Feasibility Study of the Power Plant at Langston Terrace

Prepared for Sustainable DC Budget Challenge
# Table of Contents:

- Executive Summary ........................................................................................................... 2
- Background .......................................................................................................................... 6
- Discover Phase .................................................................................................................... 6
- Infrastructure Analysis ....................................................................................................... 7
  - Site Walks ......................................................................................................................... 7
  - Utilities and Incoming Service ......................................................................................... 7
  - Utilities at Nearby Sites ................................................................................................... 8
  - Existing Equipment ......................................................................................................... 8
  - Central Plant Potential .................................................................................................... 9
  - Baseline Energy Consumption ....................................................................................... 10
  - Alternative Energy Generation ....................................................................................... 17
- Historic Preservation Requirements .................................................................................... 20
  - Langston Terrace Dwellings History .............................................................................. 20
  - Historic Preservation Designation .................................................................................. 20
  - Historic Preservation Board Reviews and Consideration .............................................. 21
  - Additional Reviews and Consideration .......................................................................... 23
- Analyze Phase .................................................................................................................... 24
  - Analysis Phase Methodology ......................................................................................... 24
  - Potential Scenarios ......................................................................................................... 25
  - Financial Analysis .......................................................................................................... 41
- Community Engagement .................................................................................................... 43
- Summary and Next Steps ................................................................................................... 45

## Appendices

- Appendix A – Weather Data
- Appendix B – Rooftop Areas
- Appendix C – Community Engagement & Responses
- Appendix D-Langston Dwellings Site Map
- Appendix E - Site Visit Report
- Appendix F - Funding Sources
- Appendix G-Langston Dwellings Presentations
- Appendix H- Phase I Environmental Site Assessment Report
- Appendix I - HazMat Report
- Appendix J - Photos
Executive Summary

A diverse team was assembled to enable a robust analysis and assessment of the opportunities to successfully redevelop the power plant at Langston Dwellings. The team includes ThinkBox Group, who has a history of successful management of energy investment projects across the DCHA portfolio; Altura, who bring deep expertise in renewable and district energy systems, particularly for the multifamily housing sector; Indigo, who have deep engineering expertise across multiple disciplines; and Setty, who bring a strong history of project development with DCHA and strong engineering qualifications. The team worked collaboratively with DCHA staff to perform a comprehensive analysis of development options for the plant. Additionally, a robust community outreach effort was undertaken to engage the community and ensure project goals are aligned to support community needs.

The results of the study show that there is opportunity to leverage the Langston Power Plant beyond just energy production – it has the potential to be a revitalization engine for the community. As discussed in this report, there are multiple development scenarios that are technically feasible and economically viable with available funding sources and procurement strategies. Beyond energy savings and renewable power production, redevelopment of the Plant can enable significant quality of life improvements to the residents through:

- improved comfort conditions and provision of cooling to the occupants,
- complimentary uses that bring needed services to the community,
- meaningful job creation, and
- increased housing stability with investment in the Plant as an anchor for the community.

The following summary sections review the findings of the study by phase:

Discover

The full Discover phase report provides background and context on the plant and site infrastructure, baseline energy usage and renewable energy potential, historical preservation considerations, and community outreach steps. A brief summary of the results of the Discover phase are shown below.

- The existing plant is not currently served by adequate gas or electrical connections, but services are easily available nearby.
  - The energy usage of the residential units is higher than comparable buildings, due primarily to an antiquated heating system that is not optimized.
  - A rooftop photovoltaics system, installed on available rooftops on the residences and power plant, can generate approximately 50% of the electricity needed for the site, which is approximately 12% of the total energy use and approximately 22% of all energy costs.
  - Preliminary occupant feedback indicates that the redevelopment of the power plant should focus on: 1) Job creation for local residents; 2) Addressing space comfort conditions and maintenance issues; 3) Creating a center of education for the community with emphasis on preparation of youth for STEM jobs; 4) Reducing pollution by generating clean electricity.
Analyze

Based on the results of the Discover phase, multiple technologies were analyzed for potential use at Langston Terrace, including:

- Solar Photovoltaics
- Solar thermal
- Split system DX cooling
- Variable refrigerant flow (VRF) heat pumps
- Geothermal Exchange
- Fan coil unit retrofit (heating/cooling)
- Microturbine generators
- Turbine generators
- Fuel cells
- Electric chillers
- Absorption chillers

Through an iterative process, the technologies were grouped into scenarios for technical and financial analysis to support feasibility assessment against project goals. Seven distinct scenarios were analyzed, including:

Scenario 1 – Rooftop Photovoltaics with Heating System Upgrades
Scenario 2a – Rooftop Photovoltaics with Air Cooled Variable Refrigerant Flow Heating and Cooling
Scenario 2b – Rooftop Photovoltaics with Geothermal Exchange Variable Refrigerant Flow Heating and Cooling
Scenario 3a – Langston Scale BioGas Combined Heat and Power Microturbine
Scenario 3b – Langston Scale BioGas Fuel Cell
Scenario 4a – District Scale BioGas Combined Heat and Power Turbine
Scenario 4b – District Scale BioGas Fuel Cell

Based on the results of the Analyze phase, three scenarios are recommended for further investigation and pre-development work. In order of priority, these scenarios are summarized below:

**Scenario 4b – District Scale BioGas Fuel Cell**

This scenario involves use of a combined heat and power fuel cell to produce electricity and usable waste heat for the community with virtually no pollutant emissions. The fuel cell would be located in the plant in the current boiler room, with some balance of plant components located in the yard behind the plant. Waste heat would be captured to provide virtually free heating and cooling to the residents through a two-pipe fan coil system, with back-up boilers and chillers located at the plant. New district hydronic piping would be required throughout the site, and gas
and electrical infrastructure would require significant upgrades. Bio-gas would be procured from an off-site location, such as a farm, through a long term contract, ensuring the delivery of true renewable power at known costs. Excess electricity would be sold back to PEPCO or delivered virtually to other community members in the DC area, increasing the resiliency of the local grid.

This scenario requires the most significant capital investment, and would require significant partnerships with key political and corporate players, including the Public Utilities Council, PEPCO, Mayor’s office, and the surrounding community. However, this scenario also likely provides the most significant long term value to DCHA and its residents, and has the potential to capture the imagination of and funding from major government agencies and non-governmental organizations.

Scenario 2b – Rooftop Photovoltaic with Geothermal Exchange Variable Refrigerant Flow Heating and Cooling

While pursuing Scenario 4b, it is recommended to continue to explore the potential for geothermal and solar photovoltaics energy at Langston Terrace. This scenario includes the installation of a centralized geothermal exchange loop to provide efficient heating and cooling to the residents, but forgoes the need to remediate the existing asbestos hydronic piping network. Additionally, it leverages the maximum potential roof space to install solar photovoltaics panels. Current solar renewable energy credits, combined with the rising cost of electricity, make solar PV an attractive and straightforward renewable energy option.

Scenario 1 – Rooftop Photovoltaic with Heating System Upgrades

Due to its simplicity and high likelihood of success, if it becomes infeasible to pursue the top options above (4b and 2b), then it is recommended to pursue Scenario 1. This involves the installation of a similar solar photovoltaic system as described in 2b, but no cooling systems are added. Instead, the existing hydronic heating system will be upgraded with new controls and retro-commissioned to ensure maximum efficiency and occupant comfort.

Engage

The DC Housing Authority, in conjunction with nonprofit Groundswell, conducted a comprehensive engagement of the community in order to ensure that the project goals aligned with community needs. The goals of community engagement during the feasibility study were to incorporate community feedback into the project design; demonstrate commitment to an inclusive and community based approach to redeveloping the site; and to establish and maintain open and honest lines of communication with community leaders and members.

As a source of local work and opportunity, redeveloping the power plant at Langston Terrace is viewed particularly favorably. Through a mixture of community surveys, small and large meetings, experiential site visits, and conversations with local leaders, the team learned that the key to community approval rests on the ability of the project to generate additional services or opportunities for the Langston Terrace community.

The project team explored the feasibility for a number of comprehensive service options to accompany the redevelopment of the power plant. In each option the power plant serves as the anchor, around which the service(s) operate. Additional details are provided in the Community Engagement section of this report. The potential services embraced by the community include:
• Increase comfort of current apartment units through installation of better ventilation and/or insulation
• Adult/Youth literacy education and STEM training
• Food/Grocery store
• Laundromat
• Additional Affordable Housing Units

HAZMAT/ Environmental Assessment

A Phase I Environmental Site Assessment (ESA) of the Langston Power Plant was completed which resulted in several key findings. While none of the findings are unexpected given the past usage of the plant and are typical of the industrial nature of the building, there are future consequences for the substances found in the power plant. Within the former power plant, the analysis concluded that the following hazardous materials will need to be remediated. A more complete description of each material can be found in the full Phase I ESA Report (Appendix).

• Coal ash
• Leaking Underground Storage Tank (LUST)
• Asbestos containing materials (ACM)
• Lead based paint
• Polychlorinated biphenyl (from fluorescent light ballasts and transformers)
• 55 gallon drums containing unknown material
• Mold

It is recommended that a full Phase II Environmental Site Assessment be completed to fully detail the steps needed for full remediation within the power plant. Additionally, it has been anecdotally noted that asbestos containing material is present within the dwelling units, however this has not been confirmed with the Phase I ESA findings. For many of the potential retrofit scenarios, work will be required in areas within the apartments that may contain asbestos. A limited survey is recommended to identify ACMs in the existing building that may require abatement prior to proposed renovations. The limited survey will not constitute a comprehensive pre-demolition survey, but will enable “order of magnitude” cost estimates for abatement.