Energy Efficiency Design Assistance As Offered Through City Planning, Zoning and Permitting Departments: Experience from the City of Oakland

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ABSTRACT

The City of Oakland rolled out a new program concept for program year 2001. The Energy Efficiency Design Assistance (EEDA) Program provided free customized energy efficiency design assistance to property owners, developers, and designers involved with new construction or renovation/retrofit of existing buildings. Early intervention is achieved by making contact with development teams through the City's Planning and Zoning Department.

The program targeted the commercial, industrial and multifamily sectors, although a few "gut" rehab and retrofit projects were also addressed. The program was developed as a third party initiative and the contract for services included a performance incentive for the EEDA implementation team.

There was tremendous interest and a very high rate of participation in our program because of skyrocketing utility rates in 2001. Although final results are not yet in, so far the program has provided assistance for over 20 developments in Oakland. Identified savings have been conservatively estimated at over 4,000,000 kWh and 50,000 therms annually. The savings are net of the new, more stringent Title 24 requirements rolled out this year.

The paper will focus on presenting the effectiveness of the approach and lessons learned, as observed by the EEDA technical lead and project manager. These will include a discussion of market barriers encountered during the process and how they were addressed. Special attention is given to problems encountered from the multifamily residential sector where market forces are driving many developers to install electric resistance heating in new apartments and condominiums.

Introduction

The City of Oakland's Energy Efficiency Design Assistance Program (EEDA) was introduced in 2001 with the purpose of offering energy efficiency design assistance to building owners and developers.

This paper discusses our experience implementing the program and lessons learned through offering technical assistance to over 20 developments. We begin with an overview of the program, its goals and achievements, and discuss the unique outreach methods that were used. We will discuss in detail some of the unique problems encountered in the multifamily sector, identify market barriers that are driving new developments to use electric resistance heat in this sector, and identify ways that some new multifamily projects are resisting this trend.

The Energy Efficiency Design Assistance Program

EEDA Program Overview

Although California energy efficiency standards establish minimum levels of efficiency for new and remodeled buildings, substantial opportunities remain for reducing building energy requirements through improved design. If not addressed early in the building design, many of these energy savings options become lost opportunities, as they are much more costly to address after the building is constructed.

The main barriers to incorporating energy efficiency into new construction are lack of awareness of energy efficiency technologies and design strategies, and lack of information on their relative costs and savings. In part this stems from a traditional building design process that does not typically include a budget for evaluating energy efficient design alternatives or design team members that have the necessary experience and expertise to evaluate energy efficiency alternatives.

To address these barriers, the City of Oakland obtained funds from the California Public Utility Commission's (CPUC) Summer 2000 Energy Efficiency Initiative, and began sponsoring the Energy Efficiency Design Assistance Program (EEDA) program in February of 2001. City staff believed that "point-of-permit" design assistance offered the best opportunity to capture the majority of buildings seeking approval for new and renovated designs.

The Energy Efficiency Design Assistance Program provided customized energy efficiency design assistance at no cost to property owners, developers, and designers involved with new construction or renovation/retrofit of existing buildings located within the City of Oakland. The services were provided at the at the point of permit in coordination with the City's planning, zoning, and building permit services. The City's active promotion of the program was a key factor in gaining access to decision makers early in the process, thereby maximizing potential savings and cost effectiveness. Through this marketing approach the program achieved a very high rate of participation, with over 50% of large development projects in Oakland participating in the program.

The program targeted the commercial, industrial and multifamily sectors and large single-family residential developments. The program aimed to improve the energy efficiency of new building construction and major renovations by reducing energy use by five to ten percent beyond what is mandated by the new state building standards. Figure 1 shows the market sectors served as a percent of the total square footage.

Outreach

A multi-faceted campaign was launched in February 2001 to market the program to the target market segments including:

- Sales calls to prospective participants after being referred to the program by City staff, EEDA team members, or BOMA Oakland-East Bay
- Development of a program brochure for use in a direct mail campaign to selected organizations

- Placement of program brochures and posters at strategic locations
- Speaking/tabling at trade and professional association events





Ongoing communication with City building and development officials was critical to successful outreach because they have the most current information about upcoming new construction and major retrofit projects "in the pipeline" and could help facilitate the appropriate points of intervention in the design/development/construction process. In particular, the EEDA team worked with the City's Major Project Planners, Building Process Coordinators, and the City of Oakland's "10K" Coordinator¹, to identify prospective program participants that were in need of or that would be receptive to EEDA services. Larger development projects of special interest to the City were targeted to receive special outreach attention through repeated sales calls and mailings. City staff helped identify these key project leads from the Planning and Zoning Division's Major Project List, or projects undergoing review at regular Planning Commission Design Review Committee meetings. Projects included in the Major Project List represented the largest projects undergoing development in the City as well those with the largest energy savings potential. Referral of prospective projects by City staff, followed with "sales calls" from the EEDA team was the most effective outreach method employed.

¹ The City's 10K program is an initiative started by Mayor Jerry Brown to develop new housing to accommodate 10,000 residents in and around downtown Oakland.

Technical Assistance

Program participants were offered technical services that were customized to the project needs and interests of developers. The program's technical assistance services included:

- Site-specific engineering analysis of energy-efficient technology options and economic analysis of expected costs and savings of design alternatives
- Prioritized list of design features and building systems that offer the best value
- Detailed product and system information for mechanical and electrical designers including sources for more information
- Referrals to other programs such as Pacific Gas and Electric's Savings by Design program, and other energy efficient design support resources available through the City of Oakland, PG&E, California Energy Commission. Program participants were also provided with information about other applicable design assistance programs (new construction) or incentives (retrofit).
- Estimated project-specific incentives that project owners and design professionals would be eligible for if they incorporate recommended design measures.

The technical assistance was highly customized to meet the individual needs of each project. Most developers had specific issues that they were interested in investigating and these were pursued wherever appropriate. By responding to developers needs this way, we achieved a very high level of satisfaction with the technical services provided.

Whenever possible, the program promoted the use of the newest technologies. Standard engineering design firms typically utilize boilerplate specifications and designs that do not specify energy efficient equipment, much less the newest efficient technologies. Where appropriate, design recommendations have included efficient technologies that have thus far seen little penetration in the commercial sector, including for example, high-performance 3200 lumen lamp T8 lamps, and the "Dual Cool"² evaporative pre-cooler and heat recovery system for HVAC rooftop units.

Because program funding was through a CPUC program for energy efficiency, program technical services had to focus on efficiency measures only. This specifically excluded examining distributed generation, combined heat and power applications, and renewable energy generation. This was a disappointment to many of the program participants who assumed we might help them with exploring these options as well.

Program Achievements

The 2001 EEDA program achievements are summarized by the following:

² The "Dual Cool" system combines an evaporative pre-cooler with exhaust air heat recovery to improve the efficiency of rooftop unitary air conditioners. It is manufactured by Davis Energy Group, Davis, California.

- The program is estimated to save approximately 37,913 MWh and 958,622 therms over the lives of the "likely to be implemented"³ energy efficiency measures.
- The program successfully recruited and served 23 projects representing over 4.5 million square feet of building space and over 800 housing units.
- Approximately 22% of the building stock served by the program is in the hard-toreach markets including multi-family residential and new single-family developments.
- The estimated total net savings is forecasted to be 3,166,631kWh. This represents 235% of the minimum EEDA program goal, and 56% of the total savings identified.

There was tremendous interest and a very high rate of participation in our program because of skyrocketing utility rates in 2001. The rollout of our program was precisely coincident with California's Energy Crisis of 2001. Project developers were thus keenly aware of energy issues, more welcoming of advice about energy efficiency, and more likely to implement recommendations from our program. The success of our program is in part attributed to this high level of interest.

Overall Program Lessons Learned

Through our experience with the EEDA program several central ideas became clear.

Outreach through the City Planning and Zoning & Permitting Departments Is Effective and Timely; Coverage of Available Market Was Very Thorough

Sixty-one percent (61%) of program participants were recruited through the assistance of City staff referrals, demonstrating that the City's active promotion of the program was a key factor in gaining access to decision makers early in the process. Of a total of 27 key project leads identified through City staff, 14 of these, or 52%, participated in the program. These 14 projects, however, represent over 70 percent (approximately 3.6 million square feet) of the total square feet associated with these 27 project leads (approximately 5.1 million square feet).

The Ability to Respond Immediately to Requests for Assistance Is Critical

New developments, particularly commercial ones, are often on very tight design and construction schedules. In many of the projects the timing of technical assistance was very critical. We often had a "window" of time during which we could offer recommendations when the developer could still act on our suggestions. If that window of opportunity is missed, the potential for making significant changes to the design may be lost.

³ Because of the long timelines for new construction projects, we do not yet know with certainty which of our recommendations will be included in final designs. We have relied on developers' estimates of which energy efficiency measures they plan to adopt.

There Is an Unmet Need for Technical Assistance with Distributed Generation & Renewable Sources

Our program received numerous requests for assistance and information about the costs, benefits, and methods of employing distributed generation, particularly with renewable sources. We had to turn down these requests because our funding was derived from Public Goods Charge (PGC) funds and must only be used for energy efficiency technical assistance, not generation. Many of our participants would have liked assistance with preliminary scoping of photovoltaics (by far the most requested), solar domestic hot water, microturbines and cogeneration, and wind power. Interest in these technologies was at an unprecedented high during 2001 because of the California "Energy Crisis."

Provide Assistance to Design/Build Projects Before Design/Build Contract Is Finalized

The EEDA program provided technical assistance to three design/build projects. Design/build has become a more popular approach in recent years due to the many potential advantages it can bring developers. Design/build has the ability to fast track the design and construction process. For example, it's not uncommon for equipment with long lead times to be selected and ordered before much of the design has been completed. Design/build provides a single point of responsibility for design and construction and can reduce conflicts amongst development team members during these project stages. It can provide an early cost commitment and more cost certainty than the traditional design-bid-build process and potentially lower the overall project costs. These advantages, however, come with some potential drawbacks. The design/build process can create the potential for cost-saving strategies that erode design and construction quality. Therefore, the project quality may be at risk if project specifications are not well defined up-front in the design/build contract.

Design/build projects also pose special challenges for an energy efficiency design assistance type program. To begin, it can be more difficult to facilitate review of the design after the design/build contract has been signed. This is because the design process tends to be less linear than the traditional design process (design and construction can overlap as much as practical). But more importantly, all recommendations made after contract signing require a change order to incorporate, since the contract specifies a fixed cost with associated specifications which tend to be more performance based. Understandably, the developer will be more reluctant to incorporate energy efficiency measures in these cases, as the incremental cost associated with any recommendations will be greater than usual as is typical in any change order process.

Therefore, the key to providing effective design assistance to a design/build project is to provide the recommendations before the design/build contract is finalized. However, this points to the "catch 22" when providing design assistance to design/build projects. In most cases, the project is not that well defined prior to the design/build contract. Therefore the energy efficient design specialist must be comfortable working with more of a clean slate, and be familiar with how to effectively define and specify the quality of various recommendations through the more typical design build performance type specification approach. The other associated advantage of catching the project before the design/build contract is finalized, is that one has then succeeded in initiating the design review process during the early design stages.

Fortunately, we were able to provide technical assistance for all three design/build projects before the design/build contract was finalized.

Multifamily New Construction Experience

New multifamily developments represented 18% of the total square footage served by the EEDA program. Through experience with these projects the program team identified some unique market barriers particular to this sector. We provide below a brief background of this market sector, and detail some of the problems we encountered.

The Multifamily New Construction Market

General characteristics. There are at least 3 market segments in multifamily new construction (Clinton 2001):

- Speculative development for condo sale
- Market rate development of units for rental
- Affordable housing development for mostly rental market

Each of these market segments has distinct characteristics that change the way that owners and developers view potential improvements in energy efficiency. For example, condominiums may be able to capitalize on energy efficiency improvements to units by marketing these benefits to potential buyers. However, market rate rental developments may see these benefits as less important to renters.

Each of the market segments shares common characteristics as well. In all cases, costs and benefits for energy efficiency measures are split between developers and occupants for all measures except those affecting common areas.

Multifamily development in Oakland. During 2001, most residential new construction in Oakland is in the multifamily sector. The EEDA Program took advantage of synergies with the City of Oakland's 10K Housing Initiative, one of the City's major redevelopment efforts. This high-profile effort to bring 10,000 new people to live in the greater downtown area will require more than 6,500 units of new multi-family housing construction. The EEDA program delivered services to five of the largest developments in the City's 10k Housing Program, representing 650 units of new housing.

Some of the multifamily developers had added incentives to incorporate energy efficiency into their new multifamily projects. The development agreements that some signed with the City require them to design these buildings to achieve Leadership in Energy and Environmental Design (LEED) certification for their buildings. These projects were naturally more interested in the assistance that our program offered.

Market Barriers Unique to New Multifamily Projects

There are significant market barriers in the new multi-family housing market that work against the installation of energy efficient heating, ventilation, lighting and appliances. The most significant of these is the traditional problem of split incentives. Additional costs for energy efficiency measures are born by the developer, while potential benefits are garnered by the occupants. We've found no magic bullet to completely answer this problem, however, some of the concepts discussed below begin to address it.

One would expect that, of the three types of new multifamily developments discussed above, the condominium market would be the most receptive to energy efficiency improvements. Condos minimize the split incentive issue because one could presumably charge more for an energy efficient condo than a typical one, thus recovering the investment. The "conventional wisdom" is that developers don't pursue this for several reasons (Kuklin 2001):

- Condos are not seen by owners as a long-term investment. Buyers don't typically expect to live in a condo for more than two or three years, so investments with moderate returns (e.g. a payback of 5 years) are not relevant.
- The marketability of energy efficiency benefits are limited and small compared to other factors influencing the buyers decision such as cost, location and amenities.
- Buyers comparison shop based on condo cost and monthly dues. Added fees to either make them compare unfavorable to competition. Utility bills typically are excluded from the monthly dues.

These factors combine to make the "sale" of energy efficiency to developers a difficult one.

Multifamily Developments Are Missed by most Energy Efficiency Programs

There is currently a void of energy efficiency programs to serve the new and retrofit multifamily building markets. These developments are generally not served by the other design assistance programs, except for common area spaces that make up a small fraction of the total building. Energy Efficiency Mortgages are also currently not available for condominium developments. Although tenants are eligible for the same incentive programs as homeowners (e.g. rebates for Energy Star appliances), there are no programs in California that we know of, other than EEDA, that are addressing new construction, common areas, central heating systems, appliances, and envelope improvements for these buildings.

Developers Are Interested in Providing Energy Efficiency Information to Tenants

We found several opportunities where building owners and developers were very interested in providing information to their tenants. Our program passed on many references for Energy Star Appliances (both home and office) that developers were very glad to get. We saw that this is one way of addressing the split incentives issue so that we could get information to tenants, while the developer or building owner could be seen as providing useful information to them.

Some Developers Are Recognizing the Marketability of "Green" Buildings

Several developers that we worked with during the program were interested in pursuing energy efficiency and "green" building techniques because they felt that it made their building more marketable to potential owners or tenants. Improved daylighting and indoor air quality are characteristics of efficient buildings that developers cited as valuable assets. Although not all developers see this market potential, there is clearly a growing niche in condominiums and apartments where owners and tenants perceive value in improved energy efficiency and lower environmental impact. Green City Lofts and Northgate Apartments are examples of such multifamily developments.

Incentives (Financing Tied to LEED) for Green Buildings Are Motivating Developers

Several projects that we assisted had funding sources or planning and zoning approval that were contingent on obtaining a LEED certification. Developers relying on these funding sources or City-held development agreements were motivated to incorporate energy efficiency measures, as intended by the incentives. However, in some cases they were clearly trying to do as little as possible, and minimize added investment to obtain the certification. The most glaring example of this was multifamily developments attempting to get LEED certification (because their development agreement required it) while relying on electric resistant heat for individual units.

Electric Resistance Baseboard vs. Centralized Natural Gas-fired Heat

EEDA 2001 provided technical assistance to over 800,000 square feet of new multifamily housing projects. Of these projects the typical heating system, used in over 83% of the conditioned floor space) is electric resistance baseboard heat.

This system is inefficient from an energy resource perspective but there are compelling reasons why developers choose it. The first cost of these systems is much lower than comparable hydronic or forced air natural gas systems. Because owners will not pay utility bills (i.e. there are split incentives), there is no incentive to invest in the higher priced, more efficient systems. Even in condo developments, where buildings are developed to sell, most developers do not see significant marketability to energy efficiency.

We discussed centralized heating schemes with several developers. The primary issue that arises is how to bill tenants. The advantage of all electric systems is that the local utility company bills the tenants individually for their use. With central systems some other option needs to be found. One option is to pay heating through the association dues or rent. Paying higher dues (condos) is not desirable due to marketability reasons mentioned above. A similar problem occurs for renters because most new apartment rents do not include heating costs. A second option is to submeter tenants for heating costs using BTU meters. These meters can add \$50,000 to \$100,000 to the construction cost of the building. With these systems someone also needs to do monthly billing. Third party firms do this for \$10 to \$15 per meter per month, a cost that also needs to be accounted for. A third option is to use individual gas meters for each apartment/condo with individual heating systems for each unit. This option solves the billing problem because the gas provider will send bills, but the additional cost for gas meters, space for them and piping is significant.

Only two project participants so far have addressed these problems and still chose a gas-fired heating system. Each was a "green" building project where environmental responsibility was one of the major project goals. In other more "mainstream" projects, the arguments for electric heat have won the day.

We have summarized below the advantages and disadvantages of utilizing electric resistance baseboard heating systems versus a central hydronic heating systems in multifamily projects.

Advantages & Disadvantages of Electric Baseboard

The typical electric resistance baseboard heating system consists of zonal baseboard heaters controlled by thermostats located within each room. Baseboard heaters contain electric heating elements encased in metal pipes. The pipes, surrounded by aluminum fins to aid heat transfer, run the length of the baseboard heater's housing, or cabinet. As air within the heater is warmed, it rises into the room, and cooler air is drawn into the bottom of the heater. Some heat is also radiated from the pipe, fins, and housing. The quality of baseboard heaters varies considerably. Cheaper models can be noisy and often give poor temperature control.

Advantages.

- Lower design and installation costs compared to a central hydronic system
- Can potentially avoid the need for natural gas service if units are only electrically supplied for cooking, heating and domestic hot water (although most residents prefer natural gas for cooking and natural gas is less expensive for domestic hot water as well)
- Each unit is metered and billed for electricity by the local utility
- There are no maintenance costs
- No standby losses for boilers, water heaters nor continuous pump operation

Disadvantages.

- Larger electric service is needed for the building as a whole requiring a larger transformer
- Makes it harder to meet the California Building Energy Standard Title 24 (may result in higher costs for other building components to compensate such as increased insulation in ceilings and walls)
- Higher operating costs for each unit and in common areas
- Higher supply temperatures makes electric baseboard panels less safe than hydronic heating panels or forced air
- Results in greater use of energy resources and emissions overall due to electric generation and transmission losses
- Will contribute to the growing power needs/constraints in the Bay Area

Advantages & Disadvantages of Central Natural Gas-fired System

The principal competitor of electric resistance heat in the San Francisco Bay Area is the central hydronic heating system. Typically it consists of a natural gas-fired central boiler that heats water to a thermostatically controlled temperature. Piping carries the heated water from the boiler to radiators installed in panels of between 2 and 8 feet in length. A small pump circulates that water through the piping. Individual panels can be controlled independently so that only individual rooms or the whole unit can be heated.

Advantages of central natural gas-fired system.

- Allows for smaller electric service to the building overall resulting in a smaller transformer
- Lower operating costs for each unit and in common areas
- Tenants will have a greater ability to pay utility bills if operating costs are lower
- Lower operating costs may provide competitive advantage compared to other similar units resulting in units being occupied sooner
- Lower supply temperature makes hydronic heating panels safer than electric baseboard panels
- Uses less resources and produces lower emissions overall compared with electric resistance baseboard heating system

Disadvantages of central natural gas-fired system.

- Higher installation costs compared to a electric resistance baseboard heating system
- Modest annual maintenance costs for tuning boiler
- Requires space for central boiler
- Requires space for running vertical shafts for the piping
- May require more administrative effort/and or costs on part of building owner to bill tenants for space heating (depending on billing method as outlined below):

Billing issues with central natural gas-fired system. One of the chief problems for developers in implementing a centralized heating system is addressing how to bill tenants. One of the biggest benefits of all electric systems is that the billing is all done by the local utility. The following are other billing options that we investigated for centralized heating systems:

- Include a flat fee for heating costs in rent and prorate for the square footage of unit. This requires minimal administrative effort, but risk of higher utility costs due to increased gas use by tenant is borne by building owner. Building owner can raise fees if gas rates increase.
- Bill each tenant monthly based upon the actual bill and then prorate the bill for the square footage of the unit. This requires a monthly billing process separate from the rent. The building owner is guaranteed of passing on all monthly gas costs to tenants. However, there is little incentive for tenants to use heating wisely since those tenants that use heat frugally will end up paying for heat that went to those tenants that used space heating less efficiently.
- Install BTU meters for each unit and bill accordingly on a monthly basis. This requires the most administrative effort and additional costs for the meters. Tenants pay for their exact share of the monthly gas costs.

• Install gas meters for each unit and design the building system with separate heating systems for each unit. This was not considered feasible by our developers because of the added costs for meters and space needed for gas piping runs to the units.

Costs and Benefits of Electric Resistance Baseboard vs. Centralized Natural Gas-fired Heat

We conducted a detailed analysis of options for one of our projects where we compared an electric resistance baseboard heating system with a central hydronic system. The comparison building was a 58,000 square foot, multi-building development with 52 units. Base heating loads were developed with an EnergyPro⁴ model of the building. Current utility rates were used to assess cost impacts.

The following benefits are attributable to the central hydronic system:

- Annual source energy savings of 58% (includes generation & transmission efficiency)
- Reduction of CO_2 emissions by 48% (32 tons of CO_2 annually)
- A savings of 13.4% in whole building energy use relative to Title 24 Standards
- A 71% reduction in heating costs for the typical tenant (\$190 per year)
- A return on investment of 8.8% (from societal perspective) or simple payback of about 10 years.

The simple payback of 10 years is a very rough approximation because of a high degree of uncertainty in overall design and installation costs of the two systems. While the energy savings calculations were done in detail, the actual costs have yet to be finalized.

Other Energy Efficiency Measures and their Acceptability by Developers in the Multifamily Market

Developers essentially have final say in what efficiency measures are installed in their buildings. Therefore the "marketability" of different measures to them can be helpful to other design assistance projects that seek to serve this market. Measures that proved successful within the Oakland market are the following:

Energy Star appliances. This measure has perceived marketability to prospective owners and renters, thus developers were more receptive to installing energy efficient appliances. Our program addressed dishwashers, clothes washers and refrigerators – the appliances most often provided along with units in new construction.

Our anecdotal experience indicates that cost premiums for energy star appliances vary greatly. In some cases the premium was almost nothing, while in others it was enough to drive developers away from the product.

Common area lighting / **ventilation.** Energy efficiency measures for common areas appealed to all developers because in this case there is no split incentive. Reduced energy

⁴ EnergyPro is the software used to show compliance with the California Building Energy Standards Title 24. It relies on a DOE 2.1E simulation engine to estimate heating loads based on envelope and system specifications.

costs in these areas lead to an improved bottom line. For these areas we were able to convince developers to install efficient lighting and ventilation that went beyond Title 24.

Garage ventilation. Similarly, garage ventilation measures appeal to developers because there is no split incentive – all benefits are garnered by the owner. We found that many developments are still relying on mechanical ventilation unnecessarily. Experience with local architects indicates that in most cases, garages can be designed so that no mechanical ventilation is necessary (Burton 2001). Mechanical ventilation is, however, still used in most developments. Because garage ventilation is not specifically covered by Title 24, mechanical systems are not designed with the best available controls to limit fan energy use.

Conclusions

The EEDA program is a demonstration of the potential impact of a locally based energy-efficiency program. The program also demonstrates that "point-of-permit" design assistance offers a highly effective strategy for capturing the majority of buildings seeking approval for new and renovated designs. The program is currently forecasted to achieve 235 percent of its program goal representing approximately 3.2 million in annual kWh savings. By leveraging the City's permitting process, the program has successfully recruited and served 23 projects representing over 4.5 million square feet of building space and over 800 housing units.

Measures that proved successful within the Oakland multifamily market include energy star appliances, common area lighting/ventilation improvements, and garage ventilation controls. There are a number of factors that are combining to put pressures on the new construction multifamily market that are driving this market towards electric resistance heat including first cost barriers and tenant billing issues associated with alterative central centralized heating systems. Unless we can find solutions that tackle these market barriers, we will be stuck with the high costs, emissions, and energy usage of these systems for many years to come.

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