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GOING DEEPER: A NEW APPROACH FOR ENCOURAGING RETROFITS

Issue Brief

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A new approach to demand-side management promotes whole-building projects and encourages owners, energy service providers and utilities to work together for significant energy savings.

INTRODUCTION

In light of state policies requiring higher levels of energy efficiency and other forms of demand-side management (DSM), utilities across the U.S. are seeking to expand their offerings. A recent report estimates the ratepayer-funded DSM market at $6.6 billion.[1] Meanwhile, private-sector investment in energy efficiency is growing, building on decades-long experience of the energy services industry and charged with new technologies and financing solutions and innovative business models. The energy services company (ESCO) industry was recently sized at $4.1 billion and is growing at 26 percent per year.[2]

[1] Julie Caracino, "State of the Efficiency Program Industry" Consortium for Energy Efficiency, December 2010.

[2] Satchwell, et. al. "A Survey of the U.S. ESCO Industry" LBNL, June 2010

The growth in the utility DSM programs and private energy services could be aligned to deliver greater savings and cost reductions. This issue brief outlines a proposed approach to encourage energy consumers to reach new levels of energy efficiency by aligning utility incentive programs with more integrated and aggressive packages of efficiency upgrades. By developing a new type of DSM program that incentivizes "deep" retrofits, this approach encourages a whole-building perspective and invites owners, energy service providers and utility program managers to work together toward substantial energy savings.

THE WHOLE BUILDING

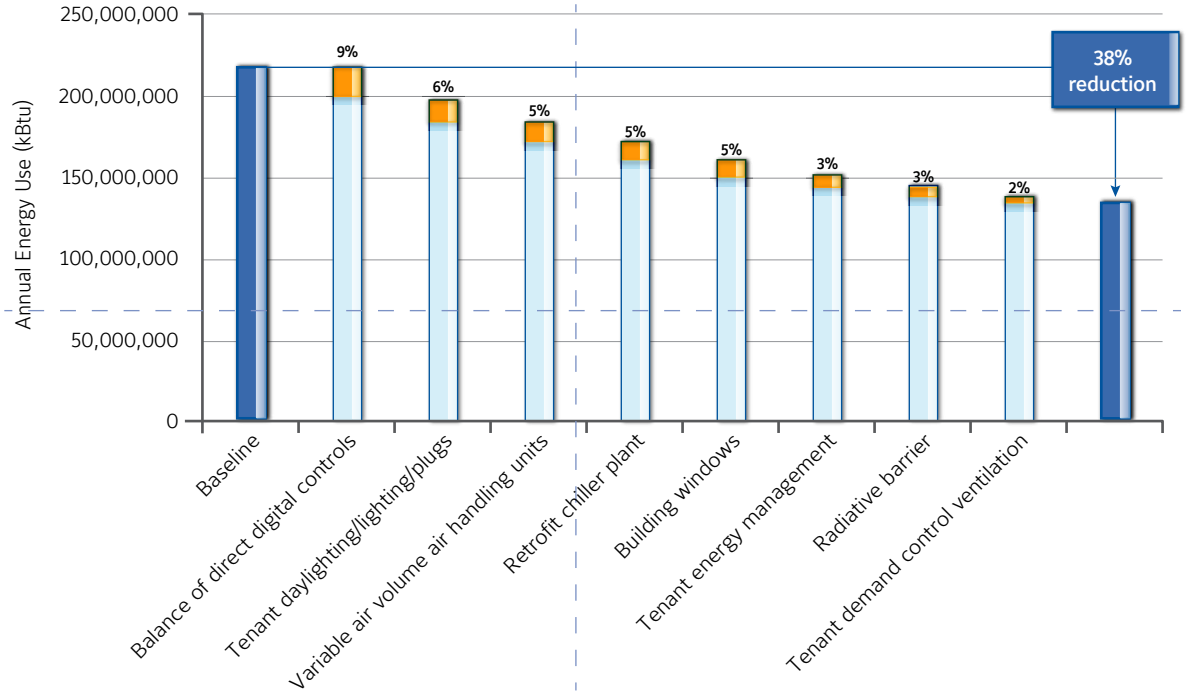
To meet aggressive new goals, utilities are reassessing their approaches to the efficiency business. Leaders in utility energy efficiency programs are exploring how to maximize energy savings by reaching more customers, often targeting market segments with low historical participation in utility programs. But simply finding more customers probably will not be enough to meet new state targets: Programs will also have to increase energy savings per customer. How can utilities achieve this? By going deeper.

Going deeper means getting more savings per energy efficiency project. In the simplest terms, it means installing more energy savings measures and addressing all possible energy end-uses. The way to do that is not to look at individual technologies incrementally, but to combine technologies and optimize the performance of the building as a whole. Through this approach, an individual building could realize 30 to 50 percent energy savings, whereas the single-technology approach most utility rebate programs use generally yields 1 and 5 percent whole-building savings. Thus bundling of energy savings measures significantly improves the outcome for the utility and the energy consumer.

An example of a deep commercial retrofit is the Empire State Building. Working with diverse stakeholders including the Rocky Mountain Institute and Johnson Controls, the owner has nearly completed a major retrofit expected to save 38 percent of the building's energy consumption with a three-year simple payback on the energy-saving investments. This success required looking beyond conventional, incremental

measures. The building owner and project team worked closely together with the goal of achieving meaningful savings. For example, with a comprehensive approach and an integrated design process, they were able to renovate and downsize the chillers after reducing cooling loads by one-third through window replacements, lighting and controls upgrades, radiant barriers behind the perimeter heating units, and a tenant energy management system.

Figure 1. The Empire State Building's energy savings were the result of eight key projects. The design team looked at how the interactions among these projects would affect both energy savings and the costs for the retrofit.



The Empire State Building's approach, however, is far from mainstream, and rebates and incentive programs do not generally support the installation of a suite of technologies.

Most utility programs today support single energy savings measures. These projects are simple to implement and evaluate results, but they do not take a whole-building perspective and so leave a major portion of the efficiency opportunity untouched. For example, a building owner may get a utility incentive by upgrading a packaged air conditioner to a more efficient model, but miss the opportunity to eliminate the unit by upgrading windows, increasing insulation, and reducing lighting and plug loads. Many utility programs would incentivize the air conditioner only.

Ideally, utility programs would provide incentives for integrated design to achieve greater savings. There are examples of such programs. In California, the Pacific Gas & Electric ACT-2 project piloted the deep energy retrofit technique, providing initial proof that these retrofits can be achieved cost-effectively as measured against utility cost tests.[3] More recently, California and Connecticut utilities are working toward the same type of market transformation, with the ultimate objective to incentivize deep energy retrofit projects.[4]

[3] Brohard, G.J. et al. 1998: "Advanced Customer Technology Test for Maximum Energy Efficiency (ACT2) Project: The Final Report." Procs. *Summer Study on Energy-Efficient Buildings*, ACEEE, 207.67.203.54/elibsql05_p40007_documents/ACT2/act2fnl.pdf; technical reports at www.pge.com/pec/resourcecenter/, "Related Links."

[4] See discussion of existing programs below.

Taking deep retrofits to scale will not be easy: There are valid reasons why they are not yet widespread. More deep retrofits require clients who demand them, practitioners who can provide them, and utilities that encourage them. The move toward deep retrofits will also require new mechanisms that help create a market. Leveraging utility ratepayer funds could change the incentive structure just enough to "tip" projects that would otherwise remain undone and so transform the existing building market to unlock significant levels of energy efficiency.

PROPOSING A NEW SOLUTION – THE "DEEP ENERGY EFFICIENCY PAYS" PROGRAM

The "Deep Energy Efficiency Pays" (DEEP) program is a proposed new concept for utilities, delivering savings that are both cost-effective and significant. The program targets commercial, institutional and industrial customers and encourages energy reductions greater than those achieved through prescriptive, single-measure-level rebates. The incentive is based on the measured performance of the whole building, ensuring that incentive funds go directly toward energy savings for clear and measurable impacts.

At the highest level, the program structure is simple – it offers an additional incentive for projects that meet a specified threshold of energy savings. This incentive is applied on top of other rebates for individual measures, and the amount of the incentive is designed to tip the economics of projects into the realm of achievable. To cover the bulk of the project cost, money from external sources (including ratepayer funds) will be used in addition to customers' capital to deliver projects with significant and cost-effective energy savings. The initial target is large buildings, as they have the size and in-house expertise to support the required collaboration and interaction among project teams. However, the same basic structure could easily extend into other sectors, such as small business or even residential.

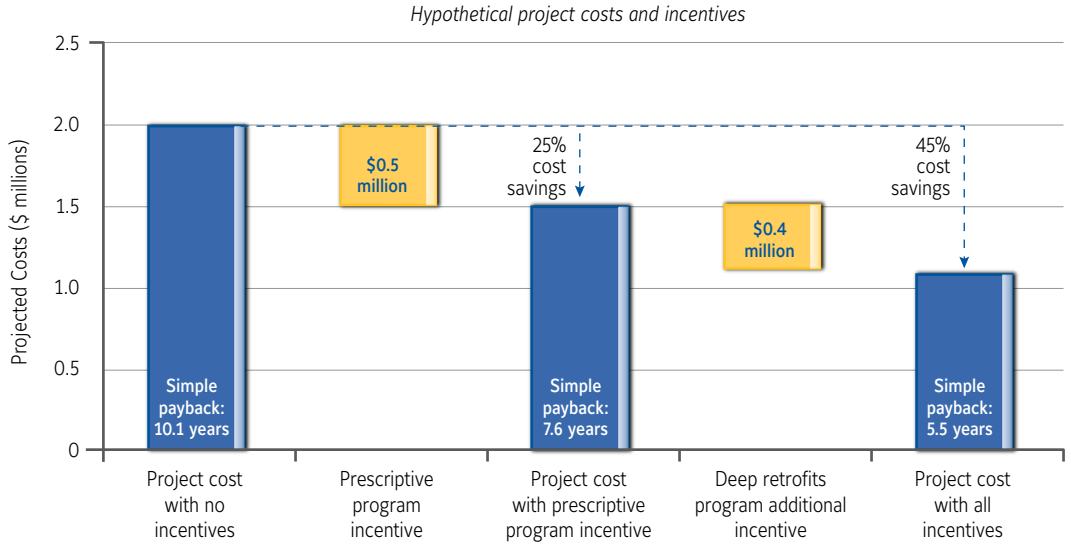
A hypothetical example shows how the DEEP program could work in practice. The owner of a 250,000 square-foot office building wants to increase its energy efficiency. Between in-house staff, a consultant, an energy services company and a financial partner, the owner identifies a package of measures that includes switching lamps and ballasts, adding occupancy sensors, replacing an aging boiler, upgrading building controls, increasing wall insulation, applying a reflective roof, adding reflective window films, and installing a small solar array. The project will cost $2 million and save close to $200,000 in energy bills per year, for a simple payback of 10.1 years without incentives. Enthusiasm fades, as this time horizon is too long for the typical commercial building owner, especially in the still-volatile U.S. real estate market.

By getting utility incentives under the existing prescriptive rebate program, the project team can reduce the simple payback to 7.6 years (assuming a 50 percent rebate applicable to half the project), but that still fails to meet the owner's internal hurdle rate and payback requirement. In response, the team could pare down the project to eliminate measures not covered by rebates program, perhaps reducing the scope and the energy savings by half.

Under existing programs, the owner has two practical choices: do nothing, or implement a small-scale project designed to maximize incentives. But the DEEP program provides another option. In this example, the program offers an additional incentive of 20 percent of the total cost of a project that reaches a

threshold of 30 percent energy savings. With this incentive, the building owner can capture all the savings identified, while meeting the internal requirement of a 5.5-year simple payback (Figure 2). The customer gets significant energy savings, the financier is able to supply the capital, and the electric system benefits from gigawatt-hours of savings over the lifetime of the project.

Fig. 2: The DEEP program strongly affects the economics of a retrofit project. In this example, the project costs $2 million (without incentives) and saves $200,000 in energy bills per year. Note that the project would receive the additional incentive only if the savings exceeded the percent savings threshold.



While this example illustrates the ability of the DEEP program to drive deeper savings by "tipping" the economics, a market transformation component may have an even greater impact in unlocking energy savings. In this example, the project team self-assembled and worked together to identify a comprehensive energy savings opportunity. However, experience shows that most projects evolve in a more opportunistic or piecemeal fashion. For example, a vendor of a particular technology may convince decision-makers to invest in an installation, or a utility rebate may trigger interest in improving lighting or HVAC equipment.

The DEEP program can align the focus of multiple stakeholders on the end goal of a 30 percent or greater energy reduction. With this focus, the project team will consider multiple end-uses and design for the greatest impact, rather than focusing on a particular technology. In this way, the program overcomes not only the financial barriers to efficiency projects, but also the organizational challenges that often prevent energy savings from materializing.

A WIN ALL AROUND

The DEEP program provides clear benefits to all three key groups of stakeholders: utilities, building owners, and third-party efficiency providers.

Utility perspective

From the point of view of utility DSM managers and their regulators, the DEEP program meets regulator and internal criteria for a DSM effort. The program allows access to more savings in a cost-effective manner, enabling utility DSM efforts to reach beyond the "low-hanging fruit." Continuing with the same example, if a utility funded 75 projects over a three-year span, a $33 million program would deliver electricity savings of 114 GWh and gas savings of 163 million cubic feet, as well as a peak demand reduction of 16 MW. Including only the roughly 50 percent of project components that do not qualify for the existing programs (to avoid double-counting), the DEEP program would generate avoided supply costs of $82 million and participant savings of $97 million. Factoring in the cost of the incentives, program administration and participant costs, the Total Resource Cost (TRC) score for the program is 1.4.[5]

[5] The Total Resource Cost (TRC) test is a common measure of the cost-effectiveness of a utility demand-side management program. TRC scores above 1.0 indicate that a program provides more benefit to the ratepayers and utility than it costs to implement. Here, the calculation includes only the incremental costs and savings of the program to avoid double-counting the impacts of other utility programs such as prescriptive rebate programs.

6 See Institute for Building Efficiency, "Energy Efficiency Indicator 2011" at http://www.institutebe.com/Energy-Efficiency-Indicator/2011-global-results.aspx

The benefits to the utility are not simply economic:

1. Leveraging the expertise and financial capital of energy consumers and private financiers allows utility DSM portfolios to meet aggressive targets and achieve meaningful energy savings without incurring expenses beyond those of a custom rebate program.
2. Targeting larger customers allows for major impacts and small transaction costs, as measured in dollars per unit of energy saved.
3. The DEEP program will provide an additional incentive to projects that meet a specific savings target, defined in terms of percentage savings. However, as the customer and service providers work toward meeting this target, many specific energy efficiency measures that already qualify for rebates under a prescriptive program can be combined. In this way, the program will drive spillover into existing programs, supporting the utility's broader DSM portfolio.
4. As the idea of whole-building retrofits and a comprehensive approach to energy efficiency gains traction among the largest buildings, markets will transform to allow for deeper savings in other building types and sectors. In this way, the program drives a more holistic view of energy management that could eventually support integration with such aspects as demand response and distributed renewable energy, as well.

Building owner perspective

While there are many documented reasons for pursuing energy efficiency, such as increasing brand or image and improving employee productivity, the clear leader is energy cost savings – 81 percent of building decision-makers identify cost savings as "very significant" or "extremely significant." And while cost is the dominant driver, the lack of capital to implement projects is the most commonly cited barrier (58 percent rank it in the top three).[6] The DEEP program addresses both financial and organizational barriers to efficiency. It would:

1. **Provide support for an "integrated design" approach:** Building owners may be incentivized if DEEP provides a metric of success, such as a specific level of savings. A specific energy savings requirement provides a tangible goal for the owner and other members of project teams, similar to

the LEED ratings for green buildings. Empowered by such a goal and their ambition to achieve it, the implementers will find themselves collaborating closely in an integrated project design process.

2. **Identify and bundle funding support for efficiency projects:** The program provides an additional incentive not only to support the overall cost-effectiveness of projects, but to unlock external capital as well. By offering the right level of incentive for achieving a deep retrofit, the program can push projects to a "tipping point," making them attractive to both the owner and a financing institution.
3. **Align interests to capture maximum value for buildings and owners:** A well-designed DEEP program will provide a "compelling event" to encourage timely action, providing an impetus to act quickly in pursuit of the deep savings.[7]

Third-party efficiency provider perspective

Energy service providers, consultants and other partners can be integral to the project design and are often responsible for turnkey implementation. A well-designed DEEP program will engage the implementation and financial communities in a way that fosters the collaborative effort required to reach deep energy savings.

1. **Streamlined transaction costs and applications possible:** In almost any business, it is important for a firm to consciously refine processes and streamline operations. This program concept will be designed through close collaboration between the utility and private-sector partners so as to meet the needs of all the organizations involved. One immediate goal is to create a streamlined process that minimizes administration costs by building on the experience of both ratepayer-funded and private-funded energy efficiency.
2. **Project alignment and shared learning:** The program will also transform the local marketplace among energy efficiency service providers by setting the bar for future projects. As teams from multiple disciplines (technical, finance, project management) work together to meet the target defined by the program, there will be a natural spillover of expertise and an increase in familiarity between components that at times have been disconnected.

[7] While competition for capital is healthy and supports the market forces that increase the program's overall effectiveness, it is crucial that the program is designed in such a way as to minimize uncertainty about the availability of incentives. For example, participants can be advised early in the scoping process about the funding available, and hold funds for a set period of time upon receipt of a preliminary agreement or memorandum of understanding.

EXISTING EFFORTS AND PROGRAMS

There are a number of utility programs that seek deeper energy savings through more comprehensive retrofits.

The standard performance contract is the most common type of program to encourage commercial retrofits and build the energy efficiency service industry. California, Texas, New York and the Bonneville Power Administration have offered these programs (sometimes referred to as a standard offer). These programs encourage energy retrofits by providing payments based on energy or demand savings from a project. To encourage deeper energy savings, many utilities limit payments for projects that implement smaller energy savings technologies or only deploy single measures, especially lighting.

Some utilities have gone beyond the standard performance contract to programs focused on whole-building performance. The first step in the path to increasing efficiency is actionable information – many emerging programs focus on benchmarking or increasing access to information. The most successful programs dole out bonuses to projects that achieve higher levels of savings. In some states, where the

utilities are facing aggressive goals, bonuses are gaining momentum as a way to encourage deeper retrofits. In Maryland, Baltimore Gas & Electric has proposed bonuses for deep energy retrofits as a way to bolster efforts to meet state policy goals.[8]

Here are more detailed descriptions of two programs in this general category:

- **California Nonresidential Standard Performance Contract Program –** Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric

  This program began in 1998 with the three investor-owned utilities. Its aim was to promote the development of an energy efficiency services industry in California. The program has two components: the large NSPC program, serving customers with peak demand of 500 kW, and the small SPC program, which serves all other customers.

  Incentive levels have varied by end-use. Lighting measures qualify for lower incentives than HVAC, refrigeration, and other measures. To encourage more comprehensive projects, lighting incentives are only allowed in projects where at least 20 percent of energy savings come from non-lighting measures. In addition, no utility can spend more than 30 percent of its incentive budget on lighting. In 2005, there were 1,499 participants in the SPC program. Total annual savings for electricity were 1,028 GWh, and total annual savings for gas were 17.3 million therms.[9]

- **Energy Opportunities Program –** Connecticut Light and Power Company, The United Illuminating Company, Connecticut Energy Efficiency Fund

  This program is merger of many of Connecticut's commercial efficiency programs. It contains many elements seen in programs throughout the country, including co-funding studies to determine the cost-effectiveness of potential energy efficiency measures, studies to qualify emerging technologies, and incentive money to reduce the installed costs for measures.

  In 2007, the program added a component to incentivize retrofit projects to find deeper energy savings. Applications require that the scope of the retrofit must bundle together multiple energy savings measures into a project-level proposal, rather than as individual measures. If the project installs multiple measures, participants can receive a comprehensive bonus incentive – the additional funding needed to buy down the project to a 2-year payback – as long as the project passes the utilities' cost test.

There are several reasons why the DEEP program may be more effective for achieving deeper savings than these programs. First, the DEEP program is better suited to align the interests of the multiple stakeholders involved in efficiency investment. Second, it provides a clear end goal that the other programs do not. Third, it is easy to market due to its simplicity – if you achieve a certain level of savings with your retrofit, you will receive a bonus.

CRITICAL ISSUES

While many factors that suggest the DEEP program will be effective in increasing the scale of energy retrofits, there are also challenges that go with this new concept. The DEEP program has several new elements, such as a threshold level of savings as a percentage of whole-building energy consumption. While proven in the energy efficiency market, some of these features are quite different from conventional utility program

[8] State of Maryland Maryland Energy Administration. **"Initial Comments on Baltimore Gas and Electric Company's Programs by the Maryland Energy Administration" Re:** IN THE MATTER OF BALTIMORE GAS AND ELECTRIC COMPANY'S ENERGY EFFICIENCY, CONSERVATION AND DEMAND RESPONSE PROGRAMS PURSUANT TO THE EMPOWER MARYLAND ENERGY EFFICIENCY ACT OF 2008. CASE NO. 9154.

[9] Itron. 2004-2005 Statewide Nonresidential Standard Performance Contract Program Measurement and Evaluation Study. Oakland, CA: 2005.

[10] GDS Associates. Connecticut Electric Conservation Programs Study. Marietta, GA: 2008.

offerings. Successful execution of the DEEP program will require a merging of lessons learned by both ratepayer-funded and privately financed energy efficiency. Some key considerations include:

- *Defining the threshold for the incentive.* A simple approach to encouraging a whole-building perspective is to identify a threshold savings (for example, save X percent of a building's energy consumption). It is important that this number be chosen carefully to expand beyond current comfort levels, while still ensuring that the projects are achievable within market constraints, such as return on investment.
- *Leveraging timing.* Timing is essential for a deep energy retrofit. By synchronizing with other capital investments like replacement of the mechanical systems or property renovation, projects can accomplish significantly more energy savings than would otherwise fit within economic criteria. Timing a deep retrofit with a major renovation is similar to incorporating green elements in the construction of a new building, where the incremental cost is small and the savings can be substantial. The DEEP program can help attract the attention of owners during the critical times where deep retrofits are most cost-effective.
- *Clarifying measurement and verification (M&V).* M&V is an important component to any energy efficiency project, but it becomes even more critical when the eligibility for an incentive is determined by the savings achieved. The utility managers and regulators who oversee the use of ratepayer funds must be able to show that the energy savings they pay for are real. Metering and instrumentation, transparent protocols, and collaboration among all parties involved will be keys to successful M&V under the DEEP program.

LOOKING FORWARD

The "Deep Energy Efficiency Pays" (DEEP) program presents an approach to unlocking greater savings by combining ratepayer-funded efforts with those of the private sector. This move to deeper levels of energy efficiency will help utilities strive to reduce costs and comply with new mandates to obtain energy savings. In addition to the higher level of energy efficiency achieved, utilities will drive market transformation by encouraging a whole-building perspective and an integrated design approach. The economics to the ratepayer are optimized by targeting opportunities to "tip" projects that would otherwise not be implemented.

At the same time, building owners are expressing high interest in improving buildings, reducing cost and minimizing environmental impacts. Taken together, these conditions suggest that the DEEP program could be successful in the marketplace.

More research is certainly needed as this concept evolves into material programs. For example, what is the right threshold level for a deep retrofit? What are the barriers to a whole-building measurement and verification approach? How can utilities leverage the experience of the private sector while meeting the needs of regulatory bodies and providing transparency to the public? Can transaction costs associated with program participation be minimized to encourage significant interest?

Future work can address these and other questions about the implementation of this new approach to achieving energy savings through utility programs. Many of the answers will lie in the experience of early adopters and pilot programs. As utility demand-side managers, building owners and their service providers work together to achieve deeper energy savings in buildings, the benefits of energy efficiency will be realized at a greater scale than ever before.

Rocky Mountain Institute (RMI) is an independent, entrepreneurial, nonprofit think-and-do tank. RMI emphasizes integrative design, advanced technologies, and mindful markets in fulfilling its mission to drive the efficient and restorative use of resources. RMI's strategic focus is to map and drive the U.S. transition from fossil fuels to efficiency and renewables by 2050.

The Institute for Building Efficiency is an initiative of Johnson Controls providing information and analysis of technologies, policies, and practices for efficient, high performance buildings and smart energy systems around the world. The Institute leverages the company's 125 years of global experience providing energy efficient solutions for buildings to support and complement the efforts of nonprofit organizations and industry associations. The Institute focuses on practical solutions that are innovative, cost-effective and scalable.

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