Aiming Higher

Realizing the Full Potential of Cost-Effective Energy Efficiency in New York

Prepared for Natural Resources Defense Council, E4TheFuture, CLEAResult, Lime Energy, Association for Energy Affordability, and Alliance for Clean Energy New York

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EXECUTIVE SUMMARY

Insufficient Savings Targets

Through its *Reforming the Energy Vision* (REV) initiative, the state of New York has set itself firmly at the forefront of U.S. efforts to promote clean energy resources, improve the efficiency of electricity generation and consumption, and reduce long-term electricity costs to customers. However, recent decisions from the New York Public Service Commission (PSC or Commission) regarding energy efficiency policies fail to provide the clarity necessary to ensure that the state maximizes energy efficiency's essential role in reaching these important goals.

In particular, recent Commission decisions regarding energy efficiency targets for electric utilities and goals for the New York State Energy Research and Development Authority (NYSERDA) could result in significantly increased electricity costs and bills by delaying the realization of the state's vast energy efficiency potential. The state's Clean Energy Standard (CES) commits New York to obtaining half of its electricity from renewable resources by 2030. A certain amount of energy efficiency is assumed, but is not required, in the Department of Public Service (DPS) Staff White Paper on the Clean Energy Standard (CES White Paper), helping to meet this standard by reducing the amount of renewable electricity needed for the CES. However, the amount is relatively modest, leaving much energy efficiency untapped. In turn, customers will ultimately pay more than necessary to meet the CES.

New York can, and should, aim higher than the electric utility energy efficiency targets recently established by the Commission. These utility targets amount to efficiency savings of roughly 0.45 percent of retail sales, which is significantly lower than historic statewide savings. Indeed, one utility proposed a savings target for 2018 that was 53 percent higher than the Commission approved level for that year.

New York can, and should, aim higher than the electricity utility efficiency targets recently established by the Commission.

Evidence from nearby states indicates that New York can achieve much higher levels of cost-effective energy efficiency savings. Program administrators in Massachusetts and Rhode Island, including National Grid (which operates in New York as well), are currently reaching roughly 2.5 to 3 percent savings as a percent of annual sales. In Massachusetts alone, these savings provided total statewide net benefits of $2.6 billion in 2014, and estimated net benefits of $2.9 billion in 2015. These achievements demonstrate that the aggressive pursuit of energy efficiency through utility-sponsored programs is entirely feasible, and is a cost-effective way to achieve clean energy goals.

Compliance with the Clean Energy Standard

Further, the Commission and Staff will need to adopt a more realistic approach with regard to using energy efficiency to comply with the CES. The Staff CES White Paper assumes that statewide annual efficiency savings will be the equivalent of 1.4 percent or retail sales, and that these savings levels will not increase over time. There are two problems with this assumption:

- First, it is not clear what will make up the significant gap between the utility efficiency savings targets of roughly 0.45 percent of sales, and the Staff's forecast of 1.4 percent of retail sales. If NYSERDA and the marketplace alone are not able to provide such a large amount of efficiency savings, then customers will pay much higher electricity costs than necessary.
- Second, the Staff's forecast of efficiency savings in the CES White Paper is well below the amount of cost-effective efficiency savings possible in New York. Therefore, even if the Staff's forecasted level of efficiency savings is achieved through the combined efforts of the utilities, NYSERDA, and third-party developers, then electricity customers will pay higher electricity costs than would be the case if the Commission adopted higher efficiency targets.

In this paper we estimate the economic implications of this second point. We compare the costs of complying with the CES with the levels of efficiency savings assumed by the Staff, relative to the costs of complying with the CES using higher efficiency savings targets combined with earnings incentive mechanisms (EIMs) for the New York electric utilities. We find that customers could save roughly $3 billion in electricity costs between now and 2030 with higher efficiency savings targets of roughly 3 percent of annual retail sales by 2020, remaining at that annual level through 2030. The increased energy efficiency would provide additional benefits such as increased reliability, increased system stability, reduced imports, and reduced distribution costs. This emphasizes the importance of establishing clear efficiency savings targets for New York, especially over the next several years during the transition to the REV framework.

Higher efficiency targets combined with earnings incentive mechanisms for New York electric utilities could save customers roughly $3 billion in electricity costs between now and 2030.

Utility-Based and Market-Based Approaches

Throughout the REV proceedings, the Commission has indicated a clear preference for using market-based initiatives and third-party developers to animate markets for distributed energy resources, including energy efficiency. Such initiatives must be tapped to support energy efficiency over the long term. But it is also important to recognize the contributions of current (and proven) program and procurement methods. Some have argued that New York will not reach the desired scale of energy efficiency relying solely on utility programs. While it is true that market-based initiatives can help New York achieve higher levels of efficiency savings, it is also true that New York won't obtain anywhere near the full potential of efficiency savings without utility programs, especially as the state transitions to a new model.

Evidence from energy efficiency initiatives over the past 30 years demonstrates that many market barriers hinder electricity customers from adopting energy efficiency measures on their own. Although energy efficiency is highly cost effective, the economics alone are not enough to motivate customers to invest in anything close to an optimal level in nearly all markets. Almost all customers are subject to many forms of market barriers, such as: imperfect information, split incentives, lack of capital, high transaction costs, lack of access to products, and more. In fact, the primary rationale for customer-funded energy efficiency programs is to assist in overcoming these market barriers so that cost-effective resources can ultimately flourish on their own as new technologies and services come to market.

To achieve its clearly articulated goal of promoting cost-effective energy efficiency, the Commission will need to address the market barriers customers currently face. Regulatory policies that attempt to overcome these barriers will be important facets of the energy efficiency and market transformation programs offered by NYSERDA and the utilities. This is especially true during the transition period from current practices to fully implemented REV practices, when the market-based, third-party developers of energy efficiency services have not yet had the opportunity to build up the necessary business approaches and infrastructure.

Tried and True Regulatory Policies

We recommend two regulatory policies to ensure that New York's energy efficiency goals are fully met:

1. The Commission should establish statewide energy efficiency targets that are significantly higher than those recently assumed in the CES White Paper. The utilities and NYSERDA should be tasked with achieving annual efficiency savings equal to 3 percent of electricity sales by 2020. Efficiency targets for later years can be determined prior to 2020 based upon updated information and experience at that time. The utilities should be encouraged to adopt any and all market-based approaches to achieve these goals in the most cost-effective manner.
2. The Commission should establish earnings incentive mechanisms (EIMs) for each of the electric utilities. The core of the EIMs should be achievement of the efficiency savings targets described above. Recognizing that NYSERDA is shifting towards market transformation, any efficiency savings achieved by NYSERDA should be applied to the utility based on the territory where the savings occurred, and should be eligible for that utility's EIMs in order to foster deep cooperation between NYSERDA and the utilities, and to align program practices. The EIMs should include a threshold amount, a target amount, a cap, and a sliding scale approach between the threshold and the cap.

The Commission's energy efficiency goals can be achieved in the short term through these tried-and-true regulatory policies. There is a vast potential of cost-effective energy efficiency resources that can be implemented by utilities, even without accounting for the specific benefits at the distribution level or the additional benefits associated with avoiding costs at the peak, highest-cost hours. These efficiency resources are so prevalent and cost-effective that they can be pursued immediately, without relying upon the outcome of complex distribution system planning processes to prove their worth. Over the longer term, as the other elements of the REV framework are put in place, the utility programs can evolve to operate within the more market-based mechanisms envisioned by the Commission.

To achieve its clearly articulated goal of promoting cost-effective energy efficiency, the Commission will need to address the market barriers that customers currently face.

1. Introduction

Despite New York's aggressive clean energy goal of obtaining half its electricity from renewable sources by 2030, recent New York Public Service Commission (PSC or Commission) decisions call for energy efficiency targets to remain at current levels into the near to intermediate future.[1] In the Clean Energy Standard (CES) White Paper, DPS Staff assumed annual incremental energy efficiency savings of 2,227 gigawatt-hours (GWh) statewide through 2030.[2] This level of savings translates into a flat 1.4 percent annual savings as a percent of 2014 sales throughout the period of analysis.

This level of savings is far below what is possible from a technical and economic standpoint, and also relative to what nearby states are already achieving. Energy efficiency is New York's most cost-effective resource, and yet the state is at risk of losing out on much of its potential in coming years. Absent an unprecedented increase in market-based energy efficiency activity, New York ratepayers may end up paying substantially more than necessary to reach the state's clean energy goals.

This paper explores the feasibility and benefits of higher energy efficiency targets for NYSERDA and the New York utilities, as well as the importance of maintaining sound regulatory oversight of energy efficiency. It also discusses ways to get more out of New York's regulated energy efficiency programs than in the past. Finally, it recommends a set of higher energy efficiency targets, and identifies the likely economic savings to customers from achieving those targets.

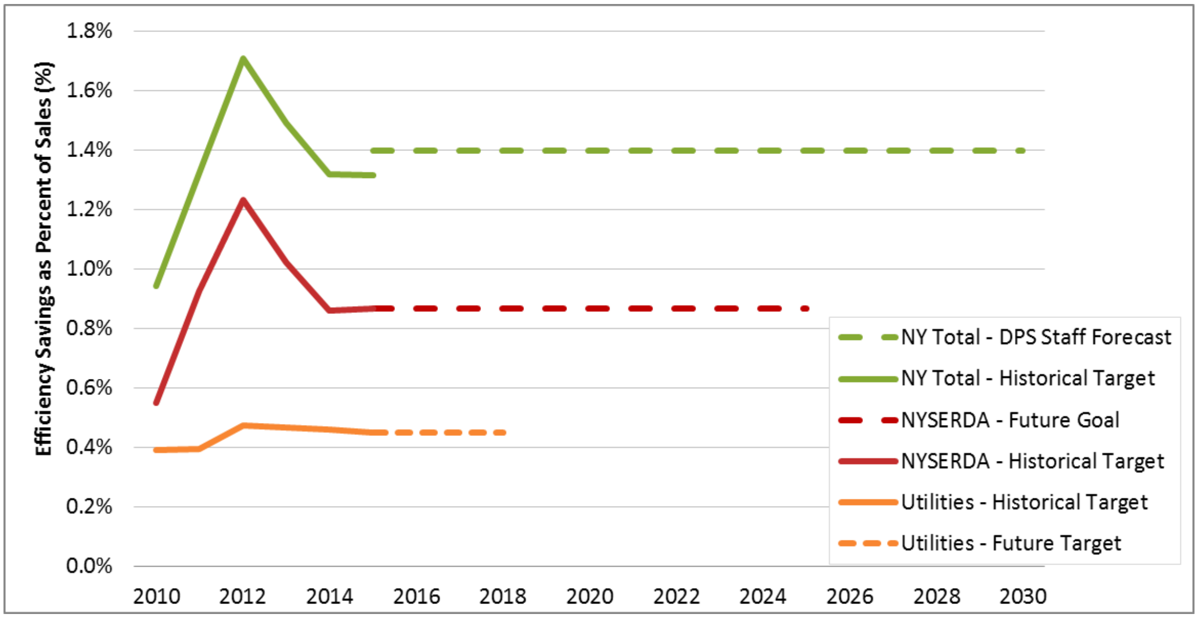
2. Current Goals, Targets, and Forecasts

Figure 1 provides an overview of historic and future efficiency savings in New York. The efficiency savings are presented as a percent of retail sales, in order to normalize the savings levels across utilities and the state. For 2010 through 2015, Figure 1 shows the historical EEPS targets for utilities, NYSERDA, and the state as a whole. For future years, Figure 1 shows the efficiency targets recently established by the Commission for 2016-2018. It also shows the amount of efficiency savings that Staff has assumed in the recent CES White Paper.

[1] In its Clean Energy Fund order authorizing the Clean Energy Fund Framework, the Commission set 10-year goals for NYSERDA reflecting a continuation of its 2015 EEPS2 MWh and MMBtu targets. (Cases 14-M-0094, 10-M-0457, 07-M-0548, 03-E-0188, and 13-M-0412. January 21, 2016, p. 47.) Likewise, the Commission held utility energy efficiency targets at 2016 levels for 2017 and 2018 in its order on the Energy Efficiency Transition Implementation Plans (ETIPs). The ETIP Order held the utilities' 2017 and 2018 budgets and MWh targets at these levels, even though some utilities proposed electricity savings targets above their Commission-authorized 2016 targets in their ETIPs. Niagara Mohawk proposed 34 percent and 53 percent higher savings for 2017 and 2018, respectively, than the ETIP targets ultimately approved by the Commission for those years. ConEd proposed 0.6 percent above its target for 2017-2018. (See "Order Authorizing Utility-administered Energy Efficiency Portfolio Budgets and Targets for 2016-2018 (ETIP Order)." Case 15-M-0252. January 22, 2016, p. 8 and Appendix B).

[2] Staff extrapolates the PSC-authorized annualized NYSERDA goal and annual utility targets to NYPA, LIPA, and direct access customers to come up with 2,227 GWh annual savings. (NY DPS Staff white paper on Clean Energy Standard. Case 15-E-0302, Jan. 25, 2016, Appendix B, p. 2.)

Figure 1. NY Energy efficiency savings: historic targets and Staff forecast



As indicated in Figure 1, the utility efficiency targets recently established by the Commission do not include any increase in efficiency savings relative to recent years. Similarly, the Commission's 10-year savings goal for NYSERDA are an extension of recent goals. However, NYSERDA no longer has the same obligation that it did under New York's most recent policy construct supporting energy efficiency—the Energy Efficiency Portfolio Standard (EEPS). Under the EEPS, NYSERDA was tasked with nearly 60 percent of the overall MWh savings obligation, with the balance expected from the state's investor owned utilities. While progress toward the EEPS has been slower than expected, 2012 achieved and committed savings reached 74% of the target for that year.[3]

Going forward, NYSERDA will play an important role in delivering market transformation and low-income efficiency programs. However, there currently is no enforceable efficiency savings target for NYSERDA. While the state has made a financial commitment through the Clean Energy Fund, NYSERDA's goals are largely grounded in market transformation efforts, which have savings that take longer to emerge and are more difficult to forecast. With the uncertainty surrounding how much savings NYSERDA's efforts will produce, and when the savings will materialize, it is all the more important that the Commission provide clarity regarding what savings levels the state intends to procure.

Figure 1 also indicates that the Staff assumes that energy efficiency savings through 2030 will be equivalent to the targets and goals of 2015. There are two problems with this assumption. First, it is not clear what will make up the significant gap between the utility efficiency savings targets of roughly 0.45 percent of sales, and the Staff's forecast of 1.4 percent of retail sales. If NYSERDA and the marketplace

[3] Morris, J. and J. Stutt. *Sizing Up Progress Toward '15 by 15': A 2012 EEPS Update*. http://energy.pace.edu/publications/sizing-progress-toward-15-15-2012-eeps-update

alone are not able to provide such a large amount of efficiency savings, then customers will pay much higher electricity costs than necessary, and the other accompanying benefits will remain unrealized.

Second, the Staff's forecast of efficiency savings in the CES White Paper is well below the amount of cost-effective efficiency savings possible in New York. Therefore, even if the Staff's forecasted level of efficiency savings is achieved through the combined efforts of the utilities, NYSERDA, and third-party developers, there will still be untapped cost-effective efficiency potential in the state, and electricity customers will pay higher electricity costs than necessary.

3. AIMING HIGHER THAN THE CURRENT TARGETS

Set Aggressive Targets

The electric utility energy efficiency targets recently established by the Commission amount to efficiency savings of roughly 0.45 percent of retail sales. There is no question that the utilities could achieve significantly higher levels of cost-effective savings than these targets. Two utilities in the state proposed higher targets than the PSC adopted. National Grid, doing business as Niagara Mohawk in New York, proposed savings targets that were 34 and 53 percent higher for 2017 and 2018, respectively, than the ETIP targets ultimately approved by the Commission.[4]

Evidence from nearby states indicates that New York can achieve much higher levels of energy efficiency savings. Program administrators in Massachusetts and Rhode Island, including National Grid, are currently reaching roughly 2.5 to 3 percent savings as a percent of annual sales. In Massachusetts alone, these savings provided total statewide net benefits of $2.6 billion in 2014, and estimated net benefits of $2.9 billion in 2015.[5] These achievements demonstrate that the aggressive pursuit of energy efficiency through utility-sponsored programs is entirely feasible, and is a cost-effective way to achieve clean energy goals.

Figure 2 presents New York's historical and future targets relative to those in Massachusetts and Rhode Island. As indicated, the future targets recently established by the Commission for the New York electric utilities are well below the comparable targets in those other two states. If these targets are not increased, and NYSERDA and third-party developers do not provide much savings beyond these targets, then the efficiency savings in New York will be only a small fraction of those achieved in these similar nearby states.

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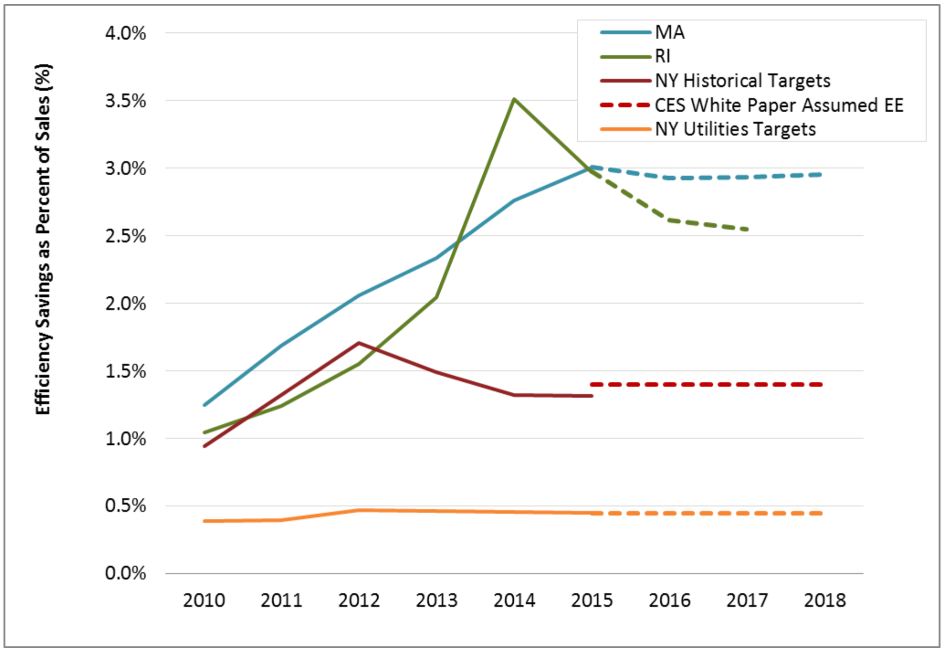
[4] As another example, ConEd proposed 0.6 percent above the target approved by the Commission for 2017 and 2018. (See "Order Authorizing Utility-administered Energy Efficiency Portfolio Budgets and Targets for 2016-2018 (ETIP Order)." Case 15-M-0252. January 22, 2016, p. 8 and Appendix B).

[5] Statewide benefits include electric benefits, gas costs, other resource benefits, and non-resource benefits. (Mass Save. http://www.masssavedata.com/Public/PerformanceDetails, accessed April 20, 2016.)

Figure 2. Energy efficiency savings in Massachusetts, Rhode Island, and New York



The fundamental driver behind National Grid's and other utilities' achievement of higher savings in Massachusetts and Rhode Island is those states' aggressive regulatory policies—chief among them clear energy efficiency savings targets. These regulatory policies include: setting higher energy efficiency savings targets; establishing effective shareholder performance incentive mechanisms; and adopting recommendations of active, inclusive energy efficiency advisory committees. Backed by these regulatory policies, leading program administrators, including National Grid, have been able to establish strong program delivery infrastructure, which in turn enables them to ramp up energy savings rapidly.[6]

To give an example of aggressive goal-setting, Massachusetts has held its regulated utilities to annual electricity savings targets of 2.5–2.9 percent for two triennial cycles (2013 to 2015 and 2016 to 2018).[7,8] These sustained, ambitious targets send clear signals to participants in the marketplace, including consumers, energy service companies, contractors, manufacturers, distributors, and retailers. By doing so, the state encourages more investment in energy efficiency. Sustainable and sustained funding

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6 Internal program delivery infrastructure includes the labor and resources necessary for program design, reporting, implementation, and evaluation. External infrastructure includes contractors and program delivery network necessary for program implementation. (Baatz, B., A. Gilleo, and T. Barigye. 2016. *Big Savers: Experiences and Recent History of Program Administrators Achieving High Levels of Electric Savings*. American Council for an Energy-Efficient Economy, p. 21).

7 Gilleo, A., S. Nowak, M. Kelly, S. Vaidyanathan, M. Shoemaker, A. Chittum, and T. Bailey. 2015. *The 2015 State Energy Efficiency Scorecard*. American Council for an Energy-Efficient Economy. p. 10.

8 Massachusetts Executive Office of Energy and Environmental Affairs. 2015. Nation-Leading Energy Efficiency Plan Proposed in Massachusetts for 2016-2018: Three Year Energy Efficiency Plan Set to Deliver Billions in Benefits to Massachusetts. http://www.mass.gov/eea/pr-2015/energy-efficiency-plan-proposed-in-massachusetts.html.

sources, robust resource planning, and institutional support are critical for the success of long-term energy savings targets.[9]

We recognize that the forthcoming distributed system implementation planning (DSIP) processes are likely to reveal additional amounts of cost-effective energy efficiency resources than have been identified in the past. The results of these processes should be used to inform utility efficiency savings targets. But there is no need to wait for the results of these processes to establish more reasonable efficiency targets. Efficiency resources are so prevalent and cost-effective--even without accounting for the specific benefits at the distribution level or the additional benefits associated with avoiding costs at the peak, highest-cost hours--that they can be pursued by the utilities immediately.

Establish Effective Shareholder Performance Incentive Mechanisms

Earnings incentive mechanisms (EIM) are one of the most important regulatory policies to encourage the successful implementation of energy efficiency resources. They are used in many states and have proven to be effective in achieving bold energy savings targets.[10] The American Council for an Energy-Efficient Economy (ACEEE) concluded that the highest levels of energy efficiency achievement are found in states with both performance incentives and energy efficiency resource standards.[11]

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In terms of incentives, New York's electric utilities currently have positive revenue adjustments for attainment of pre-specified energy efficiency performance targets. However, the impact of these adjustments on revenues varies greatly on a percentage basis; basis points at risk associated with energy efficiency range from a low of 20.3 for Orange and Rockland, to a high of 45.3 for Niagara Mohawk.[12] The design of EIMs for New York's electric utilities is discussed in Section 6.

Create an Inclusive Energy Efficiency Advisory Committee

Energy efficiency advisory councils, boards, and collaboratives—referred to collectively as stakeholder groups—have proven effective for gathering stakeholder input and feedback, and for assisting with developing, implementing, and evaluating cost-effective efficiency programs designed to meet aggressive savings goals.

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9 Gilleo, A., S. Nowak, M. Kelly, S. Vaidyanathan, M. Shoemaker, A. Chittum, and T. Bailey. 2015. *The 2015 State Energy Efficiency Scorecard*. American Council for an Energy-Efficient Economy, p. 15.

10 Nowak, S., B. Baatz, A. Gilleo, M. Kushler, M. Molina, and D. York. 2015. *Beyond Carrots for Utilities: A National Review of Performance Incentives for Energy Efficiency*. American Council for an Energy-Efficient Economy.

11 Molina, M. and M. Kushler 2015. *Policies Matter: Creating a Foundation for an Energy-Efficient Utility of the Future*. American Council for an Energy-Efficient Economy.

12 NY PSC Staff 2015. *Staff White Paper on Ratemaking and Utility Business Models*. Case 14-M-0101. July 28, 2015, Appendix C.

Stakeholder groups can promote consistency among efficiency offerings by bringing all program administrators and interested parties across the state together at one table. Such an approach reduces customer dollars spent on proceedings or settlement negotiations, and streamlines and focuses commission review of proposals. One type of stakeholder group, a collaborative, is typically composed of members who are potential interveners in energy efficiency proceedings and/or who represent various sectors of the state with expertise in energy efficiency. Such sectors include: residential, low-income, and business customers; the environmental community; the manufacturing industry; organized labor; consumer advocacy groups; housing and economic development organizations; utility representatives; and other energy and environment departments. To be effective, such a collaborative needs clarity on duration, scope, and rules. Its meetings and materials should be public, transparent, and inclusive; and it should have influence with the commission.[13]

Meetings and materials should be public, transparent, and inclusive; and the collaborative should have influence with the Commission.

Rhode Island's collaborative, known as the Energy Efficiency and Resource Management Council (EERMC), provides a good example of an effective working collaborative. The EERMC was created to "provide consistent, comprehensive, informed and publicly accountable stakeholder involvement in energy efficiency, conservation and resource development."[14] The EERMC analyzes the energy efficiency plans proposed by the utilities, monitors the progress of program administrators in achieving their goals, and submits reports to the Commission. The EERMC has a set number of members that are appointed by the governor. The 13 members include nine voting members, four non-voting members, and representatives of the utility (who are not voting members). EERMC activities are facilitated by the Rhode Island Office of Energy Resources (OER), whose director also serves as the EERMC's executive director. The EERMC has a budget (roughly $1.2 million or 1.2 percent of the electric and gas system benefits charge) that is used to retain consultants who are experts in energy efficiency to assist in the program review and evaluation process.

In New York, the PSC recently created the Clean Energy Advisory Council (CEAC), and tasked it with manifold objectives. [15] However, membership in the CEAC is somewhat more restricted than in other leading states (Massachusetts and Rhode Island).[16] The Commission has indicated that the CEAC will create several working groups to include a variety of stakeholders who are not CEAC Steering Committee members. It will be important that these working groups have broad representation and influence with the CEAC (and the PSC) and a robust role going forward. The Commission has indicated that one representative from each working group will be chosen for Steering Committee membership. It

[13] State and Local Energy Efficiency Action Network. 2015. *Energy Efficiency Collaboratives*.

[14] Comprehensive Energy Conservation, Efficiency, and Affordability Act of 2006.

[15] NY PSC. *Order Authorizing the Clean Energy Fund Framework (CEF Order)*. Cases 14-M-0094, 10-M-0457, 07-M-0548, 03-E-0188, and 13-M-0412. January 21, 2016, p. 53.

[16] The only entities that the Commission specifically identified as members of the CEAC are the utilities, NYPA, LIPA, NYSERDA, and the Department of Public Service. (Ibid.)

is critical that these Steering Committee members be chosen so as to include environmental and consumer advocates, and that those members of the Steering Committee represent their constituencies in addition to the working group from which they are chosen.

4. The Importance of Customer-Funded Efficiency Programs

Market Barriers to Energy Efficiency

It is widely recognized that there is a vast potential of untapped energy efficiency in every state, and that these energy efficiency resources cost significantly less than the cost of generating, transmitting, and distributing electricity.

This begs the question: If energy efficiency is so plentiful and cost-effective, why should there be public policies to support it, and why should utilities and others implement energy efficiency programs? In particular, why not rely on market forces to deliver energy efficiency services? It is sometimes argued that fully functional markets cause the economically efficient amount of a good to be delivered to consumers without intervention, and in the most cost-effective manner.

The answer to these questions lies in the fact that many market barriers continue to hinder electricity customers from adopting energy efficiency measures on their own. Although energy efficiency is cost effective even without valuing externalities, the economics are not enough to motivate customers to invest in anything close to optimal level in nearly all markets.[17] The markets for energy and for energy efficiency goods and services are imperfect, meaning that the market fails to produce the efficient outcome on its own. Examples of market barriers include:

- **Lack of capital access.** Customers, businesses, and industries may lack the up-front capital for an energy efficiency product. This is particularly true for low-income customers and for many who provide low income affordable housing.
- **Purchasing procedures and habits.** Many buildings are constructed, products purchased, and facilities renovated on the basis of minimizing short-term costs, not on minimizing long-term life-cycle costs, including electricity costs.
- **Positive externalities.** The societal benefits of energy efficiency—particularly the environmental and economic development benefits—are often not considered by customers and producers seeking to minimize their own costs.

Many market barriers continue to hinder electricity customers from adopting energy efficiency measures on their own.

[17] Advanced Energy Economy Institute. 2015. *Comments on Energy Efficiency Transition Implementation Plans*. Case 15-M-0252, September 28, 2015.

- **Bounded rationality.** For many customers, electricity costs represent a small portion of the total costs of maintaining a home, running a business, or operating a factory. As a result, they pay little or no attention to opportunities to reduce these costs.
- **Imperfect information.** Electricity customers do not often consider energy efficiency measures as an alternative to electricity. Customers, businesses, industries, and contractors are frequently unaware of the full range of energy efficiency options, or lack information on the economic, productivity, and environmental benefits of those efficiency measures.
- **Uncertainty and risk avoidance.** Customers may be skeptical of potential energy efficiency savings, may have doubts about whether an unfamiliar energy efficiency measure will work properly, or may find the more efficient technology to be less attractive or effective than the existing less-efficient technology.
- **High transaction costs.** An investment of time, money, and hassle may be required to obtain information, make an informed purchase, and install energy efficiency measures. This is a particular problem when construction, renovation, or equipment replacement situations require that decisions be made and products obtained quickly.
- **Limited product availability.** Many energy efficiency measures are produced and distributed on a limited scale and are not readily available to customers, builders, contractors, or industries. For example, limited product availability has been a major barrier in the transformation of the heating, ventilation, and air conditioning (HVAC) market because most HVAC equipment replacement is done on an emergency basis as a result of equipment failure. In these situations, customers typically install standard efficiency equipment, because high efficiency equipment is not readily available to contractors or distributors.[18]

Public policy support of efficiency and renewable resources is necessary even where retail electricity markets have been opened to competition.

- **Split incentives.** The financial interests of those in a position to implement energy efficiency measures are often not aligned with the interests of those who would benefit from such measures. For example, landlords make capital purchases and maintain buildings, while tenants frequently pay the energy bills. Similarly, at the time of new construction, the builder has incentive to minimize short-term costs, while it is the new owner who would benefit from lower electricity bills over the long term.
- **Institutional and regulatory barriers.** While decoupling removes the utility incentive to increase sales, it does not provide utilities with positive incentives to provide aggressive efficiency programs.

As a consequence: (a) regulatory policies are necessary to overcome these barriers, and (b) energy efficiency programs should be explicitly designed to overcome these barriers. Public policy support of efficiency and renewable resources is necessary even where retail electricity markets have been opened

[18] Quaid, M. and H. Geller. 2014. *Upstream Utility Incentive Programs: Experience and Lessons Learned*. Southwest Energy Efficiency Project. http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream_Utility_Incentive_Programs_05-2014.pdf; Sondhi, R. N. Strong, and G. Arnold. 2014. *The End of Prescriptive Rebate Forms? Massachusetts Moves Upstream*. Proceedings of 2014 ACEEE Summer Study on Energy Efficiency in Buildings, available at http://aceee.org/files/proceedings/2014/data/papers/4-618.pdf.

to competition. The market barriers and market failures described above apply just as much in a competitive electricity market as in a regulated market.

From the perspective for third-party energy efficiency service companies, there is a lack of financial resources to deliver energy savings to all customer classes across the state. Uncertainty about the longevity of market or policy drivers raises other difficulties for engaging in the market.[19] The market will need time to develop, and may require sustained signals throughout.

Addressing All Customer and Market Types

Another reason why customer-funded energy efficiency programs are so important is that they are necessary to reach all market and customer types. Figure 3 includes an illustrative example of the cost of saved energy for different market and customer types, arranged from least expensive to most expensive (from left to right on the x-axis). As indicated in Figure 3, the cost of serving different market and customer types can vary dramatically. Because market forces alone will focus on the lowest-cost efficiency savings, they tend to result in significant lost opportunities.

Figure 3. Illustrative supply curve of efficiency programs (c/kWh)

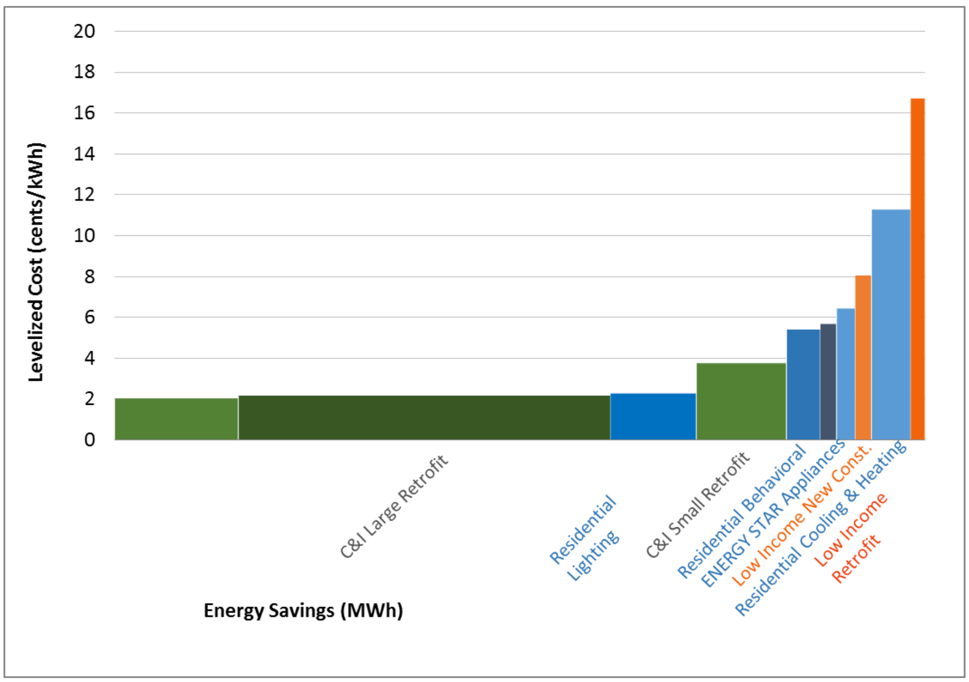

Figure 3 also indicates that programs targeting commercial, industrial, and institutional customers (shown in shades of green) tend to be less expensive to serve, while programs targeting low-income

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19 Advanced Energy Economy Institute. 2015. *Comments on Energy Efficiency Transition Implementation Plans*. Case 15-M-0252, September 28, 2015.

customers tend to be more expensive. Because of the financial constraints facing low-income customers, programs targeting this customer segment usually provide incentives that cover a larger portion of the cost of the efficiency project. Thus, market mechanisms tend to ignore hard-to-reach customers (including low-income, multi-family residential, and small businesses). Past experience with market-based energy efficiency shows that hard-to-reach customers tend to be left behind.[20] LBNL found that over 80 percent of energy service company (ESCO) investment targeted institutional customer facilities (including universities, schools, hospitals, and federal, state, and local government). Commercial and industrial facilities represented a much smaller portion of ESCO investment (9 percent and 6 percent, respectively), while investment in public housing and residential facilities was just 5 percent.[21]

Equity considerations are important in the design of energy efficiency policies and the delivery of energy efficiency services. The PSC has long recognized that low-income assistance programs are in the public interest. The Commission once again affirmed the importance of energy affordability when it opened the proceeding to examine programs for low-income residential utility customers. The comments in the case clearly illustrate the importance of energy efficiency for ensuring safe, comfortable and affordable housing for all, despite the failure to date for the proceeding to expressly address efficiency.[22]

The PSC has long recognized that low-income assistance programs are in the public interest.

5. Market-Based Opportunities to Support Efficiency Programs

The Commission has made clear its intent to transition away from traditional resource acquisition programs, and to place greater emphasis on attainment of energy efficiency through markets.[23] Markets have potential for contributing to energy efficiency savings over the long term if policies are implemented and sustained to address the market barriers discussed above. However, many opportunities will be lost in the meantime if more traditional efficiency programs stagnate, or worse, are cut or abandoned. Moreover, there will always be some barriers to consumers adopting energy efficiency that markets alone cannot solve.

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[20] Kushler, M. and P. Witte. 2001. *Can we Just 'Rely on the Market' to Provide Energy Efficiency?: An Examination of the Role of Private Market Actors in an Era of Electric Utility Restructuring*. American Council for an Energy-Efficient Economy. http://aceee.org/sites/default/files/publications/researchreports/u011.pdf.

[21] Hopper, N., C. Goldman, D. Gilligan, T. Singer, and D. Birr. 2007. *A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006*. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-62679.

[22] NY PSC. Order Instituting Proceeding. Case 14-M-0565. January 9, 2015.

[23] NY PSC. Order Authorizing Utility-administered Energy Efficiency Portfolio Budgets and Targets for 2016-2018. Case 15-M-0252. January 22, 2016, p. 28-29.

Nonetheless, the future of efficiency in New York should reflect market elements proven successful here and elsewhere. There are many ways that market-based opportunities can be used to support customer-funded efficiency programs. For example:

- Efficiency program administrators can use competitive bidding processes to hire independent, third-party contractors for a variety of services, including: program marketing, customer education, program delivery, energy audits and technical assessments, and bulk procurement of relevant efficiency products.
- The National Energy Efficiency Registry is working to establish protocols for documenting energy efficiency savings through certificates, which can be used to support more market-based approaches to procuring efficiency savings.[24]
- Third-party financing approaches can bring in outside capital to support the funding and implementation of energy efficiency products and services.
- Third-party contractor aggregation involves installation companies recruiting customers, harvesting kwh savings through installation of efficiency measures, aggregating savings, and selling to utilities, subject to rules that discourage such companies from leaving lost opportunities.
- Deployment of home or building energy monitoring systems and analytics with real time and historical usage data can empower customers to make better, more informed decisions about energy use.[25]
- Pay for Performance coupled with advanced energy monitoring and analytics methodology is an emerging model that allows ESCOs and utilities to pay incentives based on actual savings performance in a timely manner.[26]
- Other policies address information asymmetry and consumer awareness to encourage more knowledgeable participation in the marketplace, including appliance labeling as well as building rating, labeling, and disclosure.[27,28]

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[24] The Climate Registry. “Thought Leadership: Energy Efficiency.” https://www.theclimateregistry.org/thoughtleadership/energy-efficiency/.

[25] Home or building energy monitoring systems and analytics with real time and historical usage data can use advanced meters or more traditional ones. Approval of plans for implementing advanced metering should be based on a showing that such meters are cost-effective through a rigorous cost-benefit analysis.

[26] Such a model can benefit from implementation of advanced meters, but do not require their use.

[27] Vaidyanathan, S., S. Nadel, J. Amann, C. Bell, A. Chittum, K. Farley, S. Hayes, M. Vigen, and R. Young. 2013. *Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency*. American Council for an Energy-Efficient Economy. http://aceee.org/sites/default/files/publications/researchreports/e136.pdf

[28] Ribeiro, D., V. Hewitt, E. Mackres, R. Cluett, L. M. Ross, S. Vaidyanathan, S. Zerbonne. 2015. *The 2015 City Energy Efficiency Scorecard*. American Council for an Energy-Efficient Economy. Report U1502.

6. Earnings Incentive Mechanisms to Support Efficiency

Earnings Incentive Mechanisms for Electric Utilities

Used in many states, EIMs are one of the most important regulatory policies to encourage the successful implementation of energy efficiency resources. Coupled with energy efficiency targets, or standards, EIMs are highly effective in achieving aggressive energy savings targets.[29,30] New York's electric utilities currently have positive revenue adjustments for attainment of pre-specified energy efficiency performance targets. However, the impact of these adjustments on revenues varies greatly from utility to utility on a percentage basis.[31] Therefore, it is likely that the revenue adjustments will have varying levels of influence on business practices.

One of the most important elements of any EIM is a clear set of targets for energy efficiency savings. The targets should be based on well-designed efficiency programs, and should be aggressive enough to encourage utilities to achieve all cost-effective energy efficiency.

EIMs for energy efficiency should include the following key elements:

- A "threshold" level of performance, which is the point below which no incentives are earned. If utilities cannot meet this threshold level, they do not earn any reward. We recommend this be set at 80 percent of the target level.
- A "target" level of performance, which is based on the achievement of efficiency program goals, in terms of both energy (MWh) and capacity (MW) savings. We recommend the targets presented in Section 7.
- A "cap" on the incentive earned, which limits magnitude of the performance incentive. We recommend this be set at 120 percent of the target level.
- A "sliding scale" approach, which allows the utility to earn an incentive anywhere between the threshold level and the cap, based on a linear interpolation between those two points. This creates a constant incentive for the utility to increase savings, even beyond the original target if possible.

Targets should be aggressive enough to encourage utilities to achieve all cost-effective energy efficiency.

In addition to incorporating these design elements, such an EIM should be implemented as soon as possible to ensure that efficiency opportunities are not lost. Ideally, the Commission should develop statewide efficiency savings targets, with corresponding EIM targets for each electric utility, for the years 2017 through 2020.

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[29] Nowak, S., B. Baatz, A. Gilleo, M. Kushler, M. Molina, and D. York. 2015. *Beyond Carrots for Utilities: A National Review of Performance Incentives for Energy Efficiency*. American Council for an Energy-Efficient Economy.

[30] Molina, M. and M. Kushler. 2015. *Policies Matter: Creating a Foundation for an Energy-Efficient Utility of the Future*. American Council for an Energy-Efficient Economy.

[31] NY PSC Staff. 2015. *Staff White Paper on Ratemaking and Utility Business Models*. Case 14-M-0101. July 28, 2015, Appendix C.

New York State Energy Research and Development Authority

As a public entity, NYSERDA is not in a position to receive performance incentives. However, NYSERDA is expected to continue offering a more limited portfolio of "resource acquisition" efficiency programs through the Clean Energy Fund for the low-income and affordable multifamily sector (in addition to complementary upstream market transformation and financing programs), and thus it will be important to consider whether and how utility EIMs and other regulatory policies can encourage cooperation between NYSERDA and the utilities, and not competition.

Care should also be taken to design NYSERDA and utility programs to avoid or minimize overlaps and double counting where possible, without inciting disruptive competition between these entities. The Commission should investigate and pursue EIM structures that would provide incentives for the utilities both to pursue higher energy efficiency targets, and to work cooperatively with NYSERDA.[32]

Third-Party Efficiency Vendors

While the EIMs should only be applied to the utilities, the utilities should be encouraged to take advantage of third-party energy efficiency vendors and other market-based mechanisms to improve the efficacy of efficiency delivery. One way to achieve this is to monitor the extent to which utilities incorporate competitive processes in their efficiency program delivery, and to establish EIMs in the future specifically designed to increase competitive practices. Another way to achieve this is for utilities to establish financial incentive mechanisms that reward third-party vendors for achieving outcomes consistent with public policy objectives. Such objectives include reducing the cost of program delivery, attaining deep energy savings, or servicing hard-to-reach customer groups.

We recommend that the Commission establish efficiency EIMs for the utilities for 2017 through 2020. The targets that should be used for these EIMs are described in Section 6. For the years after 2020, the Commission may decide to modify these EIMs, or establish additional EIMs, that would encourage utilities to increase the extent to which they rely upon market-based practices and third-party efficiency vendors to meet the savings targets in those later years.

7. Higher Efficiency Targets for New York

We recommend that the Commission establish statewide energy efficiency targets for the utilities and NYSERDA that would achieve statewide annual efficiency savings of 3.0 percent of retail sales by 2020. Such targets would require both utilities and NYSERDA to increase their annual efficiency savings by 0.4

[32] One possible approach would be to base utility EIMs on both the utility's energy savings and NYSERDA energy savings, allocated to the appropriate utility by territory. The EIMs could either apply uniformly to NYSERDA and utility savings, or provide greater incentives for the utility energy savings than for allocated NYSERDA savings. This approach may encourage collaboration and cooperation between these entities.

percent of retail sales each year from 2016 through 2020. The recommended statewide energy efficiency targets are presented in Table 1.

The savings targets are based on the following information:

- The statewide efficiency savings target in New York in recent years has been roughly 1.0 to 1.5 percent of retail sales.
- The statewide efficiency level assumed in the CES White Paper is equivalent to roughly 1.4 percent of retail sales.
- From 2008 to 2015, the utilities in Massachusetts and Rhode Island, including National Grid, were able to increase their annual incremental efficiency savings on average by roughly 0.4 percent of retail sales each year.[33]
- In 2015, the utilities in Massachusetts and Rhode Island, including National Grid, achieved efficiency savings of roughly 3.0 percent of retail sales, and have targets for future years on the order of 2.5 to 3.0 percent of retail sales.

We expect that these levels of energy efficiency savings will be cost-effective, particularly in light of the Commission's efforts to properly account for the full value of distributed energy resources, including the social cost of carbon. Other states have achieved this level of efficiency savings cost-effectively, and a recent report demonstrates how all states should be able to cost-effectively achieve 30 percent electricity savings over 10 years, equivalent to roughly 3 percent savings per year.[34]

Table 1. Statewide efficiency savings targets for 2016-2020

	CES White Paper Assumed Savings		Proposed Targets	
Year	Cumulative Energy (MWh)	Annual Savings (% of sales)	Cumulative Energy (MWh)	Annual Targets (% of sales)
2016	4,453	1.4%	4,453	1.4%
2017	6,680	1.4%	7,324	1.8%
2018	8,907	1.4%	10,805	2.2%
2019	11,133	1.4%	14,865	2.6%
2020	13,360	1.4%	19,492	3.0%

33 Given New York's history with energy efficiency, we assume that it can ramp up by 0.4 percent per year. This is the level attained by national leaders in energy efficiency program implementation. Jurisdictions with limited program activity have been able to expand program savings by about 0.2 percent of sales per year. These rates of increase in annual savings were supported by a recent national analysis of annual energy savings increases conducted by U.S. Environmental Protection Agency (EPA). EPA found the average ramp-rate for 26 program administrators that achieved a maximum first year savings level of 1.5 to 3 percent was 0.38 percent of sales per year based on the Energy Information Administration's Form EIA-861 on EE program electricity savings. (EPA. 2015. "Clean Power Plan Final Rule: Demand-Side Energy Efficiency Technical Support Document." https://www.epa.gov/sites/production/files/2015-11/documents/tsd-cpp-demand-side-ee.pdf.)

34 Neme, C., J. Grevatt. 2016. *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years*. Regulatory Assistance Project.

The utilities and NYSERDA should work to develop joint plans to reach these annual goals. As noted above, for the purpose of EIMs, energy savings from any NYSERDA programs could be allocated to utilities. This allocation could be based on where the savings occur, or on a pre-determined formula when the location of the savings is not known.

8. Economic Benefits of Higher Efficiency Targets

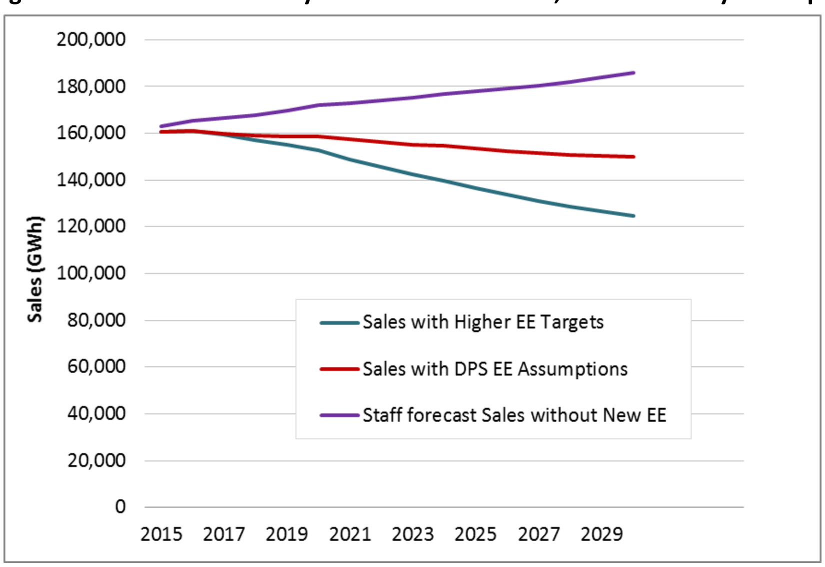
The Clean Energy Standard and Efficiency Targets

The New York Clean Energy Standard (CES) requires utilities to generate 50 percent of their electricity from renewable resources by 2030. While the CES does not establish specific energy efficiency targets, such targets can nonetheless play a very important role in facilitating cost-effective compliance with the CES. Any savings from energy efficiency will reduce total electricity demand, reduce the amount of renewable generation required, and thereby reduce the cost of complying with the CES.

As noted above, the efficiency levels assumed by the DPS Staff in the CES White Paper will only cover a portion of the cost-effective efficiency resources in New York. While third-party vendors may ramp up efforts and achieve some portion of the remaining efficiency potential, much is likely to be left on the table. Consequently, the cost of complying with the CES could be significantly higher than necessary.

In order to estimate this effect, we analyze two different future scenarios: a Reference scenario in which the efficiency savings in New York are equal to the CES White Paper assumptions, and a Higher Targets scenario in which the efficiency savings are equal to the higher targets proposed in Section 7. Our analysis includes all of the years through the CES target year of 2030. For the years after 2020, we assume that the state can achieve efficiency savings equal to 3 percent of retail sales each year.

Figure 4. New York electricity sales without new EE, Staff efficiency assumptions and higher targets



Note: Following Staff's savings forecast methodology, our estimate of cumulative energy efficiency does not assume any energy savings decay.

In order to estimate this effect, we analyze two different future scenarios: a Reference scenario in which the efficiency savings in New York are equal to the CES White Paper assumptions, and a Higher Targets scenario in which the efficiency savings are equal to the higher targets proposed in Section 7. Our analysis includes all of the years through the CES target year of 2030. For the years after 2020, we assume that the state can achieve efficiency savings equal to 3 percent of retail sales each year.

Figure 4 presents the statewide electricity sales that would result from these scenarios. It includes (a) the Staff's sales forecast assuming no new energy efficiency savings; (b) the Staff's sales forecast including its assumed levels of energy efficiency; and (c) a sales forecast assuming the higher efficiency savings targets described above.

The Economic Benefits of Higher Efficiency Targets

Synapse used the ReEDs model to estimate the costs of the electricity system in New York well into the future. This model optimizes the build out and the operation of the electricity system in a least-cost fashion, subject to reliability constraints. This model benefits from the National Renewable Energy Laboratory's detailed data sets on renewable resource potential and constraints in New York and the region. Appendix A provides details on our modeling approach and assumptions, including methodology, unit retirements and additions, cost of generating resources such as solar and wind, and natural gas prices.

Both the Reference scenario and the Higher Targets scenario start with the same information and assumptions regarding electricity system loads, fuel prices, power plants, transmission lines, etc. The only difference between the inputs of the two scenarios is the amount of energy efficiency that will be implemented statewide. The model then calculates how the electricity system would be built and operated under those two different scenarios. As shown in Figure 5, in general the Higher Targets scenario will require fewer new renewable resources to be built and fewer imports, and will result in reduced fuel costs from New York's fossil fuel power plants.

Figure 5: Generation by technology under the (a) Reference and (b) Higher Targets assumptions

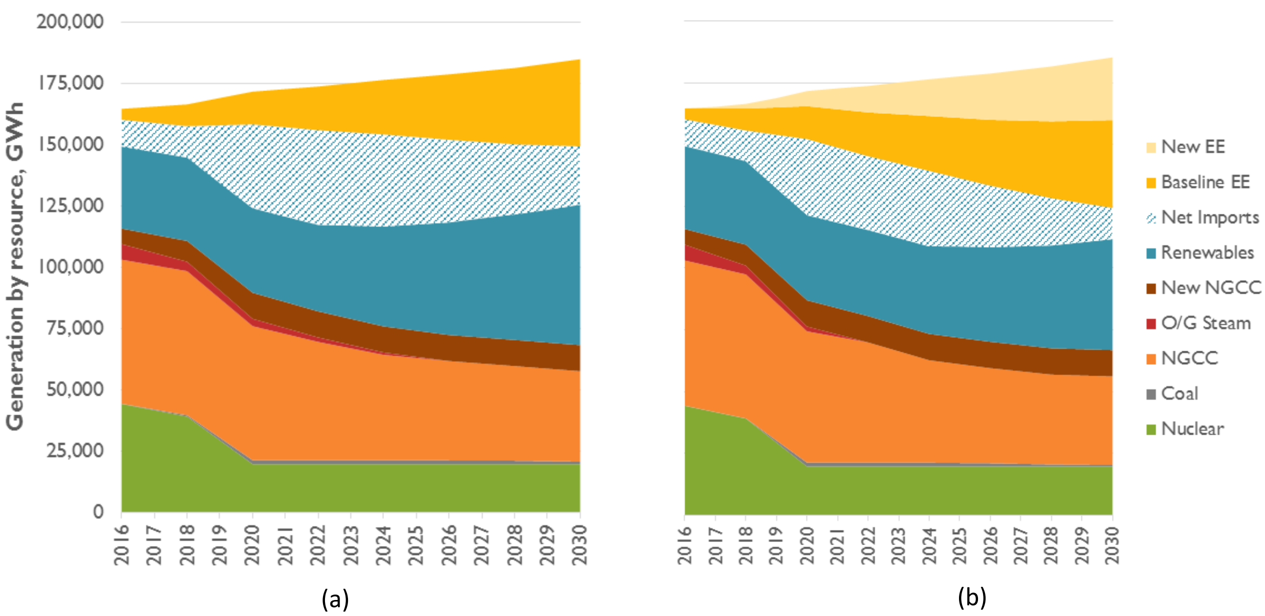
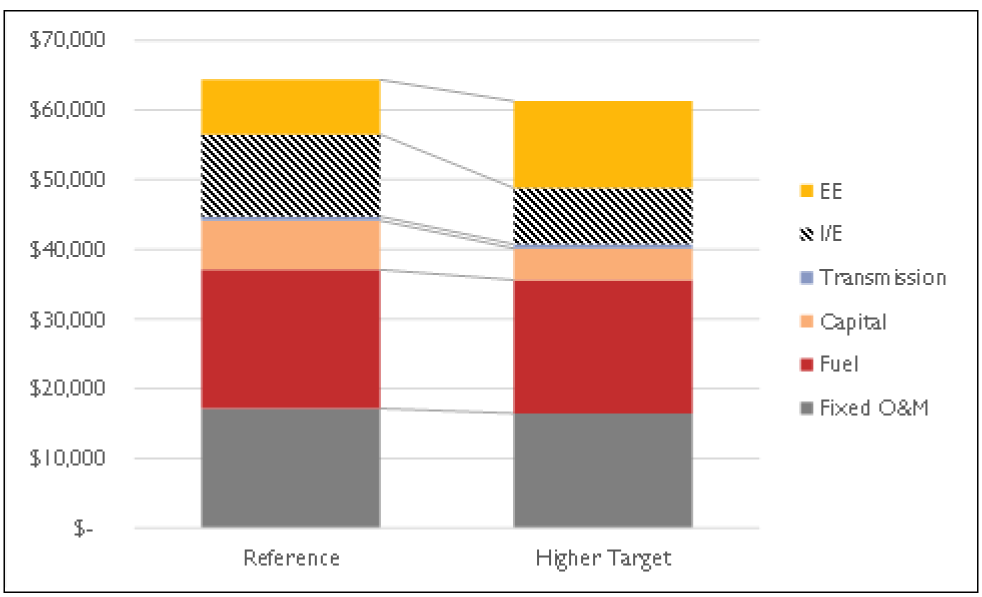


Figure 6 summarizes the results of the economic analysis. The Higher Targets scenario includes higher costs of energy efficiency resources, of roughly $4.7 billion. However, this scenario includes reduced costs from the rest of the system, primarily in terms of reduced import costs and reduced capital costs, of roughly $7.7 billion. This means that the Higher Targets scenario has reduced the total costs to electricity customers by roughly $3 billion.

Figure 6: Net present value of projected New York system costs, 2016-2030 (million 2013$)



This additional investment in energy efficiency resources in the Higher Targets scenario results in a benefit-cost ratio of roughly 1.65 to one. This means that every additional dollar spent by New York electric utilities in energy efficiency will result in $1.65 in benefits.

This economic analysis indicates the importance of establishing clearly defined, enforceable energy efficiency targets for the New York electric utilities, combined with some form of an EIM. Targets and EIMs can be used to ensure that the CES compliance costs are as low as possible. Note that if the Commission does not establish a meaningful, enforceable EIM for efficiency targets, and the utilities and NYSERDA do not meet the current energy efficiency savings levels assumed in the CES White Paper, then the cost of complying with the CES will be even higher than what is indicated in our Reference scenario.

9. RECOMMENDATIONS

The Commission can and should pursue more aggressive energy efficiency beyond the levels assumed to materialize in the Clean Energy Standard White Paper. Specifically, the Commission should set energy efficiency targets for the utilities and NYSERDA that together will increase annual efficiency savings by 0.4 percent of retail sales each year from 2017 through 2020 and reach 3.0 percent of retail sales by 2020. To this end, the Commission should require the utilities and NYSERDA to jointly develop plans to meet these targets.

To achieve these targets, the Commission should pursue strategies to get more energy savings out of regulated energy efficiency programs than New York has achieved in the past. These include the creation of stakeholder groups that can minimize regulatory processes and improve overall performance, the use of earning performance incentives to accelerate utility energy efficiency efforts, and incorporating selected market-based activities into regulated energy efficiency programs. Utility efficiency programs are by no means the *only* means of meeting the proposed ambitious but achievable savings levels for New York—effective adoption and implementation of building codes, benchmarking, access to data, and other related policies are essential to maximizing this cost-effective resource.[35] However, clear and robust statewide savings levels with the necessary regulatory constructs behind them are fundamental tenets for leading in energy efficiency, and for delivering the many benefits such approaches bring to customers.

[35] Gilleo, A., S. Nowak, M. Kelly, S. Vaidyanathan, M. Shoemaker, A. Chittum, and T. Bailey. 2015. *The 2015 State Energy Efficiency Scorecard*. American Council for an Energy-Efficient Economy.

APPENDIX A: ECONOMIC MODELING APPROACH

Synapse conducted an analysis of the impacts of a Higher Targets scenario on compliance with the proposed New York Clean Energy Standard (CES). This appendix documents the methodology, key data, assumptions, and results of a Reference scenario relative to a Higher Energy Efficiency Targets (Higher Targets) scenario.

The Reference scenario reflects achievement of the CES based on the Department of Public Service (DPS) Staff White Paper released on January 25, 2016. In this scenario, the Clean Energy Standard requirement that 50 percent of electricity generation come from renewable energy resources by 2030 is coupled with DPS Staff assumptions of annual incremental efficiency savings presented in the CES White Paper.[36] Staff's energy efficiency program assumptions are projected to result in 19 percent reduction in electricity demand relative to projected energy need without energy efficiency in 2030.[37] The combination of increased renewable generation driven by the CES mandate and the DPS assumed levels of energy efficiency drive down fossil generation relative to a future without the CES or higher EE penetration.

The Higher Targets scenario represents a substantial shift in energy efficiency policy by raising the energy efficiency target to 3 percent annual incremental savings. Such a shift is expected to reduce load by 25,404 gigawatt-hours (GWh) or 17 percent relative to the Reference scenario in 2030. This Higher Targets scenario would result in a total load reduction of 61,000 GWh or 33 percent relative to the "no energy efficiency" load forecast.

Our analysis relies on the Renewable Energy Development System (ReEDS) model, a tool designed by the National Renewable Energy Laboratory (NREL) for long-term analysis of the development of the electric power sector. We updated several of the default assumptions in the ReEDS model based on recent research.

The ReEDS Model

ReEDS is a long-term capacity expansion and dispatch model of the electric power system in the lower 48 states. It has a high level of renewable energy resource detail with many wind and solar resource regions, each with availability by resource class and unique grid connection costs. Model outputs include generation, capacity, transmission expansion, capital and operating costs, and emissions of CO_2, SO_2,

[36] Due to model structure limitations, this analysis considers the CES standard as based on electric sales in both the Reference and High Targets scenarios. Modeling the CES based on generation rather than sales would increase the level of renewables required for compliance with the CES and would likely to increase the value of energy efficiency.

[37] The baseline scenario is based on the total statewide energy need prior to energy efficiency, presented in the NY PSC *Staff White Paper on Clean Energy Standard*, Case 15-E-0302, Jan. 25, 2016 Appendix B, p. 2.

NO_X, and mercury.[38] The model operates through 2050 in two-year steps, with each two-year period divided into 17 time slices. These time slices represent morning, afternoon, evening, and night in each of the four seasons, plus an additional summer peak time slice representing the 40 highest demand hours of the summer. The time slices represent the windows of 10 p.m. to 6 a.m., 6 a.m. to 1 p.m., 1 p.m. to 5 p.m., and 5 p.m. to 10 p.m. in each season. ReEDS includes data on the existing fossil fuel facilities in each of the model's 134 Power Control Areas (PCAs). New York State is represented by two PCAs.

ReEDS benefits from NREL's detailed data sets on renewable resource potentials and constraints across the country, providing a higher level of resolution than similar industry models. Wind resources are modeled in 356 regions of the United States (10 in New York), based on high-resolution wind speed modeling and taking into account environmental and land-use exclusions. Biomass, geothermal, solar PV, and hydropower plants are built at the resolution of the model's 134 PCAs.

Input Assumptions

ReEDS optimizes new build and retirement decisions biannually based on the lowest cost solution to meet demand within reliability constraints. These biannual optimization decisions are informed largely by the assumptions and inputs used in each model run. Table 2 summarizes the key distinctions among the inputs between the two scenarios, which are described in further detail below. While the bulk of these assumptions are consistent with a recent Synapse report called *The RGGI Opportunity*, we have updated natural gas costs and resource retirement assumptions to better reflect market changes that have occurred since that report was released.[39] Consistent with previous modeling of the RGGI states, unit retirement assumptions are based on the 2014 edition of EIA's Form 860, ongoing Synapse research on unit retirement announcements, and the 2015 NYISO Gold Book.[40] We have also used the proposed New York Clean Energy Standard in both the Reference and Higher Target scenarios. In Table 2, we highlight several of the assumptions used in this analysis; for a more detailed description of ReEDS default assumptions, see either *The RGGI Opportunity* report or our 2015 study *Bill Savings in a Clean Energy Future*.[41,42]

38 Short et al. 2010. Regional Energy Deployment System (ReEDS). Available at: http://www.nrel.gov/docs/fy12osti/46534.pdf.

39 Stanton et al. 2016. *The RGGI Opportunity: Compliance Tool to Achieve 2030 State Climate Targets*. Available at: http://www.synapse-energy.com/sites/default/files/The-RGGI-Opportunity.pdf.

40 A full phase-out of the state's coal-fired units by 2020, as called for by Governor Cuomo in January 2016, would not materially change the results of this analysis in terms of cost savings. (Sierra Club. *Governor Cuomo commits to end coal in NY by 2020.* Accessed 4 April 2016: http://content.sierraclub.org/press-releases/2016/01/governor-cuomo-commits-end-coal-ny-2020.)

41 Knight et al. 2015. *Bill Savings in a Clean Energy Future*. Available at: http://www.synapse-energy.com/sites/default/files/Bill-Savings-in-a-Clean-Energy-Future.pdf.

42 Hand, M.M., S. Baldwin, E. DeMeo, J.M. Reilly, T. Mai, D. Arent, G. Porro, M. Meshek, and D. Sandor eds. 2012. *Renewable Electricity Futures Study.* 4 vols. NREL/TP-6A20-52409. Golden, CO: National Renewable Energy Laboratory. Available at: http://www.nrel.gov/analysis/re_futures.

Table 2. Key input assumptions in Reference and Higher Target EE scenarios

Assumption	Reference	Higher Target
Energy Efficiency	2,227 GWh per year (roughly 1.5% annual savings)[43]	Ramping from near-term targets to 3% annual savings beginning in 2020
RGGI	2020 emission targets are followed by an annual 2.5 % decline[44]	2020 emission targets are followed by an annual 2.5 % decline
Natural Gas	Average of AEO 2015 Reference and High Oil & Gas Supply cases[45]	Average of AEO 2015 Reference and High Oil & Gas Supply cases
Nuclear Retirements	Ginna (2018), Indian Point (2019), Fitzpatrick (2034)[46]	Ginna (2018), Indian Point (2019), Fitzpatrick (2034)
Renewable Portion of Generation	50%	50%

Electricity Loads and Energy Efficiency

Electricity loads for the state of New York come from the January 25th *Staff White Paper on Clean Energy Standard*. The Reference scenario assumes 2,227 GWh per year of energy efficiency savings, consistent with the Staff CES White Paper, while the Higher Targets scenario reaches a more ambitious 3 percent incremental savings target over time. For the rest of the United States, electricity loads from the U.S. Energy Information Administration's (EIA) 2015 Annual Energy Outlook (AEO) form the basis of the loads in both scenarios. These loads are represented as the net energy required at the busbar. ReEDS, like many power sector models, does not include a representation of the distribution system. A 5.3 percent distribution loss factor is assumed for purposes of calculating sales, based on information from EIA.

In this modeling, we use a conservative estimate of the cost of energy efficiency resources. We assume a levelized total cost of 4 cents per lifetime kWh saved, representing program administrator costs only. This figure is based on our calculation of the cost of saved electricity for the Energy Efficiency Portfolio Standard (EEPS) II programs statewide—3.4 cents/kWh levelized—using data from the NY DPS EEPS Electric Performance Summary website.[47] We round the 3.4 cents up to 4.0 cents to be conservative and to recognize the potential for program costs to go up slightly as administrators increasingly target more comprehensive retrofits, continue or increase efforts to include harder-to-reach customers such as low-income and small business customers, and shift investment to new technologies. Four cents per kWh is

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43 NY PSC. 2016. *Staff White Paper on Clean Energy Standard*, Case 15-E-0302.

44 The Regional Greenhouse Gas Initiative. "2016 Program Review: Modeling Scenarios Discussion." Released January 28. Available at: http://www.rggi.org/design/2016-program-review/rggi-meetings.

45 U.S. Energy Information Administration. 2015. "Assumptions to the Annual Energy Outlook 2015." DOE/EIA-0554. Washington, DC. http://www.eia.gov/forecasts/aeo/assumptions.

46 The assumption about the date of Fitzpatrick's retirement is conservative. We note that an earlier retirement would increase the benefits of a Higher Target Scenario.

47 For the calculation of the historical cost of saved energy, we use a discount rate of 5% and assume an average measure life of 12 years. 3.4 cents is calculated using expenditures, including an assumed 5% adder for evaluation costs, and net first-year electricity savings for the EEPS II programs from inception through the end of 2014, for NYSERDA and the investor owned utilities. No decay in savings was assumed.

also close to the results of a 2014 LBNL study, which found a levelized cost of saved energy of about 3.2 to 3.3 cents/kWh (2012$) for New York State based on savings data from 2009 to 2011 (adjusted to be gross) and a 6 percent real discount rate. Two states, Massachusetts and Rhode Island, are achieving savings as a percent of sales in the range of the Higher Targets level (3%) recommended for New York, and thus their costs of saved energy are presented here for comparison purposes. In Massachusetts, where an "all cost-effective EE" policy is in place, the levelized cost of saved energy for the 2013 through 2015 programs has been between 4.0 and 4.6 cents per lifetime-kWh assuming a 5 percent discount rate, even while achieving savings of between 2.3 and 3.0 percent of sales. Rhode Island has seen roughly similar cost and savings levels in recent years.[48]

Unit Retirements and Additions

Retirement data are based on the 2014 edition of EIA's Form 860, supplemented by ongoing Synapse research and the 2015 NYISO Gold Book.[49,50] We also assume implementation of emissions control technologies projected to be required at those coal generators that are likely to continue to operate through the study period. The cost of control technologies that will be installed at coal plants under existing federal environmental regulations other than the Clean Power Plan were estimated using the Synapse Coal Asset Valuation Tool (CAVT).[51] Environmental controls assumed necessary for regulatory compliance are dry flue gas desulfurization, selective catalytic reduction, baghouses, activated carbon injection, recirculating cooling systems, coal ash controls, and effluent controls. Note that all retirements and retrofits are assumed as inputs to both the baseline and the Higher Target policy scenarios.

Solar and Wind Technology Costs

We assume cost reduction trajectories for utility and rooftop solar PV based on the NREL's *SunShot Vision* study, which projects significant cost reductions from baseline levels by 2020.[52] In both the Reference and Higher Target EE scenarios, we assume costs decline 62.5 percent, reaching $1600 per kW in 2020 for a large ground-mounted system (in 2013 dollars). While module costs have been well below $1.00 per watt in recent years, the many other costs of a solar plant, such as financing, customer

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48 Malone, E. and J. Kallay. *Rhode Island and Massachusetts Eclipse Efficiency Targets.* Synapse Energy Economics. March 23, 2016. http://www.synapse-energy.com/about-us/blog/rhode-island-and-massachusetts-eclipse-efficiency-targets.

49 Stanton, E., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. Santen, and K. Takahashi. *The RGGI Opportunity: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets*. Synapse Energy Economics. Table 7.

50 A full phase-out of the state's coal-fired units by 2020, as called for by Governor Cuomo in January 2016, would not materially change the results of this analysis in terms of cost savings. (Sierra Club*. Governor Cuomo commits to end coal in NY by 2020.* Accessed 4 April 2016: http://content.sierraclub.org/press-releases/2016/01/governor-cuomo-commits-end-coal-ny-2020.)

51 Knight, P. and J. Daniel. 2015. *Forecasting Coal Unit Competitiveness – 2015 Update*. Synapse Energy Economics. Available at: http://www.synapse-energy.com/sites/default/files/Forecasting-Coal-Unit-Competitiveness-14-021.pdf. CAVT is available at http://synapse-energy.com/tools/coal-asset-valuation-tool-cavt.

52 U.S. Department of Energy. 2012. *Sunshot Vision Study*. Available at: http://www1.eere.energy.gov/solar/pdfs/47927.pdf.

acquisition, permitting, and inspection (together known as "soft costs") have not decreased at the same rate as module costs. We conservatively assume that solar PV costs will remain flat after 2020.[53]

ReEDS is a supply-side-only model: it does not optimize the decisions residential homeowners would make to install rooftop PV systems. These are input into the model based on a separate tool NREL developed for its SunShot analysis. In New York, we assume 420 MW of installed rooftop PV by the end of 2015, growing to 3,950 MW by 2030.[54]

Each of the 356 wind supply regions has a specified capacity potential in each wind Class 3 through 7. The potential for new wind is based on modeling results by AWS Truepower using the Mesomap® process. Results were processed to exclude areas such as urban areas, federally protected lands, and onshore water features. Our costs for land-based wind are based on research conducted for the Department of Energy's recent *Wind Vision Report*.[55] Base wind costs in 2015 range from $1,759 per kW for projects in Class 3 areas to $1,641 per kW for projects in Class 7. This represents the turbine itself—ReEDS adds interconnection costs to the regional transmission system based on GIS analysis of wind resources.

The *Wind Vision Report* assumes cost reductions and capacity factor increases over time for land-based wind. In our analysis, we hold base costs for land-based wind constant over the study period at the levels cited above, but use the increasing capacity factors from the *Wind Vision Report.* Possible land-based capacity factors range from 35 to 49 percent in 2020 and range from 38 to 58 percent in 2040.

Levelized Cost Comparison

Based on the input values discussed above, levelized cost of energy (LCOE) values can be computed for the state as a whole by amortizing the first year total installation costs over the economic life of respective energy resources at certain discount rates and adding ongoing annual operation and maintenance costs.

Figure 7Figure 7shows a comparison of LCOE values for several key technologies in this analysis. ReEDS includes a detailed representation of Class 3 through Class 7 wind supply resources with several resource types available. For simplicity, wind costs in Figure 7 represent just one class and type: a new utility-scale wind farm located in a Class 4 wind resource area with an average capacity factor of 38 percent. The wind LCOE shown in Figure 7 does not include any required grid interconnection costs, which are dependent on where resources are built. However, such interconnection costs are included in our modeling and results. The wind LCOE shown below is substantially below average power purchase

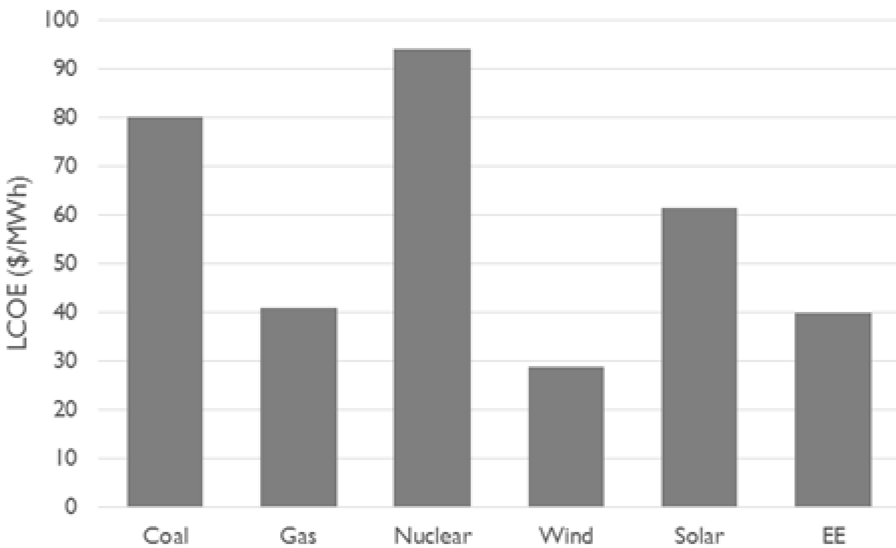
53 In the 2015 Annual Technology Baseline report, NREL projects PV costs in 2020 similar to those assumed in the Synapse analysis, but projects these costs to continue declining towards the SunShot study target of $1.00 per watt by 2030. (NREL. Annual Technology Baseline and Standard Scenarios. http://www.nrel.gov/analysis/data_tech_baseline.html)

54 Because actual 2015 solar builds were significantly higher than the SunShot study anticipated, we use actual 2015 data for New York and interpolate to SunShot values by 2020.

55 U.S. Department of Energy. 2015. *Wind Vision Report*. Accessed June 22, 2015. Available at: http://energy.gov/eere/wind/wind-vision.

agreement costs of about $53 per MWh for 2012 presented in Lawrence Berkeley National Lab's (LBNL) *2014 Wind Technologies Market Report*, although the LBNL estimate is both historical and limited to a single project.[56]

Figure 7: 2016 levelized cost of energy ($/MWh)



Note: Wind and solar costs incorporate the Production and Investment Tax Credits. While interconnection costs and transmission infrastructure costs are included in ReEDs modeling, for simplicity they are not included in the levelized costs of generation resources (on either side of the meter) in this graph. In contrast, energy efficiency does not require these infrastructure costs.

Results

In both the Reference and Higher Targets efficiency scenarios, the increase in energy efficiency and renewable energy reduces in-state fossil fuel-based generation substantially, and replaces the load served by retiring nuclear facilities. (See Figure 8 and Table 3below.) Despite low natural gas prices, the aggressive renewable energy targets drive adoption of wind and solar resources. This reduces total system emissions 34 percent from 2015 levels by 2030 under the Reference scenario, and 37.5 percent under the Higher Targets scenario.

One of the most substantial impacts of the Higher Targets assumptions is the cost savings. Over the 2016 to 2030 time period, the Higher Target scenario saves $3 billion relative to the Reference scenario.[57] (See Table 4 and Table 5.) Most of these savings come from reduced capital expenditures,

[56] Wiser, R. and M. Bolinger 2015. *2014 Wind Technologies Market Report*. Lawrence Berkeley National Lab. Available at: http://energy.gov/sites/prod/files/2015/08/f25/2014-Wind-Technologies-Market-Report-8.7.pdf.

[57] Net Present Value is based on 5 percent discount rate. We note that a societal discount rate would make benefits of the Higher Targets scenario look even higher.

largely on new renewable resources, due to lower demand ($2.5 billion less than the Reference scenario) and reduced energy imports ($3.7 billion less than the Reference scenario).

The incremental energy efficiency measures in the Higher Targets scenario come at a cost of $4.671 billion, including higher transmission costs and efficiency program costs, but provide direct energy system benefits of $7.715 billion, including savings from fuel, operations and maintenance, capital/capacity, transmission, and avoided imports. These result in a benefit-cost ratio of 1.65. (See Table 5.)

Figure 8: Generation by technology under the (a) Reference and (b) Higher Targets Assumptions

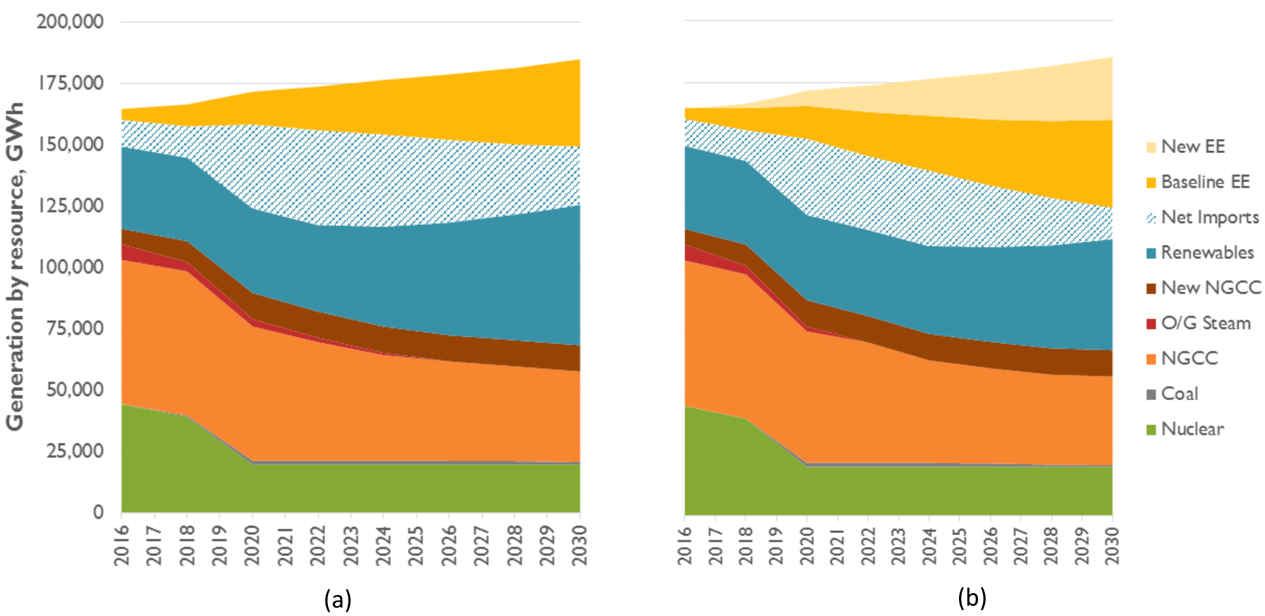


Table 3: Generation by technology (GWh)

	Reference				Higher Targets			
	2016	2020	2025	2030	2016	2020	2025	2030
Nuclear	44,199	19,591	19,591	19,591	44,199	19,591	19,591	19,591
Coal	82	1,581	1,555	1,021	82	1,590	1,450	627
Natural Gas	65,686	65,635	52,671	48,209	65,686	64,037	50,891	46,801
Oil/Gas Steam	6,373	3,001	490	0	6,373	1,951	0	0
Renewables	33,558	34,492	43,403	57,290	33,558	34,492	36,983	44,951
Canadian Hydro	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Net Imports	-4,108	19,297	20,682	8,906	-4,108	15,804	12,666	-2,358
Baseline EE	4,453	13,360	24,493	35,627	4,453	13,360	24,493	35,627
Incremental EE	0	0	0	0	0	6,132	16,860	25,404
Load	160,790	158,597	153,393	150,017	160,790	152,465	136,580	124,612

Note: Both renewables and Canadian hydro represented in this table count towards meeting the Clean Energy Standard requirements. Due to model structure limitations, this analysis considers the CES standard as based on electric sales in both the Reference and Higher Targets scenarios. Modeling the CES based on generation rather than sales would increase the level of renewables required for compliance with the CES and would likely to increase the value of energy efficiency.

Figure 9: Net present value of New York system costs, 2016-2030 (million 2013$)

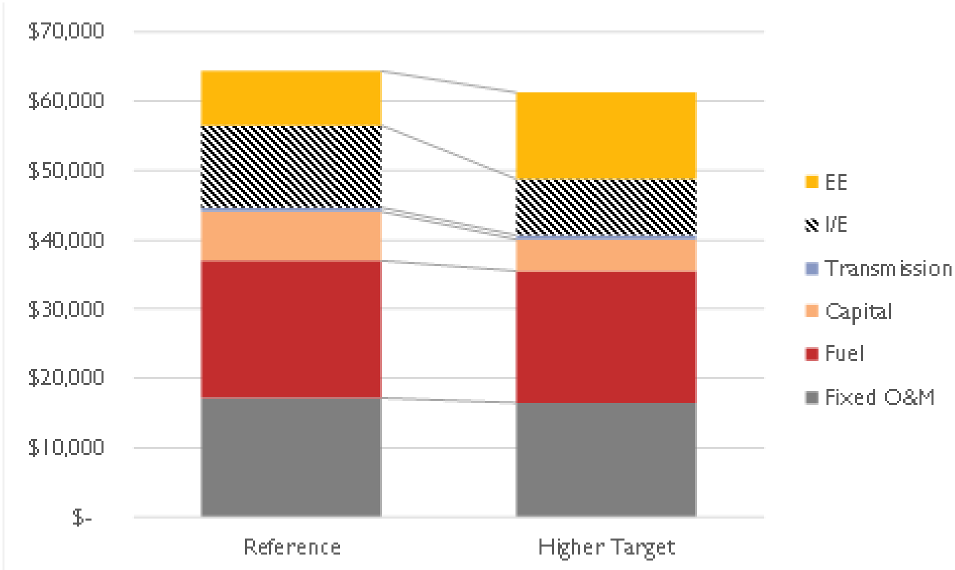


Table 4: Net present value of New York system costs, 2016-2030 (Million 2013$)

	Reference	Higher Targets	Delta
Fixed O&M	$ 17,153	$ 16,482	$ (671)
Fuel	$ 19,910	$ 19,104	$ (805)
Capital	$ 7,063	$ 4,511	$ (2,552)
Transmission	$ 588	$ 599	$ 10
I/E	$ 11,782	$ 8,095	$ (3,687)
EE	$ 7,851	$ 12,512	$ 4,661
Total	$ 64,347	$ 61,304	$ (3,043)

Table 5: Benefit-cost ratio of higher energy efficiency deployment

Cost (million $)	Benefit (million $)	Benefit Cost Ratio
$4,671	$7,715	1.65

APPENDIX B: COMPARISON WITH THE DPS CES COST STUDY

The following table highlights the key differences in inputs and methodology between the Synapse modeling and the CES Cost Study released by the DPS on April 8, 2016.

	Key differences	**Explanation and/or effect**
Levelized Cost of Wind Energy	The Cost Study finds a LCOE for large-scale wind with the Production Tax Credit of $48/MWh, compared to Synapse's LCOE result of $29/MWh.	The Cost Study's assumed capacity factor is likely lower than Synapse's. Synapse assumes increasing capacity factors from The *Wind Vision Report*, based on a nationwide GIS analysis. The Cost Study does not provide an average capacity factor; it incorporates the results of a more detailed AWS analysis of 370 representative sites in New York. While CapEx assumptions are similar, the Cost Study's higher Fixed O&M costs can be attributed in part to its inclusion of land lease or royalty payments; property taxes; NY-specific Payment in Lieu of Taxes. The studies may also assume different financing parameters to levelize costs.
Wind costs	The Cost Study assumes a wind capital expense (CapEx) of 2013$ 1692/kW, compared to Synapse's slightly higher estimate of 2013$ 1790/kW. The Cost Study's wind Fixed Operations and Maintenance (O&M) costs are 2013$ 77/kW-year compared to Synapse's assumed O&M costs of 2013$ 51/kW-year.	
Energy prices	The Cost Study did not explicitly use a natural gas price forecast. It incorporated a supply curve analysis, which only requires an assumed trajectory for wholesale energy prices based on adjusted NYISO 2015 CARIS forecast through 2024. After this point, it was adjusted based on an assumed weighting of two forecasts—one with constant post-2024 prices, and another assuming escalation at the same rate as the AEO 2015 Natural Gas price. Synapse uses an average of AEO 2015 Reference and High Oil and Gas Supply cases. The model calculates energy prices in each year based on the lowest cost dispatch of power plants.	While the natural gas portion of the Cost Study forecast is higher than the Synapse assumptions, the assumed weighting of the two forecasts used in the Cost Study should make our energy price assumptions roughly comparable. The Cost Study produces energy price forecasts for all 11 NYISO zones, whereas the Synapse study uses a more aggregated representation of the state limited to two zones.
Cost of Energy Efficiency	Synapse assumes a 4c/kWh cost of energy efficiency. The assumptions in the Cost Study are not specified.	
Nuclear retirements	The Cost Study does not retire nuclear units; the Synapse study assumes that Ginna, Indian Point, and Fitzpatrick will retire in 2017, 2019, and 2034 respectively.	Retired nuclear capacity, assumed in both scenarios in the Synapse study, likely drives up marginal energy prices compared to maintaining that capacity in place.
Model structure	The Cost Study focuses on supply-curve analysis while Synapse uses a capacity expansion optimization model.	These fundamentally different approaches can both provide reasonable and useful results, but with different purposes. A supply curve approach focuses more on a detailed treatment of available resources, while the optimization model ensures a lowest cost system expansion and dispatch.

Notes: All costs are in $2013 real dollars. The U.S. Department of Energy 2015 Wind Vision Report is available at: http://energy.gov/eere/wind/wind-vision.