



ESPC Overview: Cash Flows, Scenarios, and Associated Diagrams for Energy Savings Performance Contracts

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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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Preface

This document is meant to inform state and local decision makers about the process of energy savings performance contracts, and how projected savings and allocated energy-related budgets can be impacted by changes in utility prices.

The scenarios presented in this document are hypothetical and meant only to convey a simplified view of how actual energy operational budgets may be impacted by fluctuations in utility prices.

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Introduction

Energy savings performance contracting is a method for making capital improvements to existing facilities by using guaranteed energy and operational savings to pay for the upgrades. Savings can be generated from use reduction in electricity, heating fuels (e.g., natural gas, propane, fuel oil, etc.), water and/or wastewater. An energy savings performance contract (ESPC) is an agreement between an energy services company (ESCO) and a building owner, whereby the ESCO performs a detailed assessment of the facility and identifies a list of energy and water conservation measures (ECMs), and the building owner selects the best combination of ECMs to implement that meets his/her operational needs. The basic ESPC process is as follows:

- Step 1:** (planning phase) Building owner selects an ESCO based on a chosen set of criteria.
- Step 2:** ESCO performs a preliminary assessment of the building(s) to establish the facility's baseline energy and water use and identify a list of ECMs.
- Step 3:** (design phase) Building owner and ESCO decide on the optimal combination of facility upgrades.
- Step 4:** ESCO performs a comprehensive energy audit and engineering analysis of the building(s) and develops a fixed price proposal that includes the project costs, guaranteed energy and cost savings, M&V plan, and payment schedules. The ESCO can also identify a financier for the project or the agency/organization can select the project financing.
- Step 5:** (construction phase) Upon approval by the building owner of the ESCO's proposal, the ESCO moves ahead with the construction, installation, and commissioning of the ECMs.
- Step 6:** (performance phase) After construction, the ESCO monitors and verifies proper operation and performance of the ECMs and, with the savings generated by the facility upgrades, the building owner makes scheduled payments to the ESCO or financier.

ESPCs are an effective way to upgrade critical building energy and water systems (such as lighting, HVAC, building controls, roofs, and windows), or even install renewable energy equipment, without requiring hard-to-obtain up-front capital. This type of contracting mechanism is ideal for building owners with scarce capital and limited in-house energy management expertise, as well as those with aging facilities that suffer from deferred maintenance. By using an ESPC, building owners can upgrade their facilities and make them more comfortable for occupants, saving on energy use expenses and increasing the value of their facilities, all through a single comprehensive service provider.

While ESPCs are a widely used project financing mechanism, for those unfamiliar with the contracting process, the impacts on budgeting and cash flow can be challenging to understand. This paper addresses some of the more common concerns regarding the impact ESPCs have on an organization’s operating budget and cash flow. Common questions include, “What happens to operating costs if energy prices go up during the term of an ESPC?” and “What happens if energy prices go down?” To better understand the intricacies of how an ESPC compares to conventional energy budgets, presented are scenarios that demonstrate the effects variable energy rates have on an organization’s ability to cover their utility, and operations and maintenance (UOM) costs.

UOM Costs – Business as Usual Case

Figure 1 illustrates a hypothetical organization’s UOM annual budget. In this simplified case, there is a constant annual budget increase to account for rising utility rates, general inflation, and equipment efficiency degradation. The National Institute of Standards and Technology (NIST) publishes an annual report (Rushing et al. 2010) that provides projected escalation rates for electricity and heating fuels by region, along with the implied long-term average rate of inflation. As an example, in the 2010 report, the projected annual escalation rates, including inflation, for the next five years are: electricity (0%) and natural gas (3.5%). In practice though, annual UOM budgets are influenced by more factors than just utility rates and general inflation and, as a result, changes in budgets are irregular. However, for the purposes of illustrating how ESPCs are integrated into an organization’s budgeting process and cash flow, a simplified example of a UOM budget is used, modeling a constant escalation rate, as shown in Figure 1.

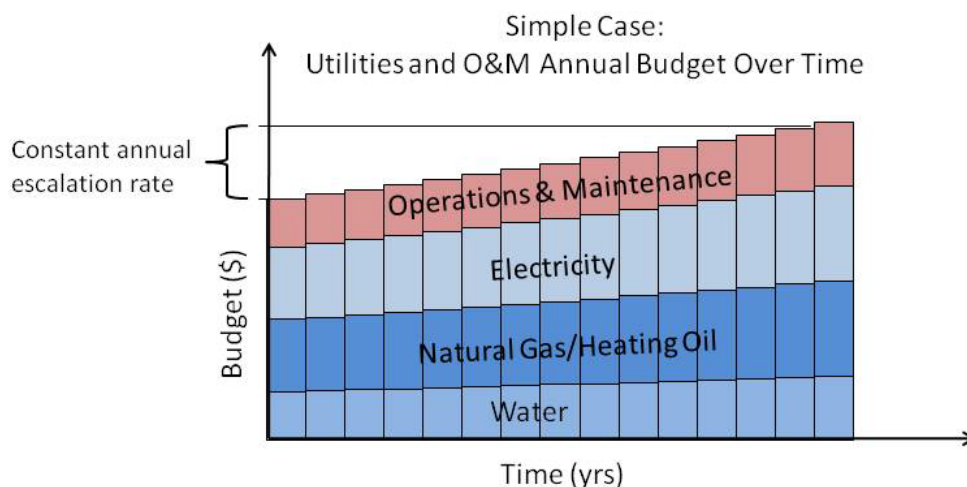


Figure 1. A simplified representation of projected utilities and O&M (UOM) annual budget

Due to a number of contributing factors (discussed later), in any given year the actual UOM costs will be more or less than what was budgeted. Figure 2 shows a hypothetical example of how actual UOM costs compare to the allocated UOM budget. One possible strategy organizations may use to manage these fluctuating annual costs is as follows: when the costs of a particular budget item are more than expected for a given year, money is moved from other cost centers to cover the deficit; and conversely, when the costs of a particular budget item are less than expected, the surplus is repurposed as needed. The fact that actual UOM costs vary from year to year is probably obvious, but it is important to understand what causes this variance.

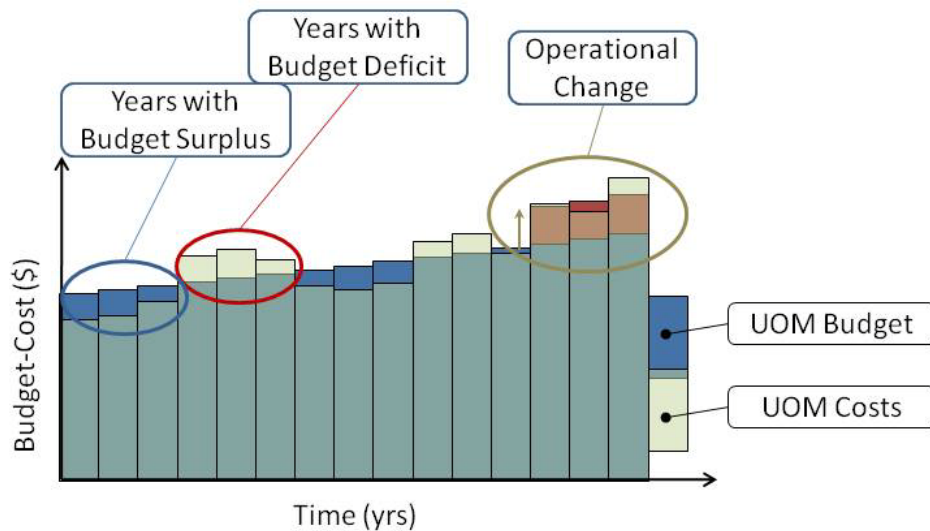


Figure 2. Example comparing actual UOM cost to allocated budget

The utility cost incurred by a facility is a function of the amount of electricity, heating fuel, and water used and their respective rates. Utility usage and rates, however, are not constant from year to year. Changes in utility **rates** are typically determined by the serving utilities and include consumption-related fees as well as fixed costs, while changes in utility **usage** are caused by three main sources: operational changes, equipment degradation, and annual weather variations. It is important to note that the fixed costs in a utility bill are not impacted by changes in utility consumption and are, therefore, immune to conservation efforts. For example, if 10% of the utility bill is made up of fixed fees (e.g., system benefit charges, standby charges, and service and facility fees), only the remaining 90% of the utility costs can be reduced through efforts to improve energy efficiency.

Because changes in utility rates are determined by the serving utility, it is likely that there will be some variation from year to year, increasing or decreasing in response to a number of factors (e.g., fuel prices). Generally, utility rate changes are estimated or known when an organization develops their annual UOM budgets and, as a result, this cost variable is reflected in annual

budget modifications. As mentioned earlier, Figures 1 and 2 represent a simplified case where annual utility rate increase is considered to be constant and accounted for by the constant rate of increase in the annual UOM budget. As a result, in this hypothetical case, any change in utility rates would not contribute to the discrepancy between the UOM budget and actual UOM costs.

Operational changes can result from changes in a building's use or physical modifications made to an existing building such as, converting a floor of a building from office space to a server room, adding a new wing to an existing building, or downsizing and vacating a floor of an office building. These kinds of changes can have a dramatic impact on an organization's UOM costs, but they are planned for and are reflected by changes to the allocated utility budget. The three bars to the far right in Figure 2 illustrate how an operational change can impact both the UOM budget and costs, as shown by the marked increase in budget from one year to the next.

Degradation of equipment happens slowly over time, resulting in an increase in energy use. In theory, degradation of equipment is managed and controlled by the operations and maintenance (O&M) portion of the budget. If all goes according to plan, an investment in O&M prevents the degradation of equipment and maintains optimal system efficiency. In practice, however, the investment of time and money in O&M is usually insufficient, resulting in increased deferred maintenance and subsequent energy use. In the best-case scenario, energy use increase is gradual and can be accounted for in a constant rate increase of the annual UOM budget. In the worst-case scenario, the deferred maintenance leads to catastrophic failure and emergency replacement of equipment, resulting in unexpected business interruptions and inflated O&M repair costs.

Of all variables affecting utility costs, weather is the most unpredictable and, as a result, it can potentially have the biggest impact on the annual differences between the actual and budgeted utility costs. However, over the long run, the annual fluctuations of energy use, due to weather variations, averages out resulting in no net change in long-term energy use. Unfavorable weather one year will be balanced by more favorable conditions another year.

As outlined above, utility costs are a function of utility use and utility rates. Both of these components vary from year to year, but in general, they exhibit a gradually increasing trend (Kumar and Sartor 2005). Different strategies are employed to budget for and manage the variability in utility costs, but in simple terms, there are cost fluctuations that can be predicted and others that cannot. As a result, in some years there will be a UOM budget deficit and in other years a UOM budget surplus. Important to note, when an ESPC is used to finance facility upgrades, it does not make the budgeting process any more complicated. In fact, by improving the energy and water efficiency of a facility, the magnitude of the UOM costs fluctuations can be greatly reduced. The next section provides illustrations of how the UOM budget changes to incorporate the fixed payments generated by energy savings upgrades from an ESPC.

ESPC – Costs Before, During, and After

Occasionally, throughout this paper, utility costs are referred to as “energy” costs. It is implied that the cost of water and wastewater are included in the “energy” costs. Figure 3 illustrates how, prior to an ESPC, a certain amount of money is appropriated for energy and O&M costs. After the ESCO implements the ECMs, the energy and O&M costs are significantly reduced. The facility’s occupants also benefit from an improved working environment. Money saved as a result of the reduced energy use is reallocated to pay for energy services and financing costs as defined by the ESPC agreement. Cost savings are used to pay for the ECMs over the course of the contract, with additional savings possibly still remaining. After the term of the contract, when all project financing costs have been repaid, all energy cost savings will then be realized by the facility owner, who benefits from not only lower operating costs, but also an overall improved facility.

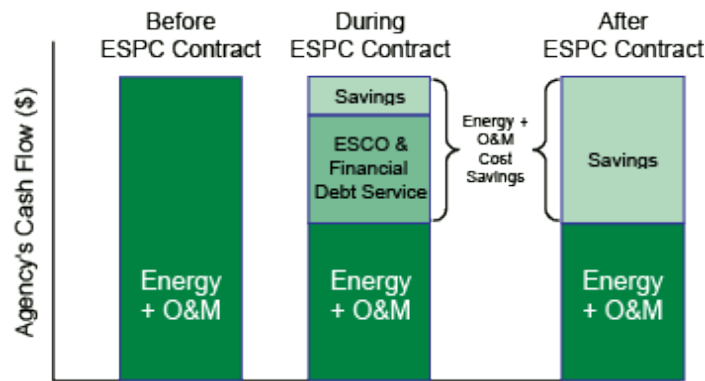


Figure 3. Reallocation of payments for energy and energy-related O&M costs (LBNL 2008)

Figure 4 is similar to Figure 3 but it shows the UOM budget on an annual basis. Also, Figure 4 includes the savings from the avoided cost of annual utility-related cost increases. These avoided costs are a result of overall utility usage reduction; therefore, any increase in utility-related costs (rate increase or usage based tariff) is applied to a smaller usage amount. For example, assume that the initial electricity rate is \$0.10/kilowatt hour (kWh) and that utility rate increases by 3% annually. After the facility upgrades, the annual electricity use and cost drops from 100,000 kWh and \$10,000 to 75,000 kWh and \$7,500. The previous year’s electricity rate was \$0.10/kWh and, after applying the 3% increase, the new electricity rate is \$0.103/kWh. Without the facility upgrades, this rate increase would have resulted in an annual cost increase of \$300. However, applying this rate increase to the reduced electricity usage results in an annual cost increase of only \$225. The difference between the \$300 and the \$225 is the annual avoided cost (shown in

purple in Figure 4). Annual avoided costs continue to increase incrementally throughout the term of the ESPC, implying a greater cost savings over time.

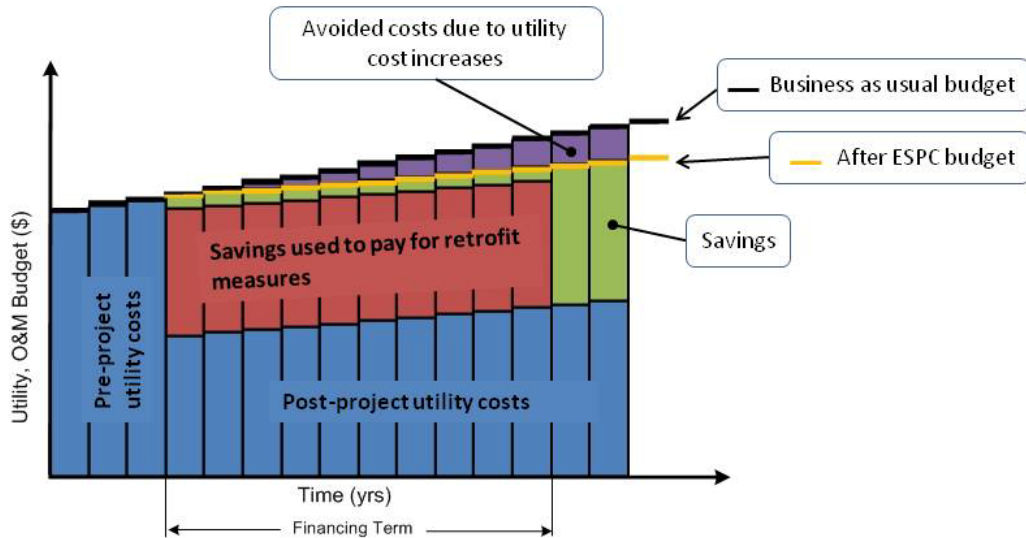


Figure 4. Annual energy-related budget, showing an increase in savings from avoided costs

Opportunity Cost of Waiting

All decisions have their tradeoffs. However, an ESPC guarantee ensures that the facility improvement project pays for itself over the life of the contract. An alternative strategy for executing facility upgrades is to identify a project(s) and request funding from financial management. Most likely, these funding requests compete with other capital projects and their fulfillment will be ranked by some economic criteria. As a result, it may take several years before an energy conservation project receives funding. By waiting for appropriated funds to implement a much-needed upgrade, the long-term cost of inaction will typically exceed the cost incurred from acting promptly. A study sponsored by the Federal Energy Management Program (FEMP 2011) compared the life-cycle costs of directly funded projects and projects carried out through ESPCs (Shonder et al. 2006). The study found that if directly funded projects take more than two years longer than an ESPC to complete, and the project development costs are more than 6% of the total project costs, ESPC projects have a lower life-cycle cost. The project development costs of the appropriations-funded projects reviewed in this study, ranged from 4% to 26% of total project cost, and the project development cycle ranged from 2.3 years to 6.2 years.

The takeaway is that paying slightly more in financing costs can often be preferable to delaying the implementation of any energy conservation project with its associated opportunity costs. The U.S. Environmental Protection Agency has a useful calculator on their website that can help compare different investment scenarios in energy efficiency projects. To find it, go to www.energystar.gov and search for “Cash Flow Opportunity Calculator.”

What Happens When Energy Prices Go Up?

When energy prices increase, the estimated savings from an ESPC may be perceived to disappear. This is because total energy costs increase. The actual effect of energy price increases on the associated savings from ECMs may not be readily apparent. Figure 5 shows how the energy use (tan bars), energy costs (dark blue bars), payments for facility upgrades (light blue bars), energy cost savings (green outline), and allocated UOM budgets (green bars) change under different circumstances. Initially, all of the energy-related cost savings generated by the ESPC are used to pay for the financed facility upgrades. This can be seen by comparing the height of the dark blue column in Case 1 with that of the stacked dark and light blue columns in Case 2. Columns in each are the same height, indicating that total payments are the same, or, explained differently, that there are no additional cost savings. The UOM budget is the same whether or not there is an ESPC. If energy prices are higher than projected, an ESPC will provide additional savings because the price increase is applied to lower total energy usage. This can be seen by comparing the height of the dark blue column in Case 3 with that of the stacked dark and light blue columns in Case 4. The height of the stacked column in Case 4 is lower, indicating that the total payments are less. The height of the green outlined bar illustrates the additional savings generated by an ESPC in the scenario where energy prices increase.

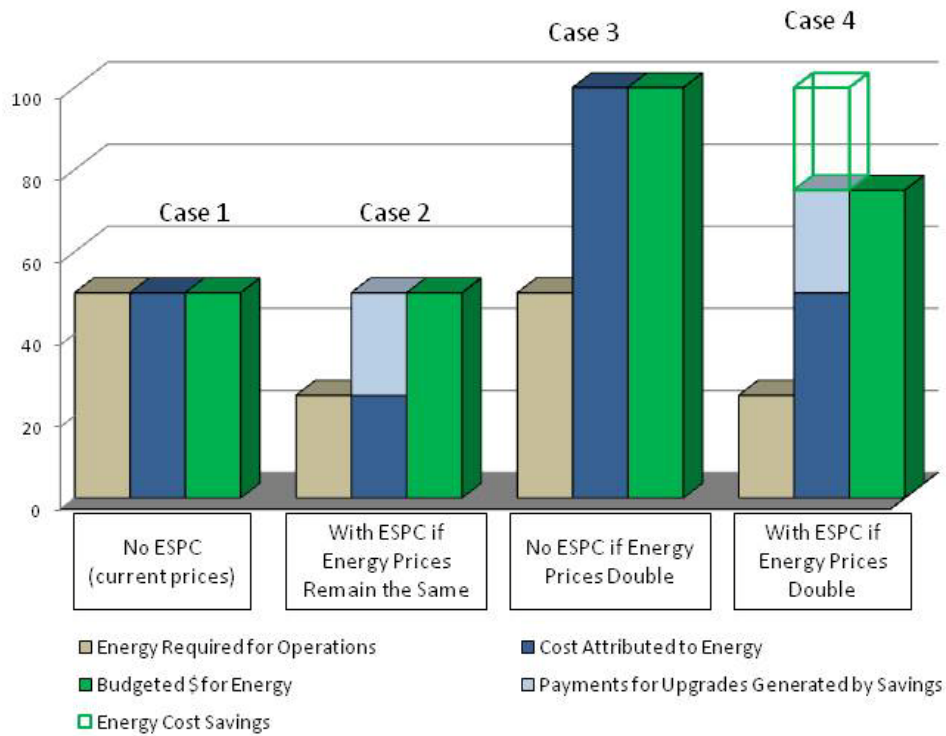


Figure 5. Modeled effect on energy-related costs and budget from an energy price increase (Knutson 2009)

To help illustrate the impact of energy price changes on the cash flow of an ESPC, a simplified version of Figure 4 is reintroduced that is consistent with the illustration in Figure 5. In this version, all savings generated by the ESPC (area shown in red) are bundled into one component and labeled “Payments for Upgrades Generated by Savings,” as in Figure 5. The significance of this distinction is that all of the savings generated by the ESPC go towards repayment of the facility upgrades and are thus fixed payments through the term of the contract.

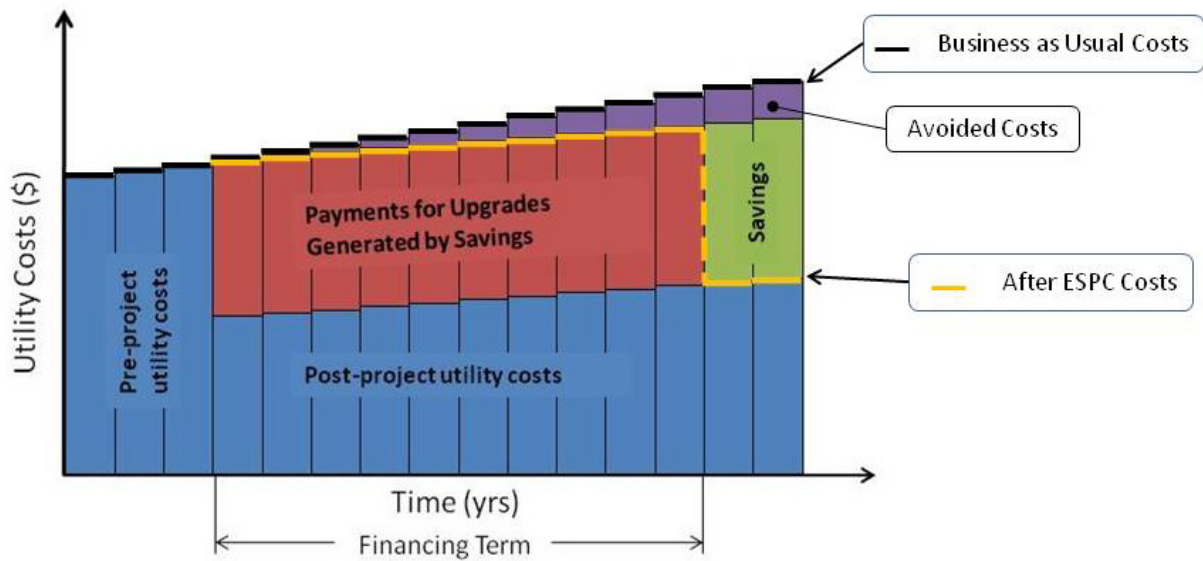


Figure 6. ESPC-generated savings repay project cost at a fixed amount

Figure 6 provides a view of how the costs and savings change on a yearly basis throughout the course of an ESPC, assuming constantly increasing utility costs. To reiterate, the payments for the facility upgrades are fixed payments as illustrated by the uniform size of the red bars for each year of the financing term. Figure 5 introduced the issue of utility price increases and how that impacts the energy costs, savings, and UOM budgets in an ESPC. Figure 7 provides another view of the impacts of a utility price increase. When viewing this illustration, it is helpful to keep in mind that the top of each stack of costs and payments for savings represents the total utility costs if an ESPC was not performed (the business as usual case). As in Figure 6, all of the savings generated by the reduction in energy use (area shown in red) are allocated to pay for the facility upgrades. This leaves the avoided costs (area shown in purple) as realized cost savings during the financing term of the ESPC.

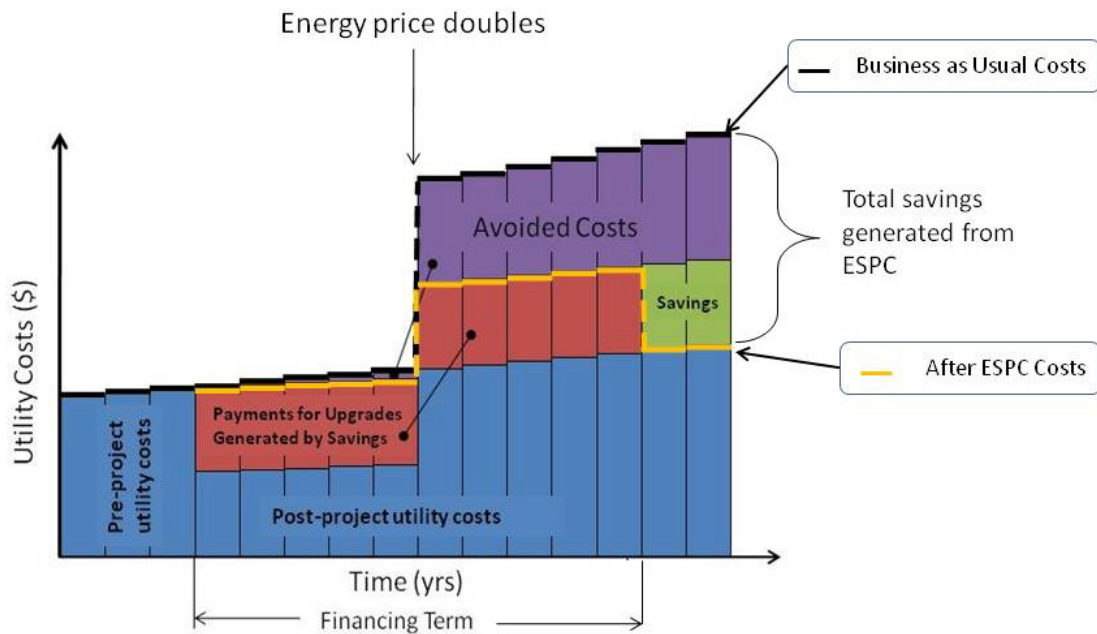


Figure 7. Representation of the impact on operation costs from a utility price increase

Figure 7 shows a series of 15 years of energy-related costs and savings represented by 15 stacked blue, red, purple, and green columns. The first three years show the “business as usual” condition with a gradually increasing utility budget and energy costs. The next five years show the impact of an ESPC on the overall operations costs, assuming the same constant increase in energy costs as before the ESPC. In this example, the utility price doubles halfway through the ESPC term. The impact of a utility price increase is that more cost savings are generated and immediately realized in the form of avoided costs (purple area). The black-highlighted line in Figure 7 represents the UOM budget and costs for the “business as usual” case, and the yellow highlighted line represents the UOM budget and costs for the ESPC case. In both of these scenarios, it is assumed that the UOM budgeting process can immediately respond to abrupt changes in actual UOM costs. In this example the budgeting process is able to accommodate a sharp increase in UOM costs due to a doubling of energy prices. It is apparent that the budget and costs for the “business as usual” case and the ESPC case are nearly identical before the increase in energy prices, but, after the increase, the budget and costs for the ESPC case are significantly less than the “business as usual” case. This illustrates the advantage provided by an ESPC in situations where energy rates increase.

What Happens if Energy Prices Go Down?

In the unlikely event that energy prices go down, the cost savings are effectively reduced. Figure 8, (similar to Figure 5), shows how the energy use (tan bars), energy costs (dark blue bars), payments for facility upgrades (light blue bars), cost savings (green outline), and allocated UOM budgets (green bars) change under different circumstances. Identical to Figure 5, comparing the

first two cases where energy prices remain the same, it can be seen that the total payments, with and without an ESPC, are equal; the height of the dark blue bar in Case 1 is equal to the height of the stacked dark and light blue bars in Case 2. Again the UOM budget covers the cost of energy and upgrade payments; the green bars are the same height as the stack dark and light blue bars. But, if energy prices decrease, the total payments for the case with an ESPC will be higher than if no ESPC was performed; the height of the stacked dark and light blue bars in Case 4 is higher than the dark blue bar in Case 3. This is because the light blue portion of the total cost is a fixed payment and is not impacted by a change in energy prices. This is illustrated in Case 4; when energy prices are halved, the dark blue bar is reduced by half but the light blue bar remains the same size as in Case 2.

It is important here to make the distinction between the utility budget and the actual energy costs. Consider the case with an ESPC where energy prices decrease. Even though the total energy costs will be higher than if no ESPC were performed, the utility budget from previous years will be more than enough to cover the fixed payments. This can be seen by comparing the height of the green column in Case 1 to that of the green column in Case 4. In Case 1, when energy prices are higher, the budget is set to cover these costs. If energy prices decrease, as in Cases 3 and 4, the utility budget will follow but, for Case 4, the budget will be reduced less than in Case 3. Utility budgets, if developed and managed prudently, are adequate to cover total costs even in the unlikely event of an energy price decrease.

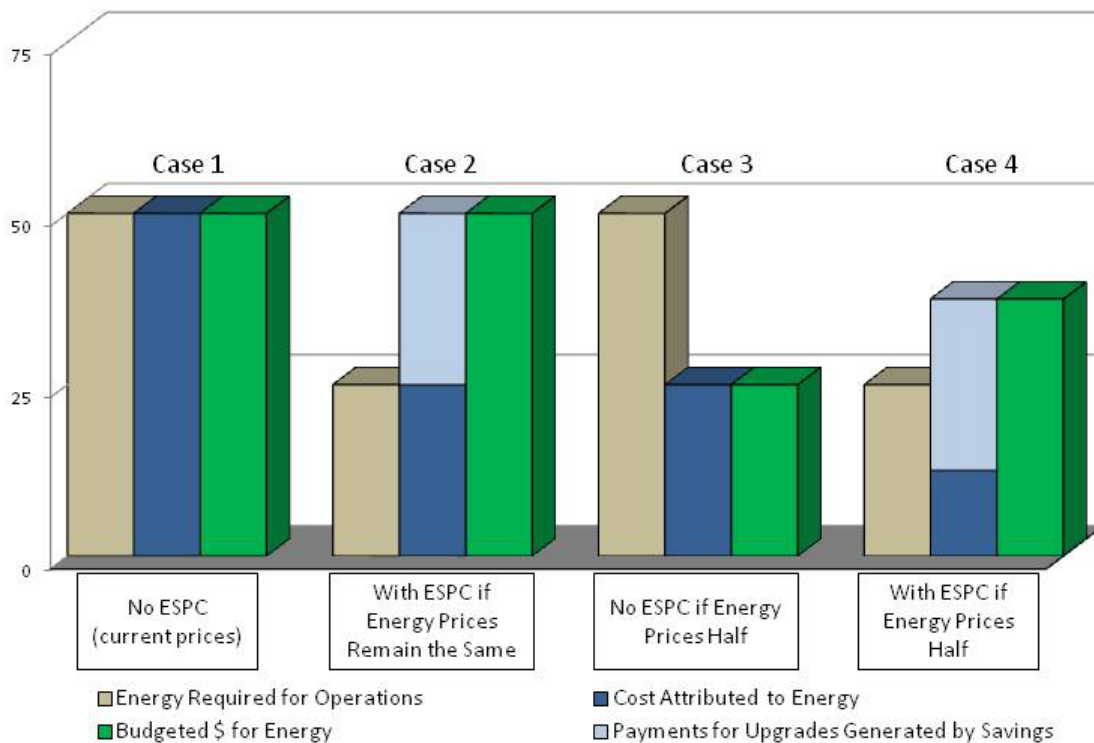


Figure 8. Modeled effect on energy-related costs and budget from an energy price decrease (Knutson 2009)

Figure 9 offers another perspective of the same scenario where energy price decreases. Again, for the purposes of discussion, assume that all of the cost savings generated by the reduction in energy use (area shown in red) are used to pay for the facility upgrades. Additionally, when “total energy-related costs” are referred to, it includes both the fixed payments for the facility upgrades (red portion of each column) and the actual energy costs (blue portion of each column). Figure 9 shows a series of 15 years of energy-related costs and savings represented by 15-stacked columns in blue, red, purple, and green. The first three years show the “business as usual” condition with a constantly increasing utility budget and energy costs. The next five years show the impact of an ESPC on the overall operations, assuming the same constant increase in energy costs as before the ESPC.

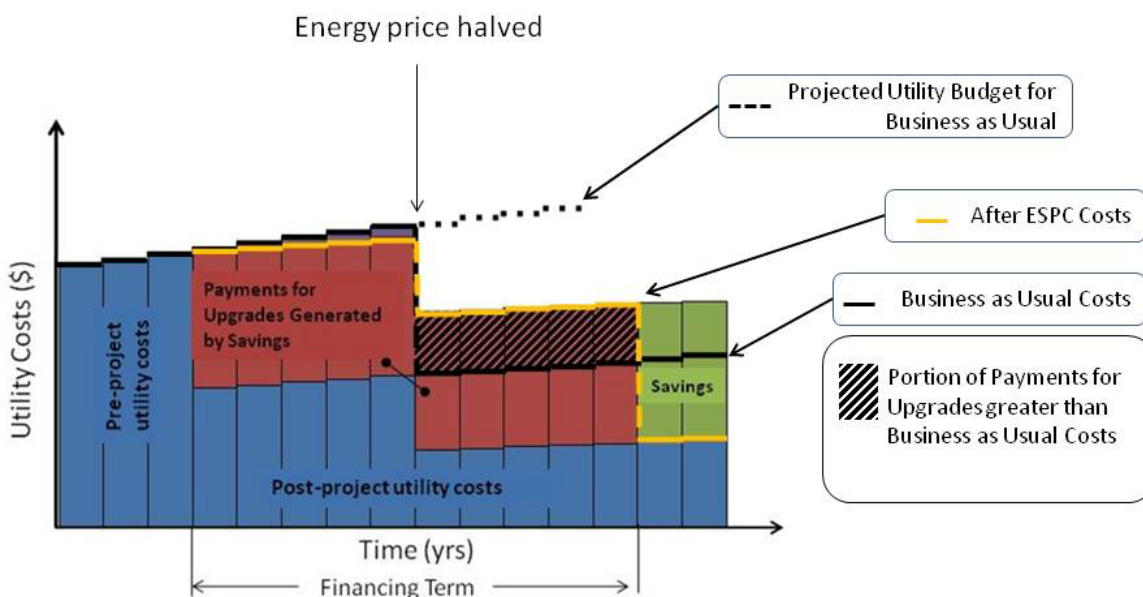


Figure 9. Representation of the impact on operation costs from a utility price decrease

Midway through the term of the ESPC, the energy price is halved, resulting in an immediate drop in energy costs. The black highlighted line at the top of the first eight bars (years) represents the total energy-related costs for the scenario without the ESPC. The yellow highlighted line, that starts with the fourth bar (year), represents the total energy related costs for the scenario with the ESPC. For the beginning half of the ESPC, the total costs are slightly less than the case without the ESPC (the yellow line tracks lower than the black line). After the energy price decrease, at the beginning of year nine, the total energy related costs for each case drop significantly, but the case without the ESPC drops more than the case with the ESPC. Again, this is because a portion of the total energy-related costs for the case with the ESPC are fixed payments that are not impacted by a change in energy prices. The difference in total energy-related costs between the ESPC and “business as usual” case, after the energy prices are halved, is highlighted by the black

crosshatched area. It is important to note the black-dotted line that represents the projected utility budget. This line represents the projected total energy related costs if the energy prices were to continue at their constant rate of increase, for the “business as usual” case. A significant concept presented in this illustration is that the projected budget prior to the ESPC is higher than the total energy-related costs for the ESPC, both before and after the energy price decrease. If energy prices were to drop during the term of an ESPC, the utility budget for the previous year (black-dotted line) would be more than enough to cover the total energy-related costs, even for those cases with fixed ESPC payments. In practice, there may a situation where a single budgeting office develops and manages the utility budgets for several geographically dispersed facilities. If the budget office becomes aware of a drop in utility prices, it may consider making adjustments to the utility budgets for all sites in the serving utility’s region. In these cases, it is important that the budget office is aware of the ESPC, so it can make any necessary adjustments that account for the fixed payments associated with the ESPC.

While it is important to investigate how changes in utility prices impact the cash flow of an ESPC, it is also important to keep in mind the likelihood of these events occurring. Additionally, waiting for enough capital to pay for facility upgrades for fear of forfeiting some savings, if utility prices go down, can result in a significant opportunity cost. To provide some perspective, Figure 10 shows the average commercial electricity rate in the United States from 1960 to 2009. There are a few periods where the prices decreased slightly from year to year, but these periods are short and always followed by periods of significant price increase. For this whole time period, the average annual price increase was 3%.

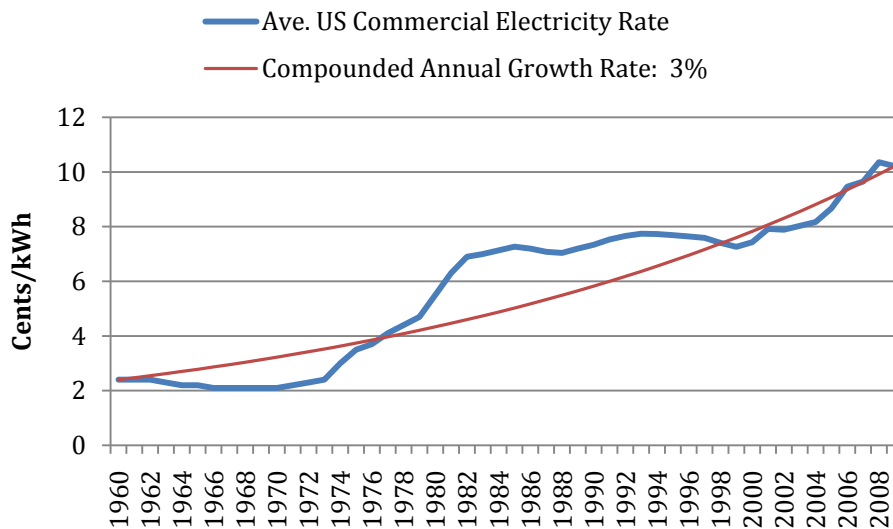


Figure 10. Average U.S. commercial electricity rate, 1960-2009 (EIA 2010)

This chart should not be used as a basis for estimating local energy cost escalation rates, however. The data are based on national average electricity rates, and every utility has a unique mix of generation sources that are impacted by market pressures differently. Additionally, historical energy escalation rates are only one indicator of future energy escalation rates. As mentioned earlier, NIST publishes an annual report (Rushing et al. 2010) that provides projected escalation rates for electricity and heating fuels by region, along with the implied long-term average rate of inflation.

Conclusion

Increasing energy costs are a factor of both rising utility rates and increased energy usage. Due to budget constraints, it is common for facilities to suffer from deferred maintenance, which further leads to rising operating costs. Aggravating the issue, most proposals for funding for energy conservation projects must compete for scarce capital against other investment options. As a result, investment in facility upgrades traditionally happens slowly or incrementally, if at all. ESPCs, therefore, are an effective means for avoiding competition for upfront capital, enabling the allocation of the existing utility budget to finance comprehensive energy upgrades to individual buildings or across an entire facility. An ESPC also provides an additional cost saving component as utility costs rise.

The question of how changes in utility rates impact the costs of an ESPC often arises. In simple terms, the budgeting and management of an organization's UOM is not much different under an ESPC. An organization/agency's annual UOM budget typically reflects the trend in rising energy costs, allocating more dollars every year to cover energy-related expenses. The actual UOM costs may vary from year to year, depending on several factors, but there is always sufficient budget to cover these costs. If the actual costs are higher than expected, money may be moved from other cost centers to cover the deficit, and if actual costs are lower than expected, the surplus may be repurposed as needed. The situation is the same under an ESPC, only there is less variability because only a portion of the energy-related costs are subject to changes in utility rates and impacts of weather. Energy and O&M cost savings obtained from installed ECMs are guaranteed to cover the fixed payments of the ESPC. In cases where energy prices increase, additional savings are generated by an ESPC. On the other hand, situations where energy prices decrease effectively reduce the cost savings from an ESPC, but because overall costs have decreased, the previous year's budget will always be sufficient to cover the obligation of the ESPC fixed payment. Whether energy prices go up or down, it is important that the budgeting office is aware of the fixed payments of an ESPC when making adjustments to UOM budgets.

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