RECOGNITION OF ENERGY COSTS AND ENERGY PERFORMANCE IN COMMERCIAL PROPERTY VALUATION

Recommendations and Guidelines for Appraisers

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About the Institute for Market Transformation

The Institute for Market Transformation (IMT) is a nonprofit organization whose mission is to promote energy efficiency in the United States and abroad. The organization's activities include technical and market research, policy analysis, public education, and creation and coordination of program initiatives. Founded in 1996, IMT is headquartered in downtown San Francisco.

The term "market transformation" encompasses various strategies for the creation of permanent, self-sustaining success of energy-efficient technologies in the marketplace. In contrast to traditional energy-efficiency programs, which have tended to focus on piecemeal procurement and installation of efficient technologies, market transformation offers a strategic approach to shift entire market sectors toward a more efficient overall product mix. Market-transformation programs may focus on stimulation of consumer demand as well as supplier innovation and, at least in the United States, have a growing track record of successful synergy with codes and standards for energy efficiency.

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I. INTRODUCTION

In many types of commercial buildings, energy costs are a significant component of operating costs and overall net operating income (NOI). In California, such costs typically represent between ten and fifteen percent of NOI. Energy costs are also highly variable, depending on the efficiency of the building and its equipment, as well as building type, location, vintage, and other important factors.

Accurate assessment of energy costs is an important element of accurate valuation. But real appraised values often fail to reflect differences between high-energy and low-energy properties.

Thus, insofar as NOI is a foundation of building value, accurate assessment of energy costs is an important element of accurate valuation. Yet many professional property appraisers tend to use cursory or inaccurate methods for assessing energy costs, and ignore the presence or absence of energy-efficient features or equipment in buildings. Many appraisers commonly use regional-average energy-cost figures as default estimates in NOI calculations. Appraised values therefore often fail to reflect differences between high-energy and low-energy properties.

The Institute for Market Transformation (IMT) has developed this document to offer guidance to appraisers and other real-estate stakeholders on enhanced methods for energy reporting. These methods are based on a variety of technical approaches and cover a range of complexity, cost, and accuracy, but should all provide more reliable information than the sources that appraisers most commonly use today. The methods described here are all established in the fields of building science and energy engineering, and are being broadly implemented already in the commercial building sector in California and throughout the United States.

The Pivotal Role of Owners and Third-Party Specialists in Energy Reporting

We emphasize that our recommendations have been formulated specifically so as *not* to place additional burdens of time, training, or money on the appraiser. The methods and procedures we propose are all intended to be initiated not by the appraiser or lender, but rather by the seller, developer, or occasionally the buyer of the subject property.

We envision that the owner or developer, independently or through a third-party specialist (such as a utility, engineering consultant, or an energy services company), would track or model energy performance in the subject building by means of one of the preferred methods described in this document. In many cases, the owner or developer would conduct such energy assessments not explicitly for the appraisal, but rather as an ongoing means to control operating costs, define maintenance schedules, and assure comfort and performance in the building. For the appraisal, the owner or developer would provide data from the energy assessment in a summary form for the appraiser.

The role of the appraiser in an enhanced energy-reporting process would be much the same as in current practice, in which the appraiser receives operating-cost information from the owner or from third-party reference sources, reviews the information, and decides whether it is credible. The difference is that enhanced methods will likely yield more accurate, more credible, and technically better substantiated results than existing approaches. This document is intended to assist appraisers by helping them to understand which methods ought to be preferred, and why.

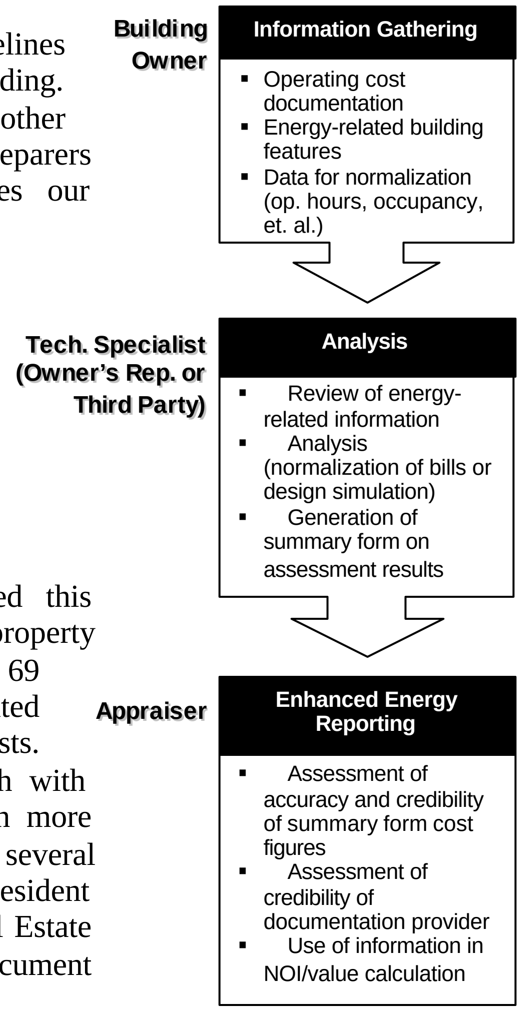
In sum, we are *not* proposing that appraisers themselves should become specialists in energy efficiency. Nor are we suggesting that they should have to spend extra money and time gathering and analyzing detailed energy records of buildings. Instead, owners, developers, building managers, or third-party energy specialists would bear the analytic and record-keeping responsibilities of documenting building energy performance. The appraiser's job would be to review summary statements from these energy-assessment regimes, assess their credibility and accuracy with the help of this document, and as warranted, to use the statements as a basis for NOI calculations.

Finally, we wish to make it clear that we are proposing that new energy-reporting procedures be undertaken on a voluntary basis. Owners and developers should decide whether it is worth their effort and money to generate enhanced energy documentation for appraisers; in cases where energy-conscious owners and developers are already carrying out energy assessments for their own purposes, energy documentation might be created for appraisers conveniently and at minimal incremental cost.

The appraiser would also have a choice whether to request such documentation, and whether to accept it if proffered. Insofar as the accuracy of the appraisal may be improved without significant additional work, we hope that appraisers would indeed give the documentation serious consideration. Then in the longer term, to the extent that enhanced energy-reporting approaches became well accepted across the appraisal industry, it might be possible for appraisal groups, oversight agencies, and lending institutions to adopt procedures and guidelines in a more formal way.

Summary of Contents

This document is divided into seven sections. Section II offers an overview of energy use in commercial buildings, with a focus on the relative effects of energy costs on NOI. Section III briefly describes deficiencies in widely-used current methods. Section IV presents methods and procedures by which enhanced energy-related documentation can be used in property valuation. This section describes the methods themselves in some detail, characterizes their relative accuracy and uncertainty, and refers the reader to commercially-available or public-domain tools that apply these methods.



Section V presents recommendations on finding appropriate baselines and comparables data regarding energy use for a given building. Section VI discusses technical qualifications, certification, and other assurances of the competence and professional responsibility of preparers of energy-performance documentation. Section VII summarizes our recommendations.

Finally, Appendix A contains sample forms which, based on any of the proposed technical methods, would present summary information for appraisers to use in calculating energy's contribution to NOI.

Foundations of This Document

The Institute for Market Transformation (IMT) has developed this document on the basis of extensive input from commercial-property appraisers in California. In the summer of 1998, IMT surveyed 69 certified general appraisers in California on their energy-related valuation practices, focusing on methods for reporting energy costs. IMT has also conducted two half-day discussion meetings, each with eight commercial appraisers, exploring energy-reporting issues in more detail. Finally, IMT has received extensive guidance from several individual appraisers — most prominently, Paul Jacobs, former President and current Director at Large of the California Association of Real Estate Appraisers. The conclusions and recommendations in this IMT document reflect the collective insights culled from these contacts.

In assessing the merits of various building-performance assessment methods, databases, and other technical matters, IMT has also consulted technical specialists in building energy modeling and engineering, developers of analytic software, and architects specializing in energy efficiency. These specialists represent a wide range of sectors, including utilities, private companies, government agencies, nonprofit energy-efficiency advocacy groups, university programs, and national laboratories. IMT's chief technical consultant for this project is Heschong Mahone Group, a leading consulting firm specializing in energy efficiency in buildings.

Limitations

Energy performance assessment for buildings, like all aspects of appraisal, is subject to some uncertainty. While IMT's proposed approaches are expected in most cases to offer lower uncertainty and significantly improved overall accuracy relative to common current methods, the reader should understand that in specific cases, the energy-reporting methods proposed here may yield incorrect results. Wherever possible, the authors have attempted to discuss the conditions and cases under which significant inaccuracies are likely to emerge. Still, it is possible that unforeseen or unidentifiable factors may lead to inaccuracies in estimates of energy cost and energy performance — inaccuracies which could in turn have an impact on real NOI and value. Therefore appraisers and other readers are advised to exercise their discretion and judgment in making use of energy-related information and energy-reporting approaches recommended by IMT.

There exist myriad methods, tools, and approaches for tracking and modeling energy performance in commercial buildings. While it would have been impractical for us to address all performance-assessment methods in detail, we have endeavored to include those which represent or have the immediate potential to represent widely-used industry standards. The chosen methods cover a broad range of cost and complexity; we hope that this breadth will make improved energy reporting accessible for various building types and owners. Still, in certain cases, appraisers may receive energy-related information based on methods not addressed here. In these cases, the appraiser should attempt to assess independently whether it meets criteria of credibility and technical rigor.

The recommendations contained in this document represent the best judgment of the IMT project team, based on currently available information. The emergence of additional information and new technical advances may warrant revision of IMT's recommendations. It is IMT's intent to offer periodic revisions of this document in the future to bring appraisers and other interested parties up to date on relevant changes.

II. ENERGY, OPERATING COSTS, AND MARKET VALUE

This document lays out methods for achieving more accurate estimates of energy costs during the appraisal process. But does the accuracy of energy reporting really have an effect on the accuracy of the overall appraisal? Skeptics might raise a number of concerns:

1. *"Energy contributes negligibly to overall value, especially as prices fall with deregulation."*

2. *"Uncertainty in energy reporting methods is so high that building-specific estimates are effectively meaningless. Thus choosing a reasonable average figure is just as reliable as a building-specific figure from a complicated analysis."*

3. *"Energy's impact on value, as with all other elements of value, is ultimately defined by the market. Therefore the only basis for considering energy in appraisal is data on market preferences, not the NOI calculation."*

This section addresses each of these objections in turn.

Energy and Net Operating Income in California Buildings

Energy is often a significant component of a building's overall operating costs. Therefore, to the extent that utility costs are not passed on to tenants, and to the extent that appraised value is calculated at least in part as a function of NOI, the accuracy of energy cost estimates is an important element of the accuracy of the appraisal on the whole.

Table 1 presents median energy costs and NOI for office buildings in the major cities of California. Note that energy constitutes between 10 percent and 15 percent of NOI, and is among the largest operating expense items for buildings sampled. Figure 1 presents the average breakdown of operating costs for office buildings in downtown Los Angeles. Other building types and other areas of California show similar breakdowns, in which energy is the predominant cost item.

Energy is among the largest operating expense items for California buildings, constituting between 10 and 15 % of NOI, and is among the largest operating expense items for many building types.

The importance of energy arises not only from the relative *magnitude* of energy costs as a portion of NOI, but also in energy's *variability.* Differences of at least 20 to 30 percent in energy costs can typically be achieved via energy-efficiency retrofits to existing buildings; energy-cost differences across actual buildings may well be considerably higher. Given energy's proportional share of NOI, energy-cost variations from such retrofits can influence overall NOI by two to five percent.

Energy-cost variations from energy-efficiency retrofits can influence overall NOI by two to five percent.

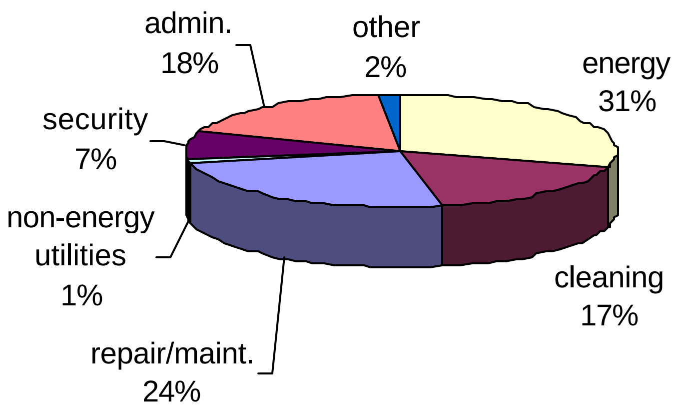
Falling energy prices might diminish the relative importance of energy costs as a contributor to NOI. This prospect may seem particularly relevant with the onset of utility deregulation. However, the only part of the cost of electricity that will be affected by competition is the cost of generation, which accounts for only about a quarter of the cost of electricity delivered to a building. The remaining majority portion of the bill will still be subject to regulated rate-setting. Thus even a substantial reduction in generating costs (e.g., 20 percent) translates to a relatively small change in total cost of electricity. It is generally expected that for the near future (at least through 2002), electricity price reductions will be modest, perhaps two to five percent.

Table 1. Median Energy Costs and Net Operating Income in California Office Buildings

Location	Income	Op. Costs	NOI	Electricity	Gas	Total En. Costs	Energy Share of Op. Costs	Energy Share of NOI
	$ per ft²-year			*$ per ft² year*				
Downtown Los Angeles	22.27	7.58	14.69	2.03	0.14	2.17	**29%**	**15%**
Downtown San Diego	18.38	5.95	12.40	1.71	0.09	1.80	**30%**	**15%**
Downtown San Francisco	24.28	7.86	16.42	1.67	0.10	1.77	**23%**	**11%**
Downtown Sacramento	20.95	5.81	15.14	1.43	0.09	1.52	**26%**	**10%**
Suburban Los Angeles	20.18	6.06	14.12	1.99	0.08	2.07	**34%**	**15%**
Suburban San Diego	17.49	4.55	12.94	1.67	0.08	1.75	**38%**	**14%**
Suburban San Francisco	26.54	5.93	20.61	1.51	0.10	1.61	**27%**	**8%**
Suburban Sacramento	16.82	4.42	12.40	1.51	0.09	1.60	**36%**	**13%**

Figure 1. Average Operating Costs by Category

Downtown Los Angeles



Source: Building Owners and Managers Association (BOMA). 1998 Experience Exchange Report.

In countries that have already undergone utility deregulation, such as Britain, experience with electricity restructuring since 1990 offers evidence that deregulation does not guarantee reduced energy costs. At first glance, it appears that customers saw a drop in electricity prices of 12 percent between 1990 and 1997. However, if the precipitous decline in coal and gas costs in the 1990s are controlled for, prices actually increased by 11 percent in the industrial sector in the first four years of restructuring.[1] Researchers in California have also shown that cost savings will likely come slowly.[2]

Importance of Energy Costs by Building Type

The relative significance of energy costs is different for different building types. Obviously, a building which uses very little energy, such as an unconditioned warehouse, will have very low and insignificant energy costs. Conversely, energy costs can be quite significant in a building with large energy consumption. It is therefore useful to have a general understanding of the building types and characteristics for which energy strongly influences operating costs.

Buildings which have significant equipment or process energy costs will usually top the list. For manufacturing or special process buildings with energy intensive equipment, energy costs can be of primary importance. Examples would include refrigerated warehouses, hothouses, and other specialized structures. In the more typical buildings, energy use from equipment and processes can also be significant. Grocery stores have large refrigeration loads, and commercial kitchens have large cooking and refrigeration loads, as well as large ventilation loads from exhaust hoods.

Ordinary building energy uses – lighting, heating, cooling and ventilation – can be more significant in some building types than others. Buildings with large numbers of people, such as theaters or gymnasiums, require large quantities of ventilation air that must be provided through fans and duct systems, and which must be heated and cooled. Buildings with specialized lighting requirements, such as theaters, museums or jewelry stores, will require unusually high lighting energy use. Buildings with unusually large window areas, such as glass façade office buildings or automobile dealerships, will experience unusually large heating and cooling loads.

Buildings with unusually long operating hours or extreme environmental influences will have significantly higher energy usage. For example,

[1] Kwoka Jr., John. "Transforming Power, Lessons from British Electricity Restructuring", in *Regulation*, 1997, Vol. 20, No. 3.
[2] LBNL, Newsletter #8, November, 1997.

hospitals operate 24 hours a day all year long. Some types of businesses, such as grocery stores, also have nearly full time operating hours. Finally, buildings exposed to constant wind or extreme temperatures, such as seaside locations, deserts or mountaintops, will have unusually high energy consumption.

Some or all of these factors may be present in a building and should be recognized in the appraisal process, especially when they might cause the subject building to stand out from other similar buildings in the same market.

The Significance of Bottom-Line Effects: An Actual Example

Table 2 shows an actual appraisal calculation for a motel in Southern California, as conducted by a certified general appraiser. The table shows estimates of income, expenses, and net operating income both before and after a major energy-efficiency upgrade. The costs shown include both budgeted figures and actual incurred expenses (including energy expenses).

Table 2. Sleepy Time Inn[3]
Property Appraisal, November 1998

		1997 Pre-retrofit		**1998 After energy upgrade**	
Income					
		$503,029.00		$503,029.00	
Other		$3,595.00		$3,595.00	
Gross Scheduled Income		$506,624.00		$506,624.00	
Vacancy Rate	35%	$177,318.40		$177,318.40	
Net Scheduled Income		$329,305.60		$329,305.60	
			% of NSI		**% of NSI**
Operating Expenses					
SCE Electric		**$18,766.00**	**5.70%**	**$10,450.00**	**3.17%**
Natural Gas		**$5,447.00**	**1.65%**	**$2,850.00**	**0.87%**
Water		$2,886.00	0.88%	$2,886.00	0.88%
Janitor		$5,475.00	1.66%	$5,475.00	1.66%
Landscape		$3,900.00	1.18%	$3,900.00	1.18%
Taxes Real & EMP		$31,059.00	9.43%	$31,059.00	9.43%
Tele & Sat TV		$4,897.00	1.49%	$4,897.00	1.49%
Insurance		$2,450.00	0.74%	$2,450.00	0.74%
Pest		$275.00	0.08%	$275.00	0.08%
Maid		$10,950.00	3.33%	$10,950.00	3.33%
Laundry		$23,500.00	7.14%	$23,500.00	7.14%
Repairs		$7,566.00	2.30%	$7,566.00	2.30%
Management		$38,500.00	11.69%	$38,500.00	11.69%
Advertising		$2,550.00	0.77%	$2,550.00	0.77%
Legal & Acct		$1,500.00	0.46%	$1,500.00	0.46%
License		$500.00	0.15%	$500.00	0.15%
Bed Tax	10.0%	$32,930.56	10.00%	$32,930.56	10.00%
Reserve	2.5%	$8,232.64	2.50%	$8,232.64	2.50%
Subtotal Expenses		$201,384.20	61.15%	$190,471.20	57.84%
Net Operating Income		**$127,921.40**	**38.85%**	**$138,834.40**	**42.16%**
Cap Rate	8.75%				
Formula Employed	Net Operating Income / Cap Rate				
Opinion of Value		$1,461,958.86		$1,586,678.88	
Energy Retrofit Effect				**$ 124,720.00**	
Based on 50 rooms at $27.50 per night GSI					
City Tax is 10% of collections all sources					

[3] The name has been changed to protect client confidentiality.

Note that in this case, energy upgrade measures led to a reduction in gas and electricity costs by nearly $10,000 per year. Simple capitalization implies that these annual savings lead to a bottom-line increase of $124,720 in present asset value, or an increment of about 8.5 percent above the estimated pre-retrofit value.

Assessing Uncertainty in Energy-Reporting Methods

Energy-reporting methods, as with other elements of appraisal, involve a degree of uncertainty — a natural consequence of making estimates with imperfect data, and projecting future income streams and market preferences based on present information. Appraisers therefore tolerate some uncertainty in all aspects of the appraisal, while seeking to keep it to a minimum.

High levels of uncertainty in estimation of revenue and cost items raises an important question: are actual meaningful variations "lost in the noise"? In the specific case of energy, if estimates of energy costs are highly uncertain relative to the magnitude of the costs themselves, then what is the difference if the appraiser uses convenient default figures instead of more technical, building-specific estimation methods?

Sources of uncertainty fall into two general categories — the inherent spread of data points (statistical variation) and the imperfection of data collection and analysis (measurement and modeling error). True, energy cost estimates are subject to uncertainty in both of these areas. But it is also apparent that uncertainty is likely no worse a problem with energy than with other factors affecting value.

Uncertainty is no worse a problem with energy than with other factors affecting value.

In statistical indices of building revenues and costs — for example, the Experience Exchange Reports of the Building Owners and Managers Association (BOMA) and Income-Expense Analysis reports of the Institute for Real Estate Management (IREM) — energy costs are typically the largest single itemized expense for California office buildings (about a third of total operating costs), while the variability of energy costs is about the same as for the other revenue and expense categories. In other words, the problem of statistical variation is probably comparable between energy costs and other elements of NOI. It follows further that the degree of care and precision that appraisers apply to estimates of non-energy components of NOI should also apply to estimates of energy costs.

Since energy use patterns are complex and sometimes difficult to track, modeling and measurement error can be a problem with estimations of energy cost — enough so that appraisers may, in their distrust of other more technical methods, use tabular regional averages or basic rules of thumb to choose figures for the NOI calculation. This strategy, in effect, seeks to avoid uncertainty problems by ignoring the complexity that underlies them. But ignoring complexity does not eliminate it — and one should note that regional averages and rules of thumb themselves carry latent "modeling" uncertainty, embedded in the assumption that the chosen averages and rules apply to the subject building. Therefore, even when measurement and modeling error is unavoidable, an appraiser should not assume that it doesn't matter; instead, the appraiser should seek to minimize error by using reliable, building-specific data grounded in well-substantiated technical methods, as elaborated in Section IV of this document.

Energy-Related Value and Market Preferences

Most appraisers would say that the truest measure of value is the market's willingness to pay, not net income. As with other elements of value, actual market preferences regarding energy efficiency are not well understood; it is not clear to what extent building purchasers would pay more for buildings with energy-efficient features, or would demand discounts on energy wasters.

Net income calculations can often be the best practical substitute for information on market preferences.

In the absence of market information, many appraisers consider energy costs along with other expenses and revenue streams in calculating net operating income of the building. Net income calculations, when well substantiated by convincing documentation of net-income figures, can often be the best practical substitute for information on market preferences. Furthermore, it is arguable that as real-estate investment becomes an increasingly corporate activity driven heavily by creation and capture of real value, with would-be purchasers themselves basing their investment decisions on pro-forma NOI calculations; under these conditions, NOI capitalization may indeed be a close proxy for empirical market information.

III. COMMON EXISTING METHODS AND THEIR DEFICIENCIES

Once the appraiser decides that NOI calculations will be the basis for considering energy costs, the objective should be to make as accurate and well-substantiated an energy-cost estimate as possible. But the most common current methods for energy-cost assessment suffer from questionable credibility and poor accuracy. This section describes the deficiencies in common existing methods of energy assessment and reporting.

In assessing building energy costs, appraisers often rely on financial statements, tax returns, or other historical records submitted by the building owner. The problem with this approach is that owners' disclosures on past energy costs may be shaped by the owner's incentive to suppress the real magnitude of costs in order to obtain a higher valuation. Owners' records may also mask anomalous conditions such as deviant weather patterns, unusual building use or occupancy patterns, or temporarily broken or idle equipment. Under these conditions, appraisers are often rightly skeptical about owners' claims on energy performance.

Where owners' disclosures are suspect or absent altogether, appraisers may seek energy-cost information from standard references such as the Experience Exchange Reports of BOMA and Income/Expense Analysis publications of IREM. These sources collect survey data from owners on income and expenses, and present results as average figures for given locations and building types.

Use of regional-average default figures for energy costs poses serious concerns about accuracy.

Some appraisers use these averages as default energy-cost figures for NOI calculations. This approach, while certainly convenient, poses serious concerns about accuracy. Given the range of building types, vintages, features, and equipment, treating all buildings as average will only rarely be accurate, and indeed, will often be egregiously inaccurate. Such inaccuracy will propagate from the energy line-item through to the estimate of overall NOI, and can adversely affect the accuracy of the appraisal on the whole.

IV. Preferred Energy Performance Assessment Methods

We believe that a number of methods can yield technically accurate, building-specific estimates of energy costs that appraisers can confidently use in the NOI calculation. Though no method is fail-safe, and anomalies will occur even with the most reliable among them, the following methods should generally provide acceptably accurate estimates of energy costs, and should be used in place of the conventional methods described in Section III.

IMT envisions that the proposed methods will *not* burden the appraiser with additional workloads or technical responsibilities, because the bulk of analysis and record-keeping will be conducted by the building owner, building manager, or energy contractor. In most cases it would be the responsibility of the current owner or developer to conduct the analyses described here, and to deliver a summary statement of results to the appraiser, along with supplemental information on methodology and on the technical qualifications of the preparer. The appraiser's responsibility would be limited to reviewing and assessing the summary document, and making adjustments or requesting additional information as he or she judges necessary. (Sample summary forms are presented in Appendix A.)

All of the performance-assessment approaches described here are well known in the field of building performance assessment and energy engineering, and most are already being broadly applied for various purposes in the commercial buildings sector. While appraisers may encounter these methods only sporadically in the short term, IMT believes that increased recognition from appraisers will in itself stimulate wider use.

Billing Histories

One of the most direct methods of assessing building energy costs is to examine the building's utility bills. Examination of bills themselves, while more time-consuming than reviewing summary financial statements, removes the potential that the owner is fudging or obscuring the numbers. Bills are also preferable to standard reference sources in the sense that billing records are specific to the building itself, and at some level, will reflect the presence of efficient built features or operations.

The problem with billing histories is that they reveal little about *why* bills show the numbers they do. A building may have low energy use (relative to the levels that appraisers might normally encounter, and/or the default average values they commonly assign) because it has advanced, well-maintained energy-efficient features; on the other hand, it may have broken equipment or an owner who is willing to sacrifice occupant comfort for energy-cost savings by running the HVAC system in a miserly way. Bills may also be anomalously low or high because of abnormal weather conditions, partial vacancies, unusually long operating hours, or the presence of unusual energy-using equipment. Furthermore, in older buildings, there may be more than one utility meter; also, the metered floor area may not correspond to the floor area used in the NOI calculation.

Given the number of confounding factors, it is only marginally desirable to use energy bills alone in estimating energy costs for a calculation of NOI. In addition to the bills, an appraiser should ask for evidence that the building's energy costs result from the presence of desired features, not undesired anomalous factors or erratic external conditions.

In assessing billing histories, an appraiser should ask for evidence that the energy cost levels result from working features, not erratic external conditions like weather or anomalies like broken equipment.

There are two ways to show that low energy bills result from efficiency, not other conditions. The first way is to verify the presence of efficient features, either visually or through a record of installation and performance verification, or ideally, both. The second way is to normalize the bills by correcting for the effects of building space use, weather, occupancy, and other factors.

Energy bills plus verification of efficient features

The simplest approach to using energy bills for appraisal purposes is to supplement the bills themselves with a procedure to verify the presence of working energy-efficient measures. The purpose of this verification is to document the energy efficiency measures which help to determine the magnitude of the utility bills. For very efficient buildings with low utility bills, this verification helps to explain why the bills are lower than for comparable buildings. Under this approach, an appraiser would verify the presence of efficient building features through a visual inspection, using a checklist. Any appraiser could complete a checklist of simpler building features; for more complex measures, special training or qualifications would be needed to identify measures and to assess their working condition. To supplement the identification of measures, the appraiser could ask for a written record of installation and performance histories for special efficiency measures.

While appealing in its simplicity, this verification approach would not provide complete answers to explain high or low energy bills. For example, if a building had consistently average energy bills, they could be the result of reliable energy efficiency measures which were offset by a history of unusually long hours of operation, or by a stretch of extreme weather patterns. This building, then, under normal operation and weather, would be expected to have lower than average utility bills because of its efficiency features. Despite these difficulties, however, this verification approach is surely an improvement over the practice of simply taking average or historical energy bills as the estimate of future energy costs.

Measure-by-measure performance verification is a common element of energy performance contracts, in which an outside contractor provides an energy-efficient upgrade, for which the building owner pays over time as savings are gradually achieved. Since savings levels are the basis for repayment terms, protocols for measurement and verification of savings under these contracts tend to be rigorously specified. The International Performance Measurement and Verification Protocol (IPMVP) is the standard for verification of energy-efficiency measures in the performance-contracting field. While the Protocol provides for varying degrees of precision (and level of effort) in verifying energy efficiency savings, all are based to some degree on careful engineering analysis. The appropriate level of precision is determined by the value of the potential savings; small projects use a simpler version of the Protocol than do large projects with potentially large energy savings. This is not unlike other appraisal practices, where small buildings receive rather quick and relatively cursory appraisals, and large properties receive a much more thorough and sophisticated evaluation.

Energy bills normalized for weather, occupancy, operating hours, and other factors

Normalization controls for extraneous variables and isolates the effects of high-performance features.

Energy bills may be corrected for various confounding variables through a process called normalization, which essentially breaks down a series of energy bills into their component parts so that the extraneous variables can be controlled for, leaving the efficiency performance variables to predict future energy savings. In this process, bills over an extended period are analyzed and correlated to the variables in question, which may typically include outdoor air temperature, occupant density, and operating hours. The billing patterns are then expressed as a multivariate linear function of the variables. This equation can then be used to predict the building's energy performance based on specified "normal" conditions.

The big advantage of normalization is that it provides a much more rigorous treatment of the energy bills than the simple validation method. In some ways normalization is simpler, because it does not require a detailed survey of all the building energy features (although listing them would be an informative complement to the analysis). Normalization does, however, require reliable historical data on a number of independent variables, such as heating and cooling degree day data, hours of occupancy, numbers of occupants, internal and equipment loads, etc. It may also require data on physical parameters that have a direct relationship to energy usage, such as floor area, glazing area, or ventilation rates. The more complicated the building, the more independent variables will need to be analyzed. Moreover, while normalization techniques are well understood, their application to a particular building can require a certain amount of trial and error to develop the most descriptive regression equation that makes the best use of the available information about the building.

Use of normalized billing is relatively common among building managers and building energy consultants, covering a range of applications. Owners and managers may use normalized billing to simply track energy use and trends, to forecast operational cash flow, and to help identify opportunities for energy cost savings via retrofits, maintenance, or improved operations. Normalized billing is also used as a basis for energy-efficiency performance contracts. In this case, normalized bills can be used to project a baseline level of energy consumption against which the post-retrofit actual energy use can be compared. For these and other applications, the most common billing-normalization tools include *Utility Manager*™ (from Illinova Energy Partners), *Metrix*™ (from SRC Systems), and *Faser 2000*™ (by OmniComp). A normalized billing projection from any of these tools should generally be a reliable source of energy-cost information for use in appraisal.

The ENERGY STAR® Building Label

Normalized billing now has another important application through the ENERGY STAR® Building Label program of the U.S. Environmental Protection Agency (EPA). Under this program, the ENERGY STAR label, which is a well-known mark of energy-efficient performance in appliances, copiers, computers, and homes, may be assigned to energy-efficient commercial buildings. Applications for the ENERGY STAR Label for Buildings are now being accepted for office buildings in the commercial or public sector.

The EPA system for assessing buildings and assigning the label is based on normalized billing. An applicant collects 12 consecutive months of utility billing information, along with information on a number of normalization factors — occupant density, space use, floor area, numbers of personal computers per person, hours of operation, and outdoor temperature. The collected data would be submitted via the Internet to the program web site, where a calculation engine would then normalize the bills for the given factors.

The ENERGY STAR system would compare the results of the normalization analysis with statistical information from a major building-energy database, the Commercial Buildings Energy Consumption Survey. This comparison would yield a rating for the subject building, on a scale of one to 100. Buildings rating 75 or higher would represent the top 25 percent of buildings on EPA's ranking scale, and would receive an Energy Star. In addition to the rating, the ENERGY STAR calculation tool would also generate a Statement of Energy Performance with detailed information on the normalized energy use, energy costs, atmospheric emissions, and other factors associated with the building.

Normalization does have its limitations. With the EPA normalization and benchmarking tool, as with other normalization software, it should be understood that results may vary depending on the normalization factors chosen. In certain cases, normalization may not recognize important anomalous factors that strongly affect energy use. For example, a building may have stuck dampers or incorrect setpoints in the HVAC system, leading to high energy use that weather, occupancy, and other normalization corrections will not catch. Normalization will also likely be unable to reveal cases where low energy use results from underheating and undercooling of occupied areas, though the EPA Building Label program will require that any buildings qualifying for an Energy Star must have an engineer's certification that minimal comfort conditions are met.

Design Simulation

For some buildings (including, most obviously, new buildings) energy billing data may be absent. For other buildings, the magnitude of energy costs may warrant a more detailed assessment of the energy performance and how it is influenced by the equipment and operation of the facility. In these cases, an owner may be able to provide the appraiser with the results of a computer simulation of the building's energy performance, based on the building's built features, its location, and other factors. In other cases, it may be worth the time and expense to develop such a simulation model of the facility specifically for the appraisal.

A computer simulation model is essentially a sophisticated engineering calculation of the energy flows in a building and their cost. Much as NASA scientists use simulations to study the effects of space flight, building engineers use simulations to study the energy performance of buildings and their equipment. As with any simulation model, the results can only be as good as the input data, so there must be a reasonable amount of effort expended to adequately describe the building and its operation. The energy analyst must necessarily make simplifying assumptions about the building, so it is also necessary that the simulation be performed by a person with the training and experience to make these simplifications in a way that does not compromise the accuracy of the simulation. Done properly, however, energy simulations provide the ultimate tool for predicting energy costs for a building in a way that recognizes the performance of the specific energy features of the building.

DOE-2

The widely-recognized standard for building energy performance simulation is a computer program called DOE-2, which was developed by the U.S. Department of Energy (USDOE) and has been undergoing periodic improvements and revisions over the last two decades. DOE-2 requires voluminous input data on the geometry, materials, equipment, and controls of the building. It also considers internal heat gains within the building, the effects of solar radiation incident on the building, the relevant utility rate schedule, the daily and weekly variations in operating and occupancy schedules, and other factors. DOE-2 calculates hourly expected energy consumption for the building, taking into account historical hourly weather files for the building location. Summed over the entire year, hourly consumption estimates can yield an estimate of whole-building consumption.

DOE-2 is the industry standard energy simulation tool for buildings, with results generally falling in the range of +/- 5% accuracy.

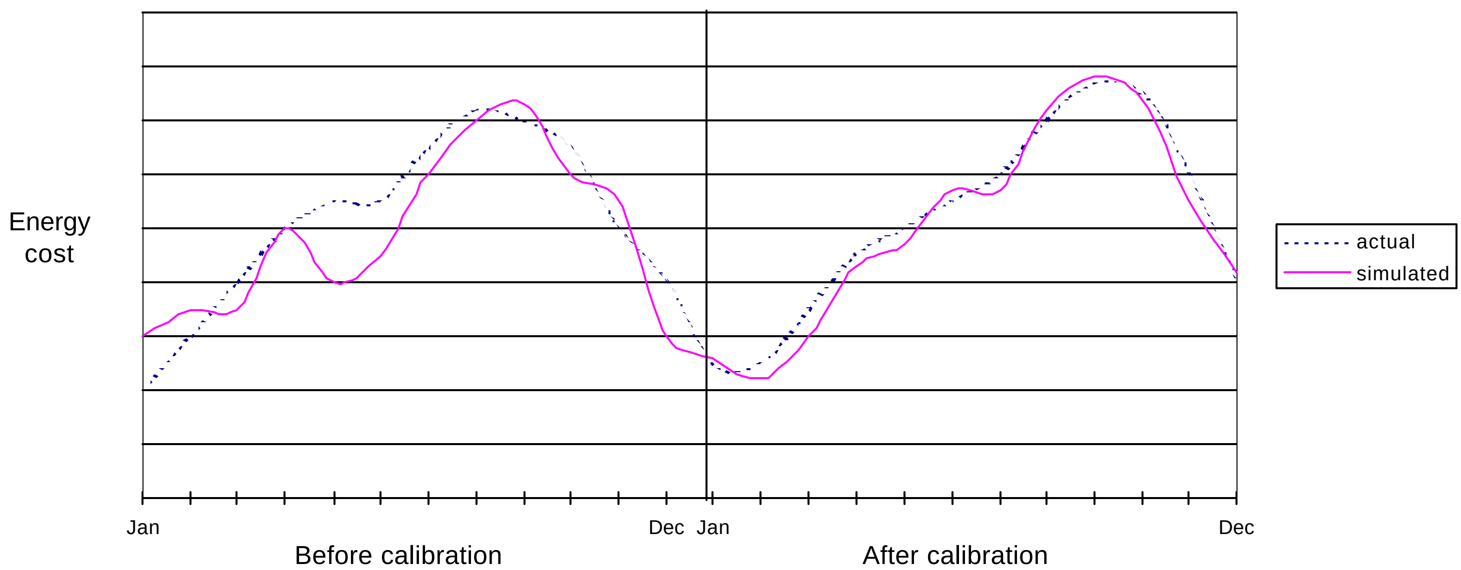
The DOE-2 simulation procedures are available in a range of software packages (user interfaces), ranging from simple text-based programs such as EZDOE, to interactive graphics-intensive tools like VisualDOE, for desktop as well as mainframe computers. Most users currently use the programs on standard personal computers. A list of commercial, PC-compatible versions of DOE-2 may be found via the Internet at http://www.eren.doe.gov/buildings/tools_directory/software/doe-_pc.htm.

DOE-2 is a rather specialized computer program, and one must possess a college engineering level of understanding of building energy and analysis principles to use it with confidence. In particular, it is necessary to ensure that input information on building parameters is accurate and reasonable; some DOE-2 versions automatically reject unreasonable input data, but in many cases, verification of inputs can only be conducted through third-party review.

Yet despite these caveats, DOE-2 is among the most widely used energy analysis tools, and is accepted as rigorous and accurate for building simulation purposes; results generally fall in the range of plus or minus five percent accuracy.

DOE-2 may be especially accurate in predicting energy use when the simulation model is “calibrated” to past energy bills. In the calibration process, the user actually adjusts the calculational engine of the simulation model so that it accurately “backcasts” (as opposed to “forecasts”) past bills. [4] The modified simulation model is then used to forecast future energy consumption and costs. Figure 2 depicts a sample energy cost calculation, before and after simulated calibration.

Figure 2. Calibration of Building Energy Simulation



The advantage of calibrated simulation is that by tuning the model to past bills, one should, in theory, generate a model that is more accurately representative of the energy-use behavior of the specific subject building. The problem, however, is that tuning the model is a highly sensitive and ultimately subjective endeavor; the model may inevitably be tuned in any of a number of ways, which will likely yield different patterns of forecasted energy use. Therefore it is imperative that the specialist performing the calibration be a real expert not only with the software, but also with technical aspects of building science, in order to assure that calibration adjustments represent reasonable engineering assumptions, not random guesswork.

Notably, DOE-2 modeling is also a common approach to compliance with California’s non-residential building energy code, Title 24. Building designers may show compliance by submitting to code officials the results

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[4] The accuracy of a calibration (that is, the closeness of fit between the simulation and the past bills) is commonly quantified by means of two statistical indices: mean bias error, or MBE, and coefficient of variation of the root mean square error, or CV(RMSE). The lower these indices are, the closer the fit. Generally, a simulation model is considered calibrated if its MBE falls within ±10%, and if CV(RMSE) is within ±30%. (From Stein, Jay. “Calibrated Simulation: An Improved Method for Analyzing Building Energy Use.” E SOURCE Tech Update. Boulder, CO. 1997. This information was provided courtesy of E SOURCE, an information services company providing organizations with unbiased, independent analysis of retail energy markets, services, and technologies.)

of a DOE-2 simulation. While these compliance results show consumption rather than costs, it is a relatively simple analytical step for the owner or appraiser to turn the consumption estimate into a cost estimate. This points to a promising possibility for using DOE-2 in conjunction with the appraisal of new commercial buildings. Because many of these building owners have already paid to develop a DOE-2 model for Title 24 compliance purposes, it is relatively inexpensive to fine-tune these models to the as-built conditions in the building and use the result to produce a reasonable estimate of the future average energy costs for the facility.

Other simulation tools

Other energy-simulation tools, which target various building types and cover a range of cost and complexity, may also yield information for use in appraisal. Here we discuss only a few tools, which exhibit such desirable qualities as technical sophistication, accuracy, and widespread availability. A more comprehensive and regularly updated list of commercial and residential energy-simulation tools, with useful discussion of the features, uses, strengths, and weaknesses of each, is available via Internet at http://www.eren.doe.gov/buildings/tools_directory/index.cgi.

BLAST

BLAST (Building Loads Analysis and System Thermodynamics), like DOE-2, performs hourly simulations of building dynamics and energy use, using input data on building geometry and materials, operating schedules, equipment types, and weather for the given location. It can also be customized by highly sophisticated users for specific types of building systems and physical plant types. Less widely used than DOE-2, BLAST nevertheless ranks with DOE-2 as one of the more technically advanced building simulation tools in the United States.

The Department of Energy is developing a new sophisticated simulation tool called Energy Plus which promises to build on the capabilities of both BLAST and DOE-2. It is currently in the testing stages.

Energy-10

Energy-10 is a design tool that performs annual energy-use estimates based on simulated hourly consumption summed over the year. Vastly simpler than DOE-2, Energy-10 requires a minimum of only four building-specific inputs, with flexibility to add more information to the simulation as it becomes available during the design process. As a design aid, it offers building designers a variety of possible cases for comparison and rank-ordering, based on variations in design features. Its use is limited to residential and small commercial buildings.

EZ Sim

EZ Sim, developed by Stellar Processes, Inc., models building energy performance based on monthly, instead of hourly, input data. Intended primarily for diagnosis of energy-use patterns and identification of potential conservation savings, EZ Sim offers a relatively simple way to estimate future energy use. Most significantly, EZ Sim is designed to be conveniently calibrated to actual monthly utility bills — much more simply than with DOE-2, whose calibration requires extreme sophistication and care in selecting input data and adjusting the model.

Billing Histories and Design Simulation: Which to Prefer?

In gathering comments from appraisers and energy-analysis specialists on these proposed tools, IMT has observed a rather distinct disparity in each professional sector's preferences. Appraisers widely consider billing histories to be most acceptable for use in the valuation process, and simulation tools much less so. Energy specialists tend to hold the opposite position; they are skeptical about billing-based assessment, and more confident in simulation methods, particularly those that involve calibration to measured performance.

Both enhanced billing histories and design simulation are preferable to straight non-normalized bills and lookup of regional averages — and both can enhance accuracy without significant incremental burdens for the appraiser.

There are various possible reasons for this divergence. Appraisers' preference for billing histories may be based on a sense that bills represent information that is more tangible than the results of an engineering calculation. Appraisers may be able to apply their own judgment more constructively to billing histories, which require relatively little technical background, than to simulation, which is a "black box" to all but the most highly trained programmers and engineers. Enhanced billing methods may also be more popular among appraisers in that they resemble currently-applied methods more closely than simulations do; changing practice by enhancing billing assessment would be a manageable incremental step, whereas assessing and trusting a simulation would be more of a leap in practice.

Energy specialists, on the other hand, prefer simulation methods because they are able to take into account the detailed dynamics of building performance, including the effects of various specific technologies in the building. They are familiar with these tools, work with them regularly, and not surprisingly, generally view the more advanced tools such as DOE-2 and BLAST as the leading edge in their work. To them billing methods are, technically speaking, a much blunter instruments, subject to confounding factors and gaming as described above.

In presenting both billing-based and simulation-based approaches, we are not suggesting that one should be preferred over the other. We do believe that the listed simulation methods are worth recognizing in the valuation process, and indeed, one purpose of this section is to provide some background and unbiased third-party assurances to allay appraisers' skepticism in this area. At the same time, we recognize billing histories (when enhanced with normalization or verification of features) as useful tools as well. The key point is that both approaches are preferable to common existing methods — straight non-normalized bills and lookup of regional averages — and both can enhance overall accuracy in the appraisal without significant incremental burdens of time, effort, or training for the appraiser.

V. BENCHMARKING AND COMPARISONS OF ENERGY PERFORMANCE

Appraisers often seek information on buildings with comparable characteristics when estimating property value as a whole, and for confirming or arriving at ranges for particular expenses, such as energy costs. The purpose of this section is to propose procedures and guidelines for evaluating currently-available data sources on comparable properties (“comps”) for use against subject buildings, including government building survey results and data from private agencies and companies.

We emphasize that comp data should be used only as *checkpoints* for estimates of energy costs, but *not* as default figures for the energy costs of the subject building. For estimating energy costs for the subject building itself, the appraiser should look to Section III.

Appraisers should evaluate the baseline source data according to the following criteria when seeking energy-related information for comparison against a subject building:

- The comp building set needs to represent the **same specific building type** as the subject building.
- The **same energy cost calculation method** should be employed for both the subject building and the comp data set.
- A **sufficiently representative or large data set** must be sampled to be meaningfully compared to the subject building.

The appraiser may conclude that, after applying these criteria, none of the available databases can offer a rigorous enough energy cost for comparison to the subject building. In this case, the appraiser will have to make a subjective judgment as to what level of credibility to assign given energy cost figures, or may request corroborating information from other analytic methods applied to the subject building.

Existing Baseline Databases

The databases enumerated below are widely accessible and convenient, but have relatively small sample sizes and informal collection methodologies. These databases examine costs only; they lack information on the specific built features of buildings. Therefore, these sources only weakly satisfy the above criteria.

Building Owners and Managers Association (BOMA)

The BOMA Experience Exchange Report is compiled from the results of 30,000 surveys of BOMA members and building managers listed in real estate publications, and is published yearly by the BOMA Research Committee. The dataset covers office buildings only; energy consumption is broken down by utility, and is represented as total dollars per square foot per year. Data are presented for downtown and suburban sectors of metropolitan areas, in aggregate and broken down by floor-area ranges. Sample sizes vary widely according to location and floor-area category.

COMPS InfoSystems, Inc.

COMPS, Inc. offers a subscription-based on-line accessible database targeted to the commercial real estate industry, called E-Comps, of over 500,000 commercial real estate transactions. The database obtains its information from Metroscan and Experian (First American Real Estate Solutions), examination of sales figures and deeds at county recorders' offices, and physical inspections of buildings. It provides appraisers with an estimate of operating revenue and operating costs based on the area, type, and age of building, and the type of lease, but it does not publish specific line items for utility costs. Instead, operating cost estimates are based on informed rule-of-thumb figures — for example, $0.15 per square foot per month for all utilities. COMPS, Inc., therefore, offers very little in terms of useful energy performance information at this time, and is recommended for use only when a range of average operating expenses is needed and other baseline sources are inadequate for the subject property.

Institute of Real Estate Management (IREM)

IREM publishes results, in book form only, of its annual survey of 2,400 property managers and other real estate professionals across the country. Income and expense analysis is conducted for over 3,300 private-sector office buildings and presented by building type, building size, region, rental range, and age group. Expenses are reported for each major utility, and a subtotal calculated. Relative to BOMA, IREM's database has fewer data points and is therefore a less reliable basis for comps.

Databases Specifically on Building Energy Performance Data

CBECS (Commercial Building Energy Consumption Survey)

The CBECS database is the only national-level survey of commercial buildings and their energy suppliers, put together by the Energy Information Administration of the U.S. Department of Energy (DOE). The main advantage of the survey is that it collects information on the physical characteristics of buildings, building use and occupancy patterns, equipment use, conservation features and practices, and types and uses of energy in buildings. Monthly utility bills are also reviewed to corroborate energy consumption and expenditure claims. This data is available in aggregated tabular form via the CBECS website (www.eia.doe.gov/emeu/cbecs/ce95det.html). Its disadvantages are that it is only conducted quadrennially and that it does not allow searches by geographic location to levels of resolution finer than the nine US census regions.

The 1995 CBECS survey data were collected for over 5,500 commercial buildings each with over 1,000 square feet of floor space, weighted to represent 4.6 million buildings. (In California and the Pacific Northwest, this accounts for 21 percent of commercial buildings.) CBECS data come from multiple sources for each building: interviews with building owners, tenants or managers, documentation from energy suppliers, energy simulation model runs, and weather data.

Utility databases

Some databases maintained by electric utility companies maintain extensive high-quality energy cost information as well, but access to these data sources tends to be restricted. While these databases may become available for public use in the future, they do not constitute a viable information source for appraisers at this time.

Other Methods

Simulated reference buildings

In California and other states, developers have the option of demonstrating energy-code compliance by conducting an energy simulation for a subject building and comparing the results to those of a similar simulation for a hypothetical minimally code-compliant reference building made with stipulated features and materials. Comparison with the reference building thus can tell the code official (and the appraiser) how the energy performance of the subject building compares to minimum code requirements.

Simulated reference building comparisons are useful because they employ the same tool to estimate energy performance between buildings, inherently represent the same building type, and avoid the need for a large comparison data set.

Since codes set forth the same basic energy-efficiency requirements that apply to all new buildings within a given type, this method also provides a possible means for comparing buildings against each other. For example, one new building may be shown to have energy consumption 30 percent lower than its code-defined reference building, while another may show levels only five percent lower than its respective reference building.

Comparison to a simulated reference building is preferable to using database comparison methods because it employs the same tool to estimate energy performance between buildings, inherently represents the same building type, and avoids the issue of needing a large comparison data set.

Rating systems

Energy performance documentation in the form of a rating delivers energy cost information to the appraiser with a built-in baseline, in that it represents where the subject building stands in relation to other buildings. As described in Section III, the ENERGY STAR benchmarking system rates the subject building relative to CBECS. Another system the LEED™ Green Building Rating, assesses energy performance relative to compliance with ASHRAE 90.1-1989, a national model code for energy efficiency in commercial buildings. When presented with such ratings, therefore, appraisers may view them as equivalent to a “comp” when estimating the operating cost schedule in a property valuation.

VI. Technical and Legal Assurances from Preparers of Energy Documentation

The reliability of energy assessment and comparisons, no matter how well-tested and technically robust the given methods, depends heavily on the competence of the person performing the analysis. Therefore, not only should an appraiser verify the technical basis of energy performance documentation; he or she should also seek assurances about the technical credibility and responsibility of the preparer. This section describes three types of such assurances:

1. **Assurance of technical competence** in the form of a professional license or other related training or experience;

2. **Assurance of legal responsibility for the document contents** in the form of a signed statement;

3. **Assurance of coverage by errors and omissions insurance.**

Technical Assurances

To some extent, the level of technical complexity of the energy assessment tool used defines the required level of expertise of the energy performance document provider. Therefore, someone preparing a building's utility bills and list of efficient features will not require the same level of qualification as someone who conducts a sophisticated whole building simulation such as DOE-2. In some cases, the tool itself may be designed for either a technical or non-technical user, as with EZ Sim, where a one-day seminar on its application is offered free with the software purchase. In this instance, the documentation provider would not require special certification at all.

In any case, where the preparer does provide evidence of qualifications, the type of certification should be recorded on the Summary Page of the Energy Reporting Form (See Appendix A).

Professional Engineer/Licensed Architect certification

Energy-performance documentation may be certified by a professional engineer (PE) or a licensed architect. PEs render services such as consultation, investigation, evaluation, planning or design of public or private utilities, structures, machines, processes, circuits, buildings, equipment, or projects. This includes evaluation and certification of buildings' energy performance. Architects, of course, are the professionals responsible for building design, and in some cases may also conduct analyses of energy performance as part of the design process.

Like other professions that are tested and licensed, engineers and architects can fulfill requirements under state licensure laws and become registered through one of numerous boards within the Department of Consumer Affairs, the California Board of Registration for Professional Engineers and Land Surveyors and the California Board of Architectural Examiners, respectively. The Boards qualify and license individuals, and establish and enforce laws and regulations. Accountability to these oversight bodies is in itself one of the most powerful aspects of the assurances embodied in the two types of licenses.

To become a PE, an individual must pass rigorous experience and exam requirements, including graduating from an accredited engineering program, passing the Fundamentals of Engineering exam, working at least four years under a PE, and passing the Principles and Practice of Engineering exam. Many belong to the California Society of Professional Engineers and/or the National Society of Professional Engineers. For architects, licensing requirements include providing verification of eight years of education and/or work experience, and successful completion of the Architect Registration Examination and an oral examination.

The ENERGY STAR® Building Label requires that applications be certified by a PE. (Architects are not recognized under this program.) In this way, the credibility of the preparer is essentially "built in" to the tool, and does not require additional verification by the appraiser. Other billing normalization methods, as well as DOE-2 and other simulation tools, do not contain the intrinsic assurances that ENERGY STAR does.

Although DOE-2 is more sophisticated than the ENERGY STAR benchmarking method, neither DOE-2's users, nor the tool's output documentation, are required to be certified in any way. In some states, code compliance based on DOE-2 simulation must be certified by a PE stamp. However, there is no such requirement in California.

It should be noted that both the PE and licensed architect designations only provide a limited degree of technical assurance insofar as they do not guarantee specific expertise in energy performance assessment. Ideally, the appraiser should seek additional evidence regarding the preparer's technical competence, such as their area of specialty, training or experience.

Certified Energy Analyst (CEA)

The California Association of Building Energy Consultants (CABEC), a nonprofit organization founded in 1986, runs a voluntary, private certification program for professional energy analysts who prepare compliance documentation for Title 24. To become a CABEC Certified Energy Analyst (CEA), applicants must demonstrate at least one year of Title 24 energy code work experience, attend six hours of CABEC-approved training, pass the Certified Energy Plans Examiner test (administered by the California Energy Commission), acquire letters of reference from peers, and fulfill yearly renewal training requirements. The Program is officially recognized by the California Energy Commission as establishing a professional standard as well as providing an important link in energy compliance.

The list of CEAs, made up of architects, HVAC contractors, lighting specialists and others, is divided by residential and non-residential building consultants, and is retrievable on the Internet at http://www.cabec.org/html/ceas.html. There are currently 40 to 50 commercial CEAs conducting Title 24 compliance consulting. Like Professional Engineers, CEAs certify compliance documentation they are responsible for with an official stamp; however, neither CEAs nor any other Title 24 documentation preparers, are officially licensed or overseen by state agencies at this time.

Expertise in Title 24 compliance is not exactly equivalent to expertise in technical aspects of energy-performance assessment. Still, it is likely that holders of the CEA designation will, as a rule, be at least as competent in conducting billing normalizations and simulations as licensed PEs or architects.

Equivalent training or background

In the absence of any of the above certifications, appraisers might consider alternative qualifications from the energy performance documentation provider of a building, such as equivalent course work or project experience.

Utility-offered training

Preparers of energy-performance documentation may demonstrate technical qualifications via a certificate of completion of a utility-sponsored training course in whole-building energy analysis tools. Southern California Edison, for example, offers periodic training courses on DOE-2, DOE-2.1, and Energy 10 commercial building energy simulation programs. While a state-recognized certification is not issued for any of the two-day utility-offered programs, the utility's own certificate of completion may be accepted by appraisers as evidence of sufficient technical competency to run a building simulation and deliver the results.

Degree courses

A growing number of degree courses are now available to those in the energy sciences or engineering field, and if presented by the documentation provider, should offer some assurance to appraisers in their technical competence in energy. Many courses are offered by both state and UC schools, such as Sonoma State University's Energy Management and Design Program, which offers a BA or BS degree in Environmental Studies, as well as a certificate course in Energy Management and Design (for those who already have a bachelor's degree in another field).

American Society of Heating, Refrigerating and Air-Conditioning Engineers

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is an international organization of 50,000 members, organized to advance the sciences of HVAC&R for the public's benefit through standards writing and continuing education, among other purposes. Its continuing-education program offers courses for its members as well as interested companies, Professional Development Seminars, Self-Directed Learning Courses, and In-Company and ASHRAE Chapter-Sponsored Seminars.

CHEERS: A certification registry for residential energy raters

IMT envisions that in the future, an energy analyst certification program could be developed for the commercial sector analogous to an existing residential program called CHEERS. CHEERS (the California Home Energy Efficiency Rating System) employs certified energy professionals to provide energy efficiency ratings for homeowners and homebuyers; these ratings, in turn, are used as the basis for "energy-efficient mortgages," which give the borrower increased financing based on expected incremental cash flow from energy savings. An analogous commercial energy analyst certification would guarantee that the Rater is a competent user of sophisticated building simulation software for use in energy-cost assessment.

Assurance of Professional Responsibility

While the various certifications and assurances of technical competence described above will provide the appraiser with some degree of protection against liability, additional assurance should be sought in the form of a signed statement from the documentation provider. With the understanding that, as with all areas of appraisal, the energy cost estimates of NOI may be contested at some future time, IMT recommends that the third party energy performance documentation provider (the preparer, reviewer, building owner, or contractor) should certify in writing that the information being provided is true and correct to the best of their knowledge. Such standard procedure is already required in Title 24 energy code compliance documentation where it states that "persons who prepare energy compliance documentation shall sign a statement that the documentation is accurate and complete" (Section 10-103 (a)).

Appraiser disclaimers and limiting conditions

In addition to requesting assurance of professional responsibility from the documentation provider, appraisers should also be certain to protect themselves in the appraisal by including disclaimer and limiting conditions language. Language already used by appraisers, such as that suggested by the International Valuation Standards Committee[5], should suffice for purposes of estimations of energy cost as well. Eventual integration of energy documentation requirements into state or national appraisal standards would also protect appraisers against liability.

Appraisers should be certain to protect themselves by including additional disclaimer and limiting conditions language in the appraisal.

Other typical general assumptions and limiting conditions are listed below as they may appear in an appraisal report:

1. The information furnished by others is believed to be reliable. However, no warranty is given for its accuracy. [6]
2. The forecasts, projections, or operating estimates contained herein are based upon current market conditions, local energy prices, anticipated short-term supply and demand factors, and a continued stable economy. These forecasts are, therefore, subject to changes in future conditions. [7]

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[5] "The statements of fact contained in the report are believed to be true and correct. The Valuer should **identify the sources of data relied upon, indicate whether there was reliance on data supplied by others**, and if data from others is relied upon, state whether there was further verification of that data by the Valuer." *Section 7.2.2. Assumptions and Limiting Conditions.*

[6] *The Appraisal of Real Estate*, p. 582 (AIREA, 9th Ed., 1987)

[7] *The Appraisal of Real Estate*, p. 582 (AIREA, 9th Ed., 1987)

3. Information contained herein is obtained from sources deemed reliable but not guaranteed by the appraiser, who is not an expert in these matters.[8]

Assurance of Third-Party Insurance

The final form of assurance that can strengthen appraisers' confidence in the output of any given energy performance assessment tool is confirmation that the documentation provider is covered by professional liability insurance, commonly called errors and omissions insurance. PEs and architects almost universally carry such insurance to protect against liability for professional errors in judgment or oversight in their respective lines of work. While neither PEs nor architects are required to carry errors and omissions insurance as a condition of licensure, it is considered standard for both, particularly those with larger firms, to carry a minimum of $1 million in errors and omissions insurance in contracts where proof of certification to a third party is necessary. The type and level of insurance coverage, if any, should also be checked for energy documentation providers without PE or architect licenses.

[8] Suggested language from an appraiser document reviewer, 12/1/98.

VII. Summary of Recommendations

1. Energy costs can be an important element of the overall net operating income associated with a building. Appraisers should therefore seek an accurate estimate of energy costs in order to assign an accurate overall value to the building. Accurate energy cost estimates are particularly important in building sectors that show intensive and highly variable energy use.

2. Like other elements of value, energy-related effects on value are defined by the market. While specific information on buyer preferences and willingness to pay are therefore the ideal gauges of energy-related value, such information is generally unavailable. In the absence of market information, estimates of energy-related effects on value may be made indirectly through income-capitalization calculations, with the use of credible, well-substantiated information on the building's energy costs.

3. It is the responsibility of the building owner to provide the appraiser with information on the energy costs of the subject building. Appraisers should ask for a completed summary statement of building energy use, such as the one shown in Appendix A.

4. Acceptable types of energy-cost information include billing histories. Billing histories should include electricity, gas, and steam bills for at least the most recent consecutive 12-month period. Longer periods are preferred. Billing histories should be normalized for weather, occupancy, operating hours, and other factors, as with the EPA Energy Star Benchmarking Tool. Conversely, billing histories may be substantiated with a review of key energy-related built features of the building. Specifically, where bills imply low energy use, the owner should provide verification of the presence of working energy-saving building features.

5. Computer simulations of energy performance are an acceptable surrogate for actual historical billing and use patterns, if such simulations are performed by established calculation tools such as DOE-2. The integrity of the input data used in the computer simulation should be confirmed, either via a third-party review or via constraints in the software that limit the ranges of given building parameters. Calibration should be conducted only by the most sophisticated users.

6. The summary statement and supporting energy-related documentation to be used in the appraisal should be stamped and signed by a certified professional engineer, licensed architect, or a Certified Energy Analyst

as designated by CABEC. If an appraiser has doubts about the technical qualifications of the preparer of the documentation, the appraiser should ask for additional evidence of such qualifications.

7. Standard references such as BOMA and IREM databases should be used only to *check* building-specific estimates of energy cost. Appraisers should exercise caution even when using databases merely as points of comparison, since the categories embodied in the databases may not match the building in question or may not have enough buildings to offer a statistically precise representative sample. Database information may also reflect different methodologies from those used for the subject building.

   Only when building-specific information is absent should the appraiser consider using standard references to assign default energy-cost figures to the building. In these cases the appraiser should be able to justify specifically that the subject building falls into the category of the dataset being used.

8. In the future, appraisers may want to seek continuing education courses in energy-efficiency as they become available. An energy efficiency course for the residential sector, titled "Using the Energy Factor to Appraise," was recently approved for continuing education credit, and it is anticipated that commercial courses will follow. While the guidelines and recommendations presented here do not require any type of supplemental training for appraisers, numerous appraisers have told IMT and the authors of this document that it would be welcomed if offered.