SELF-MANAGED ENERGY PERFORMANCE CONTRACTING

SOLUTION OVERVIEW
The Housing Authority of the City and County of Denver (DHA) completed a traditional energy performance contract (EPC) in 2007 which was administered by an Energy Services Company (ESCo). Based on the success of this Phase 1 EPC, DHA decided to undertake a second phase to generate additional savings and finance additional capital improvements. For Phase 2, DHA elected to use a self-managed HUD-approved model, which is a variation of the traditional EPC financing model used in Phase 1. DHA partnered with engineering and financial consultants and a general contractor to orchestrate the project design and financing, HUD approval, construction, and measurement and verification. The Process section below covers details on DHA’s self-managed EPC, including energy efficient upgrades, operations and maintenance, and resident impact.

ORGANIZATION TYPE
Public Housing Authority

BARRIER
Lack of funding for essential capital improvements and energy conservation measures

SOLUTION
Used a self-managed energy performance contract (EPC) to minimize up-front project costs and soft costs, increase project scope, and achieve greater energy savings

OUTCOME
The EPC has served as a vehicle for major capital improvements, facility upgrades, and in-unit energy upgrades resulting in $2.6 million in utility savings annually

POLICIES
DHA’s policy regarding energy and water conservation has established the agency as an industry leader in green building design, construction, and retrofitting. DHA’s policy is to develop and manage sustainable housing with initiatives including:

- Geothermal heating and cooling systems
- Photovoltaic Power Purchase Agreements

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In addition to the sustainable development of new communities, DHA emphasizes improving the energy performance of its existing building stock. One tool DHA leverages is the HUD-approved EPC program. DHA approached HUD’s EPC program using the traditional ESCO model in Phase 1 and undertook a less common approach, self-managed, in Phase 2 of its EPC.

**Phase 1 – ESCo Model**

Launched in 2007 in partnership with an energy services company, DHA began its housing rehabilitation process by conducting a portfolio-wide energy audit. Once a conservation program was designed and available energy rebates were identified, the fund request was submitted and successfully approved. The initial phase of EPC funding resulted in $9 million of energy conservation measures installed at 18 DHA public housing properties that included upgrades of:

- Appliances
- Lighting
- Boilers
- Furnaces
- Low-flow plumbing fixtures

**Phase 2 – Self-Managed Model**

Recognizing the substantial benefits that could be achieved by moving from contracting with an ESCo to developing an in-house, self-managed EPC model, DHA made the transition in 2011. Among other things, the self-managed model allowed DHA to:

- Administer and control the program design and HUD funding approval process
- Use locally-preferred contractors
- Maintain day-to-day project management and monitoring
- Inject additional capital into the DHA portfolio by refinancing the Phase 1 EPC and capturing additional Phase 2 savings which were the result of energy conservation measures and significantly lower project soft costs.

**PROCESS**

An energy performance contract consists of three distinct phases: project design, construction, and measurement and verification (M&V). Included here is an overview of all three phases that the Housing Authority and its team completed. The phases are explained in detail in Part A below. Part B addresses how DHA handled the process of implementing energy efficiency upgrades, the effect on established operations and maintenance schedules, and the impact on their residents.
Part A: Managing Development, Construction, and M&V

1. Project Design & Development

**Investment Grade Audit**

DHA procured a Professional Engineering (PE) firm and hired an EPC Consultant to conduct the following scope of services:

- Review current building plans and upcoming capital fund activities
- Interview housing management staff
- Collect other required audit documentation
- Compile utility bill data and complete consumption baseline analysis
- Identify all potential Energy Conservation Measures (ECMs) based on physical needs and utility savings potential
- Work with resident input, project managers, maintenance staff, and capital/development staff to identify the final bundle of ECMs
- Develop bid specifications for all selected ECMs

**Procure Architectural and Engineering (“A&E”) Firm**

DHA procured an A&E firm to perform the following scope of services:

- Review Investment Grade Audit
- Act as commissioning agent during ECM implementation
- Provide post-installation M&V services and reporting

**Procure General Contractor (“GC”)**

DHA procured a GC to perform the following scope of services:

- Provide pre-construction services to develop a project budget and schedule
- Provide construction management services to ensure the project is installed per plans and specifications

Under the guidance and support of the A&E firm and the EPC consultant, DHA submitted the following items as a package for HUD approval and financing:

- Investment-grade audit
- HUD cost summary & project cash flow
- Utility Baseline analysis and rate determination/escalation analysis

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2. Construction

DHA’s primary responsibilities during the construction phase were as follows:

- Manage the General Contractor to ensure the project is running on schedule and within budget
- Manage the Architecture, Engineer, and Commissioning firm to ensure the contractor is installing the project in accordance to plans and specifications
- Work with the lending partner to ensure adequate and timely payments are made to all parties

Once the construction phase was completed, DHA and the M&V contractor assumed responsibility for developing and submitting an annual M&V report to ensure adequate utility savings are achieved moving forward; if this is not the case, the M&V firm will recommend strategies to improve savings.

Part B: Managing EE Upgrades, O&M and Resident Engagement

With EPC financing in hand, the Denver Housing Authority invested $14 million in capital improvements and energy conservation measures (ECMs). Working with general contractor Pinkard Construction, DHA was able to install all ECM measures within 18 months of the project launch. ECMs were prioritized and selected to maximize energy conservation and make DHA homes more sustainable and comfortable for residents. Measures included several capital improvement strategies such as smart irrigation systems, roof and attic insulation replacements, and high-efficiency water heater installations. The aggregate projected payback period for the portfolio is just under 15 years, enabling all EPC debt payments to be made from ECM-related utility savings.

The self-managed EPC has allowed DHA maintenance staff to develop expertise in a range of state-of-the-art, energy-efficient technologies. DHA’s suppliers hold frequent staff trainings on ECM technologies such as occupancy sensors, furnaces, and boilers to keep DHA technicians at the cutting edge. The ability to leverage an in-house maintenance team is a considerable advantage of the self-managed EPC. The team has also assisted and educated residents as they have adapted to the new technologies in their homes.
Resident Impact

- **Environmentally-Responsible Comfort**: Resident satisfaction and comfort was a major priority of the EPC. DHA staff gathered resident feedback during the design phase to understand the behavioral impact of residents and to ensure that residents would benefit from proposed upgrades to their homes. Features such as ceiling fans, HVAC replacements, and building envelope improvement have been popular with residents and have improved unit climate control.

- **Resident Education Campaign**: While ECMs play a large role in reducing utility consumption, educating residents on energy conservation was an equally important task to ensure DHA’s vision was achieved. During weekly in-unit audits, DHA provided tips to high-energy users on how to reduce energy consumption to help them avoid paying excess charges on utilities. DHA has recently partnered with two energy consulting firms to launch resident engagement campaigns at two properties to educate residents on the benefits of responsible energy use. DHA will test a variety of outreach strategies to incentivize energy conservation and plans to expand the most successful strategies across the rest of the DHA portfolio. A successful campaign will allow DHA to reduce plug load and water consumption and further magnify the impact of the EPC.

TOOLS AND RESOURCES
The links below provide more information about HUD's EPC process:

- [HUD EPC Overview](https://betterbuildingsinitiative.energy.gov/implementation-models/self-managed-energy-performance-contracting)
- [Approval Process Diagram](https://betterbuildingssolutioncenter.energy.gov)

OUTCOMES
By choosing the self-managed EPC approach, DHA:

- Secured a $32 million loan to invest in its self-managed EPC
- Installed an additional $14 million worth of meaningful capital improvements and energy conservation measures
- Trained internal maintenance and operations staff in a range of state-of-the-art, energy efficient technologies
- Upgraded 2,800 existing housing units across 14 properties
- **Realized savings that covered**:
  - Ongoing measurement and verification costs
  - A full time Portfolio Energy Manager (PHA Employee)
  - Equipment replacement reserves
  - Resident engagement programs focused on energy and water conservation behaviors

Additional benefits DHA realized through a self-managed EPC in lieu of a traditional ESCO approach include:

- Financing capital improvements
- Reducing project soft costs resulting in greater project scope
- Additional utility savings
- Greater control and customization over project scope and design
- Integration of an operations and maintenance Program focused on energy and water conservation

Portfolio-wide improvements in DHA’s self-managed EPC Phase 2 included:

- Capital Improvements: New roofs, attic insulation, window replacements
- Facility Upgrades: Efficient furnaces, efficient water heaters, central plant upgrades, common area lighting retrofits, smart irrigation
- In-Unit Upgrades: Lighting retrofits, efficient appliances, ceiling fans, thermostats

**MEASURING SUCCESS**

DHA, with the assistance of their M&V contractor, is responsible for developing and submitting an annual M&V report to demonstrate adequate utility savings. As mentioned previously, the M&V firm will suggest strategies to improve energy performance if DHA does not achieve its target savings. A sample of the agency’s M&V report is below:

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<th>Water &amp; Sewer</th>
<th>Electricity</th>
<th>Natural Gas</th>
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