Otis House:

Green Innovation and Net-Zero for a Deaf Community Space

Grantee: Deaf-REACH
Grant Number: 2022-2205-USA-3

Final Report

DOEE Design Assistance Grant

DEPARTMENT OF ENERGY & ENVIRONMENT

Contents

Introduction
and
Project Objectives

- Create Sustainable Housing for the Deaf-REACH Inc Community
- Conduct Iterative Energy Models
- Conduct Renewable Energy Analysis

Project Team

Deaf-REACH Inc

Capital Sustainability

SK Collaborative

Inscape Studio

Sage Studio

Interface Engineering

Deaf-REACH Inc provided the inspiration, Capital Sustainability orchestrated the team's activities, Inscape Studio created the concept design, Sage Studio developed the landscape strategies, Interface Engineering conducted the energy modeling and renewable energy analysis; and SK Collaborative imagined the sustainable strategies.

Otis House's Proposed Development

1. Assisted Living
2. Independent Living
3. Residential Lobby
4. Deaf-REACH Inc Administrative Offices
5. Outdoor Plaza
6. Accessible Site Access
7. Rooftop dedicated to solar panels, green roof, outdoor living, and mechanical equipment
8. Community Space Assisted Living

The proposed development located at 1203 and 1203 ½ Otis Street, NW has a combined lot area of 15,000sf. The development will include 22 affordable independent living apartments and 15 bedrooms for assisted living for the deaf community. The project will provide space for staff and supportive services, as well as the administrative offices for Deaf-REACH.

Timeline:
We have completed schematic design and the design will be developed for permit and construction by the end of 2023, with construction to break ground in the spring of 2024.

Existing Conditions

1203 Otis Street NE (Front)

(Rear)

1203 1/2 Otis Street NE (Front)

(Rear)

1. 1203 Otis Street NE is 7,500sf with an existing two story single family home serving as administrative offices and support services for Deaf-REACH.
2. 1203 ½ Otis Street, NE is 7,500sf with an existing two story single family home serving as an assisted living facility.
3. Both structures are in a "rundown" condition, poorly insulted, and dependent on fossil fuels for heating and cooling.
4. High maintenance and utility costs make the long-term continued use of the structures prohibitive.

Project Opportunities

The project incorporates the three primary elements of sustainable development into the design.

1. **Social:** Providing affordable housing to the deaf and hard of hearing people who need special services.

2. **Economic:** Provides jobs for the residents of Washington, DC and employment opportunities for the deaf and hard of hearing in the local community of Brookland.

3. **Environmental:** The development is consciously striving to make the end product as ecologically friendly as possible.

The project site is located on two adjacent properties and is bordering the vibrant 12th Street corridor of the Brookland neighborhood in Washington, DC. The proximity of the site to downtown Brookland will allow the residents access to neighborhood amenities and be participants of the community in which they live.

Landscape Sustainable Strategies

1. planting
2. plaza / promenade
3. catenary lighting
4. drive / new curb cut
5. ramp
6. stair
7. trash
8. vegetable / herb garden
9. small greenhouse
10. rain barrel
11. chalkboard / mural
12. dwarf fruit trees / figs
13. bioretention
14. grill / counter
15. seating / dining
16. retaining wall

Deaf-REACH Washington, DC

OTIS HOUSE DEVELOPMENT

03/30/2023

inscapestudio

Deaf-REACH Washington, DC

OTIS HOUSE DEVELOPMENT

03/30/2023

inscapestudio

ACTIVITY 1: NET ZERO ENERGY

ACTIVITY 1: NET ZERO ENERGY

Net Zero Basics
and
Reduction Strategies

Net Zero: Why It Matters

"A net-zero energy (NZE) building is an extremely energy efficient building that is designed and operated to produce as much energy as it consumes over the course of the year."

- DC's Net Zero Energy Project Guide

Building energy consumption accounts for 74% of all greenhouse gas (GHG) emissions in the District of Columbia (the District). Mayor Bowser has pledged to make Washington, D.C., carbon neutral and climate resilient by 2050 and has recommitted to honoring the goals of the Paris Climate Accord. In addition, the Sustainable DC Plan (the Plan) outlines a commitment to making the District the healthiest, greenest, and most livable city in the United States.

Energy Reduction Strategies Towards Net Zero

- **Optimize Systems & Reduce Load**
  Multiple iterations of energy models were developed and ran that explored improvements to the HVAC, electrical/lighting, plumbing system efficiency and envelope performance.

- **Utilize Renewables**
  Solar photovoltaic (PV) system is being considered as a renewable energy source

ACTIVITY 1: NET ZERO ENERGY

Deaf-REACH Inc Net Zero

Net Zero Energy Activities

The following activities were conducted/developed and will be described below as needed:

- Green Charrette
- Site Visit
- Modeling Strategies (detailed below)
- block load HVAC Calculation
- Annual whole building energy simulation model
- Energy conservation measures
- Solar study
- Evaluated full electrification of the project
- Utilized Appendix Z/alternative Compliance pathways from DC Code

Iterative Energy Models to Test Energy Reduction Measures (ECM)

- Baseline energy model was developed using ASHRAE 90.1-2013 minimum values:
  - HVAC System Type & Efficiency
  - Lighting Power Density
  - Electrical Plug Load Consumption

- HVAC Energy Model was developed exploring improvements to system efficiency, systems tested included:

	System Descriptions and Improvements
ASHRAE 90.1-2013 Baseline	Packaged Terminal Air Conditioners (PTAC) Dedicated Outside Air System (DOAS) No Energy Recovery (ER) ASHRAE 90.1-2013 Minimum equipment efficiencies Annual Energy Consumption: 1,087,000,000 (318,580 kWh) 
HVAC (H) ECM 1	Mini Split Heat Pump System Dedicated Outside Air System (DOAS) No Energy Recovery (ER) Increased equipment efficiency over 90.1 Baseline Annual Energy Consumption: 530,300,000 Btus (155,335 kWh) 
HVAC (H) ECM 2	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) No Energy Recovery (ER) Increased equipment efficiency over ECM 1 Annual Energy Consumption: 428,800,000 Btus (125,674 kWh) 
HVAC (H) ECM 3	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) Energy Recovery (ER) at DOAS Annual Energy Consumption: 426,300,000 Btus (124,940 kWh)  

- Architectural Envelope Model was developed exploring improvements to wall R-value and glass Performance
  - o Increased wall R-Value
  - o Decreased window SGHC
  - o Each ECM was tested as a separate energy model

	System Descriptions and Improvements
ASHRAE 90.1-2013 Baseline	Roof: R-31 (Min per ASHRAE 90.1) Wall: R-16 (Min per ASHRAE 90.1) Window: SHGC: .40, U-Value: .42 (Max per ASHRAE 90.1)
	Annual Energy Consumption: 1,087,000,000 Btus (318,580 kWh)
Envelope (Env) ECM 1	Roof: R-60 Wall: R-32 Window: SHGC: .20, U-Value: .23 Window Improved window performance by 20% over proposed window. (Proposed SHGC: .25, U-Value: .28)
	Annual Energy Consumption: 490,500,000 Btus (143,757 kWh)
Envelope (Env) ECM 2	Roof: R-60 Wall: R-22 Window: SHGC: .25, U-Value: .28 (Proposed) Increased wall R-Value to R-42 compared to proposed wall
	Annual Energy Consumption: 502,500,000 Btus (147,274 kWh)
Envelope (Env) ECM 3	Roof: R-60 Wall: R-42 Window: SHGC: .20, U-Value: .23 Increased wall R-Value to R-42 compared to proposed wall Improved window performance by 20% over proposed window(Proposed SHGC: .25, U-Value: .28)
	Annual Energy Consumption: 487,500,000 Btus (140,240 kWh)

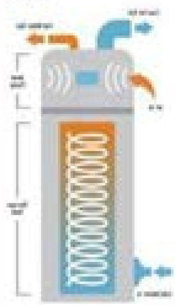
- **Wall Assembly**: The wall assembly is a high performance rain screen exterior wall system. The assembly, from inside to out, comprises of two layers of type X drywall, 2 x 6 wood stud framing with 6” mineral fiber batt insulation (R22.5), one or two layers of Densglass sheathing (one layer at 1hr assembly, two layers at 2hr assembly, vapor permeable air barrier, 2” thick mineral fiber continuous insulation board between horizontal steel girts (R8.5), and a rainscreen cladding system. This wall assembly will give a R32+ insulating effective-ness.

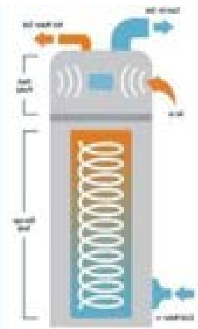
- **Roof Assembly**: The roof assembly will support a green roof and be comprised of, from inside to out, 5/8” drywall, TJI manufactured wood joists with 7” minimum closed cell spray foam insulation (R45), roof sheath-ing, 3” minimum tapered rigid insulation (R15), 60 mil TPO roof membrane, and an extensive green roof made up of a drain mat, retention mat, filter sheet, growth media, and plat community (R2). The roof assem-bly will give a R62+ insulating effectiveness.

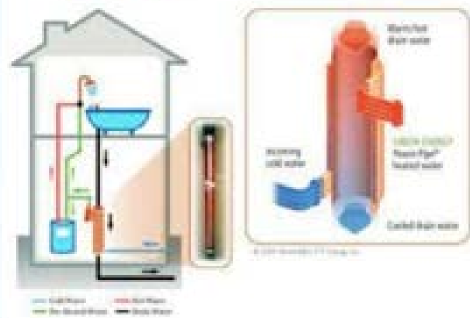
- Lighting/Electrical Model were developed to demonstrate improvements in lighting power density, plug load energy consumption and occupancy schedules
  - By using LED fixtures a 20% reduction in lighting energy consumption can be achieved over the ASHRAE baseline
  - Lighting and receptacle loads set on schedule that represents hourly demand for apartment building

	System Descriptions and Improvements
ASHRAE 90.1-2013 Baseline	**Lighting** Apartment: .51 W/SF (Max per ASHRAE 90.1-2013) Office: .82 W/SF (Max per ASHRAE 90.1-2013) Living Rooms: .57 W/SF (Max per ASHRAE 90.1-2013) **Receptacle Loads** Apartments: .3 W/SF Office: .5 W/SF **Load Schedules** Lighting is on a apartment lighting schedule, where loads are reduced during the day and normal during morning and evening hours. Annual Energy Consumption: 1,087,000,000 Btus (318,580 kWh)
Electrical (Elec) ECM 1	**Lighting** Apartment: .41 W/SF (Max per ASHRAE 90.1-2013) Office: .66 W/SF (Max per ASHRAE 90.1-2013) Living Rooms: .46 W/SF (Max per ASHRAE 90.1-2013) **Receptacle Loads** Apartments: .3 W/SF Office: .5 W/SF **Load Schedules** Lighting is on a apartment lighting schedule, where loads are reduced during the day and normal during morning and evening hours. Lighting power density (LPD) reduced by 20%. Annual Energy Consumption: 497,400,000 Btus (145,780 kWh)

- Plumbing Model was developed exploring improvements to hot water heater types and efficiencies
  - o Heat pump water heater
  - o Drain Heat Recovery

	System Descriptions and Improvements
ASHRAE 90.1-2013 Baseline	Gas Water Heater - ASHRAE 90.1-2013 83% Efficiency Annual Energy Consumption: 1,087,000,000 Btus (318,580 kWh)
Plumbing (P) ECM 1	**Heat Pump Water Heater** Approx. 25% increase in efficiency compared to standard Electric Water  Annual Energy Consumption: 934,800,000 Btus (293,975 kWh)
Plumbing (P) ECM 2	**Heat Pump Water Heater** Approx. 25% increase in efficiency compared to standard Electric Water **Drain Heat Recovery** Approx. 25% increase in efficiency compared to standard Electric Water Annual Energy Consumption: 784,600,000 Btus (229,950 kWh)





ACTIVITY 1: NET ZERO ENERGY

Energy Model Results

- HVAC System Improvements

HVAC Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
H ECM 1	530.3	18,956	51.2
H ECM 2	428.8	15,328	60.6
H ECM 3	426.3	15,237	60.8

HVAC ECM Descriptions	Improvement Over ASHRAE Baseline
HVAC ECM 1	Mini Split Heat Pump System Dedicated Outside Air System (DOAS) No Energy Recovery (ER)
HVAC ECM 2	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) No Energy Recovery (ER)
HVAC ECM 3	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) Energy Recovery (ER) at DOAS

- Envelope System Improvements

Envelope Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
ECM 1	490.5	17,532	54.9
ECM 2	502.5	17,948	53.8
ECM 3	487.5	17,424	55.2

Envelope ECM Descriptions	Improvement Over ASHRAE Baseline
ENV ECM 1	Window Improved window performance by 20% over proposed window
ENV ECM 2	Increased wall R-Value to R-42 compared to proposed wall
ENV ECM 3	Increased wall R-Value to R-42 compared to proposed wall Improved window performance by 20% over proposed window

- Electrical/Lighting System Improvements

Electrical/Lighting Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
ECM 1	497.4	17,780	54.2

Elec ECM Descriptions	Improvement Over ASHRAE Baseline
E ECM 1	Lighting power density (LPD) reduced by 20%

- Plumbing System Improvements

Plumbing Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
ECM 1	934.8	29,123	14
ECM 2	784.6	28,046	27.8

Plumbing ECM Descriptions	Improvement Over ASHRAE Baseline
P ECM 1	Heat Pump Water Heater
P ECM 2	Heat Pump Water Heater Drain Heat Recovery

HVAC &Envelope Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
HVAC ECM 1 & ENV ECM 1	517.5	18,499	52.4
HVAC ECM 2 & ENV ECM 1	414.8	14,828	61.9
HVAC ECM 3 & ENV ECM 1	419.2	14,983	61.4

HVAC &Envelope Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
HVAC ECM 1 & ENV ECM 2	523.8	18,724	51.8
HVAC ECM 2 & ENV ECM 2	427.6	15,285	60.7
HVAC ECM 3 & ENV ECM 2	423.7	15,144	61.0

HVAC &Envelope Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
HVAC ECM 1 & ENV ECM 3	509.9	18,228	53.1
HVAC ECM 2 & ENV ECM 3	413.5	14,782	62.0
HVAC ECM 3 & ENV ECM 3	418.2	14,949	61.5

- Through the modeling of these HVAC systems and envelope improvements it was discovered that the combination that provided the largest energy savings over ASHRAE baseline was a building design that included VRF, DOAS and a high performance façade.

HVAC & Elec Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
HVAC ECM 1 & ELEC ECM 1	512.6	18,325	52.9
HVAC ECM 2 & ELEC ECM 1	412.9	14,758	62.0
HVAC ECM 3 & ELEC ECM 1	410.6	14,676	62.2

Envelope & Elec Improvements	Energy Consumption (10^6 Btu/h)	Annual Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
ENV ECM 1 & ELEC ECM 1	489.8	17,509	55.0
ENV ECM 2 & ELEC ECM 1	484.8	17,330	55.4
ENV ECM 3 & ELEC ECM 1	476.2	17,022	56.2

HVAC,Elec, Envelope, plumbing Improvements	Energy Consumption (10^6 Btu/h)	Annaul Energy Cost ($)	Improvement Over ASHRAE Baseline (%)
ASHRAE 90.1-2013 Baseline	1,087	30,024	-
HVAC ECM 1, ELEC ECM 1, ENV ECM 3, P ECM 1	492	17,586	54.8
HVAC ECM 2, ELEC ECM 1, ENV ECM 3, P ECM 2	400.9	14,330	63.1
HVAC ECM 3, ELEC ECM 1, ENV ECM 3, P ECM 2	396.7	14,181	63.5

HVAC ECM Descriptions	Improvement Over ASHRAE Baseline
HVAC ECM 1	Mini Split Heat Pump System Dedicated Outside Air System (DOAS) No Energy Recovery (ER)
HVAC ECM 2	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) No Energy Recovery (ER)
HVAC ECM 3	Variable Refrigerant Flow (VRF) Heat Recovery System Dedicated Outside Air System (DOAS) Energy Recovery (ER) at DOAS

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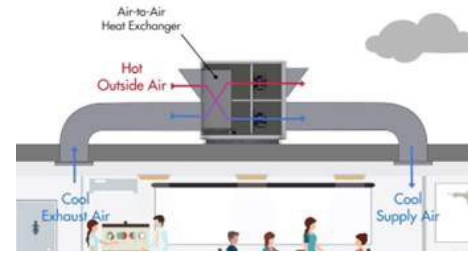
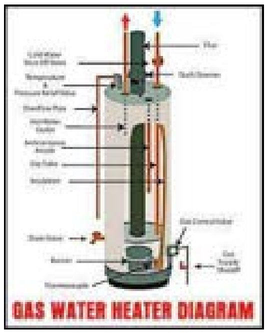
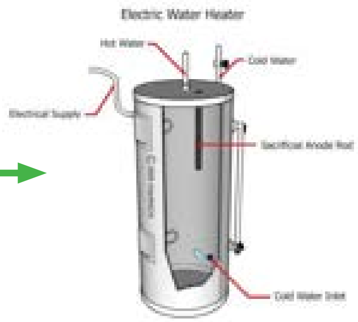
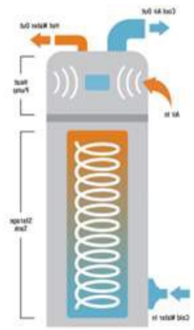
Elec ECM Descriptions	Improvement Over ASHRAE Baseline
E ECM 1	Lighting power density (LPD) reduced by 20%

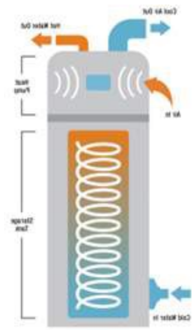
Plumbing ECM Descriptions	Improvement Over ASHRAE Baseline
P ECM 1	Heat Pump Water Heater
P ECM 2	Heat Pump Water Heater Drain Heat Recovery

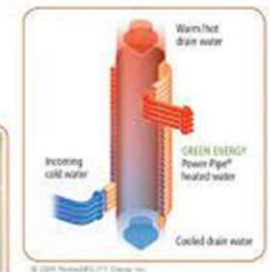












Several energy conservations measures across the HVAC, façade, electrical and plumbing systems in the building were tested. Due to the budget of the project, tax credits and funding, the improvements that have the biggest impact energy consumption and require the smallest financial investment is ideal.

- HVAC and Envelope improvements require large upfront investment, but operational cost savings is highest among improvements tested.
- The 62% energy savings from a combination of HVAC and envelope improvements compared to HVAC and electrical improvements are virtually identical. Improvements to the electrical/lighting system will likely be more cost effective than envelope improvements.
- Even with all energy improvements across HVAC, electrical, plumbing and façade combined, the energy savings of 63.5% nearly matches that of HVAC and electrical or HVAC and envelope combinations.
- Plumbing improvements alone had the lowest operational cost savings compared to the other systems.

Explore Renewable Energy Options to Get to Net Zero

PV Energy

- A PV analysis was performed to analyze various options for maximizing the available roof area and renewable energy power operation.
- Helioscope, an online PV design tool was used to evaluate two different PV system designs were performed:
  1) partial green roof with PV panels installed per DOEE Stormwater Management Guide January 2020
  2) Extended PV canopy over entire roof including green roof and mechanical equipment area

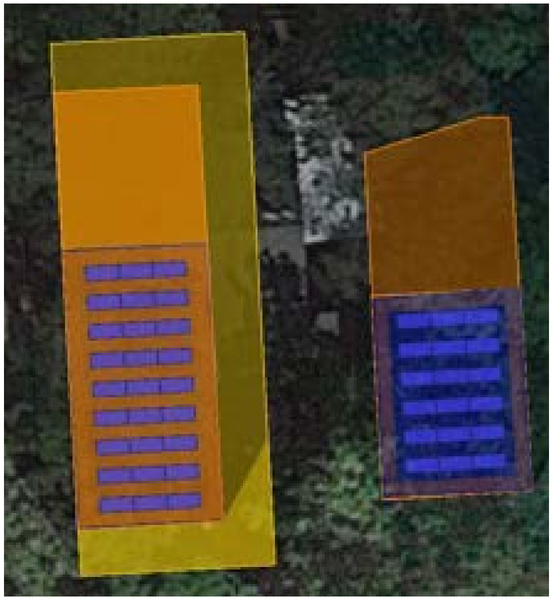


Figure 1: Preliminary PV Layout Installed above Green Roof

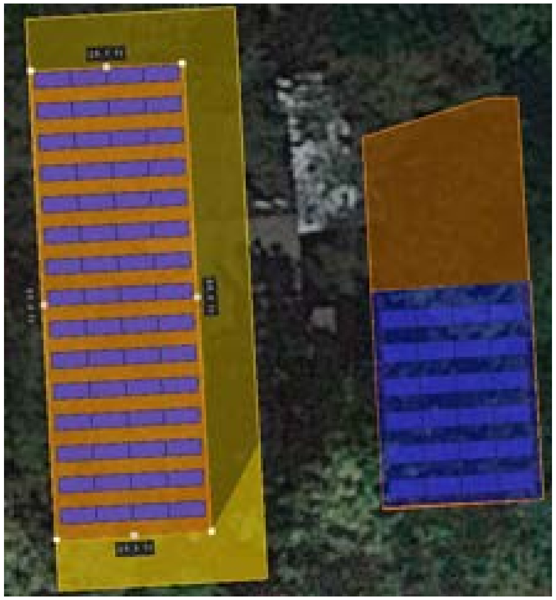


Figure 2: Preliminary PV Layout Extended Canopy

PV Production

Option	Panel Type	NUMBER OF PANELS	TILT	POWER (kW DC)	POWER (kW AC)	DC/AC ratio	ENERGY (MWH)(AC)	NUMBER OF INVERTERS	PV EUI
Max Power 32 Tilt , 36" Distance Between Panels installed above green roof	X21-470	45	32 degree	21	20	1.06	31.6	2	2.9
Max Power 32 Tilt , 36" Distance Between Panels installed above green roof on extended Canopy	X21-471	89	33 degree	37	32	1.10	57.9	3	5.3

- Option 1. Partial green roof with PV panels installed as per DOEE Stormwater Management Guidebook January 2020
- Option 2. Extended Canopy 10 feet above the Green Roof and above mechanical equipment area.

  The calculations were done using Maxeon SPR-X21-470-COM 470W solar panels, which have an efficiency of 21.7%.

- Option 1. The inverters used in the calculation were the Sunny Tripower 12000TL 12kW (SMA) and the Sunny Tripower 8.0 8kW (SMA).
- Option 2. (3) 12kw (SMA) inverters

Conclusion:

- Due to the limited space on the roof, the energy contribution from the PV system is minimal. The proposed extended canopy option would almost double PV output, but additional energy conservations measures will need to be considered in order to achieve net zero. Additionally, the canopy proposal would be cost prohibitive to the project in relation to the production as well as code and zoning regulations limiting it's installation.
- Therefore, the desire is to proceed with Option 1 of PV panels over the required green roof.

- In addition, there are possibilities for off site renewable energy as well.

  o Industry accepted means and methods for this can be found through organizations such as the Center for Resource Solutions Green-e Energy program's products certification requirements.

  o These applications involve procuring the "green energy" from sources such as:

   Green-e Energy-certified power marketer

   Green-e Energy-accredited utility program

   Or Green-e Energy-certified tradable renewable energy certificates (RECs)

Building Electrification

- In an effort to reduce the carbon footprint of the project it is being proposed that all normal operational energy shall be electric in nature without the consumption of fossil fuels.

  o This includes all new heating, domestic hot water, and kitchen/cooking equipment.
  o Gas systems used in all analysis were strictly for a comparison basis. The desire for the project is a fully electric building.

- Only emergency power is recommended to be by fossil fuels via a standby generator powered by natural gas or diesel fuel as these devices do not run during "normal" operation of the building.

- Outside of these emergency situations the generator would be required, per NFPA 110, to have periodic testing at a minimum of 30 minutes per month and run at at least 30% of the nameplate kilowatt rating.

Net Zero Analysis – 2017 DC Energy Conservation Code Appendix Z Analysis

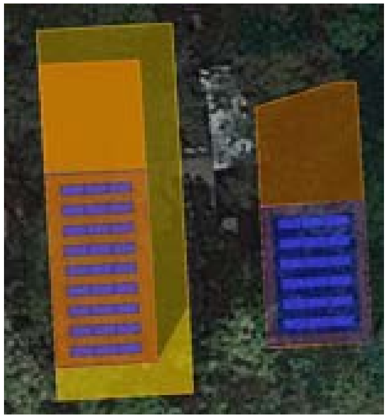
- The project also looked at the potential for Net Zero Energy Alternative Compliance Path in accordance with the 2017 DC Energy Conservation Code Appendix Z

- The design of a net-zero energy building shall be achieved through the use of three complementary approaches, to be employed to the maximum extent feasible, in the following order:
  o Reducing building energy demand for HVAC through the use of passive design and improved envelope performance techniques.
  o Reducing total building energy demand through the installation of high-efficiency mechanical systems, hot water systems, power systems, lighting, and process equipment.
  o Supplying remaining building energy needs from renewable sources of energy.

- Predicted Energy Performance Summary (Z2)
  o Zero Energy Performance Index (zEPI) of 30 or lower must be achieved with preliminary energy modeling shows the proposed building would be in compliance with these requirements.

	Total Energy Consumption [kBtu]	Cost [$]	Energy Use Intensity [kBtu/SF-Yr.]	Energy Saving	Cost Saving	zEPI
Baseline - ASHRAE 90.1-2013	1,087,000	30,024	38.8	NA	NA	NA
Baseline - ASHRAE 90.1-2016	1,001,000	27,652	35.8	NA	NA	NA
Proposed – Design	397,700	14,181	14.2	60.3	48.8	**20**

- Achieving Net Zero (Z3)
  - o In order to achieve a Net Zero status, renewable energy must be generated equal to 397,700 kBTU (116,094 kWH) for the EUI (14.2) of the building.
  - o For this project the only feasible source of on site renewable energy is solar photovoltaic panels.
  - o HelioScope was used to calculate the maximum possible PV array size across both buildings. The following parameters were used:
    - 21.7% efficient panels
    - 33 degree tilt (for fixed tracking)
    - 16.6% system losses
    - 1.25 DC to AC Size Ratio
    - 86% efficient inverter



  - o The currently proposed 21 kW PV over green roof would generate 31,600 kWh of energy, enough to offset approximately 27% of the total annual energy use (116,094 kWH). Off site renewable energy would be needed to obtain the remaining 84,494 kWh of calculated consumed energy in order to truly be a Net-Zero Building.

ACTIVITY 1: NET ZERO ENERGY

Challenges
and
Limitations

- **Renewable Energy**

  - Due to the small site footprint, there was not enough area for the infrastructure needed for geothermal design.
  - Due to the small roof area, there was limited roof space available to utilize solar energy. From multiple solar studies, we are maximizing the space available for power generation.
  - A canopy above the green roof and penthouse was explored; however, per DC Zoning Regulations, a covered structure counts toward both the height of the building and the maximum allowed FAR (Floor Area Ratio). The proposed development has maximized the FAR and height of both buildings and as such a covered structure, solar canopy, is not an option.
  - Adding solar panels that sit above the proposed green roofs was also explored; however, because of the GAR (Green Area Ratio) requirements, the spacing between the raised solar panels required for the green roof limits the quantity of panels and the amount of energy generated when compared to a typical ballasted design. The proposed design, discussed further in the presentation, will maximize the production however will not be able to offset the energy consumed.

- **Mechanical Systems**

  - Roof space available for split system condensing units is very limited and the desire is to keep ground mounted equipment at a minimum to maximize usable space for the building occupants. Geothermal systems were also deemed not feasible as the space available could not fully support that system and it would be prohibative, both from a cost and future maintenance perspective, to provide multiple systems to the building. As such, it is preferred to include a variable refrigerant flow (VRF) system which provides a high efficiency system while also reducing the quantity of rooftop equipment to an acceptable amount that also provides space for the required green roof and desired PV.

- **Energy Modeling Software**

  - This includes making assumptions on equipment energy efficiencies based on previous experience and what is currently available on the market, occupancy schedules for the building as a whole even though individual residents will have their own schedules, and utilizing the built in historical atmospheric data for the approximate area (based on Regan DCA Airport). Additionally, the software does have the ability to pull in the 3D model of the building and thus all architectural elements must be manually entered including size, materials/thermal performance, and cardinal orientation."

ACTIVITY 2: RENEWABLE ENERGY STORAGE

ACTIVITY 2: RENEWABLE ENERGY STORAGE

Renewable Energy:
Solar PV Analysis

The PV System can be provided thru a SPPA (Solar Power Purchased Agreement) or other available programs. The results of this analysis are limited due to Washington DC restrictions regarding PV panels installed on green roofs and the Mechanical Equipment yard that will be provided at the roof level.

To curb these limitations, canopies can be built above the mechanical equipment areas, which would help increase the PV production. The panels will be mounted at a 32-degree angle. This angle allows for maximum power generation and reduces snow accumulation on the PV panels to a minimum. The PV array's efficiency is drastically reduced by snow, so some level of tilt will help maintain proper efficiency values.

With an SPPA, the PV system is leased instead of purchased, which reduces cost for the owner by eliminating upfront cost, maintenance, and permitting procedures. SPPA's are readily available in the DC area if purchasing and installing a PV system is not feasible.

Option	Panel Type	NUMBER OF PANELS	TILT	POWER (kW DC)	POWER (kW AC)	DC/AC ratio	ENERGY (MWH)(AC)	NUMBER OF INVERTERS	PV EUI
Max Power 32 Tilt, 36" Distance Between Panels Installed above green roof	X21-470	45	32 degree	21	20	1.06	31.6	2	2.9
Max Power 32 Tilt, 36" Distance Between Panels Installed above green roof on extended Canopy	X21-471	89	33 degree	37	32	1.10	57.9	3	5.3

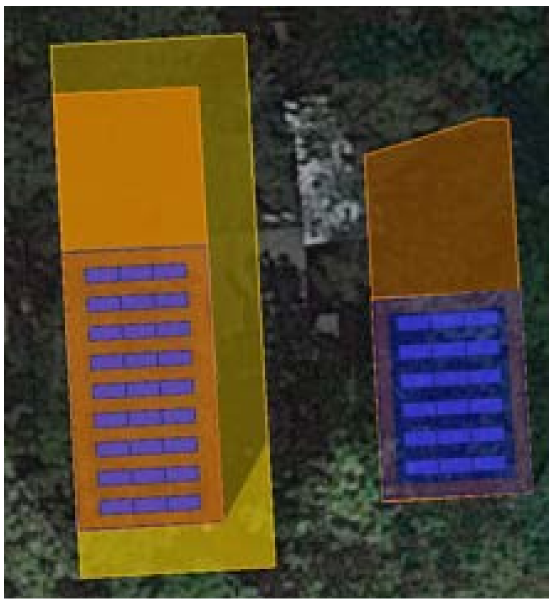


Figure 1: Preliminary PV Layout Installed above Green Roof

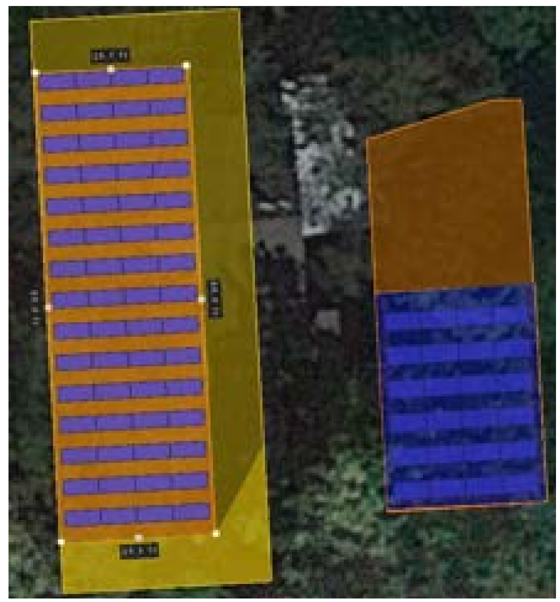
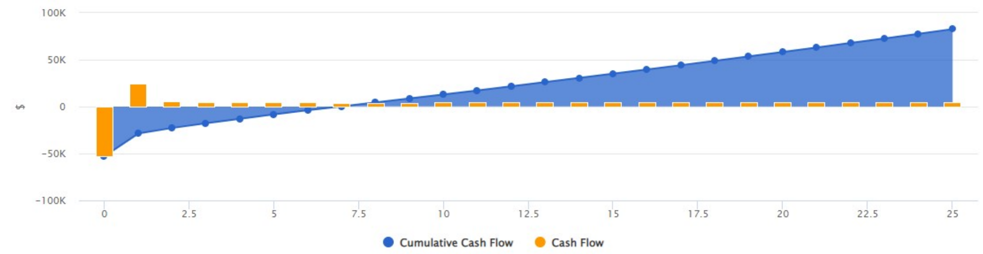


Figure 2: Preliminary PV Layout Extended Canopy

Photovoltaic Payback Feasibility

Key Metrics

System Start	May 2023
Total Value of Energy	$109,915.58
Lifetime Value (NPV)	$7,379.69
Internal Rate of Return (IRR)	12.56%
Return on Investment (ROI)	256.15%
Payback Period	6.9 years
Levelized Cost of Energy	$0.14 / KWh



*Estimated cost of system is based on current industry standards.

Assumed Parameters:

- 25 year operating period (basis of design PV panels are guaranteed 25 years)
- Annual system degradation rate of 0.5%
- Annual utility escalation rate of 2%
- U.S. Federal PV Tax Credit (30%) is obtained through online application

Renewable Energy Storage – Resiliency Plan

- The prospect of providing the building with full battery backup resiliency was investigated.
- This would include the current electrifying all HVAC and plumbing equipment and provided grid-scale battery backup for the Owner requested run time of 48 hours.
- Three battery options were explored:

o Option 1: 1300kWH lithium-ion battery to be installed indoors or outdoors. Large scale applications is typically a complete system in a cargo container

o Option 2: A modular, 220kWH Vanadium flow battery system can be combined to obtain the desire capacity. Based on a 220kWh sized flow battery, 6 total batteries would be required.

o Option 3: Natural gas generation is being specified for dedicated health and safety items that need to have redundancy for the duration of any power outage. These items include fire safety signage and equipment, bed shakers etc., elevator, common area lighting, hvac equipment, common area refrigeration for medicine etc. This is critical due to the age and the special needs of the resident population.

Renewable Energy Storage – Resiliency Plan

- Current building and site design does not provide sufficient space for either of these battery storage systems to be installed indoors or out. However ,they will be looked at further as the development and modifications of the building be made due to the conceptual phase of the project.

- The PV System will be Provided with a Microgrid Controller from eLUM or equivalent for increased resilience by allowing the building to operated independent from the utility grid.

  o The microgrid controller curtails the exact amount of solar power and generator power to maximize solar penetration and/or avoiding any penalty from the utility if NET metering will not be considered.

- Alternatively, if on site battery storage becomes prohibitive due to space limitations, further resilience can be provided by utilizing an Emergency/Standby rated generator sized for continuous operation, can be integrated into the microgrid controller, and can “island” the building during a power outage event and keep operating without interruption of power to the building or during peak shaving demand operation.

ACTIVITY 3: EMBODIED CARBON REDUCTION

Goals and Objectives
for Embodied Carbon Reduction

It was our intention to complete an Life Cycle Assessment (LCA) for the project. This aspiration was based upon our expectation that the DHCD would issue an RFP for funding in August 2022 as they publicly stated. The RFP was never issued and has been postponed multiple times. It is now slated for July of 2023.

Given that Deaf-REACH is a small nonprofit, with limited budget, the decision was made to not obtain loans for predevelopment. Funding is needed to pay for the AE professionals and others needed to begin and complete the construction documents.

We plan to complete the LCA by utilizing an integrated process, including the GC, subcontractors etc to help us work through and price the material costs,

We will use the following methodology and process for the LCA. The goal is to quantify environmental impacts.

Life Cycle Assessment

Life Cycle Assessment Process

The process of evaluating the system options included the following steps of evaluation:

1. Determine the system options for HVAC systems that will provide the energy performance required to meet the goals for energy and sustainability.
2. Performance of an Energy Model of each option to determine the annual energy consumption calculated in total energy and energy cost. Some energy modeling has been done, however, we will need to do additional modeling once pricing is received and specifications are finalized.
3. Identifying the first installation costs of each system.
4. Identifying the Annual Operations and Maintenance Costs for each component.
5. Identifying the expected useful life of each piece of equipment and identifying the replacement costs and duration.
6. Identifying the remaining value of the equipment at the end of the Life Cycle Cost Duration.

ACTIVITY 3: EMBODIED CARBON REDUCTION

Life Cycle Assessment Strategies

- Stages
- Building Carbon Cycle
- Building Carbon Assessment Stages
- Methodology to Achieve Reduction in Life Cycle Impacts
- Tools to Perform Life Cycle Assessment
- Integrated Process to Life Cycle Assessment

Stages

The various stages of a typical life cycle as defined in LCA are:

A: the production and construction stages,
B: the use stage,
C: the end-of-life stage, and
D: externalized impacts beyond the system boundary.

The stage of the life cycle is also known as the “cradle,” while the end of the manufacturing facilities is known as the “gate,” and the end of the life cycle is known as the “grave.”

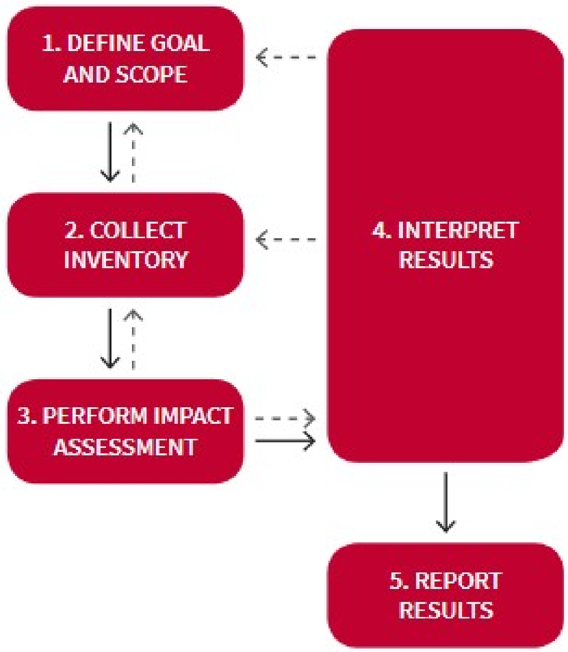
Building Carbon Cycle

A. Product Stage
   - Raw Material Supply
   - Transport (to Manufacturing)
   - Manufacturing
   - Transport (to Site)
   - Construction Installation

B. Use Stage

C. End-of-Life Stage
   - Deconstruction/Demolition
   - Transport
   - Waste Processing
   - Disposal

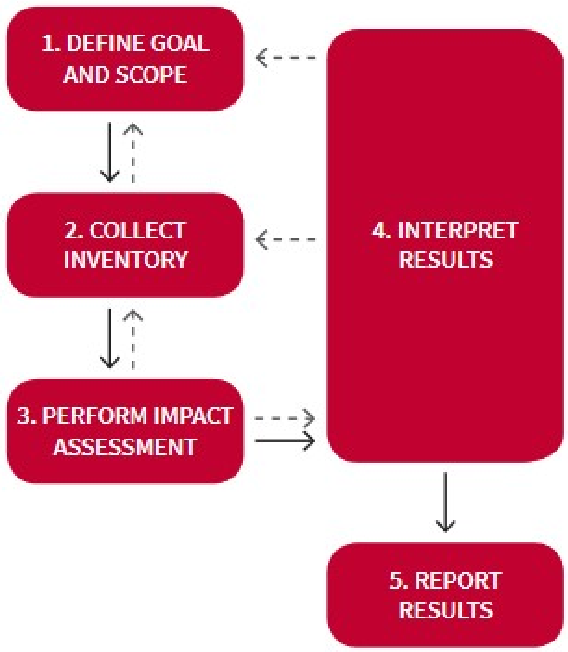
D. Beyond System Boundary
   - Reuse, Recovery, and
   - Recycling Potential



Building Carbon Cycle

The cycle will repeat multiple times so the team can reassess the scope, consider various materials, and products. Multiple iterations will allow the team to compare design options;

- Test selections from multiple suppliers of similar products with different carbon footprints and environmental impacts
- To evaluate the buildings and identify the largest contributors and their total environmental impact



Methodology to Achieve Reduction in Life Cycle Impacts

PRE-DESIGN		EARLY SD		50% SD		100% SD	EARLY DD		50% DD		100% DD	
Overall budget, program, and pro-forma set	*Draft of overall schedule set for project planning*	*OPR complete*	*Building siting (orientation + massing) set*	*Building type/ code set*	*Major systems set*	*Structural + envelope performance criteria set*	*Draft construction schedule set*	*Secondary structural systems set (curtain wall, etc.)*	*Outline specifications*	*Exterior elevations set*	*D-B: Manufacturer/ vendor chosen*	*Exterior assemblies set*

WHOLE BUILDING

SET GOALS
- Operational carbon: Set energy use intensity (EUI) goals + fuel source
- Embodied carbon: Set carbon intensity limits ($kgCO_2eq/sf$), % reduction targets, and/or limits
- Rating system metrics

LCA: MASSING COMPARISON
Study massing options

Establish relevant regulations and rating systems (Buy Clean CA, LEED, LBC, etc.)

Set baseline if tracking relative improvements (% reduction)

HOT SPOT ANALYSIS
- Perform whole building LCA
- Identify top material impacts
- Establish strategies for reducing or optimizing materials with the biggest impact

Identify optimization opportunities (see "Materials" section below)

Update LCA model + track change in life cycle impacts over DD

STRUCTURE

REVIEW GOALS
- Architect and engineer discuss carbon reduction + goals
- Discuss schedule + budget implications with contractor (D-B)
- Work with geotechnical engineer + structural to optimize foundations

LCA: STRUCTURAL COMPARISON
- Study structural concepts + alternatives
- Confirm most appropriate system (P.T. vs. mild, steel, wood, etc.)

STRUCTURE FIXED
- Structural performance criteria is fixed (loads, design strength, serviceability)
- Incorporate embodied carbon reduction targets

STRUCTURAL HOT SPOTS
- Push for cement reductions if using concrete (topping slab, mat foundations, and other low-hanging fruit at a minimum!)
- Consider schedule implications

Architect/engineers collaborate to reduce volume of structural materials as possible

Finalize reduction strategies in structure (e.g. cement reduction in concrete, sourcing goals for steel, etc.)

ENVELOPE

Envelope constraints set through code analysis, daylighting + energy modeling studies

LCA: ENVELOPE STUDIES
- Compare facade + assembly design options
- Test assemblies - insulation layers, etc.

ENVELOPE HOT SPOTS
- Identify target item reductions
- Push for low carbon insulation + other hot spots

Identify optimization opportunities (see "Materials" section below)

Establish reduction strategies for envelope (e.g. insulation preference, window type, etc.)

Methodology to Achieve Reduction in Life Cycle Impacts

EARLY CD	50% CD	100% CD	BIDDING	CONSTRUCTION	BUILT
	Specifications set	*Rating system design credits submitted*		*Buy-outs complete*	
LCA: CONFIRM REDUCTION STRATEGIES • Confidence can achieve reduction goals • LCA calcs on design complete	**SPECS/DESIGN CALCS** • Confirm reduction strategies are specified • Research best in class GWP and identify 3+ materials to specify	Update LCA Model, track changes in CDs + Submit calculations if applying for rating system credits	Design team + builder collaborate to ensure % reductions included in bid requirements	**SUBMITTALS** • Confirm optimizations maintained through buy-out **FINAL ASSESSMENT** • Update LCA model per submittals • Calculate project GHG emissions • Calculate % below or above LCI targets • Reflect on differences between design and as-built LCA and identify future strategies	**SHARE** • Document results in firm database • Share your results + lessons learned!
	SPECS/DESIGN CALCS • Confirm reduction strategies are specified • Research best in class GWP and identify 3+ materials to specify		Design team + builder collaborate to ensure % reductions included in bid requirements	**SUBMITTALS** • Collaborate to set final concrete mixes if using • Update LCA to reflect final design	
	SPECS/DESIGN CALCS • Confirm reduction strategies are specified • Research best in class GWP and identify 3+ materials to specify		Design team + builder collaborate to ensure % reductions included in bid requirements	**SUBMITTALS** • Confirm optimizations maintained through buy-out	

Tools to Perform Life Cycle Assessment

- In order to perform the Life Cycle Assessment, we will be utilizing Athena LCA Software tools. The Athena Institute software allows construction industry professionals to compare alternate design scenarios and incorporate environmental considerations from design through the end of construction.

- We will first use Athena Impact Estimator for Buildings. This is a stand-alone program that allows users to model their own custom assembly and envelope configurations, and provides flexibility for proposed designs and existing buildings. We will then use the Athena EcoCalculator for Residential Assemblies. This is a spreadsheet tool with pre-defined assembly and envelope configurations. The user needs only to input the square footage of any particular assembly to receive instantaneous embodied life cycle impact assessment results (operating energy is not included). The results presented are the same as, and derived from the parent software, the Impact Estimator. However, the user is limited to the existing pre-defined assemblies.

Integrated Process to Life Cycle Assessment

- The Life Cycle Assessment for the Deaf-REACH development will be an integrated process. Lead by Capital Sustainability, the owner, architect, MEP engineer, landscape architect, structural engineer, civil engineer, general contractor, sustainability consultant and subcontractors will collaborate on the Life Cycle Assessment. This will assure that the entire team will be engaged in the process and that the skill sets and knowledge of the of the parts will make for a greater whole.

ACTIVITY 4: DECONSTRUCTION AND REUSE

a. Conduct a deconstruction analysis of the existing structures on site.

b. Perform a material assessment appraisal.

c. Analyze and create a list of materials that can be reused in the new construction and those that can be salvaged, reused, or recycled through other means.

d. Pursue Enterprise Green Communities Criterion 2.11: Adaptive Reuse of Buildings.

e. Evaluate the total costs of at least two end-of-life scenarios for the existing structures:

   1) standard demolition;

   2) deconstruction, including salvage, reuse, and recycling.

f. Identify a partner that could monetize the donation credit.

Overview of the Purpose and Benefits of Deconstruction and Reuse

- Building deconstruction reduces carbon emissions by minimizing the amount of waste sent to landfills. When buildings are demolished, all of the materials that cannot be reused or recycled are sent to landfills, where they release methane and other greenhouse gases as they decompose. By salvaging and reusing materials instead, deconstruction greatly reduces waste with a corresponding reduction of carbon emissions.
- This practice also promotes the conservation of natural resources. By salvaging and reusing materials such as wood, metal, and concrete, deconstruction reduces the demand for new resources which would need to be extracted and processed. This can help to preserve forests, reduce the need for mining and quarrying, and decrease the overall environmental impact of construction activities.
- Finally, building deconstruction is an important component of a circular economy, in which resources are kept in use for as long as possible in order to minimize waste and maximize value. By salvaging and reusing materials, deconstruction can help to create a market for recycled and reclaimed building materials, promoting the development of a sustainable and circular construction industry, a potentially important component as the District of Columbia invests in and grows the green economy.
- The Capital Sustainability (CS) team conducted several site visits to determine the feasibility of deconstruction. While it was determined early on that there weren't any items that were suitable for reuse in the planned buildings to be constructed due to the commercial nature of the new buildings, and the need for more advanced materials that can support a high performing building. The team did believe that there was potential for a non-profit offtaker that could salvage the materials and sell them for reuse. This would keep items out of the landfill and also provide economic benefit to both Deaf-REACH and the non-profit.

Partnership Opportunities to Monetize the Donation Credit

- Additionally, the Capital Sustainability team has attempted to find a willing investor to take the tax deduction and pay the cost for Green Door to provide the deconstruction services. The new tax laws have reduced the number of individuals or corporations filing for itemized deductions, a prerequisite for benefiting from Charitable deductions. For large companies the feedback we have received is the amount of the deduction is too small and not worth having to advance the money to a on-profit partner, in this case, Green Door of Baltimore, Maryland, while waiting until they file to get the benefit. Additionally, it's also harder because many individuals and companies are not able to fully forecast their future tax bill or refund to know whether this action is financially prudent.
- Building deconstruction is the careful dismantling of a structure in order to salvage reusable materials, rather than simply demolishing an entire building and sending the waste to a landfill. This process offers a number of environmental benefits, including reduced carbon emissions, conservation of natural resources, and the promotion of a circular economy.
- To conform with further innovation in designing and developing a new Deaf-REACH facility, the team assessed the current offices and residential resources with an eye towards deconstruction rather than demolition. While deconstruction is more expensive than traditional building disposal, a deconstruction process further enhances the Deaf-REACH mission in terms of environmental sustainability and stewardship. Deconstruction mitigates impact on landfills and offers the opportunity for recycling/re-use of parts and materials for future construction projects. In assessing the deconstruction model for this project, Deaf-REACH also decided to partner with organizations where training and workforce development were mission critical and offered opportunities for the Deaf-Reach constituency.

Deconstruction Analysis

- The first phase of this process was to execute a detailed analysis of the existing structures on site. This was performed by Green Donation Consultants of Fredricksburg, Virginia (see attached appendix items for the evaluation of the two buildings.) This covers tasks A and C in the Grant.

Analyze and create a list of materials that can be reused in the new construction and those that can be salvaged, reused, or recycled through other means.

- Once completed, we executed the materials appraisal, Task B in the grant, which yielded an estimated cash value as well as tax value to the deconstruction materials. The calculation for tax credits assumes a private investor at a 35% tax rate. However, most potential offtakers would be corporate entities with a much lower tax rate, and thus a much lower potential credit package, which is currently not attractive to the firms contacted to date.

Enterprise Green Communities Criterion 2.11

- In terms of Task D, the Enterprise Green Communities criterion 2.11: Adaptive Reuse of Buildings is defined as:

Rehabilitate and adapt an existing structure that was not previously used as housing. Design the project to adapt, renovate, or reuse at least 50% of the existing structure and envelope.

- The assessment of the Deaf-REACH consultants concluded that the existing buildings were both at or past their designed life-cycle and were also incompatible with the design mission for the organization in the 21st century, particularly given the space requirements for the residential portion of the mission.

- Evaluate the total costs of at least two end-of-life scenarios for the existing structures:
  (1) standard demolition;
  (2) deconstruction, including salvage, reuse, and recycling.

- With respect to the comparison of deconstruction and reuse versus traditional demolition, the estimated cost to demolish the existing buildings is roughly $32,000. The hard cost for deconstruction of the two buildings on site is roughly on par with traditional demolition, if not higher.

- There are many options for off-takers for the credits associated with deconstruction. Most common is to offer the credits to the follow-on construction firm in exchange for a reduced capital cost.

- The DC Government can incentivize deconstruction similar to other jurisdictions that have recognized the benefits of this process in reducing waste, conserving resources, and creating new jobs in the recycling and reuse industries. Below are a few tactics deployed by different governments to encourage deconstruction of buildings:

1. Create policies and regulations that require or incentivize deconstruction over demolition. For example, some cities require building owners to conduct a deconstruction assessment before a building can be demolished. Some jurisdictions have also established tax credits or other financial incentives to encourage deconstruction.
2. Provide technical assistance to building owners and contractors to support the deconstruction process. This assistance may include training, educational materials, and technical support on how to safely and efficiently deconstruct buildings.
3. Partner with industry stakeholders, such as construction and demolition contractors, to develop best practices and standards for deconstruction. This collaboration can help to streamline the deconstruction process and ensure that materials are properly sorted and recycled.
4. Create market demand for deconstructed building materials by promoting the use of these materials in public projects, such as road construction or park development. Governments can also work with developers and architects to promote the use of deconstructed materials in new construction projects.
5. Invest in research and development to identify new technologies and processes for deconstruction that improve safety, efficiency, and environmental performance. This research can help to advance the field of deconstruction and create new opportunities for innovation and economic growth.
6. DOEE could subsidize the deconstruction costs, particularly with a workforce development opportunity to stand up a DC based company, it could also examine reducing or waiving certain fees to incentivize this approach and make it financially feasible, particularly for non-profit property owners such as Deaf-REACH.

Appendix:

Second Chance Evaluation: 1203 Otis Place

Second Chance Evalution: 1203 ½ Otis Place

Green Donation Materials Appraisal: 1203 Otis Place

Green Donation Materials Appraisal: 1203 ½ Otis Place

- Green Donation Consultants has visited the site and provided estimates for the Second Chance Deconstruction Program to generate a donation of materials with mid-range values of $155,000 and $145,000 respectively.
- An Overview for the donations at the values indicated are included on the Right. Once the decision is made to proceed, we would use the Second Chance deconstruction program.
- The foundation would not be reused under any circumstance; where possible a dumpster or room will be used to aggregate debris. The estimates give a sense of potential outcomes but assumes some information needs to be reviewed with a CPA or tax advisor. The tax bracket is one of the important elements for review. This example is meant to guide discussion with a tax advisor. Once tax savings are determined, a pledge schedule can be mutually determined with Second Chance.
- Building 1: The Net tax benefit is $33,125-$36,375. The donation to Second Chance is $27,500-$32,500. (Net cost of donation, $17,875-$21,125)

Value of Contributed Structure: Median value from appraiser estimate range	$155,000
Tax Rate (Federal and State): Assumed tax rate; yours may differ	35%
Estimated Tax Savings: Donation value times tax rate	$54,250

Program Cash Contribution Options

Choose the option that best suits your tax strategy

	Option #1	Option #2	Option #3
Donation Date Options:	30 days after completion of deconstruction	By May 31, 2024	By Dec 31, 2024
Pledge Amount:	$27,500	$30,000	$32,500
Tax Savings: (On contributions at 35%)	-$9,625	-$10,500	-$11,375
Net Cost of Donations:	**$17,875**	**$19,500**	**$21,125**

Summary

Tax Savings or Refund:	$54,250	$54,250	$54,250
Cost of Donation: (After 35% tax savings)	-$17,875	-$19,500	-$21,125
Net Benefit to Donor:	**$36,375**	**$34,750**	**$33,125**

- Building 2: The Net tax benefit is $30,600-$33,850. The donation to Second Chance is $26,000-$31,000. (Net cost of donation, $16,900-$20,150)

- In summary, the Otis Street buildings create a tax deduction, which creates a tax savings or an actual refund of money to the property owner. The property owner or its designee will keep a larger portion of its tax savings/refund and provide funding for the Second Chance training program which will be taught on site, by pledging a portion of your savings/refund to Second Chance Inc.for the deconstruction.

Value of Contributed Structure: Median value from appraiser estimate range	$145,000
Tax Rate (Federal and State): Assumed tax rate; yours may differ	35%
Estimated Tax Savings: Donation value times tax rate	$50,750

Program Cash Contribution Options

Choose the option that best suits your tax strategy

	Option #1	Option #2	Option #3
Donation Date Options:	30 days after completion	By May 31, 2024	By Dec 31, 2024
Pledge Amount:	$26,000	$28,500	$31,000
Tax Savings: (On contributions at 35%)	-$9,100	-$9,975	-$10,850
Net Cost of Donations:	**$16,900**	**$18,525**	**$20,150**

Summary

Tax Savings or Refund:	$50,750	$50,750	$50,750
Cost of Donation: (After 35% tax savings)	-$16,900	-$18,525	-$20,150
Net Benefit to Donor:	**$33,850**	**$32,225**	**$30,600**

Contribution Options for $145K House* (1203-1/2 Otis St.)

It is important to understand that you will still have the same demolition costs before and after our involvement in the project. We utilize your structures for training and workforce development.

* All information provided is an example of how the program could possibly work. It is not tax advice and you should consult with your tax specialist to verify your personal benefit analysis.

- When considering Second Chance as part of the deconstruction of your home, it may help to separate it into three parts.

1. A demolition company will need to demo the house structure. Their scope of work and their cost is a constant in the project. This will need to be completed with or without Second Chance's involvement. Second Chance does not replace the demolition company. Second Chance will use the basement and/or home-owner supplied dumpster for collection of debris on the site. If Second Chance will be using the basement or some other area within the home to contain the majority of the debris, please make your builder aware of it. This debris will be removed by the demo company. In the end the site will be clear.

2. Once Second Chance is involved in the deconstruction, a tax de-ductible benefit becomes relevant because you are supporting our workforce development training program. Additionally, Sec-ond Chance brings the opportunity to keep reusable product out of the landfill and a societal benefit as we conduct our job train-ing program and improve lives.

3. The homeowner is responsible for providing a port-a-potty on site, draining the oil tank and for the removal of refrigerant from HVAC units prior to the start of deconstruction.

Value of Contributed Structure: Median value from appraiser estimate range	$145,000
Tax Rate (Federal and State): Assumed tax rate; yours may differ	35%
Estimated Tax Savings: Donation value times tax rate	$50,750

Program Cash Contribution Options

Choose the option that best suits your tax strategy

	Option #1	Option #2	Option #3
Donation Date Options:	30 days after completion	By May 31, 2024	By Dec 31, 2024
Pledge Amount:	$26,000	$28,500	$31,000
Tax Savings: (On contributions at 35%)	-$9,100	-$9,975	-$10,850
Net Cost of Donations:	**$16,900**	**$18,525**	**$20,150**

Summary

Tax Savings or Refund:	$50,750	$50,750	$50,750
Cost of Donation: (After 35% tax savings)	-$16,900	-$18,525	-$20,150
Net Benefit to Donor:	**$33,850**	**$32,225**	**$30,600**

Contribution Options for $145K House* (1203-1/2 Otis St.)

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