

CASE STUDY: CALIFORNIA TITLE 24 ENERGY CODE

1. THE POLICY

Title 24 was developed by the State of California in response to the energy crisis of the early 1970s. The standard was established in 1978 and has undergone numerous revisions since, the latest being in 2005. The California Energy Commission formally adopted the 2008 Standards in April 2008, which will come into effect as of July 1, 2009.

The current (2005) and upcoming (2008) versions of the regulations are largely centered on energy use influenced at the design stage (for example in requiring mandatory performance standards in HVAC-R equipment and fabric to be achieved) and in construction (for example through residential duct leakage testing or non residential acceptance testing requirements). There are no provisions in the code related to the 'in operation' energy use of a building.

Title 24 is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change, from building standards contained in national codes.
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions.
- Building standards, authorized by the California legislature, that constitute extensive additions not covered by the model codes, that have been adopted to address particular California concern.

In addition, local Californian jurisdictions can modify the state energy code to be more stringent when appropriate documentation is provided to the California Energy Commission.

Compliance can be demonstrated by meeting the mandatory measures contained within the code, in addition to following either the prescriptive or performance based routes to compliance. While the performance based approach is currently only voluntary, state officials expect subsequent versions of the code to increasingly move toward requiring performance based analysis to be undertaken. Current expectations are that a performance based approach will become mandatory in the 2013 update.

Mandatory Requirements

The mandatory measures within the code require, among other standards, minimum insulation, HVAC-R, lighting and water heating efficiencies to be met. Regardless of which approach to compliance is subsequently followed, the minimum performance standards outlined in the mandatory requirements must be achieved.

Prescriptive Approach

As the simplest route to achieving compliance, the prescriptive approach requires each individual energy component within the building (for example building shell elements or HVAC equipment) to meet a prescribed minimum efficiency. The code covers all aspects of a building's design (and in some instances, construction) including, but not limited to the building envelope (insulation and fenestration), indoor and outdoor lighting, domestic hot water heating, and HVAC-R systems. In some instances, following the prescriptive route to compliance requires more stringent elemental methods than those outlined in the mandatory measures.

Performance Based Approach

Using the performance based approach, the annual Time Dependent Valuation (TDV) energy use of the proposed design must be shown to be less than or equal to the annual TDV energy use of the standard design. The standard design is defined as a building like the proposed design, but one that complies exactly with the mandatory measures and prescriptive requirements. Since 2005, TDV energy, rather than source energy has been required for this calculation. This approach values energy use differently depending on the time it is used (for example during periods of peak demand, when energy use is more costly than energy used during the periods of lowest demand).

Following the California electricity crisis of 2001, the Energy Commission has placed additional emphasis on demand reductions, hence the requirement to assess the TDV energy instead of source energy, which is the approach taken by most existing performance based building codes. The 2001 revision of the code helped to reduce peak electricity demand by approximately 150MW each year, with an additional 180MW (i.e. 330MW total) per year achieved through the 2005 revision.

Post Construction (In Operation) Performance

There are no explicit provisions in Title 24 related to the measured energy use of commercial or residential buildings. Upon the sale of a residential home, however, a buyer may request a home energy assessment which could include an inspection of insulation R-values in attics, roofs, walls, floors and heating and cooling ducts; an assessment of window types; an assessment of the age, fuel type and efficiency ratings of heating and cooling equipment, water heating efficiencies and the efficiencies of other major appliances; and an inspection of the general integrity and air leakage through walls, windows, doors and duct systems. Comprehensive energy inspections are not required under State law. Since October 2005, however, dwellings located away from the coast in climate zones specified by the Energy Commission must have their ducts pressure tested, sealed and verified by a HERS (Home Energy Rating System) rater whenever heating or cooling equipment is replaced. According to staff at the Energy Commission, this has helped to reduce average duct leakage in homes from over to 20% to around 6%, with associated improvements in energy efficiency.

2. ENERGY EFFICIENCY POTENTIAL

2.1. Policy Uptake

Compliance with Title 24 is mandatory for all new construction projects in the state of California. The code applies to all residential and non-residential new construction projects and refurbishment projects requiring a permit. Consequently, changes to Title 24 have far reaching effects on energy use in the state.

2.2. Energy Savings Potential

As there is no requirement in the code pertaining to the actual measured energy performance of buildings, detailed historical energy savings data is not readily accessible. Despite this, some energy bill and modeling analysis has been undertaken which indicates that 2005 code compliant non-residential buildings are approximately 11% more energy efficient than buildings constructed under the 2001 standard. For residential buildings, increased efficiencies of approximately 13% are seen. For the 2008 revision of the code, energy savings of approximately 8% for non-residential buildings and 13% to 15% for residential buildings are expected to be achieved, compared to the 2005 version of the code. Since its inception, Title 24 is estimated to have saved more than \$56 billion in electricity and gas costs within the state. It is estimated an additional \$23 billion of energy will be saved through 2013. The Energy Commission's route map points toward achieving carbon neutrality through the code by 2020, though no plan detailing the incremental requirements to meet this target has been published.

Staff at Consol Energy Consultants noted that the true energy savings potential of the code is often compromised in the field by poor construction and enforcement practices in the state. Anecdotal evidence suggests that building efficiencies are typically up to 10% lower than anticipated at the design stage due to poor quality construction and installation practices and a lack of strong enforcement practices. It was noted that, while State inspection staff are trained and available, there is insufficient travel budget to enable them to carry out inspections across the State.

3. COST OF IMPLEMENTATION

3.1. Program Cost

A team of 20 people administers updates to the code in three to four year cycles. State officials expect this number to increase to approximately 40 people within the next few years as the State energy code regulations move toward a performance based program, with comprehensive greenhouse gas mandates aimed at achieving carbon neutrality in new buildings by 2020. Not all of these staff are involved directly in the implementation and development of Title 24 on a full time basis, as staff are distributed across all areas of building regulation development. Updates to smaller, less controversial aspects of the code are carried out within the commission; however, more substantial revisions are contracted out to external analysts. As updates to Title 24 are carried out as part of the State's cyclic code update program, detailed cost data for each revision is not readily available, though as the standard becomes more stringent, officials expect development and administration costs to substantially increase.

3.2. Cost to the Developer

Prior to implementation of the code, the city must carry out detailed life cycle costs analysis to demonstrate that

any policies they are putting forward are cost effective. Rob Hammon of Consol Energy Consultants estimates that for an increase in code stringency of between 15% and 20%, construction costs are increased by approximately \$2000 to \$2500 per home (typically 1% to 2% of construction costs). Costs increases for commercial buildings are more difficult to ascertain due to the wide range in size and type of non-residential buildings. Anecdotal evidence similarly suggests that a 1% and 2% increase in construction costs would result from increasing the code stringency between 15% and 20%. Detailed data regarding increases in construction costs is not collected by Energy Commission.

4. ADMINISTRATIVE FEASIBILITY

4.1. Administering Agency

The code is administered by the California Energy Commission. Compliance with the code is overseen by local building officials and inspectors.

4.2. Ease of Initiation

As Title 24 is updated cyclically in 3-4 year intervals, updated versions of the code have traditionally been relatively easy to implement. According to state officials, however, the implementation process of recent versions of the code has become increasingly more difficult due to the escalating technical requirements in each subsequent revision of the code. It was also noted that the more technically challenging the standard, the more difficult it was to get the building industry in the State to understand and adopt to its requirements. Education and outreach is likely to become increasingly important and wide ranging with future revisions, particularly if a performance based compliance route is mandated in 2013.

4.3. Educational Outreach Requirements

According to Commission officials, countless different types of education and outreach programs have been conducted on the code. Currently, Title 24 compliance training is conducted through the State's utility companies and is unrelated to the Energy Commission. The State has approximately \$1MM per year for education and outreach activities; however this is not consistent year upon year. Education and outreach requirements are higher at the time before and around a new revision of the code and decrease throughout the lifespan of the code revision.

5. STAKEHOLDER IMPACTS

5.1. Acceptability to the Building Industry

The State involved stakeholders throughout the development process; maintaining a strong dialogue with California building industry associations through personal relationships and ad-hoc consultation with industry representatives. This approach was taken in order to allow the State to consult with the building industry to develop "reasonable measures" which are achievable by builders and developers alike. It was also noted by State officials that there are often contradictory requirements between local building departments and the building community regarding new code standards. While it is often advantageous to give the industry flexibility in meeting code requirements (as this allows new legislation to be more easily introduced), this approach often causes difficulties for building inspectors in enforcing code standards. As such, it was noted by State officials that it was vital to consider the enforceability of any new standards being proposed, in order to not burden building officials with unenforceable standards.

During the 2008 code development process, it was reported that there was significant opposition to some of the more far reaching requirements. Eventually, the State removed some of these to get industry approval. For instance, requirements for "programmable communicating thermostats" (PCTs) faced such backlash from the media, consumer groups and the general public that the requirements were dropped altogether. Requirements pertaining to the urban heat island effect and in particular the provision of "cool roofs" were also dropped due to concern from the product industry about the feasibility of supplying such roofing systems to all new buildings in the State, in addition to opposition from builders and developers relating to the costs of installing cool roof systems on all buildings. Requirements related to the provision of radiant barriers were also removed during the industry consultation process, primarily due to concerns from builders relating to the cost of installing radiant barriers on all new construction projects.

Other areas of contention have been ongoing with industry for a number of years. Requirements relating to the

provision of exterior shading screens were intended to be included several years ago, but opposition from the architectural and developers communities led to the requirements being removed, largely due to the threat from the industry that, if screens were mandated in the code, they would be installed for the purposes of being code compliant but immediately removed following building department approval. New legislation requiring shading screens to be permanently installed was also rebuked by the industry, due to concerns from the design community that screens would not necessarily fill in with the aesthetic or technical requirements of projects. Although legislation was never introduced, Energy Commission Officials reported that shading screens are now becoming voluntarily more commonplace on new buildings in the State.

According to Rob Hammon at Consol, in recent years there has been a move from an adversarial relationship between builders and developers to a more collaborative relationship, as the industry and the Energy Commission work together to ensure the code is satisfactory to all parties. The industry is generally concerned that the code be as cost effective and practical to implement as possible. Their concerns also extend to impacts in the market; industry is worried that stringent and costly code revisions will increase the cost of leasing or buying new buildings compared to existing buildings. It was also noted that there was some concern from the building sector that increasing the stringency of the code (with associated increases in costs for builders complying with the code) would, without proper enforcement, lead to a “black market” of “cowboy” builders undercutting more reputable builders by not fully complying with the code requirements.

6. REFERENCES

Rob Hudler, California Energy Commission

Rob Hammon, Consol Energy Consultants