller the building department, the more likely it was to indicate that inspecors made special visits for insulation or other energy conservation items. (Figure 9) In rural



XBL 818-1203

- Figure 9 -

PERCENTAGE OF TIME SPENT ON COMPLIANCE IN ADEQUATELY STAFFED AND UNDERSTAFFED DEPARTMENTS

Table #4
Percentage of Plan Review and Inspection Time Spent by Building Departments on Energy Conservation.

	Departments With Enough Staff		Departments Wanting to Add Staff	
	Less Than 5%	More Than 15%	Less Than 5%	More Than 15%
Plan Review for:				
Single-Family Residential	23%	23%	10%	37%
Large Non-Residential	35%	29%	22%	38%
Inspection for:				
Single-Family Residential	36%	10%	21%	16%
Large Non-Residential	45%	12%	33%	17%

areas, departments were least likely to make special visits for either insulation or for other energy items.

Expenditures for Enforcement

About one-third of the building departments in the state increased their fees to cover the added costs of enforcing the energy standards. Departments used various bases for their increases: some increased fees by a set amount, others raised fees according to the square footage of the project; still others charged a flat hourly rate for plan checking, and others applied a percentage increase to their plan check or their total permit fees. Departments indicating that they needed to add staff to enforce the energy standards were more likely to increase fees than other departments (38%, compared to 28% of those saying they had enough staff to enforce the regulations). However, small jurisdictions were less than half as likely to increase their fees.

A number of departments reporting fee increases seem to have used energy as a justification to help cover their general operating expenses. One piece of evidence tends to confirm such an interpretation: only 14% of the departments indicated that they added personnel to help enforce the standards, but a third raised fees to cover the costs of enforcement. Since staffing makes up the largest component of those costs, departments not hiring help for Title 24 enforcement were likely to be using money raised under the guise of energy checks to support

other parts of their operation.

The larger the department, the more likely it was to have added personnel to enforce the energy conservation standards. While only 5% of the small departments increased their staffs to deal with Title 24, 13% of the medium sized, 22% of the large, and 50% of the very large departments did so. (Figure 10)

Almost 60% of the departments indicate that the amount of money they now spend on enforcement is not adequate to assure full compliance with the standards. However, a greater proportion of the smallest and the largest departments felt that their expenditures were satisfactory. Rural areas found their budgets to be the least adequate; only 28% thought they were able to enforce the regulations with existing staff. (Figure 11)

Of those departments reporting that they needed additional staff, three-fifths thought that just one more person would allow them to handle the energy standards, and another one-fourth said that two more staff members would allow adequate enforcement. A greater proportion of departments in the least built up areas indicated that they needed to increase their staffs. The very largest departments were also more likely to say that they wanted to add at least one person to help enforce the energy regulations.

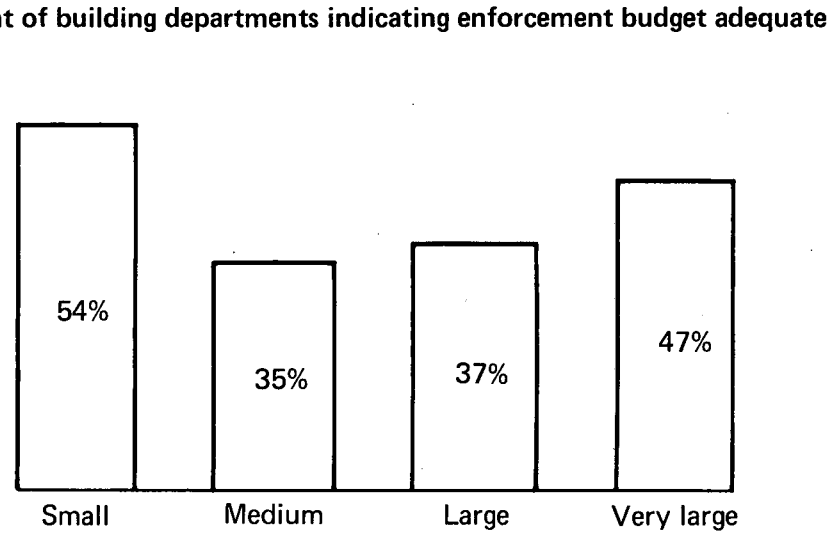
The smallest departments are not necessarily in the least built up areas. This explains the apparent anomaly which shows small departments most likely to think their budgets adequate to enforce the standards, while the least built up areas were most likely to think their budgets were inadequate for that purpose.

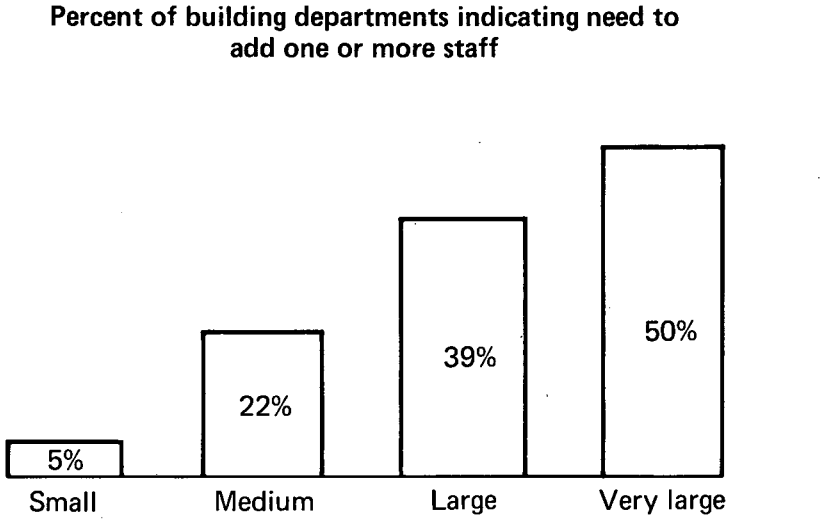
Special Enforcement Problems

More than 45% of the building departments indicated that certain practices created special problems for them in applying the Title 24 regulations. A greater proportion of officials who felt that they needed to add to their staffs mentioned such difficulties. Larger departments were also more likely than others to experience special enforcement problems. (Figure 12)

The most mentioned problems were created by: speculatively built commercial/industrial structures; sizing HVAC systems, enforcement of the efficiency criteria for appliances; and life-cycle costing calculations, especially with regard to electric resistance heating systems. Less widespread, though still significant problems cited by departments included cheating on compliance statements, difficulties in evaluating alternative designs, improper installation of insulation, and interpretations of the lighting standards for non-residential buildings. (Figure 13)

A majority of the officials referred to potential problems with speculatively built commercial/industrial structures. Departments that felt they needed to add staff tthought the problems might be especially





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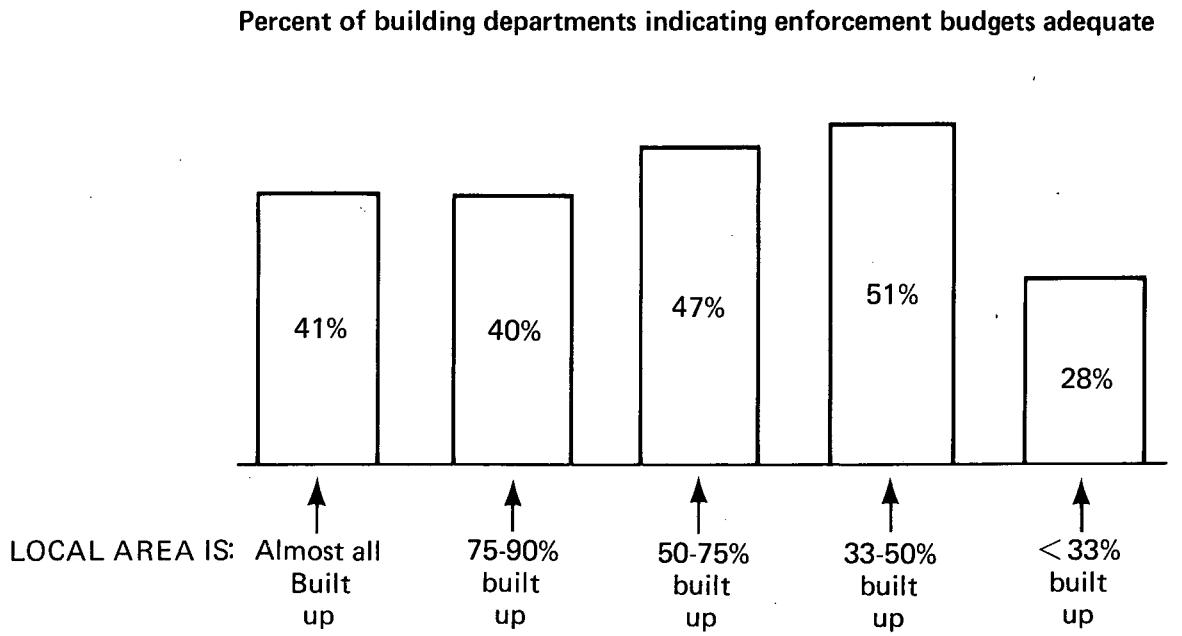
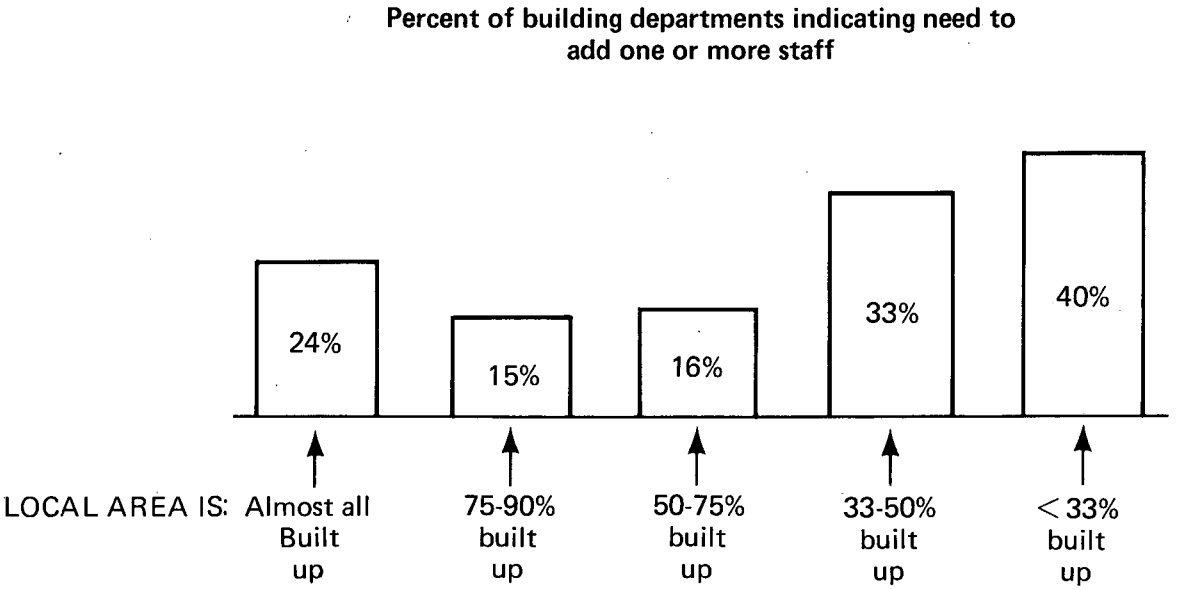
- Figure 10 -





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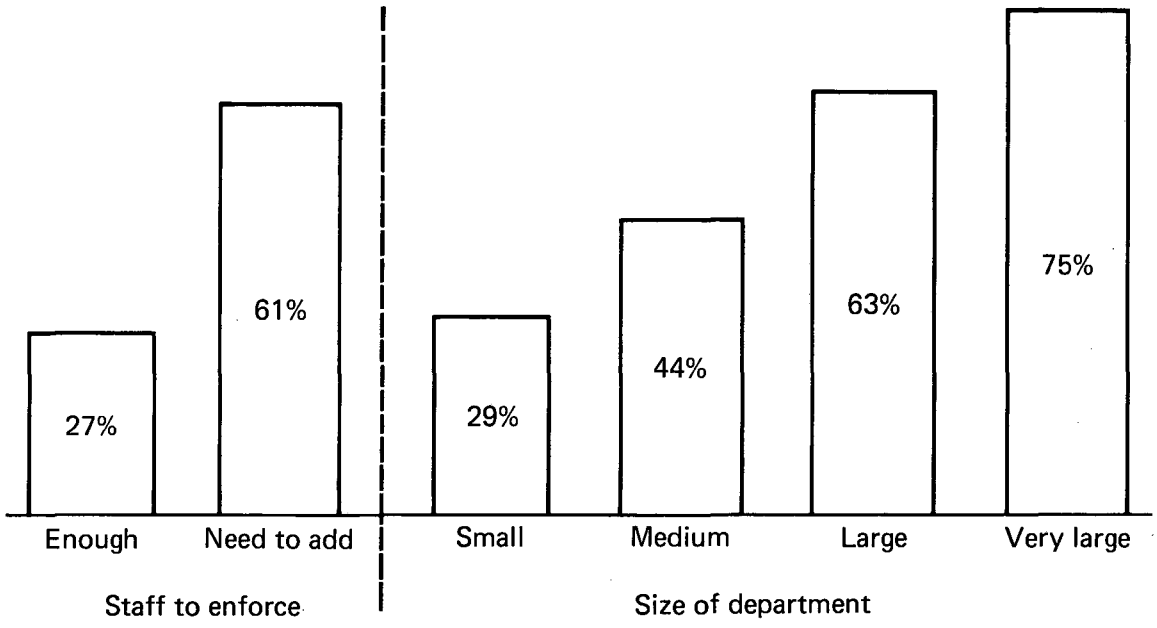
- Figure 11 -

Special enforcement problems

Percentages of building officials indicating that
particular kinds of buildings created special enforcement problems



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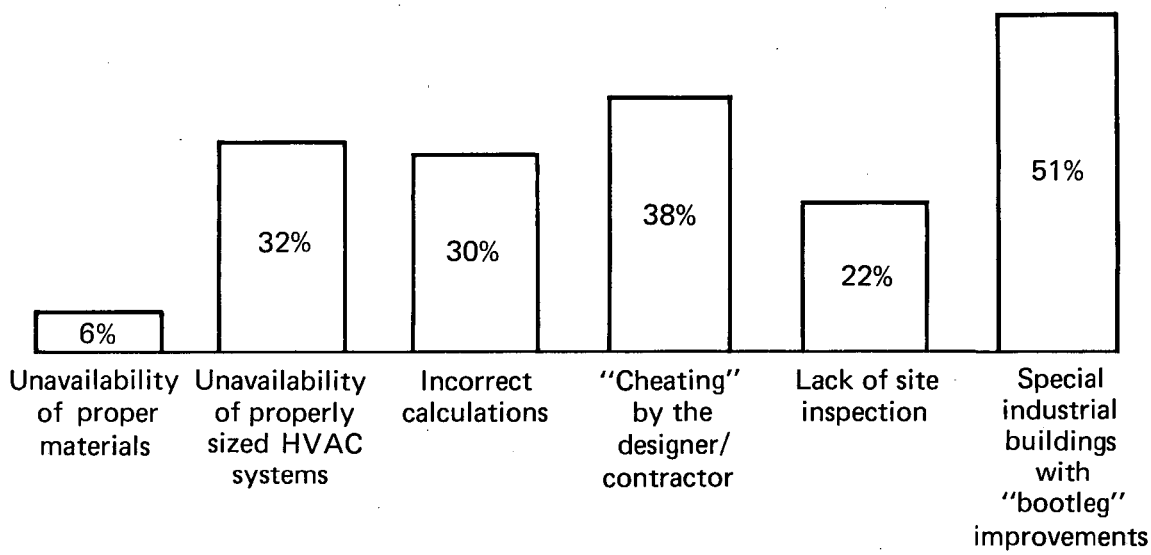
- Figure 12 -

Kinds of enforcement problems

Why might buildings be constructed that fail to meet state energy standards?



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- Figure 13 -

acute: 60% of them indicated that tenant impprovements in special buildings might fail to meet state energy standards. On the other hand, the smallest departments evidenced the least concern with the problem; only one-third felt that "bootleg" improvements might be a problem in their areas.

Speculative developers may not know who will occupy the space when they apply for a building permit. They often claim that their building will not require more than minimal heating or cooling and thus is exempt from the state energy requirements. As officials from the County of Sacramento told HCD: "The builder generally sells it or leases it and doesn't want to do the envelope initially. The builder wants to pass this requirement and cost to the new owner or lessee."

Some observers report a growing tendency for tenants to "bootleg" improvements. As the cost of both building permits and union labor continues to increase, more businesses turn to non-union contractors who frequently fail to take out permits. Local code officials rarely find out about improvemns unless a complaint is filed, or they happen to catch the contractor doing the work. The problem may become even more acute. As David Inger, a building official from Santa Barbara County and member of the Task Fore on Compliance, noted: "Considering restrictions on builders in various communities, there is an impetus to construct buildings as a shell and lease them out quickly. Tenants then have the responsibility for improvements, but in perhaps 50% of the cases, they are done without permits". If the proportion of shell buildings increases, local jurisdictions may be put in an increasingly difficult position with respect to enforcement of energy regulations.

Nearly all building departments now accept an applicant's statement of intention to construct a non-heated or cooled building. Building official Inger notes that: "Most shell buildings do end up being heated or cooled. Getting compliance after the fact is terribly difficult. It encourages bootlegging and non-compliance." He urges the Energy Commission "to create a minimum standard for shell buildings."

One-third of the officials thought that buildings might fail to meet the energy standards because of the unavailability of small enough HVAC systems. The proportion is highest (38%) in departments that feel they need to add staff to enforce Title 24, and it is lowest in small departments, where only 22% of the officials consider HVAC sizing a problem.

The original energy conservation regulations contained a provision that furnaces could only be oversized by 10%. However, the Commission, under pressure form SMACNA (Sheet Metal Air Conditioning National Association) and industry groups, suspended that section, at first temporarily, then permanently. No matter how small the calculated heating load, it appears that the builder usually installs a 48,000 Btu furnace.

This result leads building officials to question the value of heat loss calculations for typical residential projects. "Basically, the manual is a hell of a big book with lots of equations," said one official. "In conventional homes . . . builders can't get minimum size furnaces, so they go the size that's available, which turns out to be what

they would have used originally" (without having to go through calculations). Officials recomended that "a simplified table or chart. . . be developed to determine proper sizing . . . " Were the CEC to provide that information, buiding departments feel compliance could be increased, and "time and costs could be reduced".

A different type of HVAC problem bothers officials in some of the larger jurisdictions. The design of the system usually hasn't been completed when an applicant applies for a permit to build a highrise. However, as a San Francisco official points out, major equipment has to be installed on the roof as part of the superstructure. "The building will likely be shelled, possibly for years, before final tenant improvements are made. Therefore, the HVAC load calculations are long term estimates only, with generous contingency. Without plans for each floor, it is difficult to know (or corroborate) the type of system being installed . . . if it later develops that equipment is oversized 200%, we can't expect the owner to replace it."

In fact, the pressure is often on the HVAC system designer to oversize. If he fails to provide enough capacity for the building, a lawsuit from unhappy tenants may result. Since fees are usually tied to the cost of equipment, more expensive, oversized systems often yield higher earnings for the designer.

The Energy Commission requires that major appliances conform to its standards of energy efficiency. However, building officials complain about the difficulty of verifying whether those standards are actually met. Manufacturers often fail to stamp products with the information needed to judge whether they meet state requirements. Furthermore, the CEC's directories of approved models have proved difficult to use in the field, both because of length and failure to keep up with model changes.

Many building departments have simply stopped field inspection for compliance with the appliance efficiency standards. Local officials urge the CEC to take enforcement entirely out of their hands. The simplest way would be to prohibit non-complying appliances from being sold in California. If the Commission feels that it can't take on responsibility for enforcement, local officials certainly think it should require manufacturers to clearly label products to allow quick and easy checking in the field.

Building officials generally dislike complicated calculations of any sort. When asked whether they favored various methods for meeting energy conservation goals, officials rated life-cycle costing far below any other choice. A greater proportion of departments that need to add staff for enforcement opposed LCC calculations (61%). The proportion of those opposing calculations increased with the size of the building department (until the very largest departments), rising from 34% among small departments to 69% among large ones, and then dropping to 57% among very large departments. This latter result could have come about for a combination of reasons: larger departments have a greater recognition of the amount of time and effort calculations take to check, but they also have greater resources available for the task.

A designer or bulder hoping to use electric space or water heating must submit a life-cycle cost justification to the local building department. In the Energy Commission's suggested form, the designer is asked to compare electric heat with natural gas or heat pumps (electric water heating must be compared with gas or solar). Costs are broken into four components: equipment cost (including installation), replacement cost, maintenance cost, and energy cost. The cost of energy is calculated from the heat loss of the structure and factors for fuel fired equipment, present worth of utility prices, seasonal efficiency of the equipment and fuel conversion. Summing all costs for each option allows a comparision to be made; electric resistance heat (or water heating) can only be allowed if the LCC comes out lower than the gas (or solar) alternative.

The whole procedure has been called "a farce" by one Bay Area building official. Most departments lack the expertise to check the calculations. The result, in the view of one Energy Commission staff member, is that "despite our regulations (resistance heating) is actively in buisness. Industry associations do life-cycle costing to facilitate getting a permit. They are getting permits where it is impossible to be life-cycle cost effective." The CEC has not issued detailed guidelines or published cost and design data to help building departments with those enforcement problems.

Building departments deal wih life-cycle costing in different ways. Some of the largest departments, such as San Francisco and San Bernardino County, review calculations thoroughly. Others seem to be waiving cost justification for electric water heating in areas where gas is not available. Most departments require calculations signed by a licensed engineer, but then file them without further checking.

However, some departments apparantly discourage applicants from choosing electric heating, while other departments have made it easier to apply for electric resistance heating in certain circumstances. The city of San Diego's "experience shows that without exception, electric resistance space heating can be justified by life-cycle comparison for multi-unit building falling within . . . limiting conditions."[2] For buildings that meet those conditions, a signed request, with some brief information about the porposed project takes the place of detailed calculations.

Many building officials would like the CEC to relieve them of responsibility for checking life-cycle cost calculations. They argue that the Commission should calculate where, and under what conditions, electric heating can be cost justified. Then building departments could simplify their permit procedures, and probably enforce the energy standards more effectively. If nothing else, local officials think the Energy Commission should develop a format for computer outputs so they can make sense of the figures shown to them in LCC or alternative design calculations.

A substantial proportion of the officials feel that buildings can fail to meet state energy standards because of intentional or unintentional errors on the part of applicants. Departments needing to add

staff are most likely to regard cheating as a problem (43%), while very large building departments are least likely to think of the situation as serious (31%).

Cheating can take a variety of forms. Some applicants provide incorrect calculations or include design features that fail to conform to the standards. Other problems occur in the field. Builders sometimes substitute materials or equipment for what is marked on the plans; specified products may not be available, or another product may be less expensive. Installers sometimes take shortcuts.

Building officials have experienced similar problems in other areas of code enforcement. Many display a wary attitude toward certain types of applicants. Reputable builders with "track records" in the community may be treated differently than speculative developers or owner-builders, who, officials feel, are more likely to take short-cuts. Enforcement may well be stricter for their projects. In fact, most departments told HCD investigators that they used "experience and judgement" to decide how thoroughly to check each application for compliance with the Title 24 standards.

Solar designs and alternative approaches pose special problems for building departments. The overwhelming majority of officials say that they have received few such applications. An alternative design causes difficulties even for departments with energy plan check engineers on their staffs. As San Francisco asked: "Who can verify that the plans look like the data inputs (for the computer studies)?" That city's plan check engineer suggested that "the CEC should require all certified programs to list in one spot the input component characteristics, such as glazing, square feet, orientation, wall and roof types, U-values, lighting watts/ft^2, etc."

Depatments may well be cautious about approving such designs, especially if they are unclear about the computer studies used to cost justify the approach. They may require additional data, or send for review by state officials. They may also be reluctant to approve projects that bend rules in the Uniform Building Code. Convincing building departments of the validity of a new approach usually takes time, and sometimes causes problems for the designer or builder. Code officials' natural caution may even discourage some innovative designs.

Some builing departments indicate problems with installation of insulation. Ventura County told HCD that it generally opposes "the increasing desire of local contractors to use foil insulation. . . because of the difficulty encountered in making actual installation match the test conditions used to substantiate 'R' values." A number of departments reported that products are sometimes not even marked with "R" values, and are therefore difficult to field check.

Slab edge insulation also causes problems in some areas of the state. In cold Shasta Count, installation is troublesome "due to the termite problem when placed on the exterior, and when placed on the interior, the edge crack is so large that it is difficult to install carpet." In sunny San Diego County, there have also been "problems with

a satisfactory method of installing slab insulation." County officials felt that their area should be exempt from such requirements, and urged the Energy Commission to "clarify this portion of the standards".

The lighting portion of the non-residential standards has been much criticised by building officials. It is "overly complex" in the view of Sacramento County officials and others. The standards "are not clear as to when switching for natural light is required"; if they were simplified, "overall compliance would be better." San Francisco's plan check engineer concludes that the current lighting standards are "difficult to plan check and impossible to field check."

Attitudes Toward Energy Standards

Building officials were asked for their opinions about means for achieving greater energy conservation. By an overwhelming margin, they favored trade-offs within an over-all energy budget. By a lesser, but still substantial margin, they disliked calculations to determine life-cycle costs. (Figure 14) Officials favored both performance and prescriptive standards as ways of meeting energy conservation goals. This last result was unexpected; originally, we thought that building officials would be far more receptive to prescriptive standards. But from their answers, it seems that they think more about facilitating trade-offs than they do about checking calculations when they think about the performance approach.

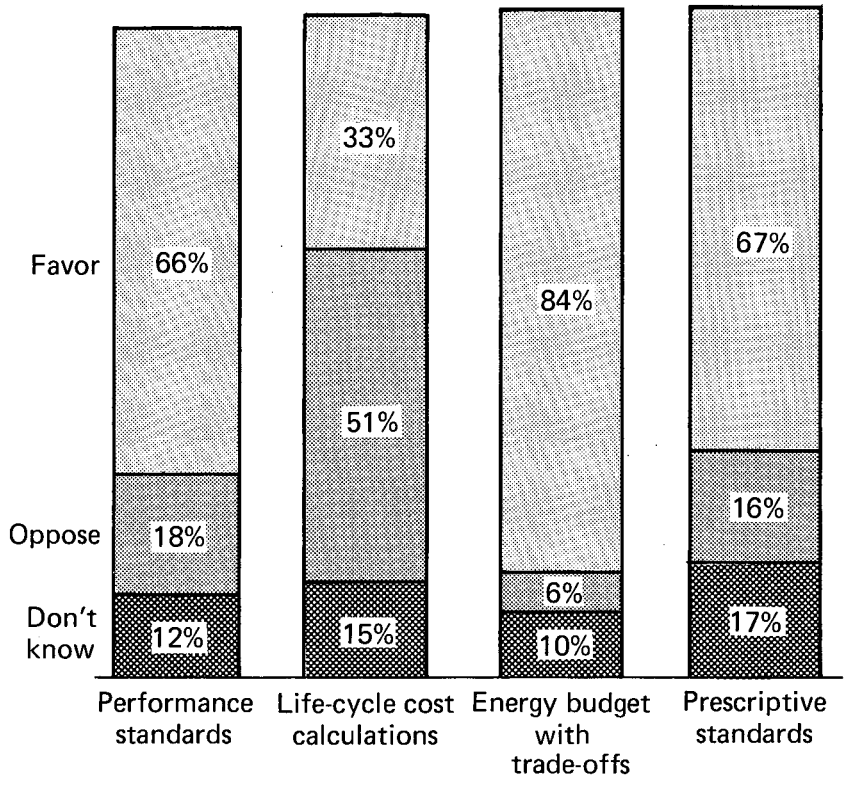
The proportion of officials favoring performance standards decreased, and the proportion favoring prescriptive standards, increased, with the size of the department. The very largest building departments are the most likely to dislike performance standards and to embrace the prescriptive path. Several factors may help to account for this result. Larger departments may have a clearer realization of the checking that performance standards entail, and might also expect a flood of permit applications requiring additional staff time to process.

Building officials generally agree that performance standards will lead to greater energy savings than prescriptive standards, and they believe that the performance path allows building designers to take more innovative approaches to their projects. (Figure 15) However, they also feel that performance standards will mean more work for them. Between 75% and 80% of the officials thought that performance standards are difficult to enforce, that they require too much time in plan checking, and that they involve too many calculations. (Figure 16)

Respondents from larger building departments were less likely to credit performance standards with energy saving potential. Officials from larger departments seem to feel more strongly than their counterparts in small or medium sized departments about the problems involved in implementing performance standards; enforcement, plan checking, and calculations, will pose more difficulties, in their view. (Figure 17)

Favored methods for achieving energy conservation

Do you generally favor or oppose using each of the following methods for meeting building energy conservation goals?



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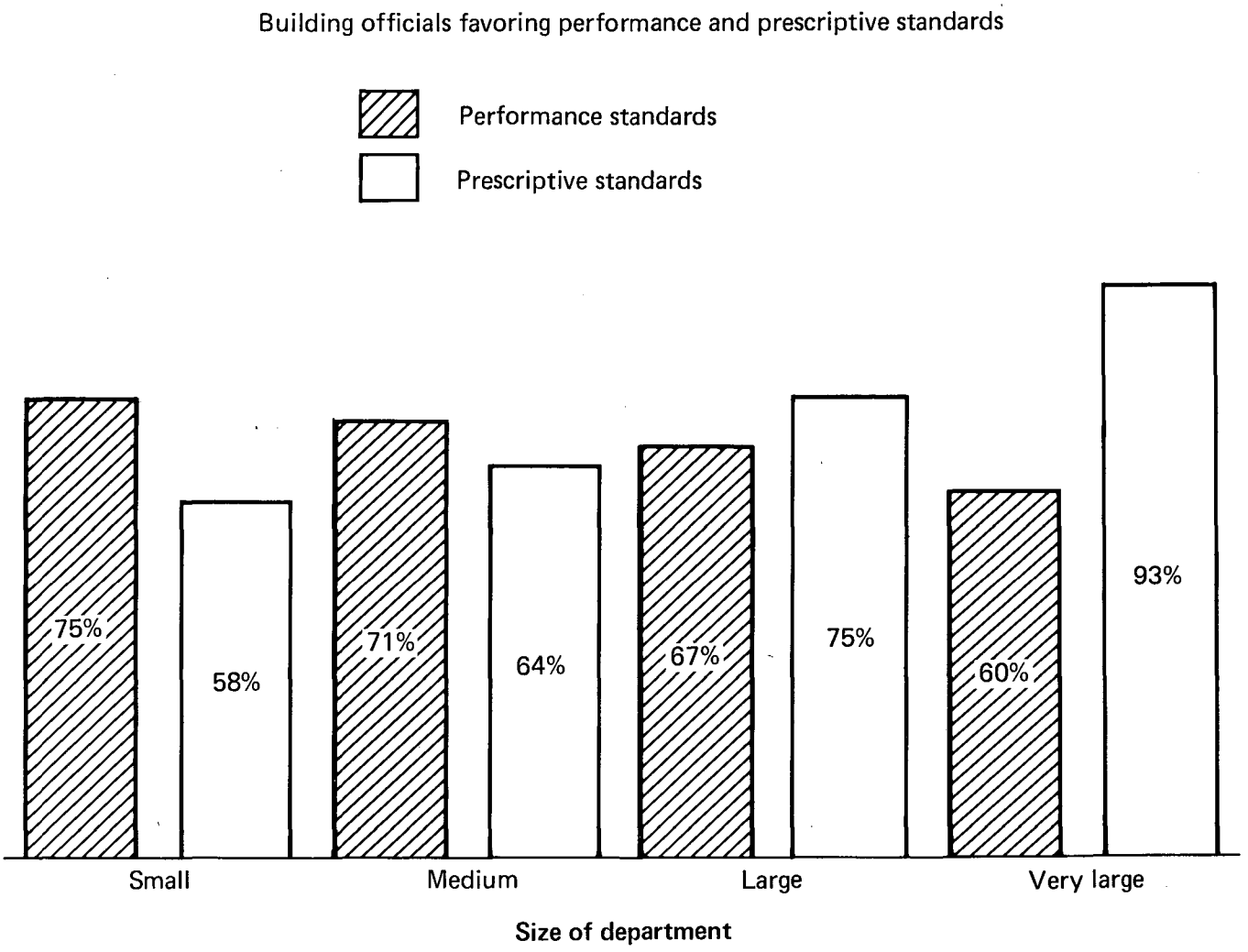
- Figure 14 -



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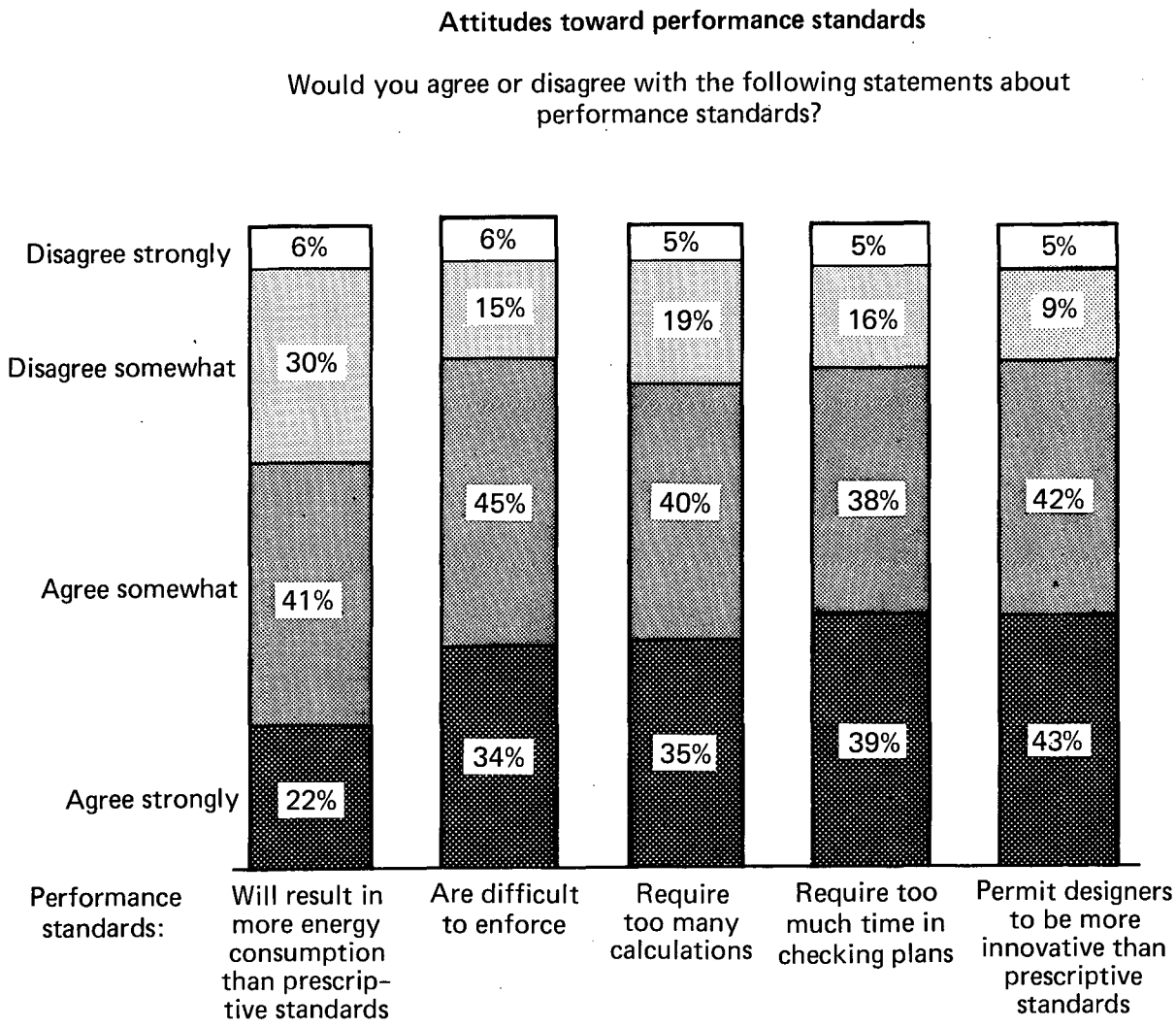
- Figure 15 -



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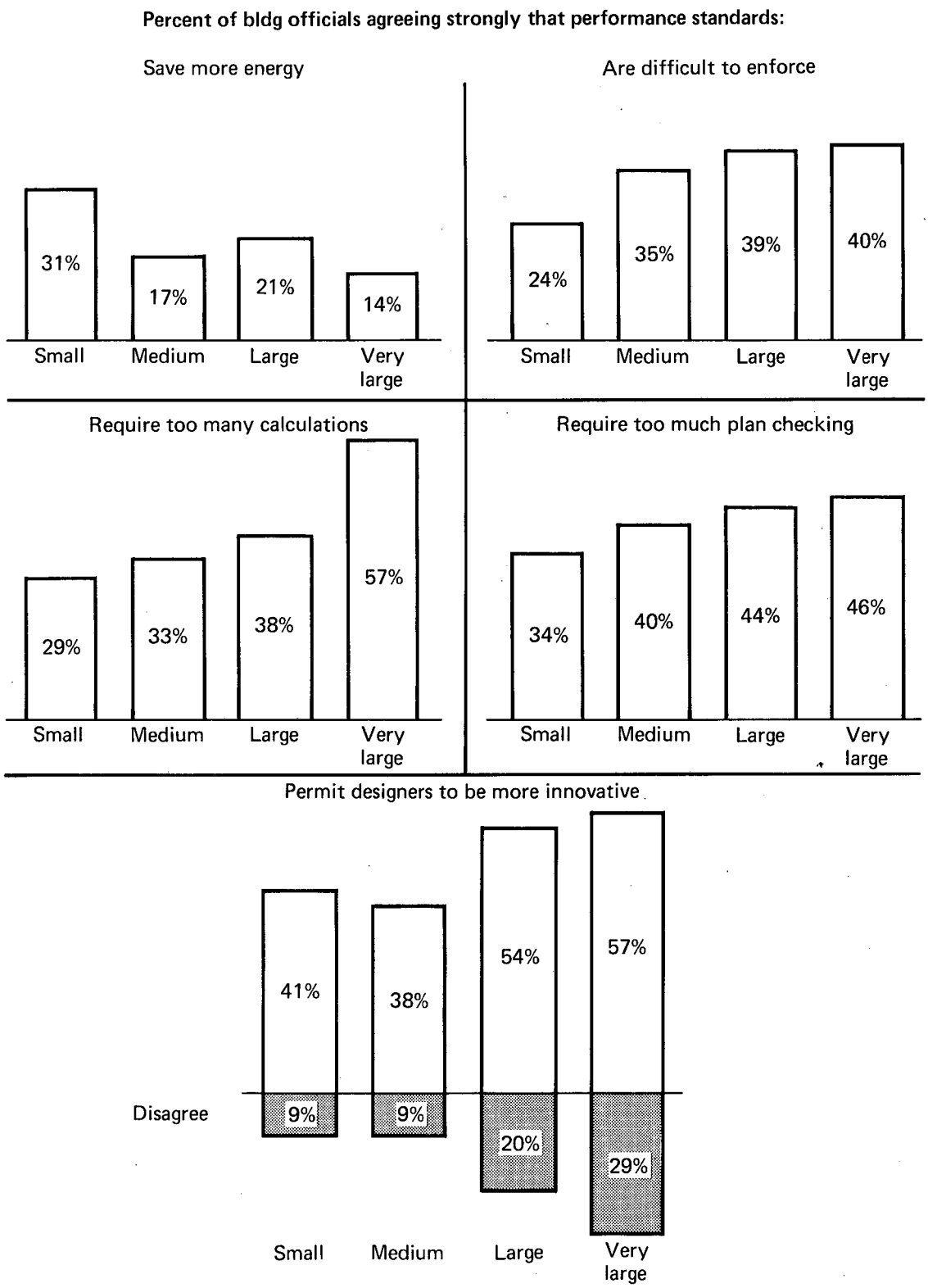
- Figure 16 -



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- Figure 17 -

Departments in rural areas were the least likely to credit performance standards with greater energy saving potential than prescriptive standards; however, those officials were just about as likely as officials from other areas of the state to see enforcement difficulties.

Nearly 60% of the building officials thought that their department's legal liability had increased since the implementation of energy standards. Departments that needed to add staff were more concerned about their legal position than departments that had adequate staff. Size of the department was also related to feelings of increasing legal liability. The smallest and the very largest departments seemed least concerned, while large departments indicated the greatest concern. Among all groups of officials, those from rural areas stood out as most troubled by the liability problem. Nearly three-fourths thought their liability had increased; nearly two-thirds of the officials in slightly more built up areas also thought their legal problems had grown since the implementation of Title 24.

Building officials were asked to indicate which aspects of the current state energy regulations needed improvement. Their most emphatic responses were: calculation procedures, the design manual, and HVAC sizing. (Figure 18)

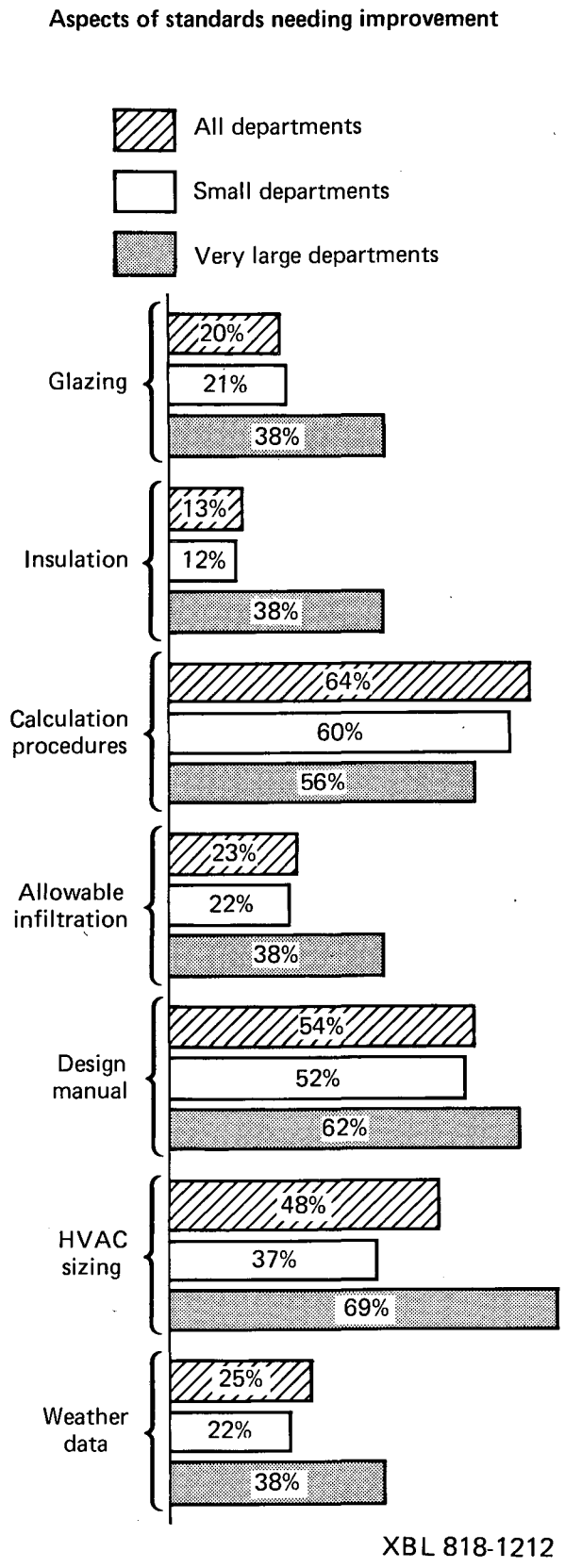
The very largest departments were most critical of every aspect of the standards -- with one exception. For this group, calculations were of somewhat lesser concern than HVAC sizing or the design manual; calculations were of most concern to smaller departments. Departments that needed to add staff for enforcement were more likely than adequately staffed departments to criticize calculations and HVAC sizing procedures.

Effectiveness of the Standards

Building officials seem to regard the Title 24 requirements as effective energy savers. More than three-fourths of the respondents thought the standards saved energy "compared to what the market would have produced". Among the positive aspects of the regulations, officials cited "forcing everyone to insulate", "compelling the building industry to save energy", "allowing design freedom (through the alternative design option)", and "starting people thinking in useful direction to save energy".

Larger departments were more likely than smaller departments to think that the standards saved energy. While two-thirds of the officials from small departments felt that the regulations were more effective than market response alone, 70% of those from medium sized departments thought so, as did 78% from the large, and 81% from very large departments.

On the average, officials thought the standards increased the cost of a new residential unit by about $900. Departments that thought they needed to add staff saw smaller increases than departments with enough staff. The very largest departments were also likely to see relatively


Aspects of standards needing improvement
All departments
Small departments
Very large departments
Glazing
20%
21%
38%
Insulation
13%
12%
38%
Calculation procedures
64%
60%
56%
Allowable infiltration
23%
22%
38%
Design manual
54%
52%
62%
HVAC sizing
48%
37%
69%
Weather data
25%
22%
38%
XBL 818-1212

- Figure 18 -

small cost increases; two-thirds of those officials thought that a new residential unit would rise in cost by less than $400.

Building officials were asked to estimate the proportion of different types of construction in their areas which they thought exceeded the Title 24 standards. Custom homes were most likely to go beyond the standards, and non-residential buildings were least likely to incorporate additional energy saving features.

WHAT TYPES OF CONSTRUCTION EXCEEDED STANDARDS?

Table #5
Proportion of Building Officials Estimating
That Types of Construction Exceeded Standards.

% of New Units Estimated to Exceed Standards	Tract	Custom	Multi-Family	Non-Residential
0%	42%	25%	47%	50%
1 - 10%	24%	26%	21%	21%
11 - 34%	9%	14%	5%	8%
35 - 74%	6%	13%	5%	7%
75 - 99%	10%	9%	9%	6%
100%	10%	12%	12%	7%
	(199)	(197)	(186)	(190)

Between 40% and 50% of the officials thought that no buildings in their area exceeded state regulations (for every type of construction except custom residential). About two-thirds of the departments indicated that less than 10% of the buildings were built to save more energy than the standards required (again with the exception of custom housing). At the other end of the scale, about 20% of the officials thought that more than 75% of new housing exceeded the energy standards.

Between 70% and 80% of the officials thought that all buildings in their areas conformed to state standards, and most of the rest felt that less than 10% of the buildings failed to meet Title 24 requirements. They regarded non-residential buildings, especially speculatively built structures, as least likely to meet the energy standards.

Most building departments indicated that compliance is probably better for residential than for non-residential buildings. The current California residential standards can be met simply for most housing. But non-residential standards are considerably more complex. They often require calculations to show compliance, and present enforcement problems for speculative construction.

WHAT TYPES OF CONSTRUCTION FAILED TO MEET STANDARDS?

Table #6
Proportion of building officials estimating that type of construction failed to meet energy standards:

% of New Units Estimated to Fail to Meet Energy Standards	Single Family	Multi-Family	Non-Residential
0%	82%	82%	68%
1 - 10%	12%	12%	18%
11 - 34%	2%	3%	9%
35 - 74%	2%	2%	3%
75% and above	2%	2%	2%
Total Number of Respondents	(216)	(207)	(206)

Some officials feel that the best way to handle the situation is to put more responsibility on the person signing the compliance statement. Others think that procedures for compliance with the non-residential standards ought to be simplified. One northern California department urges development of prescriptive alternatives for non-residential buildings similar to those in the residential standards. A large southern California city department suggest cutting down on the calculations required.

In the last analysis, most building officials in the state would probably sympathize with a comment from the County of San Diego:

"If energy compliance is to be improved, the Energy Commission should contact poliical people to increase staff and funding for inspection and plan checking."

ACTORS FROM THE PRIVATE SECTOR

DESIGNERS, CONTRACTORS, AND SUPPLIERS HAVE BEEN THE MAJOR PRIVATE SECTOR ACTORS IN ENERGY CONSERVATION FOR BUILDINGS. LBL ANALYSIS OF PRIVATE SECTOR REACTIONS FOCUSES ON TWO GROUPS MOST CLEARLY AFFECTED BY TILE 24--ARCHITECTS AND BUILDERS.

Involvement of Private Sector in Energy Standards

Groups representing the building industry -- designers, contractors, and suppliers -- have been the main private sector participants in the implementation of energy conservation standards for buildings. Environmental and consumer groups, which played important roles in other energy policy issues in California have been largely absent from the process. With the brief exception of the original residenial standards advisory committee, and the recenly announced intention of the Natural Resources Defense Council (NRDC) to take part in the revision of the residential energy standards, private sector pressures have all come from the industry.

Several factors account for this situation. Public interest groups have a natural tendency to move on to other issues as soon as policy has been established in one area of their interest. But, because their livelihood is at stake, industry groups remain involved during the implementation process.[1] In this case, however, the major factor was probably the technical nature of the issue itself. From the beginning of the standards development process, discussions centered around modeling energy use, cost figures, design assumptions, and economic indicators. Industry people had ready access to information bearing on these issues, but consumer groups possessed scant expertise with such matters. As the regulatory process became enmeshed in technical considerations, groups with general concerns were effectively precluded from meaningful participation in decision making.

Prominent participants in the deliberations have included the California Building Industries Association (CBIA), representing the major home builders in the state, the California Council of the Amercian Institute of Architects (CCAIA), the Sheet Metal Air Conditioning National Association (SMACNA), representing the HVAC contractors, the California Society of Professional Engineers (CSPE), and various material and equipment suppliers. CALBO also participated, as previously noted. Utilities have been following developments closely, but have been cautious about taking public positions. Financial and real estate interests have been largely absent from discussions about the energy regulations.

Our analysis of private sector reactions to Title 24 will focus on two of the groups most clearly affected by the regulations -- architects and builders. Although we have been able to interview leaders in both fields and conduct pilot studies of member's concerns, our findings should be regarded as more tentative than those previously reported for the public sector.

ARCHITECTS AND THE ENERGY STANDARDS

ALTHOUGH LICENSED ARCHITECTS DESIGN ONLY A SMALL FRACTION OF THE SINGLE-FAMILY HOMES BUILT IN CALIFORNIA, THEY INFLUENCE RESIDENTIAL CONSTRUCTION OUT OF PROPORTION TO THE NUMBER OF HOMES THEY ACTUALLY DESIGN.

THE MAJOR ARCHITECTS ORGANIZATION, CCAIA, HAS RECENTLY HIRED AN ENERGY CONSULTANT AND FORMED THREE COMMITTEES TO DEAL WITH ENERGY CONSERVATION. THE CCAIA COMMITTEE CONCLUDED THAT BOTH REGULATORY AND NON-REGULATORY PROGRAMS ARE CALLED FOR.

CCAIA STRONGLY FAVORS PERFORMANCE STANDARDS. IN GENERAL, ARCHITECTS REGARD DESIGN FLEXIBILITY AND FREEDOM FROM EXCESSIVE DOCUMENTATION AS IMPORTANT ELEMENTS IN THEIR ABILITY TO COMPLY WITH ENERGY STANDARDS.

ABOUT HALF OF THE 53 ARCHITECTS RESPONDING TO THE SURVEY INDICATED THEY SOMETIMES ENCOUNTER PROBLEMS IN MEETING ENERGY REGULATIONS. THE MOST COMMON DIFFICULTY FOR RESIDENTIAL DESIGNERS IS RELATED TO GLAZING. OTHER PROBLEMS NOTED WERE EXCESSIVE PAPERWORK, AND JURISDICTIONAL VARIATIONS IN ENFORCEMENT.

MOST ARCHITECTS FEEL THAT THE CEC HAS NOT BEEN EFFECTIVE IN REACHING THE PROFESSION WITH INFORMATION ABOUT ENERGY STANDARDS. THE SURVEY AND INTERVIEWS SUGGEST A TWO-STEP MODEL FOR FUTURE EFFECTIVE CONTACT WITH PROFESSIONALS -- FROM THE CEC THROUGH ESTABLISHED CHANNELS OF COMMUNICATION (ASSOCIATIONS, MAGAZINES) TO THE PRACTITIONERS, WITH SPECIAL EMPHASIS PLACED ON PROVIDING USEFUL TRAINING MATERIALS TO INTERMEDIARIES SUCH AS ENERGY CONSULTANTS AND BUILDING OFFICIALS.

INNOVATIVE ARCHITECTS REPORT GREATER PROBLEMS WITH ENERGY STANDARDS THAN MORE TRADITIONAL PRACTITIONERS. ALTHOUGH REGULATIONS PERMIT USE OF PASSIVE TECHNIQUES, SURVEY RESPONDENTS FEEL TITLE 24 DOES LITTLE TO ENCOURAGE INNOVATIVE DESIGN. IN NOVEMBER, 1980, THE PROFESSION PUT FORWARD ITS PROFESSIONAL RESPONSIBILITY PROGRAM, WHICH INCLUDED CREATING INCENTIVES BY AWARDING SPECIAL CREDENTIALS FOR DESIGN EXCELLENCE, SPONSORING TRAINING PROGRAMS, AND FACILITATING INFORMATION FLOW WITHIN THE PROFESSION.

THE STATE BOARD OF ARCHITECTURAL EXAMINERS HAS BEEN PHASING ENERGY CONSERVATION INTO LICENSING EXAMINATIONS. HOWEVER, CONTROVERSY HAS ARISEN AS TO WHETHER KNOWLEDGE ABOUT ENERGY DESIGN SHOULD BE REQUIRED FOR LICENSE RENEWAL.

Architects and the Energy Standards

Licensed architects design only a small friction (perhaps 5%) of the single-family houses built in the state. With that in mind, the profession feels that it has been criticized too heavily for energy inefficient housing.

However, architects influence residential construction out of proportion to the number of homes they actually design. Avant garde practices from today's custom homes filter into tomorrow's mass-market homes. Architects also design prototypes for many tract builders -- designs that are repeated (with variations) by the hundreds or thousands. Larger builders often have architects on their staffs to develop or modify house designs. Finally, architects are involved in a far greater proportion of projects involving unusual sites, or multi-housing, or urban in-fill than in typical suburban projects. Such situations (and consequently the demand for professional services) show signs of increasing as metropolitan areas in the state become more densely populated.

The architects' organization, CCAIA, represents about 5800 members. Over the past several years, it has become increasingly concerned about energy matters. In March 1978, it hired a San Francisco architect, Charles Eley, as its energy consultant. In January of the following year, three CCAIA energy commitees were formed to deal with residential construction, non-residential building, and professional responsibility issues (such as ways to exchange information). The committees are composed of volunteers and meet regularly to consider energy policy for the profession; Eley serves as technical staff to all the commitees.

CCAIA recently issued a major policy statement in which it noted that regulations have been "the dominant type of government program designed to reduce energy use in buildings." Their advantage is in being able to "cut through institutional and economic barriers and impose uniform requirements on the building industry with relative speed." Although the architects' group thought that "regulations certainly have their place", it also suggested that "they are expensive to develop and enforce with more than 400 permit jurisdictions in California and with the highly dispersed and fragmented nature of the building industry." Furthermore, CCAIA thought that energy standards "can become unnecessarily restrictive or even counter productive if not adequately developed, implemented, and/or enforced." The architects concluded that "what is needed is a creative and multidimensional strategy . . . (which) must include both regulatory and non-regulatory programs -- the carrot and the stick."[1]

The group's statement criticized the state's residential energy regulations for including only a component path to compliance: "They are often overly simplistic and ignore many of the most important conservation issues, including shading of windows, orientation, daylighting opportunities, and the dynamic character of energy flow in buildings." Component standards, they felt, fail to "acknowledge the relationship between components" of a building. Charles Eley summed up the problems wih prescriptive energy codes: "In architecture, every site is

different, yet prescriptive standards represent design decisions made without benefit of specific knowledge that the designer would take into account."

The architects group emphatically favored performance standards as "the best regulatory option". Even after acknowledging that adoption of the performance approach would entail "reeducation of the building industry", the CCAIA listed six "compelling reasons" for its position:

1. Performance standards allow flexibility to explore innovative energy conservation strategies.

2. Compliance leads to an understanding of energy flows in buildings and helps to improve designers' skills for future projects.

3. They can be used to set goals for energy consumption in homes.

4. They can provide valuable consumer information.

5. Performance standards can be readily modified as the art of energy efficient design advances.

6. They can be tied in with non-regulatory programs to achieve energy savings.

For both residential and non-residential buildings, CCAIA advocates that "standards need to be more stringent, more performance oriented, and more workable".

Architects generally seem to be in accord with the position taken by their professional associaton. Our survey of respondents at the Lake Tahoe conference found almost unanimous support for performance standards as a means of meeting energy conservation goals. Architects, like building officials, were much more favorably inclined toward trade-offs than to calculations. Nearly 90% thought that trade-offs to meet an overall energy budget were a good means of achieving energy savings, while only 50% thought that life-cycle cost calculations were useful in meeting conservation goals. However, architects differed with building officials in their evaluation of prescriptive standards. Slighly under 30% of the respondents favored their use, while more than half indicated opposition to the prescriptive approach.

Although wanting to divorce himself from those "who are pushing for performance standards", an architect who is heavily involved in multi-family housing indicated a need for "uniformly imposed sensible constraints". For him, prescriptive standards posed few problems "as long as there's a way to trade off". But calculations bothered him: "I'm an architect, and I've got buildings to site and enviornments to deal with, and that's what I concentrate on. If the arithmetic is too involved, then someone else is going to do it for me." Thus, whether expressed as support for performance standards or trade-offs, architects regard design flexibility and freedom from excessive documentation requirements

as important elements in their ability to meet strict energy standards.

Architects' Experiences with Title 24

About half the architects responding to our survey indicated that they sometimes encounter problems in meeting California's energy regulations. The most common difficulty is related to glazing. Custom home owners and developers of expensive projects usually want a greater amount of glass than state regulations allow. This makes it difficult for the designer to accommodate the client "without resorting to extensive extra insulation". However, one architect involved in designing multi-family housing felt that the problem may be easing: "Now, more clients are willing to go for double glazing, and that puts you over the hump. Our clients are becoming more energy conscious as a merchandising feature."

Architects also found some inflexibility in the regulations. According to several respondents, "the code does not allow for specific differences in micro-climate", nor does it allow for "accurately assessing the positive values of passive solar" techniques.

Other respondents experienced problems with building officials. Architects complained about plan checkers who "are fuzzy on the code", and about difficulty in "finding out what the latest edition of the regulations covers". A number of them noted wide differences in enforcement from one jurisdiction to the next, attributable to "significant variation(s) in professionalism of building departments". Respondents also decried excessive paperwork: "The paperwork required for a relatively simple single-family residence seems inordinate", in the view of more than one architect.

Many architects feel that building permits have been harder to obtain since the energy conservation standards went into effect in July, 1978. Not all the delays were attributed to Title 24. "Constant added regulations from every form of government" (e.g., handicapped access, safety regulations) came in for criticism, as did reviews by regional planning agencies (especially the Coastal Commission and the Lake Tahoe Regional Planning Agency). Still, about one-third of the respondents attributed a large part of their permit problems to the energy standards. One respondent cited the "lack of experience by plan checkers with new design techniques and technology, and their overriding fear that they might be sued" as contributing to lengthening the permit approval process. Another suggested that the low "volume of projects currently underway (left) bureaucrats with time on their hands" and the need to justify their existance.

Architects with complex projects usually sub-contract some elements to specialists. More than 90% of our survey respondents report that their firms sub-contract HVAC system design; about half the firms go outside for computer assistance and life-cycle costing studies, while one-third indicate that they contract for services in the solar field. Part of the sub-contractor's job entails satisfaction of state energy requirements. A San Francisco architect noted that his firm works "with

the vendor or the sub-contractor. For electric radiant heating (the supplier) provides design services, heat loss calculations, and (fills in) state forms." The sub-contractor generally deals with questions from the building department. Especially on larger projects, compliance with major portions of the energy standards often falls on suppliers or consultants, rather than on the designer.

About one-fifth of the respondents indicated that building officials always accept an architect's or an engineer's certification that designs meet state energy codes, without further checking. Another 35% said that officials sometimes accept certification; however, about one-fourth ofthe architecs reported that local officials rarely or never accept statements from designers that buildings meet energy codes without further checking. This again points to variable enforcement practices throughout the state.

Information Dissemination for the Profession

Most architects feel that the CEC has not been very effective in reaching the profession with information about the energy standards. One major reason was that "not all architects belong to the AIA. The Commission needs other means to communicate" with non-members. Another architect noted that "we are in an outlying area and never hear about changes in the regulations". A number of respondents suggested that mailings should go to all registered architects, not just those on lists compiled by the Commission. Another architect criticized the lack of continuing contact: "They sent us the book. Period."

Respondents who gave the Commission higher marks for communication indicated that "with a little bit of effort, the material is available". Said another, "we are on their lists and keep after them for information". One architect even felt that material is available "in such bulk that it's time consuming to sift out what's relevant". As for continuing contact, another respondent noted that "the Blueprint has explained a good deal of the staff's interpretations and provided a few helpful simplifications and alternatives".

Other factors contributed to the CEC's failure to provide information useful for many practitioners. One architect criticized the form of the standards as "not compatible for an architect's office". Another indicated that "information has come by way of the building departments, and most seem to have their own interpretations of the standards". Other respondents criticized the agency itself, one for having "no staff architects" and another for providing only prescripive standards which "have fostered a cookbook approach, plan check hassles, and no real learning". Several were even blunter in their criticism: "They don't know what they're doing -- this is obvious," said one, and another alluded to the CEC as a "weak bureaucratic agency, afraid of their solar shadow".

Only a relatively small proportion of the survey respondents attended workshops or seminars dealing with the energy regulations sponsored by the Energy Commission. Over twice as many participated in

sessions put on by their local AIA chapter, or by the CCAIA. Architects were considerably more likely to consider training coming from their professional organizations as helpful, compared to CEC programs. Over half the respondents who knew about the Energy Commission sessions rated them as "unhelpful", while just slightly more than 10% considered those sponsored by the AIA to be "unhelpful". Workshops from suppliers or manufacturers received the lowest ratings of all; about two-thirds of the participants considered them unsatisfactory.

Architects consider workshops (such as the Lake Tahoe session) and interaction with consultants who deal specifically with energy matters as the most useful means of obtaining information about the Title 24 regulations. The Energy Commission ranks third on the list, followed closely by contact with professional associations. However, for finding out about new products, and for information about energy conservation projects, professional magazines ranked highest, closely followed by workshops. (Figure 19)

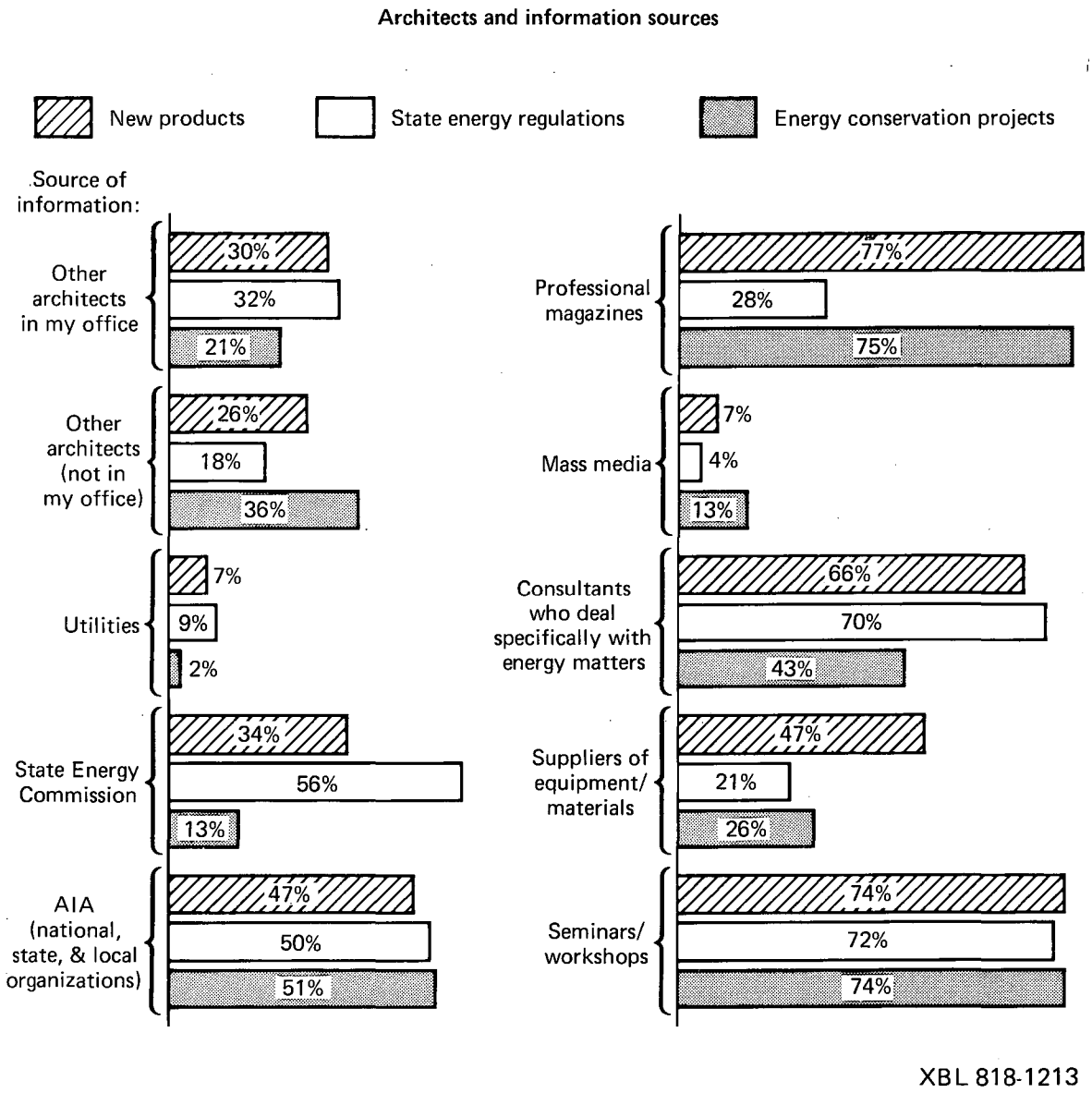
This evidence suggests a two-step model for effective contact with professionals -- from the Energy Commission through the established channels of communication (associations, magazines) to the practitioners. Since intermediaries such as energy consultants, and to some extent building officials, play important roles in the flow of information, special emphasis also ought to be placed on providing them with useful materials. This might be of particular help in reaching the "isolated professionals" -- those who won't make the effort to get on mailing lists or join professional organizations.

Innovative and Traditional Designers

Nearly two-thirds of the respondents to the Lake Tahoe survey indicated that they had participated in designing passive solar projects. This percentage is undoubtedly higher than would be found in a random sample of architects; thus, an overall characterization of respondents as "energy aware" can hardly be called an overstatement. Still, some interesting differences emerge when architects who have had experience with passive designing (innovators) are compared with those who haven't (traditionals).

Although the energy regulations permit the use of passive techniques, respondents feel that Title 24 does little to encourage innovative design. One architect commented: "No methods are suggested to figure the solar factor. We are essentially on our own." This leads to a situation where "the most creative new work takes a great deal of work to be approved, while standard energy efficient designs are routinely approved". As a result, the line of least resistance is often to keep to "approaches that have been done on a wide basis. Larger projects occasionally have budgets to explore other methods, but this is not true of the bulk of projects done."

The proportion of innovative architects saying they encounter difficulty in meeting energy standards is double that of the traditionals. Innovators are also more likely to believe that current state energy


Architects and information sources
New products
State energy regulations
Energy conservation projects
Source of information:
Other architects in my office
30%
32%
21%
Other architects (not in my office)
26%
18%
36%
Utilities
7%
9%
2%
State Energy Commission
34%
56%
13%
AIA (national, state, & local organizations)
47%
50%
51%
Professional magazines
77%
28%
75%
Mass media
7%
4%
13%
Consultants who deal specifically with energy matters
66%
70%
43%
Suppliers of equipment/ materials
47%
21%
26%
Seminars/ workshops
74%
72%
74%
XBL 818-1213

- Figure 19 -

standards have inhibited energy efficient design. (Figure 20)

Innovators report some specific problems with the energy code. One southern California based architect's designs "required performance standards and competent staff to review same. One project did not quite meet requirements for 70 degrees at 3 feet and we had to alter the design to meet standards. This resulted in higher consumption, a much more elaborate back-up system, and significantly high life-cycle costs." Hal Levin, a member of the Board of Architectural Examiners, noted that in his area, Santa Cruz County, there was initially a "tremendous amount of difficulty in getting interpretations on greenhouses -- whether they needed two hour fire separation and use of wire glass on the roof. These made big differences in cost and aesthetics." The whole situation became a "disincenive to energy conservation".

Architects at San Francisco based E'koseas Corporation faced special problems getting building departments to accept their double envelope houses. In addition to the 70 degree requirement, which troubles most passive designers, they also have a hard time convincing building officials that their design meets fire code and ventilation requirements.

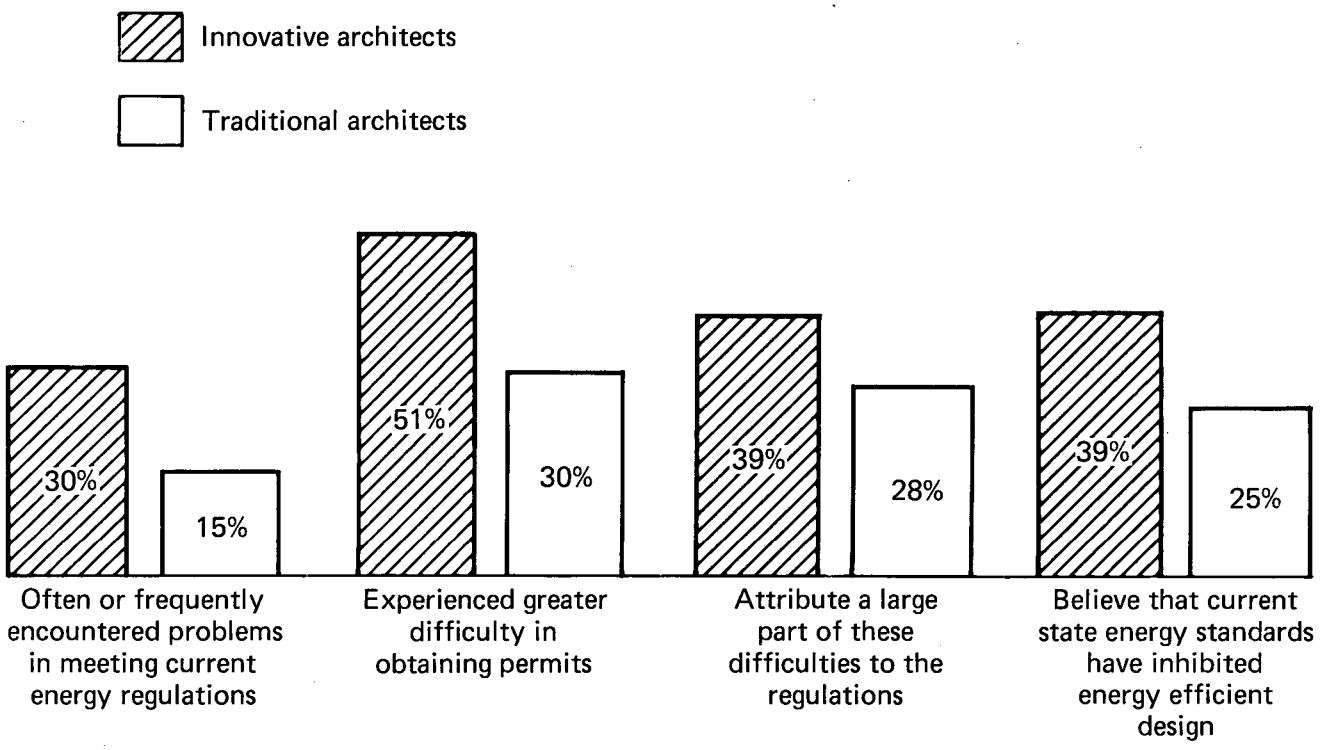
Such experiences may make innovators a bit too ready to condemn the energy standards as the cause of their problems. Other codes may create even greater difficulties, and the attitude one inspector betrayed to Hal Levin when he remarked that "the Uniform Building Code is a fat, dumb book, and if you follow it, every one will be happy" may cause the most trouble for new energy conserving designs.

Innovators receive information about energy matters from the same basic sources as traditional practitioners. But, the mix is somewhat different for the two groups. Innovators appear to emphasize contacts with other architects in their office, while the traditionals seem to depend more on suppliers and workshops for information. (This result is suggestive, but the percentage differences are relatively small.) Innovators are also more likely to find out about new products from the CEC but less likely to obtain information about energy conservation projects from the Commission.

Innovative architects differed from traditionals in some significant ways -- they were, on the whole, in practice for less time and worked for smaller firms or as solo practitioners. A greater proportion of those experienced in passive design did most of their work outside the two main metropolitan areas -- San Francisco Bay Area, and the Los Angeles-San Diego metropolitan area. As might be expected, a considerably greater proportion of innovative architects' firms offered consulting services for energy conservation and passive and active solar designing. They also sub-contracted computer and life-cycle cost analysis to specialists more frequently than traditional firms, perhaps reflecting the fact that they do more work requiring such analyses.

Innovators are considerably more likley to design single family residences, and somewhat more likely to do rehabilitation work than other architects; tradiional practitioners report that their firms are more likely to work on special buildings, such as schools and hospitals.

Problems with regulations: innovative vs traditional architects



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- Figure 20 -

When asked to estimate the proportion of their clients falling into several categories, more than twice the percentage of innovators indicated that they had no institutional clients. None of them failed to report owner-occupant clients. (Figure 21)

Clients of innovative firms seem more inclined to accept energy conservation measures than clients of traditional firms. Innovative architects are considerably more likely to indicate that their typical institutional and owner occupant clients consider energy savings more important than first costs. A few innovators even say that their speculative clients rate energy savings above immediate financial considerations. (Figure 22)

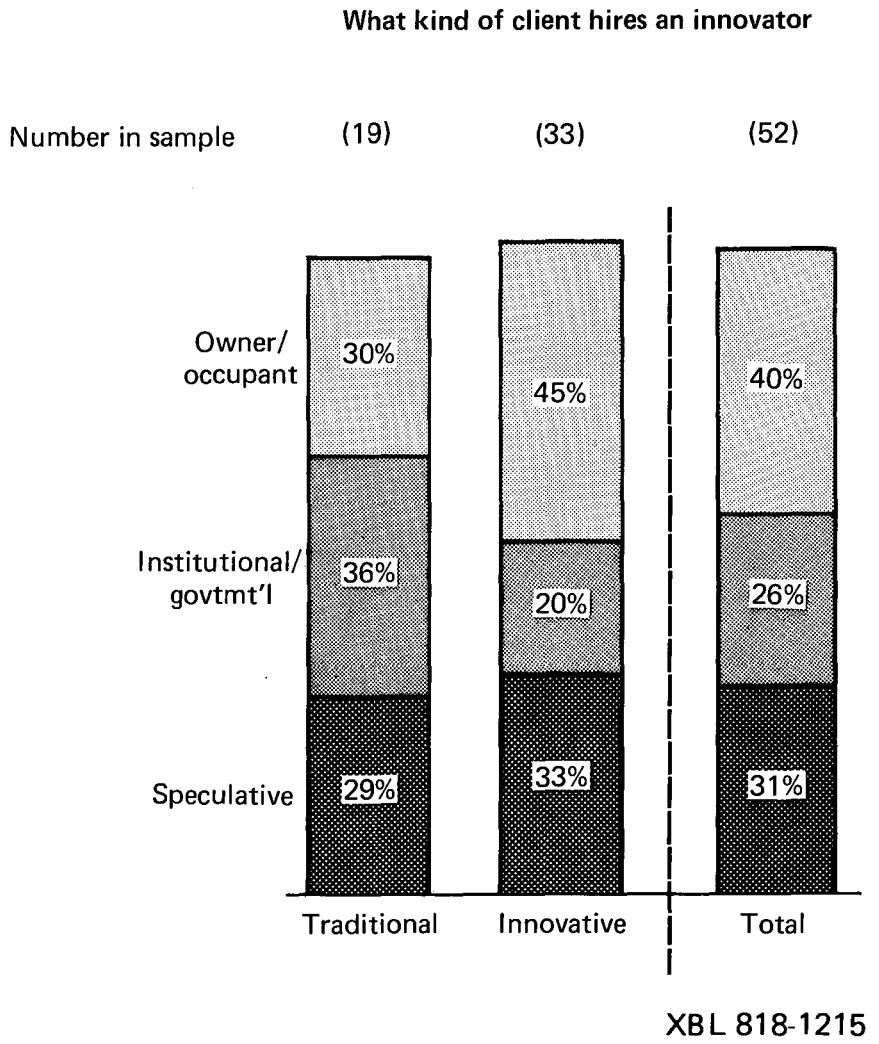
Innovative architects believe that their clients would be more receptive to passive solar design than traditional practitioners. Three times as many innovators claimed that "most" or "all" of their clients would be willing to consider passive features (15% of the traditional architects did, as well). Their main objection was expected to be added first costs for passive design projects, but a somewhat smaller proportion of innovators thought their clients would consider cost as an inhibiting factor.

Clients affect the ability of architecs to incorporate energy efficient design principles into their work. Speculative clients may not allow much leeway, while energy conscious clients make the task much easier. In either case, creative opportunities for saving energy may be available in many projects. One repondent from a large San Francisco firm reported an ability to "get more energy conscious design in our developer projects," noting as well that "solar is in projects now because it can be merchandised . . . developers want it and we want it".

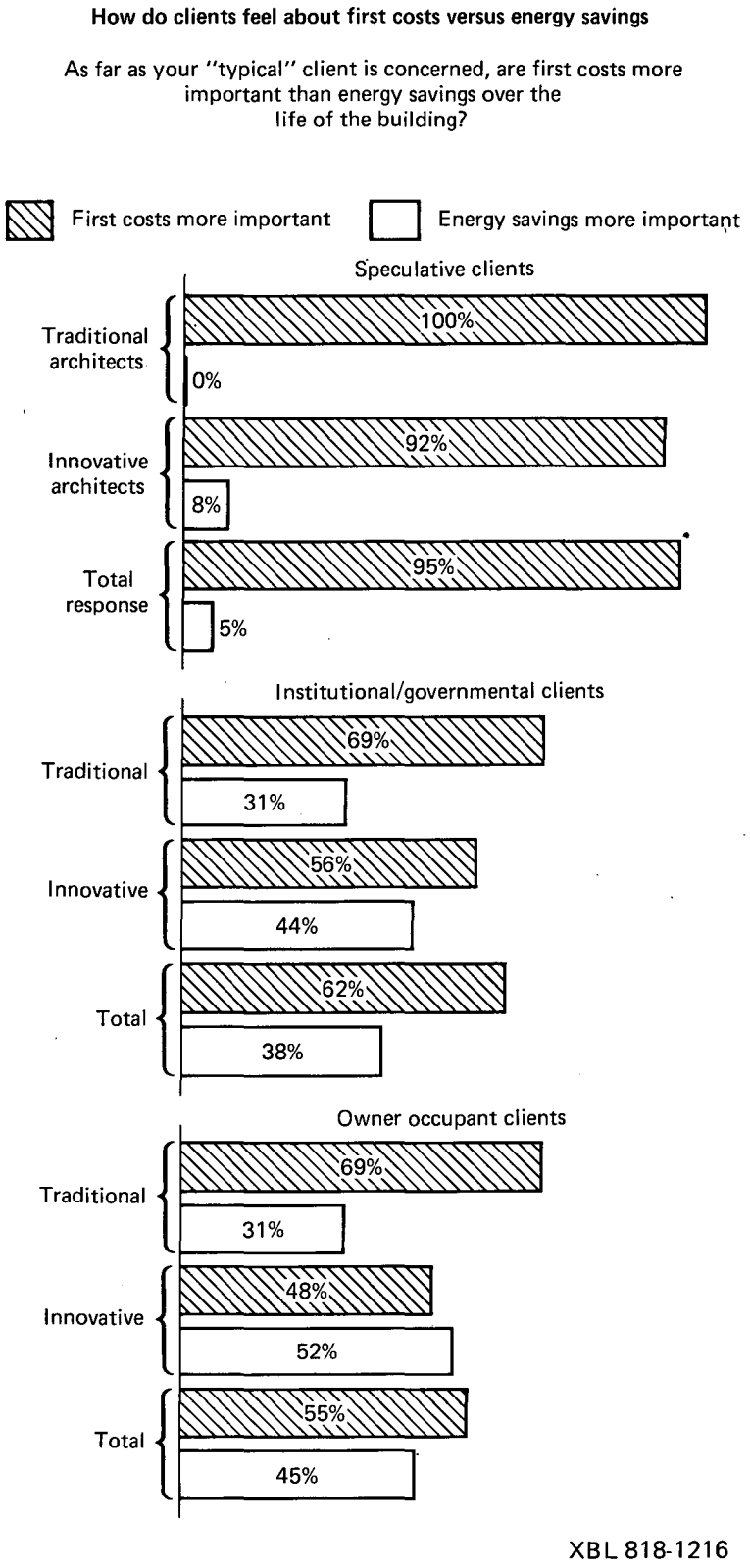
Professional Responsibility

The practice of architecture in California is regulated by the State Board of Architectural Examiners. In 1977, the Board received a petiion from the Citizens' Action Group to require architects to undergo continuing education for energy conservation. At the time, the Board rejected the idea because it wasn't convinced of its effectiveness. In 1979, the Board considered another means for improving architects' energy consciousness. According to Hal Levin, a public member of the Board: "By writing into our regulations what competence meant, we could discipline licensees whose designs were not energy conscious."

The idea of re-certification for competence in energy efficient design was extremely unpopular with the profession. The CCAIA protested vigorously, and testimony from individual architects weighed heavily against the idea. In the spring of 1980, the Board decided (on a split vote) not to ask the state legislature to give it additional powers to require architects already in pracice to show competence in energy effi-


What kind of client hires an innovator
Number in sample
(19)
(33)
(52)
Owner/ occupant
Institutional/ govtmt'l
Speculative
30%
36%
29%
45%
20%
33%
40%
26%
31%
Traditional
Innovative
Total
XBL 818-1215

- Figure 21 -


How do clients feel about first costs versus energy savings
As far as your "typical" client is concerned, are first costs more important than energy savings over the life of the building?
First costs more important
Energy savings more important
Speculative clients
Traditional architects
100%
0%
Innovative architects
92%
8%
Total response
95%
5%
Institutional/governmental clients
Traditional
69%
31%
Innovative
56%
44%
Total
62%
38%
Owner occupant clients
Traditional
69%
31%
Innovative
48%
52%
Total
55%
45%
XBL 818-1216

- Figure 22 -

In November, 1980, the profession put forward its four point professional responsibility program. Its strategies included: creating incentives by recognizing architects' success in energy conservation and awarding special credentials for design excellence; sponsoring training programs; facilitating exchange of information in the profession; and helping architects to expand their practices to include more energy design services. The CCAIA put its faith in the carrot, rather than the stick which the Board could wield.

Nearly all of the architects responding to our survey thought their professional associations ought to play a greater role in encouraging energy efficient design. Two-thirds agreed with the CCAIA position that the Board should not discipline architects whose designs waste energy. However, respondents split almost evenly on whether existing license holders ought to be tested for knowledge of energy conserving design principles as a condition for license renewal -- 55% thought they should.

Disagreement with the idea was more passionate than agreement -- most of those who disagreed did so strongly, while most of those who agreed expressed only moderate support for the porposal. There was little disagreement, however, about whether architects coming up for licensure for the first time should know about energy conservation; only one respondent opposed that requirement.

The Board of Architectual Examiners has been phasing energy conservation into licensing examinations. However, the task has been difficult because California uses a national examination, and changes must be negotiated in meeting with representatives from other states, many of whom seem not as concerned with energy conserving design as California architects.

The Board itself would be hard pressed to exert more stringent control over the profession with respect to energy efficient design practices. Although it seems inclined to identify violators of Title 24, it doesn't have the resources to make more than a token effort to discipline miscreants. Paul Welch, executive secretary of the Board, pointed out that last year's enforcement budget was only $35,000, and that it could cost $4000 or more to resolve a single complicated case.

As Welch commented, it becomes especially costly "to enter complex areas of investigation, such as the energy regulations, (where) compliance is usually farmed out to consultants, and it's very difficult . . . (to) understand whether a builder does or does not comply". Since architects are as reluctant as other porfessionals to testify against each other in such matters, the CEC would have to "provide expert witnesses and techncal assistance when we are ruling on complaints". Otherwise, the Board might not be able to judge whether an architect's design met the energy standards.

Some architects probably need to be pushed to bring them up to minimal standards of competence. But for most of the profession, energy conservation ought to become an opportunity rather than a requirement. Increased attention to design usually translates into greater economic

rewards for designers. Equipment suppliers (especially HVAC suppliers) may find themselves coming into competition with professionals who try to decrease hardware requirement through attention to design principles such as massing, orientation, daylighting, etc. In some passive designs, heating and cooling equipment have even been rendered unnecessary; a wood stove or a fireplace may substitute for an expensive HVAC system.

Architects are likely to be put in the happy position of having their professional responsibility coincide with economic advantage. As clients become more sophisticated about life-cycle costs, this convergence of interests is likely to become a powerful incentive toward energy saving practices.

THE BUILDING INDUSTRY'S RESPONSE TO ENERGY CONSERVATION

THE BULK OF CALIFORNIA'S HOUSING IS PRODUCED BY RELATIVELY SMALL FIRMS. BECAUSE OF CASH FLOW PROBLEMS, BUILDERS SEEK TO MINIMIZE DELAYS IN GETTING THEIR PRODUCT ON THE MARKET. THE STRATEGY OF MARKETING HOUSES WITH PROVEN ACCEPTABILITY TO THE CONSUMER IS ONE REASON FOR THE SLOW PACE OF CHANGE IN THE INDUSTRY. IN ADDITION, THE TIME LAG OF THREE TO FIVE YEARS BETWEEN DEVELOPMENT AND CLOSING ESCROW, HAS SLOWED ENERGY CONSERVATION'S ENTRANCE INTO CONSRUCTION PRACTICE.

WHILE HOME BUILDERS BELIEVE THEY HAVE TO RESPOND TO THE MARKET IN ORDER TO STAY IN BUSINESS, THEY ALSO SEEK TO CARVE OUT UNIQUE NICHES IN ORDER TO LESSEN THE IMPACT OF MARKET FORCES. SHIFTS IN CONSUMER PREFERENCES POSSESS A SIGNIFICANT POTENTIAL FOR CHANGE IN THE HOME BUILDING INDUSTRY.

ALTHOUGH BUILDERS RESPOND NEGATIVELY TO REGULATION, THEY ARE READY TO USE CONSERVATION FEATURES AS SALES TOOLS TO REACH ENERGY CONSCIOUS CONSUMERS AND AS A MEANS OF PRODUCT DIFFERENTIATION. LARGE BUILDERS ARE MOST LIKELY TO BE MOTIVATED BY THIS DESIRE FOR A MARKETING POSTURE. CUSTOM HOME BUILDERS, SINCE THEY CATER TO CLIENTS WHO ARE USUALLY ABLE TO AFFORD "EXTRAS", MAY BE RESPONDING MORE DIRECTLY TO EXPRESSION OF INTEREST FROM CLIENTS.

THE BUILDING INDUSTRY AS A WHOLE TENDS TO REGARD ENERGY STANDARDS AS PART OF THE SAME COMPLEX OF GOVERNMENT "OVER-REGULATION" AS LAND USE CONTROLS, ENVIRONMENTAL CONSTRAINTS, AND HANDICAPPED ACCESS REQUIREMENTS, BUT THE INDUSTRY IS NOT OF A SINGLE MIND ABOUT ENERGY STANDARDS. ONE FACTION FOUGHT TITLE 24 IN THE COURTS AND CONTINUES TO OPPOSE THE GROWTH OF WHAT IT SEES AS "REGULATORY BUREAUCRACY"; ANOTHER PART, REPRESENTED BY THE CBIA HAS SOUGHT TO MODIFY THE STANDARDS TO BETTER REFLECT INDUSTRY PRACTICES.

BUILDERS REPORTED SPECIFIC PROBLEMS WITH IMPLEMENTING TITLE 24: CALCULATIONS AND COMPLEXITY OF COMPLIANCE FORMS, INITIAL SHORTAGES OF MATERIALS AND EQUIPMENT, EXCESSIVE PAPERWORK, SLOW PERMIT PROCESSING, CHANGING INTERPRETATIONS, CONFLICTS WITH OTHER CODES, LACK OF TECHNICAL TRAINING BY PLAN CHECKERS, AND NON-UNIFORMITY OF INSPECTION PROCEDURES.

DESPITE THE IMPLEMENTATION PROBLEMS, FEW BUILDERS REPORT MAJOR DIFFICULTY WITH MEETING THE CURRENT RESIDENTIAL STANDARDS. THIS PROBABLY RESULTS FROM SHIFTING RESPONSIBILITY FOR COMPLIANCE TO SUB-CONTRACTORS, AN ABILITY TO NEGOTIATE WITH LOCAL OFFICIALS FOR "REASONABLE" INTERPRETATIONS, AND THE FACT THAT THE VAST MAJORITY OF HOMES ARE DESIGNED TO MEET PRESCRIPTIVE REQUIREMENTS. IN GENERAL, BUILDERS SEEM TO REGARD THE REGULATIONS AS EFFECTIVE IN SAVING ENERGY, BUT NOT AT A COST COMMENSURATE WITH THE BENEFITS.

INNOVATORS ARE INCORPORATING SOLAR WATER HEATING AND PASSIVE SOLAR DESIGN STRATEGIES ON A GROWING SCALE. SOME OF THE STATE'S LARGEST BUILDERS ARE ENTERING THE MARKETPLACE WITH VERY ENERGY EFFICIENT HOMES. MANY OTHER BUILDERS ARE WATCHING THESE INNOVATORS WITH INTEREST, BUT THE

INDUSTRY AS A WHOLE STILL LACKS A GOOD FEELING FOR BUYER REACTION. BUILDERS DO NOT REGARD THE REGULATIONS AS A MOTIVATION FOR INNOVATION; IN SOME CASES THEY ARE SEEN AS AN OBSTACLE.

THE CBIA REPRESENTS 5000 COMPANIES, RESPONSIBLE FOR BUILDING ABOUT 70% OF CALIFORNIA'S HOUSING. A RECENT CBIA POLICY STATEMENT EMPHASIZED THE NOTION OF "BALANCED DESIGN", BY WHICH THE BUILDER/DESIGNER CHOOSES THE PACKAGE OF DESIGN FEATURES THAT BEST BALANCES ENERGY SAVINGS AND INCREASED FIRST COSTS. BUILDERS FEEL THAT TRADE-OFFS ARE ESSENTIAL: CBIA URGED DEVELOPMENT OF TWO PATHS TO COMPLIANCE, ONE BASED ON COMPUTER BASED PERFORMANCE ESTIMAES, THE OTHER CONSISTING OF A POINT SYSTEM WHICH WOULD ALLOW BUILDERS TO DEVELOP THEIR OWN CONSERVATION PACKAGES FROM A MENU OF FEATURES.

SUPPORT FOR A DESIGN BUDGET APPROACH REPRESENTS A SIGNIFICANT CHANGE IN CBIA'S THINKING. ALTHOUGH BUILDERS ARE NOT ENTHUSIASTIC ABOUT STATE REGULATIONS, THEY SEEM WILLING TO ACCEPT "REASONABLE" STANDARDS. HOWEVER, MANY POINT TO THE PRIVATE MARKET AS A BETTER MEANS FOR ACHIEVING ENERGY CONSERVATION. IN THIS DIRECTION, THE NATIONAL ASSOCIATION OF HOME BUILDERS ESTABLISHED THE HOME OWNERS WARRANTY PROGRAM (HOW); ALTHOUGH THE CURRENT HOW PLAN DOESN'T COVER ENERGY CONSERVATION, A PROGRAM MODELED ALONG THE SAME LINES COULD. REPLACING STANDARDS BY WARRANTIES RAISES SERIOUS PROBLEMS, MOST IMPORTANTLY THE POSSIBILITY OF OPENING THE HOUSING FIELD TO "COST CUTTERS".

Structure of the Home Building Industry

With the exception of agriculture, home building is the state's least concentrated major industry. Large firms producing 100 or more units accounted for only one-third of California's new housing in 1979. Although the CBIA estimates that 136 builders completed some 73,000 units, the bulk of the state's housing (61% or 137,000 units) was produced by relatively small firms. On the average those small companies built 13 houses each during 1979.

Most builders work on fairly small profit margins. The Bank of America's authoritative cost breakdown for standard residential construction includes 15% for overhead and profit.[1] On a typical $100,000 house, a builder will invest $85,000 in materials, labor, carrying charges, permits, and other expenses. Small builders clearly can't afford to have their investment tied up for any length of time and still remain in business. Cash flow often becomes a serious problem, so builders naturally seek to minimize delays in getting their product on the market.

One of the most important ways in which firms try to lower their risks is by marketing houses that have proven acceptability with consumers. A recent survey conducted for Housing magazine by Walker & Lee, the large southern California real estate marketing firm, indicated that "the plan sparks the buying decision no matter where shoppers live, what type of household they belong to and whether they're looking at an attached or detached house. Next in importance: room sizes."[2] The typical builder, seeking to attract the typical buyer, hesitates to construct anything too much out of the ordinary for fear of consumer disapproval. As Mark Anderson, former technical director of CBIA, commented: "Builders can't hold their product in inventory for long, or sell at a loss. It is not an industry that can shift gears overnight."

Other factors also contribute to the slow pace of change in the building industry. Anderson notes that "housing projects take three to five years from the time of design to closing escrow." Given this lag, newly emerging concerns, such as energy conservation, take time to be reflected in construction practice. Builders have long been regulated by codes. Each jurisdiction may modify the Uniform Building Code to suit unique situations (and many do). "Because the variation among codes is great, and administration localized, a national market place for producers has not developed in the construction field." This localized market structure, according to one analyst seeking to reform building codes, "is a significant barrier to the introduction of producion efficiencies in construction . . . Since codes represent a concensus with respect to effictiveness, they inevitably reflect traditional solutions and put a heavy burden upon innovation."[3]

Ironically, one of the most important innovations in recent building practice may also work against further changes. In California, manufactured housing commands a substantial share of the market. Compared to the rest of the industry, large firms with heavy capital investments in current modes of production dominated modular construction. Those builders may be even more reluctant to change their practices than

traditional stick builders. However, modular housing may also be more easily regulated than other parts of the industry. Relatively few builders need to be reached to change practices, even though those firms may be harder to convince initially.

Home builders firmly believe that they have to respond to the market in order to stay in business. Even the biggest firms subscribe to this notion almost as an article of faith. Most builders also try to create a unique image for their product. Custom builders stress quality and responsiveness to clients' needs, while mass market builders emphasize price and financing terms. All builders try to differentiate their product by pointing to amenities, location, or to features in the homes that might catch the public fancy. Though builders pay homage to the market, they actually seek to carve out unique niches for themselves in order to lessen the impact of market forces. To do so, they must try to keep up with shifts in consumer preferences. This process introduces a significant potential for change into the home building industry.

Builders and the Energy Standards

Energy conservation affects the building industry as a mraket force, as a state requirement, and as a markeing consideration.

The cost of energy has become a factor in the home purchase decision. According to Walker and Lee, added insulation is a popular option for many home seekers; however, the 1979 survey found the percentage of respondents willing to pay for it "lower than found in last year's survey". Other features, such as double-paned windows and solar water heating, would be chosen by less than one-third of the California respondents. Even though high, sloped ceilings increase heating/air conditioning bills, about 60% of the Southern Californians indicated that they would choose that feature in a new home. Thus, the current market seems to transmit mixed signals about energy conservation to California builders.

State regulations add another dimension to the industry's response to energy concerns. Title 24 standards impinge on all builders equally; none is alowed to cut prices by eliminating basic conservation features. Though some home buyers may not want to pay the increased first cost, builders can claim that they have no choice but to comply with the regulations.

Builders exceed the standards primarily for marketing reasons. Although a few builders may be motivated by an ideological commitment to saving energy, most of the industry would agree that "nobody does building for practice. You house people for profit."* [4] Conservation features become a sales tool for marketing to energy conscious

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* This section draws on in-depth interviews with 15 Bay Area builders, conducted by Dave Stover, under contract to LBL, during July 1980. My appreciation to Stover for his work and for his comments concerning builders' reactions to the standards.

consumers, and they serve as a means for product differentiation. Among large builders the motivation for exceeding state standards comes from a desire to establish a marketing posture and to create a unique image for their product. However, custom builders who feature conservation may be responding more directly to expressions of interest from clients.

Energy conservation seems to be a relatively minor concern for much of the home building industry. At the 1980 annual meeting of the Pacific Coast Builders Conference, Merrill Butler, president of the National Associaltion of Home Builders (NAHB), and himself a California builder, listed the principal issues facing the industry. Among them were morgage rates, government "over-regulation" (in sub-division planning), and problems caused by environmentalists and no-growth advocates. All came in for mention before energy. In fact, none of the builders we interviewed regarded energy conservation as their leading priority. All of them were concerned with the costs attributable to Title 24 regulations, estimated at between 2% and 5% of unit cost. Most builders felt that "adding one dollar is moving the house out of consumers' reach."

Custom builders and mass market builders have somewhat different orientations toward energy conservation. In the Bay Area, most custom home buyers want expanses of glass to take advantage of views. This may make trade-offs necessary to meet energy standards. Since custom home buyers are usually able to afford "extras", energy conservation beyond minimum standards may be largely a function of consumer awareness. As one builder put it, "the standards are low compared to market demand" and the builder will "do what people are conscious of." Mass market builders are conscious of having to meet state standards and have a tremendous interest in seeing that their projects move through the permit channels as quickly as possible. They need to keep prices low to qualify buyers. Therefore, large builders have an incentive to meet energy requirements in the simplest and least costly way (through fulfilling prescriptive requirements of the code). In this situation, energy conservation becomes a function of buiders' awareness of alternatives and their marketing motivations.

Most builders express generally negative attitudes toward government regulation. Invaribly they refer, as Merill Butler does, to "over-regulation". The prespective was most forcefully put in a full page advertisement in the San Francisco Chronicle by Builders For Affordable Housing, a joint communications program of the Building Industry Association of Northern California and the Construction Industry Advancement Fund. "The Northern California Housing Debacle" decried the "$6000 building permits": "What we don't need are more steps to the approval process. More paperwork. More obstacles. More schemes to force builders and new home buyers to subsidize low-income housing. More no-growth ordinances which force up the price of land."

The industry tends to regard energy standards as part of the same complex of government "over regulation" as land use controls, environmental constraints, and handicapped access requirements. Many builders feel that government agencies are wasting their time trying to regulate the industry with energy standards. They feel that market pressures will induce greater conservation efforts as the price consumers pay for

energy rises. Home buyers, motivated to cut energy costs, will then react as automobile customers have been reacting -- by turning to more efficient products.

The state's building industry is not of a single mind about energy standards. One portion fought Title 24 in the courts and still mutters about regulatory bureaucracy as a "cancer in the society". After the Superior Court affirmed the Energy Commission's authority to issue standards, even intransigent builders began to become aware of the need for compliance. Another portion of the industry, best typified by the Sacramento-based CBIA, has taken a more pragmatic approach toward state regulation. Rather than attacking the entire concept, the state home builders association has tried to modify standards to better reflect industry practices.

Builders reported problems with compliance for more than a year after the implementation of Title 24. One difficulty related to calculations. Echoing the reaction of building officials and architects, builders felt that the CEC's forms were unnecessarily complicated, and criticized the Commission for having "nobody who would accept responsibility for clarifying the standards." Even though most large builders sub-contract compliance calculations, they felt that "the state should be clear on what to do. You should not have to hire a consulting engineer to meet code." Another problem involved building officials. Home builders initially reported considerable delays in obtaining permits, and confusion among officials who went by the "book" but weren't quite sure what the "book" was requiring.

Many builders told of shortages of materials and equipment needed to satisfy energy conservation requirements. In the months after the standards went into effect, insulation was often in short supply. Some builders attributed the shortage to attempts by manufacturers to drive up prices. Finding HVAC systems that complied with the regulations was also troublesome. Builders reported that the supply of pilotless ignition furnaces, and water heaters, could not keep pace with demand for some time and that small furnaces were often difficult to find.

As builders and code officials have become more accustomed to the standards, and as more efficient equipment and adequate (albeit higher priced) supplies of insulation have become available, problems with meeting Title 24 standards have eased. The CBIA's Anderson claims that compliance is now "good"; most builders seem to have adjusted to meeting the requirements. Problems remain, however. Builders feel that the CEC is failing to reach the industry with practical informtion, and they still feel that Title 24 paperwork is excessive.

Builders see the need for better materials and equipment to meet the increased level of conservation likely to be required in the future. They ask for better insulation products to avoid having to use 2x6 framing, for double glazed windows that don't leak, or warp (as some current models do), and for a willingness on the part of local code officials to approve new energy saving products. Above all, they see a need for faster permit processing. Builders attribute only a portion of the delays to energy conservation checking, but they continue to seek ways to

expedite approval of their projects.

Large builders usually sub-contract with specialists to take care of compliance with some, or all, of the Title 24 regulations. By shifting responsibility to HVAC, glazing, or insulation sub-contractors, or to outside engineering consultants, builders try to minimize their involvement with Title 24. Thus, it came as no surprise to CBIA's Mark Anderson that a telephone survey coducted by the Contractors' State License Board found many builders uninformed about major portions of the regulations. The survey "asked rather technical questions about Title 24 (of) the contractor who was usually not the Title 24 specialist in the organization. It usually goes to the building designer or architect to get compliance forms filled out". Concluded Anderson: "Contractors will associate themselves with consultants -- it's a matter of survival".

However, small builders depend heavily on local building departments to help them meet the requirements. The local building office becomes a source of information, whether they like it or not.

Whenever a builder, intends to use electric resistance heating, manufacturers' representatives are more than happy to do the paperwork. Most builders regard the forms as "a big numbers game played with the local building department". Even so, builders seem less inclined to put electric heating in their projects since the regulations have gone into effect, due mainly to the added obstacles to permit approval. In fact, some builders admit to using heat pumps in areas where air conditioning is not normally included in homes, primarily because heat pumps are allowed by the energy regulations and electric heating is not.

Builders report some specific problems with local officials since the regulations went into effect. Changing interpretations of the standards have caused difficulties. They also have particular complaints about conflicts between Title 24 and other codes, notably fire code restrictions.*

Builders indicate that local departments now require more information on permit applications than they did two years ago. There are mixed feelings about whether these paper requirements actually translate into more thorough plan checking or inspection. Some builders conclude that longer waits for permit approval mean that building departments are conducting their reviews more carefully. "It used to take three days," said one respondent, "now it takes two weeks." Building departments now have time for careful checking because applications are down. The situation may change and practices may loosen, as soon as activity returns to normal.

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*However, most of those conflicts are resolved: "If they think insulation is more important than code, building officials go with that. Common sense in communications takes care of those things."

However, other builders don't believe that plans are being checked more thoroughly than they were in the past. "How careful can someone be who is not technically trained enough to see the ideas behind the regulations?" Longer permit processing times, in this view, may be attributed to lack of expertise rather than to more thorough review. Builders also have mixed reactions ragarding inspections. Some think that they have become more thorough since Title 24 went into effect; others maintain that it is an "individual matter", dependent upon the particular inspector. Some inspectors do a slipshod job; one builder noted that he has added windows without being detected by the inspector. From builders' reports, it appears that some departments and some inspectors are doing a more thorough job since the energy regulations went into effect, but the situation is by no means universal.

Most builders would rather have their sub-contractors handle Title 24 compliance, but when a tricky situation arises, even large builders report getting involved in negotiations with local code officials. In doing so, they commonly make use of several strategies. One is to get interpretations in writing, particularly when builders are faced with conflicting interpretations of the standards. Another means of dealing with officials is to seek agreement on important elements of the project before submitting a permit application. Large builders are likely to try a third approach -- if all else fails, protest to higher officials (e.g., the department director). Small builders report that in their case, "you can't afford to argue or you're losing money . . . There's no appeal because of the cost of time on the financing." For firms building on a large scale, the savings from some decisions may clearly outweigh the costs and make vigorous appeals worthwhile.

Few builders report major problems with meeting the standards. This probably results from a confluence of factors, such as shifting responsibility for compliance to sub-contractors, an ability to negotiate with local officials for "reasonable interpretations", and perhaps most important, the fact that the vast majority of homes are designed to meet the prescriptive requirements of the current code.

Many builders share the belief that Title 24 has contributed to energy savings. "In the past they were a hindrance," said a representative of one of the state's biggest builders. "Today the industry recognizes the merit of energy conservation. If they don't, they are out of business". Another large builder commented: "We wouldn't be doing some of the things we do now if it wasn't for Title 24, and we wouldn't have done them so quickly." A smaller builder noted that the "home buyer has become aware of the advantages" of conservation.

Despite these generally favorable comments, respondents also question the cost effectiveness of the energy regulations. One asks: "Will the average guy live in a house long enough to realize the costs? I question this, since people move so often in California." Another builder feels that he "cannot offset the economic cost with an economic benefit. If the CEC could show it was in every home buyer's interest, that would be something." In summary, builders seem to regard the regulations as effective in accomplishing energy savings, but not at a cost

commensurate with benefits.

Innovative Builders

Some builders are already including far more energy conservation in their homes than Title 24 regulations require. A growing number of developments are offering solar water heating as a standard or optional feature; other builders are incorporating passive design strategies to help minimize heating and cooling requirements.

In January 1980, the state Solar Business Office compiled a list of sub-divisions planning to use solar energy for either water heating or space conditioning. The list included 128 developments, ranging from Auburn in the northern part of the state to Chula Vista, near the Mexican border. Most of the activity centered in the southern part of the state; 46 of the sub-divisions were in the San Diego area, 50 in the Los Angeles region, 16 in the Central Valley, 2 in the Sierra foothills, and 14 in the San Francisco Bay Area. Development plans ranged in size from 6 condominium units in Santa Monica using active solar water heating to 400 single family homes in Los Angeles using passive water heating and space conditioning.[5]

Some of the state's largest builders are now entering the marketplace with very energy efficient homes. Among them are firms such as M.J. Brock, William Lyon, and the Presley Companies. New companies, such as Paintridge Development and Tandem Properties, have recently come into existence specifically to offer passive design homes. These builders, quite naturally, see a bright future for passive solar technology.

Many other builders are watching these innovators with interest. However, the industry as a whole still lacks a good feeling for buyer reaction to these homes. Brock, for example, finds it necessary to tell consumers that "the actual performance of your home will depend greatly upon your ability to live within the prescribed temperature range recommended by the United States Department of Energy and your desire to follow all of the homeowner participation requirements. This experimental energy home is designed to live up to our research findings. However, it is possible that computer simulations could be in error and your home will not perform as well as currently anticipated."

In order to increase product acceptability, the innovators have tried to design homes to look like their suburban neighbors on the outside and to incorporate features popular with buyers on the inside. An observer looking at Brock's Sundial or Paintridge's SunRidge would have difficulty distinguishing the homes from other new developments in the Sacramento area.

Builders do not regard the state's energy regulations as a motivation for innovation. As Mark Anderson commented, "Title 24 has been a disincentive to use electricity, not an incentive to use solar". In fact, the regulations may have created barriers for some innovative builders. "The alternative design methodology is a great disincentive to passive solar," says Anderson, who urges new procedures to encourage

energy conscious design. Firms now making a commitment to passive design share the Brock company's belief that they are on "the leading edge of a new technology that will evolve throughout the housing industry over the next decade." They are willing to take some risk to establish an image for marketing to consumers who are now looking for energy conserving homes, and to future buyers who will be increasingly concerned with energy costs.

Passive design requires a whole new way of thinking for the building industry. Energy considerations have to enter the design process at the very outset. Even most of the builders who currently construct houses that exceed Title 24 requirements now add energy conservation features onto their basic designs. They often use the analogy of the automobile: rather than designing a new engine, car manufacturers added pollution control equipment onto the internal combustion engine. By modifying the exterior envelope with added insulation or double paned windows, most builders are using the "more miles to the gallon" approach.

Builders are naturally reluctant to change their practices. They are still waiting to see whether consumers will accept passive design houses. Some are put off by state requirements for lengthy documentation of alternative designs. Other practical matters also figure into their evaluation of passive design. Available land in most of California is expensive. For economic reasons, builders try to get as many lots as possible out of a piece of ground. Some lots, however, cannot be given a southern exposure so useful in passive design. In that case, either lots have to be combined to give each the proper exposure, or a number of different design strategies have to be used in the subdivision. Both situations lead to difficulty for the builder.

Tract housing and multi-family housing depend on economies of repetition. An architect familiar with large scale projects pointed out: "If you remove repetition by having different passive measures for fractions of the units, you lose economy." With proper orientation, you can down size the furnace, but if instead of purchasing 50 of the same size furnaces, you have to get 30 of one kind, 10 of another, and 10 of another, the unit cost goes up." Thus, the fewer the lots, the more earth moved, or the greater the number of design variations, the higher the eventual cost is likely to be to the consumer. In the present economic climate, that worries builders.

Active solar water heating has been incorporated into a growing number of projects throughout California. Usually, the solar system is an add-on to the basic design, requiring few modifications in building practices. However, most respondents still approach active systems cautiously. They express concern about the technology itself, and about current installation practices. One large builder asked: "Can we put a product together and stand behind it with a warrantee?" Others worry about the amount of maintenance that might be required, and about difficulties in finding competent installers. These difficulties led several builders to conclude that solar water heating is "not there on the product development level yet." Even one builder who is committed to offering solar as an option on all his projects admitted that "the tax credit

is basic to the economics. Without it, it's shaky."

The Role of the Homebuilders Association

The CBIA, the California affiliate of the National Association of Home Builders, represents most of the major builders in the state. Its 5,000 member companies build about 70% of California's housing. The organization is actually a federation of six local groups, each predating the formation of the state-wide group. Local Building Industry Associations (BIA's) still maintain a great deal of autonomy.[6]

CBIA's office is located in Sacramento; its staff tracks legislation and coordinates the industry's political response. Other employees engage in research related to building practices, and provide valuable technical information for members. The organization also sponsors educational programs, foremost among which is the annual Pacific Coast Builders Conference (the nation's largest regional builders' meeting), where builders "take in sessions covering a multitude of subjects relating to dynamic new trends in homebuilding and construction as well as the largest product exposition in the West." In addition, CBIA organized seminars on a variety of subjects, ranging from energy to housing costs, throughout the year.

The organization has conducted a number of sessions dealing with active and passive solar construction as well as with compliance with energy conservation standards. However, as Mark Anderson notes, many of the attendees at CBIA seminars may not be members. "The contractor knows who to go to in order to comply, and that person will go to the seminar because his livelihood depends on it."

The CBIA has also tried to eductate home buyers to the advantages of energy efficient homes. In cooperation with the Energy Commission, it recently issued a pamphlet calling attention to energy saving features in homes, such as insulation, window and door placement, shading, thermal mass, and solar hot water systems. It pointed out that an energy efficient home is designed to "save you money in four ways": by needing less energy, by using more efficiently the energy it does need, by taking energy from the climate to provide as much heating and cooling as possible, and by requiring smaller, cheaper, auxiliary heating and cooling systems.[7]

A recent CBIA policy statement emphasized that the key to building affordable, energy efficient housing is the notion of balanced design: "Balanced design recognizes that the builder/designer is best equipped to choose the 'package' of design features which optimizes energy savings and first costs." Trade-offs are essential for builders seeking to meet site specific condiditions in the most cost effective manner. The CBIA urged that guidelines, whether mandatory or advisory, be based on design energy budgets which realistically weigh life-cycle costs, increased first costs, technological feasibility, and the difficulty of enforcement.

The CBIA urged the development of two paths to compliance: One could be based on a performance estimate using either computer based design tools (such as DOE-2), or an alternative calculation method; the other would consist of a point system which would allow builders to develop their own energy conservation package from a 'menu' of features.

Support for a design budget approach represents a significant change in CBIA's thinking about energy conservation. As Mark Anderson noted: "The state of the art is more advanced than in 1976, when the Energy Commission started to develop standards. The industry has changed. It is somewhat more capable of adapting to performance standards now. It is important that a shift to a new type of standards takes place. The performance approach gives the designer freedom to come up with the least costly energy package that complies with the regulations. With housing costs going up . . . producing an energy conservation package with the least front-end costs to the buyer is important."

Guided by the experience of some large builders who have developed very energy efficient homes, the CBIA has come to weigh the advantages of flexibility in the design budget approach more heavily than the predictability of prescriptive standards. Not all builders can be expected to agree with the new attitude. CBIA sees itself as providing leadership for the industry without getting so far out ahead of its more recalcitrant members that it brings about a backlash.

Although CBIA may not be enthusiastic about state standards, it seems willing to accept "reasonable" regulations. Its staff keeps in close contact with the Energy Commission to make sure the industry can live with new regulations that are being developed. However, many builders still scorn the California approach and point to the private market as a better means for achieving energy conservation. "Americans are getting tired of the Big Brother attitude that tells them what foods thay can eat, what their children can watch on television, whether or not they need air bags in their cars," says National Association of Homebuilders president Merrill Butler. "NAHB has been in the forefront of consumer protection. In 1975, we established the Home Owners Warranty (HOW) program which offers the first 10 year home buyer protection plan in the U.S."[8]

Some builders think HOW offers a means to promote conservation without burdensome government regulation. HOW programs are run through local affiliates of the Building Industries Association. In California, only the San Diego group currently offers the program; the other five BIA's according to a HOW spokesman, are "studying it". Builders who qualify for the program buy insurance at a cost of $2 per $1000 of the home's value, and pass the expense of the policy along to the buyer.

To join the program, builders agree to meet applicable construction standards, basically those set by the local building codes. The warranty covers the home's first 10 years: during the first year, the builder warrants against defects caused by faulty workmanship or materials; in the second year, builders' exposure tapers off to coverage of the major systems (electrical, plumbing, HVAC); then, for the next eight years, the insurance company protects the buyer against major structural

defects. Disputes between buyer and builder are handled through a system of conciliation and arbitration, which seems able to substitute for costly court proceedings in nearly all cases.

Although the current HOW plan doesn't cover energy conservation, a program modeled along similar lines could. Homes could be required to meet some established standard, set either by an insurance company or by a state guideline. Proponents of warranties argue that such a system would allow buyers to be sure that energy saving features would be built into their homes without the high cost or intrusiveness of state standards. A voluntary program would produce the amount of conservation that buyers were willing to pay for.

The idea of replacing standards by warranties raises serious problems. The housing field would then be open to "cost cutters" who might leave out all conservation features in order to qualify the greatest number of potential buyers. The result might be a situation in which a significant share of the new homes would include few energy saving measures. Ironically, those houses would most likely be sold to people least able to meet the increasing cost of energy.[9]

UTILITY-SPONSORED CONSERVATION PROGRAMS

STATE UTILITIES HAVE ALSO BEEN INVOLVED IN EFFORTS TO IMPROVE ENERGY PERFORMANCE OF NEW HOMES. IN 1976, PG&E STARTED MAKING AGREEMENTS WITH BUILDERS WHO PLEDGED TO INCLUDE IN THEIR HOMES MORE CONSERVATION FETURES THAN REQUIRED UNDER STATE OR FEDERAL CODES.

THE ENERGY CONSERVATION HOME PROGRAM (ECH) IS BASED ON A POINT SYSTEM BY WHICH CONSERVATION MEASURES ARE RATED ACCORDING TO POTENTIAL ENERGY SAVINGS. BUILDERS MUST AMASS AT LEAST 50 POINTS TO QUALIFY FOR REBATES. THE 1980 VERSION AWARDS POINTS FOR MAJOR APPLIANCES, SPACE HEATING/COOLING, WATER HEATING, WEATHERIZATION, FIREPLACE EFFICIENCY, LIGHTING, PASSIVE AND ACTIVE SOLAR DESIGN FEATURES.

UTILITY STAFF MEMBERS REFER TO THE PROGRAMS'S RELATIVE SIMPLICITY AND POSITIVE PERCEPTIONS BY BUILDERS. THE PROPORTION OF UNITS QUALIFYING FOR PG&E'S ECH HAS GROWN FROM 6% IN 1976 TO 60% IN 1980. BUILDERS SEEM TO LIKE THE ECH IDEA, BUT MEASURES BUILDERS CHOOSE TO GAIN POINTS MAY NOT BE THE MOST COST EFFECTIVE ENERGY SAVERS.

PG&E RECENTLY STARTED PROGRAMS TO ENCOURAGE BUILDERS TO USE SOLAR ENERGY. IN 1979, THE COMPANY BEGAN ITS SUNTHERM PROGRAM, OFFERING CASH INCENTIVES FOR SOLAR DESIGN FEATURES.

A POINT SYSTEM SIMILAR TO PG&E'S FIGURES INTO A MORE COMPREHENSIVE APPROACH BEING FORMULATED BY THE STATE PUBLIC UTILITIES COMMISSION. IN FEBRUARY, 1980, A DRAFT DECISION BY THE PUC ELIMINATED LOAD PROMOTING ALLOWANCES AND PROVIDED CREDITS FOR BUILDERS WHO INSTALL CONSERVATION FEATURES BEYOND THOSE MANDATED BY LAW. THE PROPOSALS RAISED A STORM OF PROTEST FROM THE INDUSTRY; THE PUC SCRAPPED THE ORIGINAL POINT AND IS DEVELOPING A MORE ACCEPTABLE SYSTEM OF CREDITS.

THE ECH PROGRAM AND LINE EXTENSION CREDITS CAN FUNCTION AS COMPLEMENTS TO STATE STANDARDS, BUT THE POSSIBILITY FOR CONFUSION BETWEEN STATE AND UTILITY STANDARDS IS GREAT UNLESS CREDITS ARE CAREFULLY COORDINATED WITH THE CEC'S STANDARDS.

The Energy Conservation Home Program

Since the mid-1970's, a number of the state's utilities have also been involved in efforts to improve the energy performance of new residential construction. In 1973, PG&E began a Model Home program to demonstrate energy saving measures. Three years later, the company started to make agreements with builders who pledged to include more conservation features than required under state or federal codes. The Energy Conservation Home (ECH) program, according to one staffer, "promoted things not required by codes. At the origin we were promoting insulation. As measures were required, we deleted them from the program. The focus is on opional energy efficient measures."

The ECH agreement is based on a point system. PG&E rates conservation features according to potential energy savings; one point is allowed for each three therms of gas or 30 kilowatts of electricity saved. Builders must amass 50 points per dwelling unit to qualify for the rebate; PG&E pays the builder $2 per point exceeding 50 points ($150 maximum per unit and $15,000 maximum per project) to offset costs for conservation devices and systems installed in each qualifying dwelling. In addition, one point is allowed for each 2,000 gallons/year of water savings.

The 1980 version of the program awards points under eight headings: major appliances, space heating/cooling, water heating, weatherization (caulking, weatherstripping and insulation), fireplace efficiency, lighting, passive solar design features, and active solar design features. The agreement clearly indicates that points "will not be allowed for features mandated by state or federal codes", but it does allow "other conservation features in lieu of those listed" subject to PG&E verification and approval. One staff member commented: "The builder is best able to determine the most cost effective mix of alternatives for that project. The mix will vary from builder to builder. We don't say you have to do this or that. All we say is accomplish a certain improvement in the house -- an improvement in performance over the code."

Although the company has not publicly compared the ECH approach to the Title 24 standards, utility staff members seem to have little doubt that their approach is preferable. One commented that: "In contrast to Title 24, the ECH program is relatively simple. It is explained to builders by our marketing representatives. It involves the builder who voluntarily chooses an option rather than being required to do something." Another PG&E staffer adds: "We're perceived to be the good guys helping the builder, while the building official enforcing standards is perceived to be the bad guy."

In the ECH program, the builder initially signs an agreement with PG&E to include certain measures in his homes. When the project has been completed, the builder writes a letter stating that he has complied with the original agreement. The PG&E representative may make spot checks to verify compliance. If the builder failed to include some agreed-upon features, incentive payments would be witheld and he would not be able to display the ECH advertising. However, according to a

PG&E staffer: "In every case where there was an omission, the developer was contacted by letter, and subsequently corrected the problem. It usually turned out to be a sub-contractor's error. For energy conservation items that the representative can't see, order forms can verify if the developer paid for the items." As a result of this proceedure, PG&E feels "pretty confident that builders have actually put in the features that they said they were going to."

The proportion of units qualifying as energy conservation homes has grown rapidly. In 1976, ECH connects were only 6% of PG&E's total. The following year the figure rose to 20%, 37% in the year after that, and 55% in 1979. 1980 data show that 60% of the homes in the PG&E service fall under the ECH program.

Builders' Reactions to ECH Program

Builders seem to like the ECH idea. An evaluation by the PG&E Research and Analysis Unit in April 1979, found "a high level of awareness for the program among homebuilders in Northern California", and also noted "very favorable" attitudes toward the program among the builders.[1] About 40% of the randomly selected set of respondents were building ECH units, or had previously been involved with the program.

Nearly half the participating builders felt that the program "helped them sell homes". PG&E stimulates the program through advertising", one staff member noted, "and that provides a marketing tool. Certification as an Energy Conservation House makes the house more saleable . . ." Two thirds of the builders indicated that they had seen or heard advertising for ECH, and nearly all (94%) thought that "this advertising would have a positive effect on home buyers".

Nearly 30% of the builders not already involved in the program thought that they might participate in the future. Builders who would not consider the ECH program gave two main reasons -- either the expense of the program (extra conservation features that had to be included in the home) or because their homes were designed to suit individual clients. The PG&E analysts suggested that "more effort be placed on publicizing the return on investment aspects of the energy savings features", as well as on the "very favorable reaction" by homeowners to lower utility bills in ECH dwellings.

Over four-fifths of the builders participating in the program gained points for chimney/fireplace closure, fluorescent lighting, high efficiency appliances and water heaters. Only about 60% included insulation above the R-19 ceiling, R-11 wall level. And approximately one-third of the builders chose to provide double paned windows when not required to do so. This ordering suggests that measures builders choose to gain ECH point may not be the most effective energy savers. Builders in our survey gave some additional examples of problems with the point system. One thought that "gimmicky" items such as microwave ovens might actually add to the load. Another questioned the cost effectiveness of automatic thermostats; in his experience, most homeowners switch the setting to manual and could be easily satisfied with a less expensive thermosat.

PG&E recently started another program to encourage builders to use solar energy. Its Residential Solar Technology Demonstration constructed nine homes throughout Northern California, from Ukiah to Fresno. More than 170,000 people visited the homes before they were sold; PG&E is now monitoring each home's performance. In 1979, the company began its Suntherm program, which requires builders to meet tight energy conservation standards and to provide from 50% to 75% of the remaining energy needed for space and water heating through solar design features. The builder is offered a cash incentive of $500 to $1000. It is estimated that "the Suntherm Home will cost about $5,000 more to buid than a comparable conventinal home, but many will, in addition to the PG&E incentive payment, qualify for substantial state and federal tax credits."

A PG&E representative indicated that the utility wants to "focus on replicability. So we will work with large scale builders to become more visible in the eyes of the public." The first Suntherm Home, built by M.J. Brock & Sons, in Sacramento, was dedicated in the fall of 1980.

PUC Approach

A point system similar to the one PG&E developed for its ECH program figures into a more comprehensive approach to energy conservation in new homes now being formulated by the state Public Utilities Commission (PUC). "In the days of declining marginal cost of new electric plants or additional gas supplies," says Commissioner John Bryson, "it seemed to make sense for utilities to promote increased demand, and so the CPUC authorized them to provide substantial 'free footage' allowances for new consumer connections, varying directly with the anticipated new load. The Commission's current reforms are intended to eliminate incentives for consumption and replace them with inducements to conserve energy."

In a preliminary decision in February 1980, the PUC eliminated load promoting allowances and provided credits for builders installing conservation features beyond those mandated by state law. The basic allowance for electric extensions was eliminated and allowances for residential gas extensions were sharply reduced. Incentive payments of $2.50 per point for saving a unit of gas or electricity (up to a maximum of $520 per home, or twice that amount in areas not served by natural gas mains) were proposed.

The PUC's proposals raised a storm of protest from the building industry, as well as from organized labor and agricultural interests. They maintained that the cost figures used in developing the point system were out of date, and they also questioned whether credit should be given only for items not mandated by law. As a result of hearings in July, the Commission scrapped the original point system. It is now in the process of pinning down costs and developing a more acceptable system of credits.

The ECH program and line extension credits can function as complements to state standards. Both are based on credits for features over and above those required under Title 24. Incentives are attractive

because cost effective conservation measures currently out-strip state standards. Should the Title 24 requirements be tightened, as the Energy Commission intends, competing programs may cause considerable confusion for the industry.

One PG&E staffer suggests that: "In the future it is likely to become difficult to get 50 points, so the ECH program may fade away. As energy standards become stricter, there is less need for an ECH program." In this event, the concept may find application in retrofitting houses. But line extension credits are another matter. Builders could conceivably be caught between conflicting standards from two state agencies, one enforced by building officials, and the other by the utilities. The possibility for confusion is enormous unless line extension credits are carefully coordinated with the CEC's new standards.

A point system for line extension credits may even be considered as an alternative to the current mode of enforcing standards. Utilities, under PUC guidance, could check to see whether measures were actually included in houses built under the program's guidelines. However, that would place the utilities in the uncomfortable role of standards enforcers. Now, PG&E and other companies with ECH programs are seen as the "good guys", helping the industry; they would certainly not relish taking over the building officials' responsibilities, nor the building officials' image. Utilities would undoubtedly argue that they have neither the staff nor the expertise to get into the conservation enforcement business.

UPDATING THE RESIDENTIAL STANDARDS

THE CEC IS REQUIRED BY LAW TO PERIODICALLY REVIEW AND REVISE ENERGY STANDARDS. CEC'S BUILDING STANDARDS COMMITTEE HELD A SERIES OF WORKSHOPS TO GATHER PUBLIC TESTIMONY WHILE STAFF COLLECTED AND ANALYZED DATA. PROPOSED STANDARDS, ISSUED IN SEPTEMBER 1980, WERE CONSIDERABLY TIGHTER THAN THE CURRENT TITLE 24 REGULATIONS.

ONE PART OF THE PROPOSAL IS BASED ON AN ENERGY BUDGET APPROACH; CEC STAFF ESTABLISHED BUDGETS FOR THREE DIFFERENT BUILDING TYPES AND 16 CLIMATE REGIONS. EACH BUDGET CONTAINS TWO COMPONENTS -- THE MAXIMUM AMOUNT OF ENERGY THAT CAN BE CONSUMED FOR HEATING AND COOLING, AND THE MAXIMUM ALLOWED FOR WATER HEATING. TRADE-OFFS BETWEEN THE TWO COMPONENTS ARE ALLOWED.

BUILDERS CAN MEET THE REQUIREMENT BY SHOWING COMPLIANCE WITH THE ENERGY BUDGET, USING CEC APPROVED CALCULATION METHODS, OR THEY CAN FOLLOW A PRESCRIPTIVE SET OF MEASURES DEVELOPED FOR THEIR CLIMATE ZONE. IN ADDITION TO PRESCRIPTIVE AND PERFORMANCE STANDARDS, THE PROPOSAL SPECIFIED MANDATORY FEATURES FOR ALL NEW RESIDENTIAL BUILDINGS. APPLIANCES INSTALLED IN NEW RESIDENTIAL BUILDINGS WERE REQUIRED TO COMPLY WITH CEC EFFICIENCY STANDARDS.

AT PREHEARING WORKSHOPS, STAFF'S RECOMMENDATIONS CAME IN FOR CONSIDERABLE CRITICISM. THE MOST IMPORTANT POINTS CONCERNED SELECTION OF WEATHER ZONES, MANDATING SOLAR HEATING, CALCULATIONS OF COST EFFECTIVENESS, THE ROLE OF ELECTRIC HEATING, DIFFICULTIES WITH GLAZING PROPOSALS, PROBLEMS WITH BUDGET FIGURES, ENFORCEMENT, AND POSSIBLE ALTERNATIVES TO THE STANDARDS.

AFTER THE HEARINGS, STAFF RE-WORKED ITS PROPOSAL. IN APRIL 1981 STAFF PROPOSED A REVISED SET OF REGULATIONS. AMONG THE MAJOR CHANGES WERE WEATHER ZONES CORRESPONDING MORE CLOSELY TO CLIMATE AREAS, THREE ALTERNATIVE COMPONENT PACKAGES, MANDATORY MINIMUM CEILING AND WALL INSULATION, CONSIDERABLY LOWER ESTIMATED COSTS, AND PARED DOWN ENERGY SAVINGS.

THE EARLIEST POSSIBLE IMPLEMENTATION DATE IS JULY 1982. CEC REALIZES THAT PROBLEMS WITH COMPLIANCE ARE LIKELY WITH NEW, STRICTER REGULATIONS. IN ORDER TO SMOOTH IMPLEMENTATION, THE COMMISSION INTENDS TO CERTIFY A SIMPLIFIED CALCULATION METHOD, DEVELOP HANDBOOKS, CONDUCT "TRAIN THE TRAINER" SESSIONS, ESTABLISH COMMUNITY COLLEGE COURSES IN BUILDING ENERGY STANDARDS, SET ASIDE A FUND FOR MONITORING ENFORCEMENT, AND PROVIDE QUICKER INTERPRETATION FOR LOCAL ENFORCEMENT OFFICALS.

The CEC's Standards Revision Proposal

The Warren-Alquist Act requires the Commission to "periodically review the standards and adopt such revisions as in its judgement it deems necessary". CEC's 1979 Biennial Report specified stronger sstandards for new buildings as a major step "to insure that the state moves toward an acceptable energy future". The new standards were to "incorporate active and passive solar design, encourage the use of natural gas as a cost effective substitute for some uses of electricity, and recognize the need to shift peak demand through load management as well as to reduce demand . . . "

The CEC's Building Standards Committee, then chaired by Commissioner Ron Doctor, held a series of workshops to gather public testimony conerning revision of the standards. At the same time, staff collected data, developed analytic assumption, let technical contracts, and modeled various combinations of energy conservation measures. In September 1980, after nearly a year of work, staff published its proposal for revised standards together with a series of reports detailing its assumptions and analysis.

Unlike the situation which occurred in the earlier round of standards development, staff worked independently of the Commissioners. An Advisory Committee, composed of representatives from the industry, provided information about the impact of alternative measures. However, the advisory group made none of the actual decisions about measures to be included in the recommended standards leading to charges that concerns articulated by its members had been ignored.

The proposed standards were considerbly tighter than the current Title 24 regulations. More energy conservation measures are now cost effective than at the time the original standards were developed in 1977: "These standards have been developed to reduce the energy required to heat and cool new homes to less than 20% of the energy required by new homes built prior to 1975. In addition, the standards are designed to reduce the energy required to heat domestic hot water to less than 50%, and the energy required for permanently installed lighting to less than 40% of the pre-1975 home. Homes built to these standards which are operated correctly will save an estimated 280 billion kwh of electricity and 25 billion therms of natural gas statewide by the year 2000. Energy savings of this magnitude would result in energy cost savings of approximately $30 billion. Also, the electricity savings would be expected to reduce California's need for power plant capacity by approximately 4900 MW in the year 2000, the equivalent of about 5 typically sized coal or nuclear power plants. (Although staff recognized that) these benefits are not free . . . their costs are excellent investments . . . The standards would cause an initial increase in the cost of the pre-1975 house of between $5,000 and $8,000. However, this added initial cost will be paid back quickly through reduced energy bills and tax credits"[1]

The proposal had several parts. One was based on an energy budget approach. The CEC staff established budgets for three different building types (single family detached, single family attached, and multifamily) for each of the state's 16 climate regions. The budget

contained two basic components -- the maximum amount of energy for heating and cooling (expressed in Btu's/square foot) and the maximum allowed for water heating (expressed in Btus/dwelling). The proposal allowed trade-offs between the two components.

Builders could meet the requirements by showing compliance with the energy budget, using calculation methods approved by the Energy Commission, or by following a prescriptive set of measures deemed to meet the standards for each climate zone.

In addition to prescriptive and performance standards, some mandatory features for all new residential buildings were proposed -- a dual setback thermostat, duct insulation, weatherstripping and caulking to limit infiltration, fireplace doors and outside combustion air intake, efficient lighting, insulation wrapped around water heaters and around pipes from the heater, and appropriately sized furnaces. The standards also required that any appliances installed in new residential buildings had to comply with the Energy Commission's appliance efficiency standards.

Issues Raised During the Standards Revision Hearings

The Commission's Building Standards Committee held pre-hearing workshops in November to receive comments about the staff proposals. In January, it conducted four days of hearings -- two in Los Angeles and two in Sacramento. At those meetings, the staff's recommendations came in for considerable criticism. The most important points concerned selection of weather zones, mandating solar water heating, calculations of cost effectiveness, the role of electric heating, difficulties with glazing proposals, problems with budget figures, enforcement, and neglected alternatives to the standards.

In order to minimize enforcement problems, the climate zones "generally correspond with county boundaries." However, in some areas, weather fails to correspond to administrative lines. Charles Eley of the CCAIA pointed out that the staff's proposal would create hardships: "In San Diego County, 4,000 Btu/ft^2 applies in all areas, while in Imperial County the budget jumps to 7,000 Btu/ft^{u2} -- but the climate in eastern San Diego County is similar to Imperial County's" and very dissimilar from coastal San Diego locations. As a result of the hearings, staff changed the weather zones, but that leads back to the enforcement problem the proposal intended to avoid -- varying requirements within the jurisdiction of a single building department.

The draft standards included solar water heating systems as part of the component package in all weather zones. CBIA questioned the costs used to justify solar domestic hot water, claiming that their own survey of established solar firms showed significantly higher figures. A number of builders in the LBL survey indicated that they opposed mandatory solar. "At this point," said one, "we would probably fight it tooth and nail." Many builders are concerned with finding competent installers for solar, added first costs, and especially about system reliability. Most builders feel that the "bugs" should be worked out

before the state mandates solar.

The Warren-Alquist Act specifies that "the standards be cost effective when taken in their entirety, and when amortized over the economic life of the structure when compared with historic practice." The Commission staff has interpreted the requirement to mean that the combination of envelope, lighting, and water heating measures must be cost effective when compared to a pre-1975 building. Marginal costs were used to justify the component packages and the budget levels. However, the CBIA took exception to many aspects of the life-cycle cost analysis; it questioned utility prices, the inflation and discount rates, and the costs of various conservation measures.

A number of witnesses went even further, challenging the operative assumption behind the language in the Warren-Alquist Act. Alan Wicks, former technical director of SMACNA, urged the Commission to: Avoid regulations that disrupt the construction industry without saving energy for the consumer. (The regulations) should aim for the bottom of the cost curve, not for some arbitrary point to the left where the Commission thinks it should be." In this view, each component measure ought to be cost effective by itself.

The resistance heating industry already feels at a disadvantage under existing state energy regulations. Art Schwartz, speaking for the electrical industry trade association, commented: "The CEC has put electric heat into a solitary category. Electric heating should not be the sole heating source for which a life-cycle cost (analysis) has to be done." With the proposed revisions, industry people feel that they may be forced out of the new home heating market in California entirely. "We have not tried to capture the entire heating market", says Schwartz: "All we ask is a fair chance to capture that share of the market that can use electric heating."

The electric heating industry criticizes the CEC for failure to realize that its product can be cost effective in certain situations (e.g., small square footage, low heat loss, where natural gas is not available, and in colder regions where heat pumps perform poorly). The advantages of zonal control with electric heat were also cited. Industry representatives urged the commission to include electric heating in a component package by which builders could comply with the standards. Manufacturers of radiant heating went one step further, urging the Commission to establish a separate category for their systems.

The staff's glazing recommendations came in for criticism on several grounds. A requirement for 50% south facing glass may be impossible to achieve in some areas, and even where it is possible, such a standard creates difficult design problems. Santa Barbara architect Larry Thompson notes: "The (component) standards compromise the ability of the designer to create openness. If 50% south glass is applied, it puts the pinch on other uses of glass. You might even have to go below the 10% glass specified in the Uniform Building Code". In densely developed, built up, urban areas such as San Francisco, the requirement may make building virtually impossible without expensive trade-offs against other elements of the design.

The window industry may not be able to meet the proposed standards within the Commission's time limit. One representative of an aluminum window company claimed: "Dual glazing manufacturing companies are not in a position to handle this requirement this fast. The availabilty of dual glass in California (and) the technology (is) not developed for triple glazing in the state." Another expert cautioned the Commission about trying to change window and door designs all at once: "Most manufacturers would have to redesign their window line to meet the .5 (insulating) requirement. It should be possible to trade off so that some windows can exceed the requirement and others don't have to meet .5. Otherwise, it would be enormously difficult for the industry."

The staff's proposed energy budgets included both heating and cooling in all areas of the state except for the extreme north, the Sierras, and a portion of the coastal area from San Francisco south to Monterrey. "The combined budget is a little bit questionable," said Earl Ruby of CBIA. "The Commission is concerned that builders will use all of the budget for heating and then stub in an air conditioner for after-market air-conditioning." In addition, hot water budgets may be very much out of line with the actual needs of occupants of different sized houses. Should the same requirement apply to a childless couple in a two bedroom house as to a family in a four bedroom house? Perhaps, several comments suggested, the level of consumption ought to be based on some measure of occupant load (e.g., the number of bedrooms in the house).

Building officials and members of the industry share the feeling that performance based standards will pose more difficult enforcement problems than the current Title 24 standards. Earl Ruby noted: "Neither money nor time has been allocated adequately to train the building officials or to train the building industry. The cost of increasing the building department staff has not been addressed . . . " Building officials contacted by CALBO shared similar concerns. One wrote: "It is not reasonable and nearly impossible to expect the construction industry and the building departments to comply with what has been written . . . We have made every effort to comply with the existing regulations. I am in favor of energy conservation, as is my local governing body, but we can only go so far. If you would like to try and enforce this set of rules in our jurisdiction, I hope you have the staff available".

Several officials indicated that enforcement of the staff's proposed standards would require substantial additions to their staffs. One estimated that "plan checking will be more detailed, thus more time consuming than before, requiring the addition of one more electrical and one more mechanical plan check engineer. Enforcement in the field, having never been required by mandate before, will necessitate increasing field inspection staff by seven positions." Tony Nisitch, Sacramento County's building department head, estimated a 50% increase in plan checking and a 25% increase for inspection staff to enforce the proposed standards, at a cost of $500,000 (between $50 and $100 for each single family tract in the area). The CALBO Advisory Committee closed its compilation of comments by warning, "If these standards are adopted basically as they are written . . . local building officials may recommend to their governing bodies that they join with similarly affected jurisdictions in combatting the state mandation of the proposed regulations".

Don Terner, head of the state's Housing and Community Development Department, made an impassioned plea for the Energy Commission to consider the economics of remodeling older housing. He and other witnesses understood the staff proposal to require owners to bring entire buildings up to the level of the regulations when they undertook any substantial work on the property: "You can't put fire escapes and sprinklers up unless you triple glaze and bring them up to the energy standards. People don't dare to make modifications because they trigger an all or nothing mentality." Staff tried to assure Terner that the regulations would not require "things not applicable to the change (to) be done." However, he still maintained that another alternative might be preferable to the proposed regulations: "For existing buildings, the only thing that makes sense (is to) budget (energy) users to cut down or charge very high rates . . . The entire philosophical basis of standards focuses on a technical fix. It is people who have to be budgeted, not buildings . . . Give people the option of saving energy in all ways . . . they might be able to save as much heat by other means than triple glazing."

Another participant suggested an alternative based even more closely on a market approach. In his view, permits should record the energy budget for the unit; that would become "part of the permanent record of the property". When the owner decided to sell, potential buyers would know about the energy design, and about actual consumption from utility bills. "Then everyone would struggle to crete energy efficient buildings." With such low budget numbers (as the Commission staff suggested) "nobody will live with it. The budget numbers and the real world are disconnected."

The Process for Changing the Standards

After the round of hearings, staff took the public comments and looked closely at the proposed standards. Several months later (April 1981), it came back with a revised set of regulations. Among the major changes were:

* Weather zones corresponding more closely to climate areas rather than to political boundaries.

* Three alternate component packages (for each of the 16 zones) instead of one. One of the packages is based on a passive solar design, another on inclusion of an active solar water heater, and the third (corresponding to the original prescriptive alternative) on a high insulation approach.

* Minimum ceiling and wall insulation is now included in the mandatory portion of the standards.

* Estimated costs are considerably less than the previously cited $5,000 to $8,000. The staff estimates that the passive alternative for Fresno will now cost $2,189, and for San Diego, $534 over the cost of a house built to current Title 24 standards. The active solar home in Fresno is estimated to cost $4,879 more than present

practice.

* Energy savings have been pared down. The revised standards are now expected to save 60% of the energy for space conditioning, 60% for lighting and 12% for water heating.

The full Commission will hold adoption hearings upon receipt of the Committee's recommendations and then send new standards on to the State Building Standards Commission (BSC) for approval. The newly formed Commission is charged with eliminating duplication and resolving conflicts in the state's codes. If the BSC approves the standards, they will become effective upon publication in the Building Standards Code annual supplement. The earliest possible date for implementation is July 1982.

The Commission realizes that problems are likely to occur when its new and stricter regulations go into effect. CEC intends to certify a simplified calcualtion method at the time the standards are issued. Staff has proposed that a method, based on its Passive Solar Handbook, be used to demonstrate compliance with the standards. Since the method has the "capability to model both heating and cooling energy" and to model "conservation and solar options available to the building designer", it would be able to estimate the effects of "tightening and insulating the building envelope (conservation) and using the building itself for diurnal thermal storage (passive solar)". In addition, staff proposes to develop handbooks to "help the industry comply with the requirements of the standards".

The Commission also plans to conduct training sessions for building officials and for members of the industry. Unlike its earlier approach, however, staff will be training the trainers, rather than attempting to reach the entire industry by itself. Staff proposes to conduct 26 training sessions "for building officials, which include instruction in both plan checking and field inspection requirements. Sessions are planned for designers and builders through trade organizations. Persons attending these sessions would then train their colleagues."

The Commission has already approved a $93,800 contract with CALBO for development of a comprehensive training program concerning Title 24 standards, and it has arranged with the state's community college system to establish two courses relating to the building standards. The courses will allow people coming into building departments or into the industry to become familiar with the regulations.

The CEC has increased its own staff working on implementation. It has set aside a fund to monitor enforcement of the building and appliance efficiency standards. The Commission also passed (April 8, 1981) a resolution designating the Executive Director as "the person responsible for proposing interpretations regarding building standards". Although interpretations will be placed on the consent calendar "and ratified by the Commission prior to issuance", the new procedure should provide less confusion for local enforcing officials.

LESSONS FROM THE CALIFORNIA EXPERIENCE

California's Title 24 standards have undoubtedly saved more energy than the market alone would have conserved over the past two years. After some initial problems, compliance with the residential standards has been fairly good. The Energy Commission is the only agency to give compliance a numerical rating; its 60% estimate (1980) may even be on the low side for new residential construction.

However, there have been a number of problems attending the effort to implement energy conservation standards. Some problems are probably inherent in any large scale regulatory effort (e.g., resistance from parts of the industry, cheating, difficulties in communication, some incompetent enforcement), but other problems seem amenable to correction, given the necessary resources for enforcement.

Implementation difficulties occurred in starting up the program and information dissemination. Local enforcement practices proved variable, and ambiguities in the standards created special problems for building officials.

Start-Up Problems

The BCA lawsuit delayed implementation of portions of the standards for more than two years. The Energy Commission was forced to issue corrections immediately after the regulations went into effect. A certain measure of confusion occurred throughout the building industry, and an impression that the Commission was changing its standards too often

gained currency. Many local officials were unclear about the regulations for at least the first several months, contributing to initially lax enforcement. Since training programs were usually geared to manuals prepared for the original standards, the suit also created problems for the Commission's effort to educate the industry.

The Energy Commision rushed to pass standards under the spur of a tight legislative deadline. The technical nature of the issues, and the fact that standards would have a substantial impact on established practices, largely precluded much public participation. Throughout the code writing process, most of the pressure to modify the regulations came from the industry. However, local building officials, who were expected to enforce the regulations, played almost no part in their development. Neither CALBO nor the industry were able to direct the content or the pace of regulatory change, in maked contrast to the situation for changes in other building codes. The process left a residue of bitterness among those who were expected to comply with the regulations.

The CEC's efforts to educate the industry about Title 24 regulations can only be regarded as partially succesful. Many building departments failed to attend training sessions sponsored by the Commission. Although all the large departments reported sending someone, about 30% of the small departments responding to our survey admitted that none of their members attended. It was simply not possible for the Commission or for building departments to pay for release time to allow all those who needed training to attend.

Many of those who attended were not enthusiastic about the instruction they received. Commonly they complained about a lack of practical

examples; participants desired "more application and enforcement than economics." Too much material was crammed into one or two lengthy sessions. Some participants felt that instructors were not able to answer questions clearly and definitively. Nearly every session included officials with varying levels of sophistication (from licensed engineers to high-school educated tradesmen), making instruction difficult. Since the effort was put together hurriedly, the Commission was unable to send material out in advance, making the sessions less effective than they might have been.

Building officials and architects both considered training from their own organizations (CALBO and CCAIA) as more helpful than that received from the CEC. But Commission staff felt that the industry was slow in responding to the need to train its own members. If the Commission had not organized sessions, training would probably not have been offered at the time standards went into effect. All parties agree that training should have been offered well before the effective date of implementation, and that there is a need for an ongoing training program.

Information Dissemination

The Commission tried to assist the industry in a variety of ways -- by preparing manuals to aid designers of residential and non-residential buildings, through staff interpretations of the regulations, and by a regular newsletter.

The manuals were confusing to most of the industry; they were loaded with technical information, and not focused enough on common

applications. Staff interpretations of the standards also came in for criticism. Many building officials found difficulty in obtaining consistent, timely, or definitive interpretations of the regulations. Energy Commission staff tried hard to help local officials, but only the Commission could make binding interpretations, and that required a procedure involving notification, hearings, and findings. What seemed to building officials as as inability to give clear answers may have been partially a function of the CEC's structure for making decisions. The newsletter, especially the section in which staff answered common questions from the industry, was a helpful source of information for nearly all building officials. But they were troubled by the fact that answers appearing in the Blueprint were still not official responses from the Commission.

The private sector reported other gaps in the Energy Commission's efforts to provide information. Most architects indicated that the Commission had not communicated effectively with the profession. They cited failure to reach non-AIA members, difficulties in reconciling the form of the Commission's material with their design needs, and a "cookbook approach" which did not encourage new design ideas as some of the problems. Builders were even blunter. They saw a lot of paper coming from the Commission, but little practical help in actually complying with the regulations.

Too few Energy Commission staff people have been trying to regulate too large an industry. Matters were also complicated by the fact that staff members who worked on the first set of standards had little prior experience with the building industry. The private sector wondered why

a program that affects billions of dollars of construction and tens of thousands of jobs should have such a small and inexperienced staff assigned to it by the Commission.

Staff has often seemed to be pushed by events. The Hot Line, a valuable source of information for the industry, had to be discontinued after only a few months. Staff was swamped by the calls, and couldn't get other work done. The Building Liaison team that surveyed compliance with the standards in the summer of 1978, was supposed to continue as a point of contact between the Commission and local officials. However, the team was disbanded shortly after issuing its report. No further efforts to minitor compliance took place until the middle of 1980, when the Commission let a small contract to HCD to study enforcement practices.

For the better part of two years, the Commission was unable to determine how effectively its standards were being enforced. Few local officials reported frequent contacts with the Commission. The very largest departments were more likely than others to maintain close relations with CEC staff. Building officials had to depend primarily on telephone contacts and the Bulletin for information about the energy regulations.

Most questions were answered immediately over the phone, except for those from the largest departments, and those officials tended to be less satisfied with responses from Commission staff. While about 55% of the building officials indicated that they "always or usually" received clear answers from the staff, somewhat more than 40% said they "sometimes, rarely, or never" did. Among the largest departments, half the

officials were in the latter category. Although most building officials' contacts with CEC staff appear to have been about relatively uncomplicated matters, those with more complex problems found that responses took longer and were less satisfactory.

The Energy Commission is not the sole source of information about the regulations. Our survey of architects indicates that it may not even be the most important source. A greater proportion of the respondents depended upon workshops sponsored by professional organizations, and on interaction with consultants dealing with energy matters, for information about energy standards. For other types of information (about new products or projects), architects looked to professional magazines and other sources, but rarely to the state energy agency.

Maximizing the effectiveness of communications with professionals may require a two step process -- from the Energy Commission through the established channels and then to practitioners.* The Commission undoubtedly needs to pay special attention to reaching energy consultants, since other professionals seem to rely on them for specific information.

Variability of Enforcement Practices

The Current Califronia regulations require building departments to check plans for compliance with Title 24. Nowhere do they mandate field inspection to verify whether measures specified in the plans are installed. CEC training concentrated on plan checkers; it was assumed

*The two-step theory of communication was originally developed to explain the way in which the media influence voting behvior and consumer decision making. See Elihu Katz and Paul Lazasfeld -- Personal Influence (New York: The Free Press of Glencoe, 1955).

that inspectors were less likely to need training, since they only needed to see whether specifications were being followed.

Many building departments think they should have more manpower to fully check for compliance with the energy standards. Very few departments actually inspect buildings thoroughly for energy conservation features. Some find that they have to make a special trip for insulation, but most accept the installer's certificate as evidence of compliance. Few departments, if any, try to verify whether appliance efficiency standards have been met; building officials feel that it is nearly impossible to do so in the field. Few departments seem to check in detail for other energy conservation features such as infiltration controls. Thus, building officials cannot be certain about compliance, although they probably have a fairly good idea about the thoroughness of plan checking.

Only about one-third of the building departments indicated that they raised fees to cover any of the costs attributable to enforcement of Title 24, and less than 15% added staff to enforce regulations. Small departments were the least likely to increase either their fees or their personnel for energy purposes.

Even those departments that raised fees may not have been able to use the added revenue for its intended purpose. In nearly all communities, fees go to the general fund and building departments compete with other city services for allocations. At a time when many functions are being cut because of a shortage of funds attributable to Proposition 13, building officials have a hard time arguing for higher budgets. The argument is especially difficult since inspection for Title 24

compliance is not mandated, and local political leaders are reluctant to grant funds for performing a service not required by higher authority. Some departments seem to have justified fee increases by referring to the energy regulations, but actually used most of the added revenue for other operating expenses.

Most building departments now seem to be squeezing Title 24 compliance into their other duties. The current slump in construction allows them to do so, but when building volume increases, departments may be less willing to spend time checking for code violations which are not being monitored by the Energy Commission.

Some building departments routinely send complicated plans to the Department of Housing and Community Development for checking, and permit applications are taken only after HCD has given its stamp of approval. Other jurisdictions contract with larger (usually county) building departments to provide plan checking and inspection services. Many departments apparently accept compliance statements from builders/designers in lieu of thorough checking. This last practice risks turning state standards into voluntary guidelines. Compliance may be affected if the industry feels that building officials are merely accepting statements to protect themselves against legal liability rather than carefully looking at the plans submitted.

Most architects and all but the smallest builders sub-contract with specialists to demonstrate compliance with at least part of the state regulations. HVAC sub-contracts usually require the designer to complete state forms; insulation is commonly sub-contracted to installers who sign the compliance statements. Electric heating representatives

handle life-cycle costing for builders who wish to use their product. Some builders and architects even contract for engineering assistance that includes all calculations required for the CEC's forms.

Builders especially dislike these calculations, and many feel antagonistic toward the Energy Commission for forcing them to hire consultants to deal with Title 24 compliance. Both code officials and private industry have shown a tendency to shift documentation for compliance onto specialists (some of whom, as in the case of electric heating, are financially interested in the outcome).

Enforcement of the standards varied throughout the state. A rough estimate, based on the proportion of time spent in plan checking and inspectin for energy conservation features, placed between 25% and 35% of the building departments as "minimal enforcers", while 20% to 25% of the departments reported spending a fairly substantial protion of their time on compliance with Title 24.

The size of the department correlated with the time spent in checking for energy matters, and so did building offical's perception of whether their staffing was adequate or not. Larger departments generally spent a greater proportion of their time checking for compliance, while departments that felt they had adequate staffing generally spent less time, proportionally, on energy than departments that felt they needed to add staff. Most departments indicated that they made trips to building sites to check on insulation, but that usually seemed to mean looking for an installer's certificate rather than inspecting workmanship.

Three-fifths of the departments felt that the amount they spent for enforcement was not adequate to insure full compliance with the energy standards. Small departments and very large departments were most likely to see their budgets as adequate. However, few small departments indicated that they needed to increase their staffs for enforcement purposes, while fully one-half of the largest departments felt they should do so.

The type of building activity in the respective areas may help to explain the discrepancy. Small departments are usually faced with residential and minor commercial development, while the largest departments are often confronted by complex construction projects. Since compliance with the residential energy standards is relatively straightforward, small departments may not have many problems in assuring compliance. The largest departments have greater resources (e.g., plan check engineers specializing in energy), but also have a longer turn-around time. Thus, they might want to add staff to expedite processing of applications.

Officials thought most buildings in their areas met the standards. Few indicated that any significant proportion failed to meet Title 24, and few thought any large number exceeded Title 24. While custom homes might exceed the standards, non-residential buildings, expecially speculatively built commercial and industrial structures, were most likely to fail to meet state requirements. The regulations seem to have provided a floor for building practices. Unfortunately, the standards may also have provided a ceiling for most construction as well.

Builders report that local officials are now asking for more information to be included with plans than was required prior to Title 24. However, not all agree that paper requirements translate into thorough compliance checking. Some builders maintain that increased surveillance by local officials is only temporary, and will decrease when building volume picks up. Others see enforcement as a function of the individual building department, and even of the plan checker or inspector looking at their projects.

Generally, builders feel that compliance with the residential standards is quite good. This may result from the confluence of several factors -- shifting compliance to sub-contractors, negotiation with local officials for "reasonable" interpretations, and perhaps most important, designing houses under the code's prescriptive requirements, which require few changes in standard practice.

Energy standards meet more resistance, and are probably less well enforced, in rural areas than in other parts of the state. Rural building officials showed less favorable attitudes toward the Energy Commission's efforts to provide information and assistance. They were least likely to make special visits to inspect insulation or other energy conservation features. They were also least likely to find their budgets adequate to deal with energy standards, or to think their existing staffs were able to fully enforce the regulations. Rural officials were also more concerned than officials from any other area over potential liability problems arising from enforcement of Title 24.

Special Enforcement Problems

Speculative development presents particularly difficult problems for building officials, who readily concede that many improvements are done wihout benefit of a permit. Under California regulations, buildings which are not to be heated or cooled are exempt from Title 24 standards. Tenants who "bootleg" improvements may waste much of the energy, since the structure was not originally made to conform to minimum thermal standards. The problem takes on another dimension in speculaive office buildings. Since tenant needs are often not known, designers tend to oversize mechanical systems to guard against future complaints. Building officials have no real way to check on the accuracy of estimates of potential use; thus, permits are granted for systems that may turn out to be considerably larger than occupants really need.

Residential furnace oversizing has also created some problems. Immediately after implementation of the standards, small furnaces were in short supply. The CEC relaxed its original requirements and more efficient units have become available, easing the situation. However, building officials still question the value of heat loss calculations for determining furnace sizing. No matter how low the calculations turn out, the builder will likely put in a 48,000 Btu furnace, the smallest unit commonly available. Officials and people in the industry favor the CEC's development of sizing charts that would spare them all the agony of producing needless calculations.

Building officials maintain that enforcement of appliance efficiency standards in the field is almost impossible. Models change, the CEC's lists of approved units quickly become out of date, and specifications

are often not clearly marked on the equipment. As a result, officials rarely do more than check plans for appropriate equipment efficiencies. Most of them recommend that the state prohibit models not meeting its requirements rather than place a difficult enforcement burden on inspectors.

Most building departments dislike checking calculations. They indicated a special distaste for computer-generated outputs, which they often cannot understand due to unclear specification of input parameters. Officials felt they had neither the time nor the expertise to check complicated life-cycle cost calculations. Many considered the whole procedure to be a "numbers game" which could usually be manipulated to justify electric resistance heating. Even though builders realized that officials usually did not check calculations carefully, and even though manufacturers provide assistance with the forms as a matter of course, many seem to have shied away from electric resistance heating systems. Differences with officials -- which might hold up permits -- were just not worth risking. Some builders have installed heat pumps, which seem to be favored by the regulations, even in areas where air conditioning has not traditionally been included in homes; ironically, builders thought energy consumption might actually increase over that of an electric heating system.

Architects report several types of difficulties with California's current energy regulations. The most common problem concerned the glazing restricions; many designers exceeded the limits on glass, and therefore had to arrange trade-offs which building officials would allow. In areas such as the San Francisco Bay region, weather characteristics vary

significantly within a few miles. State standards have not been drawn finely enough to take account of microclimates, creating problems for designers in some instances. Architects generally felt that many building officials were uninformed or overly rigid in applying the standards. In fact, quite a few members of the profession seem to have experienced more difficulty in obtaining permits since the regulations went into effect (although not all of the difficulties could be attributed to the energy regulations themselves).

Builders' problems were greatest at the onset of the Title 24 standards. They reported shortages of materials (especially insulation, and to a lesser extent, double glazing) and equipment (particularly HVAC sysems able to meet the standards) immediaely after the regulations went into effect. Although these difficulties have been overcome, builders worry about new shortages if the Energy Commission's revised standards go into effect in 1982.

Innovation

Most building departments find innovative designs especially difficult to review. The are naturally leary of approving projects based on computer calculations, expecially if the projects require them to bend other code restrictions. Innovative architects regard the cautious approach taken by building officials as discouraging to new approaches. Architects who propose alternative designs seem to have more problems with state regulations than more traditional practitioners. Interpretation of the UBC requirement that a temperature of 70 degrees at three feet off the ground be maintained has hindered passive design; esta-

blished state code requirements for ventilation and fire access have also inhibited alternative design, though to a lesser extent.

Some professionals have seen energy conservation as an opportunity. Architects are coming to regard the concern for conservation as a means for selling more of their services. Innovators tend to be younger, part of smaller firms, practicing outside the main metropolitan areas of the state, with primarily residential rather than institutional clients. These practitioners seem to be gaining greater recognition within the profession. Innovative architects also reported that their typical clients were more receptive to passive design than clients of more traditional practitioners.

A number of California builders have recently started to market advanced energy conservation and passive solar homes. Large firms entering the field seem to be motivated primarily by marketing considerations; by establishing an image as an energy conscious builder, each hopes to differentiate their product and to appeal to buyers who place a premium on saving energy. At the same time, innovative builders try to keep their homes looking like conventional homes that sell well. Builders report some specific concerns about moving into solar production homes. Many have real questions about the reliability of active solar technology -- questions which must be answered before they make large scale commitments to include solar water or space heating in their projects. They also believe that orienting home sites to take advantage of solar heat gain may lose buildable lots, thus increasing their costs and the eventual price to the buyer. Builders feel strongly that the Energy Commission should not mandate either of these approaches until

the industry has had more experience with them.

Attitudes Toward Energy Standards

Building officials and industry people like the idea of trade-offs in any energy standard as much as they dislike required calculations. A greater proportion of officials from large departments see those problems as serious, perhaps because of greater familiarity with the performance approach.

Most officials felt that the Title 24 standards were saving energy compared to what the market would have done during the past two years. Larger departments were more likley to credit the state regulations with energy savings. On the average, officials thought the standards increased the cost of a new residential unit by $900; estimates ranged from $0 to $5,000.

Architects have pushed hard for performance standards; the CCAIA sponsored a bill passed by the state legislature to adopt a January 1, 1981, deadline for development of a performance approach (which it felt the CEC had been postponing). Architects like performance standards because of the flexibility they allow designers, and the ease with which goals can be changed to conform to practices in the industry.

The CBIA, which represents a moderate position within the building industry, has recently moved toward support for a performance based approach. Builders especially like the idea of a point system which allows them to choose the least costly ways of meeting energy budgets from a menu of conservation items. However, not all builders have come

to accept standards for energy regulation. Some still look to the free market as the best means of assuring cost effective conservation, and question whether an average buyer (who moves in 5 to 7 years) will ever recover the actual cost of measures mandated for new homes. Many builders regard energy standards as part of a complex of over-regulation forced on them by government agencies, which is escalating the price of new housing beyond the means of most buyers.

Builders and professionals licensed by the state vigorously oppose the idea of recertification for mastery of energy efficient design or construction practices. Nor do they much like licensing boards setting out to discipline practitioners who build or design energy wasteful structures. In fact, the difficulty of proving incompetence, plus the limited investigative budgets of the boards, make significant efforts to discipline errant licensees impossible. The industry thinks it can police itself. By offering training and information as well as awards for well designed structures, both the CBIA and the CCAIA feel they can reach practitioners more effectively than the licensing boards.

Conservation and the Structure of the Industry

The state's home building activity hit a five year low in 1980. Soaring costs for new construction, coupled with record high interest rates, sharply cut the number of potential home buyers. Nearly every builder felt the effects of the market downturn. In difficult times, the average builder with substantial capital invested in his projects feels he cannot afford to take chances with new ideas that may not be accepted by consumers.

Energy conservation impinges on California's housing industry in several ways -- as a market force through consumer demand, as a state requirement through Title 24, and as a marketing consideration. All builders are concerned about the added first costs attributable to conservation measures; our sample of builders estimated the increase at between 2% and 5% of unit cost. Those who build, or who are interested in building energy conservation homes urge financial institutions to take account of savings on utility bills when qualifying home buyers. Since banks and savings institutions now fail to include energy costs in their loan criteria, some builders might be tempted to cut back on conservation features to keep the price down. In the absence of state standards, homes might have been built without even minimal attention to energy use. The main effect of the standards may well have been to bring all building up to a minimum level of thermal integrity.

Although utilities have not been directly involved in developing or enforcing the Title 24 standards, they are offering programs that are now complementary to the Energy Commission's standards. Many of the state's utilities have incentive programs to encourage energy efficient home building. PG&E's program is based on a point system which gives credit for features not mandated by existing state or federal standards. About 60% of the new homes connected in the PG&E service area in 1980 came under the ECH program. Compliance, according to utility representatives, is excellent. But that could be partly a function of the voluntary nature of the program, and the lack of tight controls demanded by a regulatory effort.

The Public Utility Commission's proposal for revision of the line extension credit formula may have a direct bearing on the Energy Commission's regulations. Like ECH, the line extension credits are based on a point system for measures beyond those required by state standards. However, if the state tightens its standards as the CEC intends, builders may become caught in a cross-fire between two sets of regulations, with utility representatives and building officials having different expectations for new construction. Obviously, the two state agencies need to coordinate their activities to avoid such a situation.

Up-Dating the Standards

More energy conservation measures are now cost effective than in 1977, when the Title 24 standards were developed. The Commission has initiated a process to revise its standards. For the past year, staff has been developing a set of residential standards which could save at least 60% of the energy compared to a typical 1975 house. The standards are based on an energy budget approach, with two paths to compliance -- either by a prescriptive package, or through a simplified calculation method based on the Commission's Passive Solar Handbook. In addition, certain measures, such as infiltration controls, would generally add between $2,000 and $4,000 to the cost of a new residential unit, compared to 1975.

Substantial questions have been raised about the appropriateness of mandating solar water heating, the determination of cost effectiveness, the future of electric heating, the ability of the industry to meet anticipated demand for products, and potential difficulties in enforce-

ment. These issues need to be worked out before a final set of regulations can be adopted by the Commission. At the earliest, the new standards could go into effect in July, 1982.

The revised standards will have to be enforced by local building departments. However, the Commission has learned from its experience with implementation of the original Title 24 regulations. It recoginzes that training must be given before the standards go into effect. The CEC has thus adopted a "train the trainers" strategy which depends largely on organizations in the private sector. Furthermore, it recognizes the need to monitor the results of the enforcement effort, and has provided HCD with a continuing contract to do so.

The Commission also acknowledges the need for compliance tools, and for manuals to clearly explain the principles behind, and the application of, those methods. By providing a simplified calculation technique with the standards, the Commission thinks it can avoid some of the confusion which attended its earlier standards. Through recent increases in staff, greater familiarity with the building industry, and separation of responsibility for the standards into a unit of its own, the Commission hopes to increase the effectiveness of its staff effort.

NOTES

THE DEVELOPMENT OF STANDARDS

1. Warren-Alquist State Energy Resources Conservation and Development Act, Public Resources Code Section 2500 et. seq. (December 1979, incorporating all amendments to the Act through 1979) (Sacramento, California)

2. Building Code Action vs. Energy Resources Conservation and Development Commission (Superior Court of the County of Marin, decision filed May 16, 1978) -- pp. 1-2.

3. Department of Planning and Land Use, County of San Diego -- Residential Energy Law Summary, (5/1/79).

4. Willet Kepmtion -- Energy Efficient Buildings: The Causes of Litigation Against Energy Conservation Building Codes (Lawrence Berkeley Laboratory, University of California, Berkeley, September 1978 -- LBL7896).

5. Building Code Action vs. Energy Resources Conservation and Development Commission (Court of Appeals, State of California, decision filed, February 26, 1980) -- pp. 6-7.

IMPLEMENTING THE STANDARDS

1. Ken Kern, Ted Kegon and Rob Thallon -- The Owner-Builder and the Code (Owner-Builder Publications, Oakhurst, California, 1976), p. 42.

2. Enforcement of the California Energy Commission's Standards for Residential and Non-Residential Buildings: A Report of the Building Department Liaison Team, August 25, 1978.

3. Compliance with State Energy Conservation Standards for New Buildings -- California Energy Commission Task Force on Code Enforcement -- October, 1980.

4. Energy Conservation Design Manual for New Residential Building -- Energy Resources Conservation and Development Commission, Conservation Division, February 1978.

5. The guides which became available on December 3, 1980: Guide to Energy Budgets; Guide to Non-Depletable Energy Sources; Guide to HVAC Systems; Guide to HVAC Equipment; Guide to Service Water Heaters; Guide to Lighting (all from the California Energy Commission, Sacramento, CA.).

6. U.S. Department of Housing and Urban Development -- Energy Conservation for Buildings: A Case Study of California -- prepared by Harbridge House and Public Technology Inc. -- November 6, 1978.

EVALUATIONS OF IMPLEMENTATION

1. "Because of the delay between building plan review and construction, the inspected buildings were not necessarily the same buildings plan checked by the HCD staff. Approximately 140 building plans were reviewed by HCD staff . . . and 61 residential buildings and 29 non-residential buildings were inspected in June 1980.

2. Letter to Don Watson, Task Force on Code Enforcement, from Eric A. Heim, Director of Conservation Planning, Pacific Gas and Electric Company, December 8, 1980.

ENFORCEMENT BY LOCAL BUILDING OFFICIALS

1. Warren-Alquist State Energy Resources Conservation and Development Act, Public Resources Code Section 2500 et. seq. (December 1979, incorporating all amendments to the Act through 1979) (Sacramento, California)

2. Enforcement of the California Energy Commission's Standards for Residential and Non-Residential Buildings: A Report of the Building Department Liaison Team, August 25, 1978.

3. As one local official put it: "Our fees go to the general fund. The building department gets the dollars in but doesn't get extra personnel. Proposition 13 decreased taxes so the city tries to get money back through the building department."

4. As one CEC staffer noted: "In non-residential, the clause on compliance is not worth a nickel. It is only useful in the case of a lawsuit so building officials can pass off responsibility to the builder

THE BUILDING OFFICIALS SURVEY

1. California Energy Commission -- Biennial Report, 1979. (Sacramento, California)

2. The city of San Diego's conditions: the building contains 10 or more units; no unit has a floor area of more than 800 square feet (except for one which may be up to 1000 square feet); the first floor is slab on grade; the glazed area is not more than 12% of the gross heated floor area; each heater has a separate thermostat; water heating is provided by an energy source other than electricity; maximum exterior U-value is .08, and floor is .05 or .06; the building is not electrically cooled.

ACTORS FROM THE PRIVATE SECTOR

1. See discussions of this issue in: Marver H. Bernstein -- Regulating Business by Independent Commission (Princeton University Press, 1955) and Grant McConnell -- Private Power and American Democracy (Knopf, 1967).

ARCHITECTS AND THE ENERGY STANDARDS

1. California Council of the American Institute of Architects -- Architects on Energy (San Francisco, November 1980).

THE BUILDING INDUSTRY'S RESPONSE TO ENERGY CONSERVATION

1. Cost Study -- Standard Quality Single-Family Residence: San Francisco Area (Bank of America, Appraisal Department, January 1980).

2. Home Shopper Survey -- Housing -- November 1979; Consumer Preferemce Survey -- Walker & Lee, 1980 (Southern California market area).

3. "Courting Change: Using Litigation to Reform Local Building Codes", Steven Rivkin, Rutgers Law Review, Volume 26 (1978) 774-802.

4. David L. Stover -- Preliminary Findings from 15 Interviews with Residential Home Builders (unpublished report, Lawrence Berkeley Laboratory, July 1980).

5. Solar Housing Developments in California -- The Solar Business Office, California state Business and Transportation Agency (Sacramento, California, January 1980).

6. For example, the huge BIA of southern California opposed Proposition 9, the income tax slashing amendment, on the last state election ballot, while none of the other local affiliates took a position on the initiative. As CBIA staff point out, "they did not have to consult or advise us before taking that position".

7. California Building Industry Association -- "What is an Energy Efficient Home? (Sacramento, California, 1980).

8. "Good News, Bad News at the 22nd Annual PCBC", Daily Pacific Builder, June 30, 1980.

9. Robert Feinbaum -- Policy Options for Saving Energy in the Building Sector -- paper prepared for the 1980 Summer Study on Building Energy Efficiency; University of California, Santa Cruz, August 1980.

UTILITY-SPONSORED CONSERVATION PROGRAMS

1. Evaluation: Energy Conservation Homes Program -- Builders; PG&E Energy Conservation Market Research Report, April 1979, (MR-78-21).

UP-DATING THE RESIDENTIAL STANDARDS

1. Overview of the Proposed 1980 Residential Building Standards -- Project Report #17; Building and Appliance Standards Office, California Energy Commission, September 1980.

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