Research Report

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Alternatives for Reducing Army Installation Utility Bills While Enhancing Installation Readiness

Many Army installations are facing significant and increasing monthly costs in their utility accounts for energy and water services. Utility bills have been rising for several reasons, such as commodity price increases and distribution system improvements under utility privatization (UP) contracts. At the same time, installations are under pressure to reduce costs and are tasked with finding ways to maintain operations and even enhance installation readiness with declining budgets. In recent years, fewer appropriated funds have been available for facility infrastructure operations and maintenance, more risks have been taken in operations and maintenance accounts, and energy efficiency and energy security mandates and goals have increased. In response, the Army has turned more toward energy performance contracting financed by third parties, such as Energy Savings Performance Contracts (ESPC) and Utility Energy Services Contracts (UESC), to help renew its infrastructure and support mission requirements. However, the use of third-party financing mechanisms to fund energy and water efficiency projects also lowers flexibility within the utility budget during the repayment period.

Thus, in addition to finding ways to reduce installation utility bills, the Army is trying to determine what level of third-party energy and water project investment (such as ESPC, UESC, and UP) is sustainable within the utilities budget, so that installations retain sufficient flexibility both to support competing mission requirements and to lower utility costs when budgets decline or when market conditions change. At the request of the Assistant Chief of Staff for Installation Management (ACSIM), now called the Army Deputy Chief of Staff, G-9 Installations (Army G-9), RAND Arroyo Center researchers identified installations with a high level of contractual commitments to repay investments in energy and water projects and assessed different ways that installations could reduce their utility bills while maintaining or enhancing energy and water security and installation readiness.

Installation utility costs have two main components: The first is bills from electricity, natural gas, and water providers. This component includes commodity payments (which depend on the price per unit of water or energy and the amount consumed), fixed charges, and sometimes charges based on peak demand. The second component consists of contractual commitments, which reimburse contractors for infrastructure and other investments made to improve or expand on-post utility distribution systems or to reduce future energy and water use. For this study, we used existing Army databases to identify installations with high levels of contractual commitments, which potentially reduce budget flexibility. We also examined utility management and market trends in water, wastewater, electricity, and natural gas to assess opportunities for installations to reduce utility costs while maintaining or enhancing energy and water security. In addition, we identified alternative funding sources for installation energy and water system investments, including nontraditional partnerships (such as leases and other outgrants) and Intergovernmental Support Agreements (IGSAs) with state and local governments. Using this information, we recommend approaches for reducing installation utility costs, including both commodity payments and contractual commitments, while maintaining or enhancing installation readiness.

Findings

We summarize our findings for the three main areas of our study: the assessment of installation utility costs, utility management and market trends, and options for reducing Army installation utility costs.

Assessment of Installation Utility Costs

In 2017, the Army did not have a reliable single data source that could be used to assess the relative magnitudes of payments and contractual commitments. There were three primary data sources—the Army Energy and Water Reporting System (AEWRS), the General Fund Enterprise Business System (GFEBS), and the Federal Procurement Data System—each with different strengths and weaknesses.[1] GFEBS was the best available source of data on both commodity payments and contractual commitments. However, using comparisons with manually collected data on contractual payments, we concluded that costs were not always allocated correctly in 2017.[2] Therefore, we used GFEBS to identify the U.S. Army Installation Management Command (IMCOM)-managed installations in the continental United States (CONUS) with the highest levels of contractual commitments both in terms of absolute dollar value and as a percentage of total utility costs. The installations with the highest levels of contractual commitments are more likely to have less flexibility to reduce utility costs.

The GFEBS data included four annual observations of utility costs for 39 installations. Using the

Abbreviations

ACSIM	Assistant Chief of Staff for Installation Management
AEWRS	Army Energy and Water Reporting System
Army G-9	Army Deputy Chief of Staff, G-9 Installations
ASA(IE&E)	Assistant Secretary of the Army (Installations, Energy and Environment)
CONUS	continental United States
DER	distributed energy resource
DOE	Department of Energy
ESPC	Energy Savings Performance Contracts
FLW	Fort Leonard Wood
GFEBS	General Fund Enterprise Business System
IGSA	Intergovernmental Support Agreement
IMCOM	U.S. Army Installation Management Command
PBR	Performance-Based Ratemaking
PV	photovoltaic
TOU	time of use
UESC	Utility Energy Services Contracts
UP	utility privatization

80th percentile as a cutoff to identify installations with the highest contractual commitments, we found that 15 of the 39 installations had contractual commitments above 51 percent of total utility costs in at least one fiscal year from 2013 through 2016, and 13 of 39 installations had contractual commitments of more than $11 million in at least one of those years.[3] Given the concerns about the quality of the GFEBS data, we compared GFEBS data for six installations that had high contractual commitments with data collected by ACSIM headquarters on UP payments. We found that only about one-half of the payments in GFEBS were within 10 percent or $10,000 of ACSIM records. Thus, although GFEBS data do not always allocate utility costs accurately, they can be used as a starting point for further investigation into these installations to determine whether contractual commitments are affecting budget flexibility and whether contracts are achieving the desired improvements in utility infrastructure and reductions in energy and water use.

Utility Management and Market Trends

To better understand the opportunities for Army installations to reduce utility costs, we examined management and market trends in water and wastewater, electricity, and natural gas to identify implications for the Army. We summarize our main findings for each of these areas.

Implications for the Army of Water and Wastewater Management and Market Trends

In water and wastewater management, the focus has shifted from accessing new water sources to more efficiently managing already existing sources—including nontraditional ones, such as reclaimed water. Wastewater has become a valuable commodity in some areas because of water reuse.[4] Water scarcity and quality concerns are already an issue in some areas, and some Army installations are already experiencing challenges because of such concerns—which are likely to increase in the future. Water prices are likely to go up as water sources become overused and utilities charge to replace aging infrastructure; this, in turn, will likely mean higher water utility bills for some installations.[5]

Partnerships with local, state, and regional governments and with water utilities are becoming more important to communities and to military installations, especially now that installations have new authority to implement IGSAs. Such partnerships can help Army installations reduce costs, maintain water rights, invest in shared infrastructure, and sustain access to water supplies, which is important for long-term water security. For example, in 2017, spring flooding affected the potable water system at Fort Leonard Wood (FLW), and the installation almost had to alter training activities. This motivated a partnership with the City of Saint Robert, Missouri, to provide a redundant water supply for both the installation and the city by installing a connector water line between the two systems. Through this line, the city will be able to supply the 3 million gallons per day that FLW would need in an emergency situation. This project is mostly funded by state and local government agencies.[6] In some cases, IGSAs and other nontraditional partnerships are useful alternatives to traditional ESPC, UESC, and UP partnerships.[7] For instance, UP can limit future opportunities with other potential partners, especially because of the long-term implications of privatizing installation water assets with contracts of up to 50 years.

Emerging water market mechanisms create potential opportunities to help Army installations improve water security, reduce utility costs, and fund water system investments. For example, should growth on the installation occur, market approaches could be used to expand current water supply, sell water as a way of financing new water infrastructure, or increase water supply reliability during dry years. (For more information, see Lachman, Resetar, Kalra, et al., 2016.)

Water supply, nontraditional water sources, and rights issues are becoming more important aspects of installation readiness because of the increasing competition for scarce water. However, many installation staff might not fully understand these water security issues for their installations. In addition, given the military interests and the complexities of water security, Army installation staff cannot rely on non-Army organizations, such as utilities and contractors, to track their military water security concerns and needs. (For more information see Lachman, Resetar, Kalra, et al., 2016; and Lachman, Resetar, McGovern, et al., 2015.)

Implications for the Army of Electricity Market Trends

In many electricity markets in the United States, deregulation has introduced a wider variety of companies involved in power generation, transmission, and distribution and has created new opportunities for Army installations (Warwick, 2002; Center for Responsive Politics, undated; Direct Energy, undated). In deregulated states, installations are not required to buy power from their local utilities, and the Defense Logistics Agency's DLA Energy conducts competitive electricity procurements that installations can join if doing so is cost-effective (Defense Logistics Agency, undated).

The electric grid is evolving from centralized systems to more-diverse power systems that feature distributed energy resources (DERs). DERs are generally smaller in scale (i.e., generating only up to hundreds of kilowatts) than traditional, large-scale centralized systems (i.e., generating megawatts to gigawatts of power), and DERs are generally distributed closer to power demand instead of being centrally located.[8] DER technologies include small-scale fossil generation (e.g., natural gas), renewables (e.g., rooftop solar photovoltaics [PVs]), distributed electrical storage (e.g., batteries, including vehicle batteries when connected to the grid), and combined heat and power. The grid is also changing by becoming "smarter," with advanced components that communicate and work together and other technology advancements, including: smart meters, two-way communication technologies, control systems, computer processing, advanced digital meters, and batteries to store excess energy.[9] Army installations also have been changing in response to these trends. Some installations have implemented DERs and developed other types of on-site generation sources, such as large scale solar arrays, through third-party agreements and long-term contracts. For example, Adelphi Labs, Fort Benning, Fort Bliss, Fort Carson, Fort Gordon, Fort Huachuca, Fort Stewart, and Redstone Arsenal have all deployed or are deploying significant amounts of solar PV energy.

However, the Army might wish to maintain flexibility that would allow it to take greater advantage of different market players and trends to save money and enhance energy security as market approaches evolve and as new technologies enter the market. Given these evolving electricity markets, for some installation electrical systems, it may be better to avoid some long-term deals, such as some UP efforts and some longer term ESPCs and UESC activities, which may limit installation staff's ability to work with other providers as market opportunities change over time. For example, UP deals are a special concern because they last up to 50 years and because privatizing the installation's electrical system limits (1) the Army's control, flexibility, and ability to enter into deals with other utilities and companies in the future and (2) use of some appropriated funding sources for system improvements.

In addition, utility business models are changing in response to culture and technologies that are more energy efficient, an increasing deployment of DERs, and the rise of "prosumers" that produce and consume their own power (e.g., by using rooftop PV systems that can feed back into the grid). Some state programs offering renewable energy and other credits have helped make rooftop PV systems affordable, creating more residential and commercial prosumers (Mouat, 2016). These prosumers use less utility power and want to sell excess power back to the grid. As these types of trends continue, utilities will be less able to rely on electricity commodity payments to recover all of their fixed costs, so they are experimenting with new rate structures and business approaches, including nontraditional partnerships. For instance, some electric utilities are using Performance-Based Ratemaking (PBR) approaches, and some electric cooperatives are introducing business models that are more focused on recognizing and meeting consumers' goals.

First, PBR approaches are being developed because traditional cost-of-service rate structures are insufficient—electric utilities will face increasing difficulty covering fixed costs, much less making a profit—by charging volumetrically for the electricity commodity. PBR provides a rate structure that shifts the electric utility's focus from collecting cost-of-service charges to earning revenues for improved performance.[10] An example of PBR is value-based pricing, which factors in time of use (TOU) and the emerging concept of the value of solar.[11] One example is Austin Energy's value-of-solar tariff experiment. (For more information about this experiment, see Murray, 2016; and Brugal, 2017.) In this experiment, prosumers who are generating and using solar energy purchase all of their electricity at the retail rate and provide all their excess electricity back to the grid at the solar tariff rate, which is supposed to account for the real value provided by the PV systems to the overall grid.[12]

A second new type of business approach occurs with the electric cooperatives consumer-centric business model, where the energy service provider is a cooperative that is focused on recognizing and meeting the consumers' goals.[13] These cooperative companies provide consumers with what they want and need as determined by how their use of energy affects their quality of life or economic prosperity. These companies will increasingly offer a variety of information and services beyond just selling electricity, such as battery and community storage, energy efficiency updates, information about solar power, and smart thermostats (Karaim, 2016).

This plethora of alternatives could allow installations to further reduce costs and increase energy security by taking advantage of utilities' new approaches and by becoming smarter prosumers. However, not all utilities are willing partners when installations become prosumers and want to sell back power or island from the grid.[14] This dynamic electricity market means more uncertainty regarding long-term energy business deals and could provide opportunities for new competition and approaches. It also means that some common Army approaches that lock the Army into dealing with one company (for up to 25 years for ESPCs and UESCs and up to 50 years for UP) may not be the best deal for some electrical system projects at some installations, and a wider variety of execution paths should be considered and assessed—especially regarding future uncertainty, flexibility, and long-term risks.

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Utilities are also implementing diverse pricing schemes that are based on TOU and demand-response programs to reduce peak electricity usage and the need for more power-generation capacity. For instance, some utilities are using TOU pricing or critical peak pricing (i.e., customers are charged more for electricity when demand is highest)[15] to get some customers to shift usage to nonpeak times of day: This allows these customers to save money and utilities to reduce peak energy demand enough to avoid having to invest in additional generating capacity. Army installations can reduce electricity costs by increasing participation in demand-response programs and shifting electricity usage away from peak periods.[16]

Additionally, if installations were early adopters in solar and other DERs—especially dispatchable ones, such as batteries—they could potentially save (or even make) money because the value of these resources to the overall grid system might decline with increasing market penetration. Furthermore, if installations are allowed to keep part of the savings from incentive and demand-response programs to invest in other energy projects, it would help motivate installation managers to increase their participation in these programs. Under 2018 laws and policies, if installations participate in some utility rebates and incentive programs, the funds are deposited in a Treasury account and the installation must apply to use them in the following year;

in future years, the installation's budget might be reduced because of the prior-year savings. Altering this practice could require both an Army policy change and a legislative change to ensure that installations can keep some of the savings, both in current and future years.

Because of the technical challenges associated with integrating and managing DERs, such as the intermittent availability of solar energy, utilities are finding that energy storage technologies are becoming more valuable for grid stability. For instance, community energy storage is an emerging approach in which participants share the benefits of energy storage available in water heaters, electric vehicles, or home battery-storage systems.[17] Community energy storage can provide three important services for the grid: "(1) capacity for excess generation from distributed energy resources (DERs), (2) integration of higher penetrations of intermittent renewable resources (through, e.g., power quality regulation and "smoothing") or (3) backup power during outages."[18] The utilities' interest in energy storage is an important opportunity for Army installations, which are large customers with land and other assets that could be used to provide large-scale energy storage to utilities in exchange for such benefits as cost savings and enhanced energy security. By helping increase the reliability and resiliency of the electricity grid, installations could reduce the risk of local and regional power outages; this, in turn, could help increase installation readiness. A strategic enterprise approach across CONUS military installations could have a national impact on enhancing grid stability and enhancing Army readiness and national security.

Implications for the Army of Natural Gas Market Trends

The natural gas market has experienced two key trends: (1) deregulation[19] and (2) the development of unconventional natural gas resources, especially shale gas resources, made possible by innovations such as hydraulic fracturing, or "fracking" (U.S. Energy Information Administration, 2019). These trends have resulted in the increase in availability and reduction in prices for natural gas. In some areas of the country, Army installations might be able to use on-site development of shale gas resources to increase energy resilience and security and to reduce costs.

However, the Bureau of Land Management controls the mineral rights on Army installations and takes the money from sales to industry, so legislative changes would likely be needed to enable installations to keep the revenues. Installations might be able to earn fees from leasing land for unconventional natural gas development. Even after recent years of aggressive drilling on private and other federal lands and resulting declines in natural gas prices, there is still an opportunity to develop this resource for financial benefit. However, the potential to generate revenue will depend on the prevailing price of natural gas, including regionally specific market factors, and on the specific terms and conditions of the negotiated agreement.[20] Additionally, there would still be benefits from increased energy resiliency and reliability if installations had access to their own natural gas. Another benefit is some potential cost reductions.

Options for Reducing Army Installation Utility Costs

There are three options for reducing installation utility costs: reducing commodity payments and contractual commitments, identifying alternative funding sources for energy and water system investments, and implementing nontraditional partnerships.

To reduce commodity payments and other types of utility charges, installations can use less electricity or water, negotiate lower rates, lower peak electricity demand, and increase participation in demand-response programs. To reduce contractual commitments, contracts should be designed to ensure that investments in new infrastructure are cost-effective for the installation and include ongoing sustainment costs of energy- and water-saving technologies. It might also be possible to renegotiate contracts, such as adding clauses to ensure flexibility and competition over the contract length. For example, where possible UP contracts should include (or be renegotiated to include) a clause indicating that for system additions above a certain size (such as an installation expansion with a contiguous campus of a dozen or more new buildings being constructed), other options, (such as proposals from other vendors, an IGSA partnership, or the system being retained by the Army), could be considered, evaluated, and perhaps implemented as the best option for the expansion .[21] In addition, installations could include fewer new investment projects in UP contracts after initial system enhancements are completed.

Some contractual commitments might also be reduced or avoided by examining all the advantages and disadvantages of available funding options and finding diverse funding sources for some utility investments.[22] Some Army installations have creatively used other Army funding sources for selected energy and water system investments, such as military construction; sustainment, restoration, and modernization (SRM); and overseas contingency operations funds.[23] Mission funding from Army activities that benefit from increased energy and water resiliency and security can be used to fund microgrids and other energy and water security infrastructure.[24] Office of the Secretary of Defense funding sources include the Energy Resilience and Conservation Investment Program (ERCIP),[25] the Strategic Environmental Research and Development Program (SERDP), and the Environmental Security Technology Certification Program (ESTCP). Installations have also been able to obtain funding from the Department of Energy (DOE),[26] U.S. Environmental Protection Agency,[27] and congressional infrastructure funds. State and local government grants are another potential funding source for some installation energy and water infrastructure investments. For example, the FLW connector water pipeline project with the City of Saint Robert was mostly funded by a state grant and by the city (Lachman, Adgie, et al., unpublished research). Some of these other sources might be limited and only work in installation-specific circumstances, but they might be combined with or used to supplement traditional approaches to help reduce utility budgets while enhancing installation readiness.

Some installations have used funding from nontraditional partnerships to help with installation energy and water system and infrastructure investments as a way of reducing costs and maintaining or enhancing energy and water security. These reflect important opportunities to cut installation utility costs and enhance installation readiness. Such nontraditional partnership approaches include large-scale leasing and other outgrants and partnerships with state and local governments. Funds earned from leases and other outgrant projects can be used to help fund some installation facilities and infrastructure investments, including for water and energy systems; to enhance energy and water security; and to pay installation utility bills (Lachman, Hastings, et al., 2019).

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A new authority on IGSAs created by Congress in 2013 allows installations to develop innovative partnerships with state and local governments, including in water and energy projects. Using this authority, the Army and the other Services have been helping installations develop and implement nontraditional partnerships with communities to reduce installation utility costs and enhance energy and water security and installation readiness. Partnerships with state and local governments present important opportunities because they usually have common goals and strategic synergies with Army installations—and, in many parts of the country, the Army can leverage state and local government funding sources (Lachman, Adgie et al., unpublished research). In addition to IGSAs, other types of authority can be used to develop installation water and energy infrastructure partnerships as alternatives or additions to using UP deals, UESCs, and ESPCs. We found that a wide variety of partnerships between military installations and communities (both public and private organizations) related to installation energy and water infrastructure are already being implemented at Army, Air Force, Navy and Marine Corps installations (Lachman, Resetar, and Camm, 2016). Installations can leverage partnerships by identifying common goals that partners will help fund, such as security of energy and water supplies or stability of the electric grid.

Recommendations

In this section, we summarize our main recommendations for each area of analysis.

Assessment of Installation Utility Costs Recommendations

To better understand the components of installation utility bills and the impacts of contractual commitments on budget flexibility, the Army needs more-accurate data. Our recommendations are as follows:

- The Army should use GFEBS as a starting point to identify for further investigation those installations that have high levels of contractual commitments. Additional data collection on actual contractual commitments and payment timelines will be needed to address potential inaccuracies in past GFEBS data. Also, these installations should (1) continue to track whether UP deals, ESPCs, UESCs, and other contracts are achieving the desired improvements in infrastructure and reductions in energy and water use and (2) take mitigating action if they are not performing.
- ACSIM (now Army G-9) updated its accounting guidance in fiscal year 2018 to specify more clearly how installations should record utility payments in GFEBS. IMCOM and other land-holding commands should review their annual funding guidance to ensure that it aligns with G-9 guidance and that it provides clear instructions to installation personnel. If inaccuracies persist in GFEBS data, then installation personnel might need additional training and assistance to ensure that all guidance is followed. Another approach could be to put management controls into GFEBS that prevent errors in the attribution of utility costs. Improving the accuracy of utility cost allocation in GFEBS could also reduce other data reporting requirements in AEWRS and manual collection of contract data by Army G-9 and IMCOM.

Utility Management and Market Trends

Next, we summarize our main recommendations for each of the three utility markets, water and wastewater, electricity, and natural gas.

Water and Wastewater Management and Market Recommendations

Given our findings regarding the water and wastewater management and market trends, we have five recommendations for the Army that could reduce costs and enhance water security and installation readiness:

- Installations should track water trends for their regions to understand water scarcity and security risks and then factor these issues into installation strategic planning.
- Installations should collaborate and partner more with state and local governments in water facilities and infrastructure investments, in water planning, and on water rights.
- Installations should consider participating in water markets when it helps with installation readiness or reduces costs.
- Army headquarters organizations should ensure that installation strategic planning and guidance emphasize the importance of water collaboration with state and local governments and that installation staff understand

regional water supply and other water security concerns and maintain their water rights.

- Given the wide variety of opportunities and long-term water security concerns, nontraditional installation water partnerships, such as IGSAs, should be considered and evaluated as alternatives to water system UP contracts, taking into account long-term water security, risks, and cost concerns.

Electricity Market Recommendations

Given our findings regarding the evolving electricity market, we have developed a set of recommendations for Army installations and Army headquarters that could help reduce costs and enhance energy security, grid stability, and installation readiness.

For Army installations, we recommend the following:

- Installations should consider seeking more opportunities to participate in TOU pricing approaches, demand-response programs, and other emerging rate structure programs, and, where they can, installations should consider participating in such programs sooner rather than later, because early adopters might achieve the greatest financial benefits.[28]
- When feasible, installation staff should consider (1) taking additional advantage of electricity deregulation programs and (2) working with DLA Energy in competitive electricity procurements.
- Staff at Army installations should become more-active and shrewder consumers to get better deals. The opportunities will vary depending on location. However, selected installations should experiment with becoming prosumers and implementing energy storage approaches. Because the value of these DERs to overall grid system stability might decline with increasing market penetration, early adopters might benefit the most.
- Installations should consider taking more advantage of the different players and new approaches in the electricity market to save money, instead of implementing some longer-term UP, ESPC, and UESC activities.
- Given changing business models, installations should be savvier and more strategic in dealing with companies that sell electricity services; they should explore diverse options for any system addition (i.e., microgrids); and they should try to introduce more competition between utilities and other companies. When possible, installations should consider taking additional advantage of the multiple players, nontraditional partnerships, and the new business models based on an installation's location. For all options, installations also need to consider current and long-term energy security opportunities and risks.

For Army headquarters organizations, we recommend the following:

- Army G-9 should address the barriers to installations keeping some utility rebates and other incentive payments by changing Army policy so installations can keep a percentage of the savings over time to invest in installation energy projects. The Army should also consider proposing legislative changes to address federal deposit requirements so that installations can receive the savings in the first year.
- Army headquarters should consider facilitating more-strategic approaches and deals regarding electricity services by offering guidance and assistance to help installations take advantage of utility deregulation, multiple players, nontraditional partnerships, and new business models.
- Army G-9 should increase collaboration among its UP staff, its Army Partnerships staff, and the Assistant Secretary of the Army for Installations, Energy and Environment's (ASA(IE&E)) Office of Energy Initiatives (OEI) staff to help installations explore nontraditional partnerships and other diverse options for any system addition (i.e., microgrids) besides just focusing on the traditional UP, ESPC, and UESC partnership approaches.
- Army G-9 and ASA(IE&E) should consider exploring the Army's potential role in energy storage for enhancing grid security to benefit Army installation readiness. Such an approach

would leverage Army installation assets and electric utilities' increasing need for energy storage. A strategic enterprise approach across CONUS military installations in partnership with electric utilities could be considered to enhance grid stability and thereby enhance Army readiness and national security.

Natural Gas Market Recommendations

Given our findings regarding the natural gas market trends and to help reduce costs and enhance energy security, we have developed two interrelated recommendations for Army installations:

- The Army should consider taking advantage of natural gas resources on Army installations when feasible and when the benefits outweigh the costs. Some Army installations could potentially earn limited income from shale gas extraction deals by leasing installation land for natural gas drilling and possibly from mineral rights. The latter would likely require changing legislation to address the Bureau of Land Management mineral rights issue; the Army could consider exploring the feasibility of such an option.
- When feasible, Army installations should consider implementing shale gas extraction deals to help with energy security and installation resiliency and readiness. For example, having natural gas available from an on-installation source ensures supply in case of a disruption in local natural gas supplies or, when used with a combined heat and power system, to provide a hedge against electric grid failure.

Options for Reducing Army Installation Utility Costs

Finally, we summarize our main recommendations for reducing Army installation utility bills while maintaining or enhancing installation readiness.

- Installations should consider reducing installation commodity payments by using buying power to renegotiate rates; by becoming smarter and more-active consumers or prosumers; and by lowering peak energy demand and increasing participation in demand-response programs.
- Army installations should continue to make cost-effective energy and water efficiency and infrastructure investments, but they should consider a broader array of funding mechanisms and strategic approaches for these projects. Options include leveraging Army mission funding for energy and water resiliency and security needs; taking advantage of Department of Defense, DOE, and other federal funding sources; leveraging state and local funding sources; and implementing nontraditional installation energy and water partnerships.
- Finally, the Army should increase collaboration across headquarters organizations in Army G-9 and ASA(IE&E) to promote the use of all available funding sources, especially ones that do not increase utility payments. The Army could consider expanding the mission of UP office staff members to use their expertise to facilitate more-innovative approaches, such as helping with energy and water IGSAs and other nontraditional partnerships.

Notes

[1] AEWRS provides information on energy and water usage, commodity payments, and unit costs. However, it does not include payments made under UP, ESPC, UESC, and other types of energy and water contracts to reimburse investment costs. It also excludes some types of energy and water usage and costs, such as those attributed to privatized residential housing. The Federal Procurement Data System includes all contractual payments made to utilities and other service providers, but locating all the relevant contracts can be difficult because of the inconsistent use of data fields, such as the place of performance and the product or service associated with the contract. Another problem is that some contracts combine both commodity payments and contractual commitments.

[2] Given guidance changes regarding GFEBS, the data quality has likely improved.

[3] In other words, contractual commitments were less than 51 percent of total utility costs, or they were less than $11 million in dollar value in 80 percent of the 156 annual observations. Thus, these installations had unusually high contractual commitments in at least one of the four years.

[4] For example, in 2007, an investment firm paid more than $67 million for groundwater credits derived from Prescott Valley, Arizona's effluent in a water auction, because it was a reliable water source. For more information, see Lachman, Resetar, Kalra, et al., 2016; "Arizona Water Rights Auction Tops $20m," 2007; and Scott, 2012.

[5] For more information on these water management, scarcity, and water price trends, see Lachman, Resetar, Kalra, et al., 2016.

[6] For more information, see Lachman, Adgie, et al., unpublished research.

[7] For more information on some of these alternative partnerships, see the case study involving Moody AFB and Lowndes County IGSA in Lachman, Adgie, et al., unpublished research.

[8] A DER is generally considered to be the generation or storage asset, such as a rooftop PV array or a home-scale stationary fuel cell; a DER system includes DER assets. DER systems are potentially more resilient because of redundancy and distribution; they can help reduce transmission and distribution losses and improve overall system efficiency.

[9] The smart grid has the potential to be a much more resilient grid, delivering electricity more reliably and efficiently and reducing outage frequency and duration. The smart grid helps facilitate system changes. For instance, it enables DERs, more-sophisticated electricity pricing approaches, and more options in demand response programs; it also allows non–power company DER systems to supply power to the grid.

[10] For more information on PBR, see University of Texas at Austin Energy Institute, 2018; and EQ Research, 2017.

[11] *Value of solar* refers to a method for establishing the true value of electricity provided by solar installations (Taylor et al., 2015).

[12] The value-of-solar rate is determined by a bottom-up calculation of every benefit and cost that distributed solar provides to or imposes on the electricity system. These values mostly represent avoided costs to the utility and the overall system (e.g., avoided transmission and distribution services) and the costs of incorporating the extra solar into the electrical system. These value streams are added together to develop a single value-of-solar rate at which customers are paid for electricity generated by their grid-connected distributed PV systems.

[13] For example, Roanoke Electric Cooperative in North Carolina provides its customers with an energy audit and on-bill financing for energy efficiency improvements. This cooperative also provides customers with credits on their electric bills from all online purchases made through an online Shopping Assistant website. This example shows how creative some cooperatives have gotten to save their customers money and help their cooperative utility earn revenues in other ways (Roanoke Electric Cooperative, 2017).

[14] Islanding from the grid is when a DER source connected to the grid, such as a rooftop solar PV and battery system, temporarily disconnects from the electrical grid and continues to provide power.

[15] The peak demand for electricity is a key cost and system concern for utilities because the utility must have sufficient generating capacity to meet this demand. If electricity demand exceeds the capacity of their power systems it can cause a brown out.

[16] The Navy and Marine Corps saved more than $13 million during fiscal years 2008 to 2017 by participating in utility demand response programs. By comparison, the Army saved a little more than $4 million by participating in utility demand response programs in that same period. These data suggest that the Army could reduce its electricity costs if more installations enrolled in demand-response programs (DLA Energy, 2017).

[17] Electric cooperatives are using such energy storage approaches because of the benefits, including the grid benefits. For example, Steele-Waseca Cooperative Electric in Minnesota links a community solar project with community storage. Members receive a free large-capacity electric thermal storage water heater when they purchase a solar panel in its community solar project. To receive the free 115-gallon storage water heater, the customer has to allow Steele-Waseca Cooperative Electric to control the hot water heater for up to 16 hours each day to use it as an energy storage device when needed (Steele-Waseca Cooperative Electric, undated).

[18] Petta and McConnell, 2018, also provide examples of different community energy storage projects throughout the United States.

[19] Beginning in 1978, natural gas deregulation removed federal price regulations; separated production, distribution, and marketing; and allowed independent suppliers to sell natural gas directly to customers (Warwick, 2002; and Direct Energy, 2017). Deregulation of the natural gas industry paved the way for electric industry deregulation both by increasing the availability of natural gas for electricity generation and through the Federal Energy Regulatory Commission's experience with gas industry restructuring.

[20] This is different than the early adopter advantage for technologies that integrate into a connected grid system. In the case of grid-connected PV or battery storage, the value of these resources to the overall grid system could decline with increasing market penetration.

[21] We illustrate two other items to consider including in the contract. First, when the UP contractor proposes additions that expand the system, such as adding extra security features, the contract should specify that an independent third party (which

is chosen and supervised by qualified Army staff, not by the UP contractor) will assess whether the addition is truly needed and the appropriate cost range for such options. Second, a UP, ESPC, or UESC contract could specify that proposals from other vendors can be solicited for acquisition of additional equipment and parts above a certain dollar or volume amount. Although the Army initially competes these contracts, this idea focuses on incorporating this type of flexibility over the length of the contract.

[22] In the face of changing utility markets, especially in the case of potentially dramatic changes in electricity markets over the next several decades, contracts that look beneficial in today's market might not be good deals in the future. There is, of course, great uncertainty associated with these changes, so there might be cases or locations where entering into long-term contracts now would still be beneficial going forward. On balance, however, we believe the likely future market trends point to value in maintaining flexibility.

[23] For example, one approach is to phase the water or energy infrastructure project over time to spread out the costs to be able to use SRM funding. Fort Detrick was able to acquire SRM funds for water and sewer pipeline replacements by breaking them into smaller projects over multiple years to acquire the funding.

[24] For instance, Adelphi Laboratory Center is planning to become a net zero energy installation. Adelphi's managers are planning on installing a microgrid because of energy security concerns, and were considering pursuing funding from a tenant research lab that is interested in a microgrid to help with its mission energy security.

[25] For examples, see Office of the Secretary of Defense, 2016.

[26] For example, consider the Fort Carson Energy Research Project conducted from 2011 to 2013. In this project, DOE, the National Renewable Energy Laboratory, the Pacific Northwest National Laboratory, and the General Services Administration partnered with Fort Carson. The project focused on identifying strategies that were most cost-effective throughout the life cycle, on both the building and portfolio levels, to achieve net zero energy performance (General Services Administration, 2014).

[27] For example, the Environmental Protection Agency provided most of the funding for a drywell system demonstration project at Fort Irwin as a best management practice for stormwater treatment and aquifer recharge (Lachman, Adgie, et al., unpublished research).

[28] For example, the greatest TOU savings might go to early adopters because the value of these resources to the overall grid system could decline with increasing market penetration—and the savings will change over time.

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This report documents research and analysis conducted as part of a project entitled Reducing the Cost of Installation Utilities Investments, originally sponsored by the Assistant Chief of Staff for Installation Management (ACSIM), now called the Army Deputy Chief of Staff, G-9 Installations (Army G-9). The purpose of the project was to identify and assess different ways that installations might reduce their utility bills and to determine a sustainable level for third-party energy project investments.

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