TECHNICAL GOALS

- Net Zero Energy
- Net Zero Water
- Passive Ventilation
- Off the Grid
- Natural Light
- Replicability

COMMUNITY GOALS

- Home Ownership
- Accessibility
- Affordability
- Flexible Space
- Aging in Place
- Food Growth
Our Team

Theresa Chiarenza, Bachelor of Architecture '20, Minor in Photography

Nhân Dung, Bachelor of Architecture '20

Ross Capaccio, Bachelor of Architecture '20

Alexxa Ingalls, Bachelor of Architecture '21, Minor in Real Estate Development

Chadd Ziegler, Bachelor of Architecture '21, Minor in Construction Management

Omar Abdurahman, Masters in Architecture '23. Bachelor in Architecture and Urban Design

Riya Malik, Master of Science in Construction Management '20

Faculty Partners

Max Zahniser, LEED Fellow, CEO of Praxis Building Solutions
Bungane Mehlomakulu, Managing Principal, Integral Group
Apoorv Goyal, Senior Building Performance Analyst, Integral Group
Shreshth Nagpal, Principal, Integral Group
Kim Zamora, PhD, LEED AP BD+C, Construction Management Faculty

Industry Partners

Glenn Rentschler, Senior Principal Engineer at Wiss-Janney-Elsner Associates
Darnetta Arce, Executive Director Lower North Philadelphia CDC
Alisia Strong, Senior Construction Manager, Philadelphia Housing Authority
Leslie Smallwood-Lewis, Owner, Mosaic Development Partners
Roger Clark, Director of Clean Energy, Reinvestment Fund
Torjia Karimu, AmeriCorps Community Outreach Coordinator, Habitat for Humanity Philadelphia
Tya Winn, Director of Project Planning, Habitat for Humanity Philadelphia
COMMUNITY BACKGROUND
Owner Occupied: 30.09%
3,761 units

Renter Occupied: 69.91%
8,740 units

Houses With a Mortgage: 1,254
33.34%

Houses Without a Mortgage: 2,507
66.66%

Median Home Value
With Mortgage: $138,900
Without Mortgage: $67,700
VACANT PROPERTIES

SHARSWOOD, PHILADELPHIA
VACANT LOT IN BETWEEN EXISTING BUILDINGS
PHA MODEL:

LEGACY HOME OWNERS → EMINENT DOMAIN OR HARD TIMES → RENTERS FOR LIFE
DEVELOPER MODEL:

1. CHEAP HOMES FOR SALE IN UNDER APPRECIATED NEIGHBORHOODS
2. EXTRACT VALUE AND OUT PRICE THE NEIGHBORHOOD. DON’T USE LOCAL TRADES OR COMPANIES.
3. SELL FOR HIGHEST DOLLAR. RAISING PROPERTY VAULE AND TAXES. ALSO NOT PUTTING MONEY INTO THE LOCAL ECONOMY.
ENDLESS POSSIBILITIES
RENOVATION AT 1423 N 29TH ST
N 29th St.

Renovation

ADA ACCESSIBLE ALLEY
CEILING EXPLORATION

EXISTING BRICK CONDITION

MASTER BEDROOM EXISTING FRAMING

ROOF EXAMINATION

SND FLOOR CEILING CAVITY

EXISTING LIVING & DINING ROOM

STRUCTURAL ANALYSIS
NEW FRAMING METHOD

FRAMING AXON

FRAMING PLANS
BRICK MASONRY PARTY WALL 6" THICK

2X8 STUD WALL (TYP) WITH HORIZONTAL (2X4) BLOCKING AT MIDHEIGHT

CHP TOP OF BASEMENT WALL SO JOIST BOTTOM DOES NOT HAVE TO BE TRIMMED MORE THAN 3/4" HIGH

2X0 @ 16" ON CENTER TO BRICK MASONRY WALLS AT END (TYP) W/ 1/2" FLOOR SHEETING

W. 8X8I W/ 2X0" BOLTED TO TOP FLANGE

1/8" IN THE FRONT PART OF REAR PART OF BASEMENT

HHS 6X6 W/8X12" @ PL TOP & BOTTOM

EL -7'-7"
SECONDARY AIR BARRIER & MASONRY TREATMENT:
REPAIR & REPOINT AS REQ'D. APPLY VSCONN LIQUID MEMBRANE OR LIME PLASTER. USE VSCONN FIBRE FOR LARGE STUDS WITH DENSE-PACK QUTEX THERMOFIBER OR CELLULOSE, OR LOOSE-FILL HAVELock WOOL INSULATION

PRIMARY AIR BARRIER:
INTELLO PLUS/INTELLO X /DB+ AIRTIGHT MEMBRANE & SMART VAPOR RETARDER
2X SERVICE CAVITY WITH OPTIONAL INSULATION

MAINTAIN SPACE FOR MASONRY REPAIR & REPOINTING AS REQUIRED/REPOSITION SPANDREL JOIST AS REQUIRED

EXISTING MASONRY WALL (REPAIR & REPOINT AS REQUIRED TO SHED WATER AT EXTERIOR FACE & MAKE WINDTIGHT)

LEDGER FOR FLOOR
NEW FLOOR JOIST

STRIP OF AIRTIGHT MEMBRANE TO CONNECT ABOVE & BELOW FLOOR STRUCTURE

TESCON VANA TAPE

PRIMARY AIR BARRIER:
INTELLO PLUS/INTELLO X /DB+ AIRTIGHT MEMBRANE & SMART VAPOR RETARDER
2X STUD WITH DENSE-PACK QUTEX THERMOFIBER OR CELLULOSE, OR LOOSE-FILL HAVELock WOOL INSULATION

INTERIOR Finish
2X SERVICE CAVITY WITH OPTIONAL INSULATION

PARTY WALL DETAIL

OVERHANG DETAIL

EXISTING MASONRY WALL

R-30 INSULATION

TEES ON VANA TAPE

PRIMARY AIR BARRIER:
INTELLO PLUS/INTELLO X /DB+ AIRTIGHT MEMBRANE & SMART VAPOR RETARDER
2X STUD WITH DENSE-PACK QUTEX THERMOFIBER OR CELLULOSE, OR LOOSE-FILL HAVELock WOOL INSULATION

INTERIOR FINISH
2X SERVICE CAVITY WITH OPTIONAL INSULATION

WALL DETAILS
## COST ESTIMATE

### Project: Attached Housing - Renovation at 1423 N 29th St

<table>
<thead>
<tr>
<th>Gross SF</th>
<th>2185</th>
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<tbody>
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<td>Date:</td>
<td>15/2/2020</td>
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<table>
<thead>
<tr>
<th>CSI</th>
<th>Description</th>
<th>Amount</th>
<th>$ / S.F.</th>
<th>% of Total</th>
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<td>GENERAL REQUIREMENTS</td>
<td>$38,758</td>
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<td>02</td>
<td>PERMITS</td>
<td>$2,000</td>
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<td>02</td>
<td>EXISTING CONDITIONS</td>
<td>$39,025</td>
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<td>03</td>
<td>CONCRETE</td>
<td>$2,400</td>
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<td>04</td>
<td>MASONRY</td>
<td>$412</td>
<td>$0.19</td>
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<tr>
<td>06</td>
<td>WOOD, PLASTICS, AND COMPOSITES</td>
<td>$36,206</td>
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<td>07</td>
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<tr>
<td>08</td>
<td>OPENINGS</td>
<td>$8,763</td>
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<tr>
<td>09</td>
<td>FINISHES</td>
<td>$13,026</td>
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<td>SPECIALTIES</td>
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<td>21</td>
<td>FIRE SUPPRESSION</td>
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<td>26</td>
<td>ELECTRICAL</td>
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</table>

**TOTAL DIRECT COSTS**  
$182,613  
83.58  
92.0%

**SALES TAX**  
6.0%  
$ -  
0.00  
0.0%  

**GENERAL OVERHEAD**  
3.0%  
Subtotal  
$182,613  
83.58  
92.0%  

**CM FEE/PROFIT**  
2.0%  
Subtotal  
$188,091  
86.08  
94.7%  

**SUBTOTAL A**  
$191,853  
87.80  
96.6%  

**BONDS**  
0.0%  
Subtotal  
$191,853  
87.80  
96.6%  

**INSURANCE**  
1.0%  
Subtotal  
$193,722  
88.68  
97.6%  

**CONTINGENCY**  
2.5%  
Subtotal  
$198,568  
90.88  
100.0%  

**SUBTOTAL C**  
$198,568  
90.88  
100.0%  

**TOTAL**  
$198,568  
90.88  
100.0%  

---

### Shared Elements

- (windows, insulation, etc)

#### Typical Renovation
- Scope of Work: $150k
- 7% INTEREST

#### Net-Zero Energy
- Scope of Work: $200k
- 3% INTEREST
NEW 1ST FLOOR PLAN

NEW 2ND FLOOR PLAN

BEDROOM

OFFICE

FAMILY ROOM

NEW FLOOR PLANS
MASSING REPRESENTING ADJACENT PARTY WALL

LEED Metrics
12% sDA

8 DEGREE ROTATION
LEED Metrics
16% sDA

98 DEGREE ROTATION
LEED Metrics
11% sDA

189 DEGREE ROTATION
LEED Metrics
12% sDA

-81 DEGREE ROTATION
URBAN INFILL MODEL
The Old Way
2x4 @ 16” O.C.
R-11

The Advanced Framing
2x6 @ 24” O.C.
R-19
<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>$/S.F.</th>
<th>% of Total</th>
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<td>00 PERMIT</td>
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<td>01 GENERAL REQUIREMENTS</td>
<td>$113,645</td>
<td>$48.57</td>
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<td>02 EXISTING CONDITIONS</td>
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<td>03 CONCRETE</td>
<td>$12,000</td>
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<td>04 MASONRY</td>
<td>$5,000</td>
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<td>06 WOOD, PLASTICS, AND COMPOSITES</td>
<td>$63,635</td>
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<td>07 THERMAL AND MOISTURE PROTECTION</td>
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<td>09 OPENINGS</td>
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<td>09 FINISHES</td>
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<tr>
<td>10 SPECIALTIES</td>
<td>$18,075</td>
<td>$7.72</td>
<td>4.9%</td>
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<td>21 FIRE SUPPRESSION</td>
<td>$225</td>
<td>$0.10</td>
<td>0.1%</td>
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<tr>
<td>22 PLUMBING</td>
<td>$8,485</td>
<td>$3.63</td>
<td>2.3%</td>
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<tr>
<td>23 HVAC</td>
<td>$12,265</td>
<td>$5.24</td>
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<td>26 ELECTRICAL</td>
<td>$16,484</td>
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<td>TOTAL DIRECT COSTS</td>
<td>$344,662</td>
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<td>SALES TAX</td>
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<td>GENERAL OVERHEAD</td>
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<td>CM FEE/PROFIT</td>
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<td>SUBTOTAL A</td>
<td>$362,102</td>
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<td>BONDS</td>
<td>$3,621</td>
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<td>1.0%</td>
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<tr>
<td>INSURANCE</td>
<td>$3,621</td>
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<td>1.0%</td>
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<tr>
<td>CONTINGENCY</td>
<td>$1,811</td>
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<tr>
<td>DESIGN</td>
<td>$0.00</td>
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<td>0.0%</td>
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<tr>
<td>OTHER (PLUG)</td>
<td>$0.00</td>
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<tr>
<td>TOTAL</td>
<td>$371,154</td>
<td>$158.61</td>
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</tbody>
</table>
RAINWATER (Irrigation)
POTABLE WATER (Sinks and Showers)
GRAYWATER
TREATED GRAYWATER (Laundry, Dishwasher, Toilet, Irrigation)
BLACK WATER (Unusable)
SOLAR CHIMNEY DIAGRAM
TYPICAL CONSTRUCTION

NET ZERO CONSTRUCTION

ORIENTATION 1

ORIENTATION 2

ORIENTATION 3

ORIENTATION 4

45 ADVANCED FRAMING

ENERGY
ENGINEERING
FINANCIAL FEASIBILITY
RESILIENCE
ARCHITECTURE
OPERATIONS
MARKET POTENTIAL
COMFORT & ENVIRONMENT
INNOVATION
Baseline Energy

Whole Building EUI
13.52

LEED Points - EAc2 Credit
No data available for this project.

CO2 Reduction %
70

Benchmarking Energy
Baseline
Your EUI
2020 Baseline
2020 Tenant

Whole Building EUI Breakdown

INFILL EUI BEFORE SOLAR

Single Family Home 13.52 kWh/yr
Electricity $872.89 yr
Natural Gas $0 yr

2000 Baseline Emissions
2.1 tons CO2e/yr

1 truck CO2e/yr

INFILL EUI WITH SOLAR

Whole Building EUI
-8.58

LEED Points - EAc2 Credit
No data available for this project.

CO2 Reduction %
No Data Available

Whole Building EUI Breakdown

Height (ft) 32
Roof Area (ft²) 0.0096
Floor Area (ft²) 1943
Skylight Area (ft²) 0

Rotate Building 0°

Wall Area (ft²)
N 1726.3 NE 0 E 437.8 SE 0
S 1775.2 SW 0 W 452.3 NW 0

Glazing Area
N 64.8 NE 0 E 112 SE 0
S 65.6 SW 0 W 54.5 NW 0

Envelope
Usage and Schedules
Building System
Energy Generation
General

Roof R-Value (h ft² BTU/F°F)
0.6
Wall R-Value (h ft² BTU/F°F)
0.36
Glazing U-Value (BTU/h ft² °F)
0.15
Skylight U-Value (BTU/h ft² °F)
0.15
Skylight SHGC
0.36
Envelope Heat Capacity
Very Heavy
Blinds/Curtains/Shades
(Extension) Blinds
Wall Emissivity
Our infill model can fill in 228 vacant lots between buildings, and 245 vacant properties can be renovated to produce a net positive energy balance as well as heavily reducing the burden on water management in the city.
Row homes make up 60% of housing in Philadelphia, as well as a significant portion of building stock nationwide. Our individual designs have the potential to transform attached housing development and renovation across the city and even the country.

<table>
<thead>
<tr>
<th>City</th>
<th>Single unit detached</th>
<th>Single unit attached</th>
<th>Two units</th>
<th>Three or four units</th>
<th>Five to nine units</th>
<th>Ten to 19 units</th>
<th>20+ units</th>
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<tbody>
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<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>New York City</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
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<tr>
<td>Washington</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
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<tr>
<td>Baltimore</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
<td></td>
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<tr>
<td>Chicago</td>
<td>0%</td>
<td>20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
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<tr>
<td>Los Angeles</td>
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<td>20%</td>
<td>40%</td>
<td>60%</td>
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<td>Seattle</td>
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<td>80%</td>
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<td>60%</td>
<td>80%</td>
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<tr>
<td>Detroit</td>
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<td>40%</td>
<td>60%</td>
<td>80%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau, American Community Survey
Icons by Martin Lebreton and Arthur Shlain, The Noun Project
In addition to our technical goals of being off the grid for both water and energy,
we also set social, economic and cultural goals based on our meetings with community members. A single net-zero energy row home can improve economic stability and quality of life for one family, but we wanted our project to have the potential to impact the entire community of Sharswood.
We set out to do this through a block scale intervention that combines infill and renovation models for a total of 12 units.
Our plan for 6 infill models and 6 renovations sits one block just North of Girard College.
We began by filling in gaps between existing buildings, leaving large open areas for public shared space and back of house access. This led to the design of a shared backyard model that connects to these open spaces, increasing accessibility while providing community space and resources that increase social and economic resilience, food access, air quality and public safety.
The idea for a shared backyard stems from an obvious waste of space in existing Philadelphia city planning. Lots are required to leave 25% open area, but because there isn't much space to move around, these tiny backyards are often neglected, used for storage and fenced in. Instead, the front porch, stoop and sidewalk have become the cultural playground in Philadelphia. In Sharswood and in many North Philadelphia neighborhoods where city planning did not allot space for public parks, this means there is not much green space for residents to enjoy.
To utilize this wasted space, we developed a backyard buyback program in which residents would still own their backyard, but receive a subsidy from the Philadelphia Water Department to take down their fence and offer a portion of their land for shared space. This becomes a safe, sheltered area for the residents to gather, cook together at shared grills,
grow produce, and build a sense of community. This model is inspired by co-living models where shared spaces are looked after by everyone.
This encourages residents to have a sense of pride in their neighborhood and to get to know their neighbors better.
This shared backyard space also provides a solution for the water management problem in Philadelphia. The current sewer system is combined with rainwater runoff, which means that every time there is a major storm, the sewage overflows into the Delaware River. The city pays so many fines to the Environmental Protection Agency every year for violating the Clean Water Act that it actually has a budget for that purpose. This contaminated water is the city's main source of potable water.
The city of Philadelphia recognizes the flaws in the current system and has proposed some strategies for rainwater retention. Curb cuts from the street feed into rain gardens, which vary in size and are funded from the same budget that pays fines to the EPA. However, these strategies do not address the runoff from buildings and are few and far between.
Our design suggests a new model for water management in which the city block can become a tool for rainwater collection, filtration, and retention that will eventually lead to the closure of the combined sewer system and the rejuvenation of our city's rivers, saving the city of Philadelphia thousands of dollars per year.
Using the most advanced water modeling program in the world provided by our engineering faculty at Integral Group, we determined that roof collection alone is enough for all units to have a positive water balance on an average year. This graph shows the water balance as the black line. Although it dips below 0 gallons in dry months, the excess water collection in wet months nets a positive balance.
In a dry year, the infill homes with smaller footprints will struggle in the dryer months, dipping too far below the line for the wetter months to balance out.

**Annual Water Balance -1200 gal**
However, when the collection systems are consolidated at the block scale, shared cisterns allow excess water from the larger roofs of renovations to offset the large dips below the line for the infill models in dry years.

Annual Water Balance +14241 gal
Integral Group's advanced computing system takes into account wet and dry years to determine the optimal cistern size so that it is never empty throughout the year. Using this tool, we determined that 12 units would need a total storage capacity of 37,500 gallons.
The block is phased in 3 sections of 4 homes, each with their own 12,500 gallon tank that is integrated into the landscaping.
The block is phased in 3 sections of 4 homes, each with their own 12,500 gallon tank that is integrated into the landscaping.
The block is phased in 3 sections of 4 homes, each with their own 12,500 gallon tank that is integrated into the landscaping.
Each unit includes smaller "day tanks" for potable water and treated greywater that are easier to maintain and hold enough water for about a week's worth of water usage. Adding new amenities such as play areas and parks in each phase helps convince neighboring properties to participate in the backyard buyback program. In the final plan, it is assumed that 80% of the block will opt into the program, allowing space to connect the bioswales.
Block operations are powered by panels that are entirely off the grid, with a battery located in an existing vacant property which we have identified as a potential location for a laundromat. Laundromats are community hubs in many Philadelphia neighborhoods, so we hope this will build a sense of community while also reducing water usage in the units.
The second floor is a flexible community space that can double as a satellite office for the CDC, making operations easier for the whole block.

This laundromat's water supply is a separate system which diverts runoff from the street and through the backyard bioswale. This bioswale becomes a location collection, as well as a first layer of filtration before the water is pumped through a series of filters and used in washers.
Local flora helps retain and filter the water and doubles as a carbon sequester, cleaning the air for the whole block.
This system has a positive water balance of over 30 thousand gallons per year even with 16 washers. This shows the enormous amount of water runoff that is going to waste every year and contributing to the contamination of the Delaware River. This excess water will be retained and reintroduced to the aquifer through percolation pits in the bioswale.
We initially proposed this bioswale in the backyard of the infill properties as a source of coolth for the solar chimney.
At the block scale, the bioswale can run through all yards participating in the backyard buyback program. This creates a cooler outdoor environment which actually improves performance of existing buildings.
If PWD made it a priority to retain water in backyards on every block while converting existing and new homes to a rainwater capture and reuse model like we are proposing, the aging sewer infrastructure could eventually be retired and water quality in the river would increase over time.
We recognize that all of these elements come at a price, so we began to design a business plan in which a portion of the profit from selling the infill models at market rate is able to bankroll affordable renovations. The net profit from a paired infill and renovation is about $180,000. Although this is successful, it does not leave room for revenue growth.
Adapting this core concept, we designed a growth model in which profit from installing solar panels around the neighborhood will be able to fund construction and exponentially grow the profits and capabilities of the CDC.
Beginning in 2021, the CDC will become a solar company. The cost of installing solar on an existing home is about 5,000 dollars—a relatively low number due to the capability of the CDC to utilize workforce development training as an inexpensive installation tactic. The CDC can then afford to sell energy to homeowners at a lower rate than the Philadelphia Electric Company while selling excess energy back to the grid.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SCOPE OF WORK &amp; COSTS ASSOCIATED</th>
<th>SOLAR INCOME</th>
</tr>
</thead>
</table>
| 2020 | BORROW FROM REINVESTMENT FUND FOR RENOVATION @ 1423 N 29TH ST  
LOAN: $198,000  
SELLING PRICE: $245,000  
PROFIT: $47,000 | $27,489  
(21 homes) |
| 2021 | BORROW FROM REINVESTMENT FUND FOR  
SOLAR INSTALLATION ON 20 EXISTING HOMES  
x20  
LOAN: $100,000 @ 4% INTEREST RATE FOR ENERGY MEASURES | $27,489  
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| 2021 | BORROW FROM REINVESTMENT FUND FOR SOLAR INSTALLATION ON 20 EXISTING HOMES  
LOAN: $100,000 @ 4% INTEREST RATE FOR ENERGY MEASURES | $27,489 (21 homes) |
| 2022 | BORROW AGAINST EXPECTED INCOME FROM 11 PANELS OVER 15 YEARS  
LOAN: $198,000  
SELLING PRICE: $160,000  
PROFIT: -$52,950  
PAY OFF COST OF 10 PANELS: $54,000 NO LONGER OWED | $27,489 (21 homes) |
| 2023 | BORROW FROM REINVESTMENT FUND  
LOAN: $371,238  
4% INTEREST RATE FOR ENERGY MEASURES  
7% INTEREST RATE FOR TYP. BUILDING SCOPE  
RENOVATION  
LOAN: $198,000 (+$4,950 IN INTEREST)  
SELLING PRICE: $160,000  
PROFIT: -$52,950  
PAY OFF COST OF REMAINING 10 PANELS: $54,000 NO LONGER OWED | $27,489 (21 homes) |
|      | INFILL  
LOAN: $371,238 (+ $9,281 IN INTEREST)  
SELLING PRICE: $600,000  
PROFIT: $219,461 | $62,531 TO CDC OPERATIONS |

NET PROFIT: $166,531  
$62,531 TO CDC OPERATIONS
Investing this profit into more solar for the neighborhood increases the CDC's assets, allowing them to borrow more money and increasing yearly revenue.

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</tr>
<tr>
<td>2023</td>
<td>RENOVATION</td>
<td>$27,489 (21 homes)</td>
</tr>
<tr>
<td>2024</td>
<td>SOLAR INSTALLATION ON 10 HOMES</td>
<td>$27,489 (21 homes)</td>
</tr>
</tbody>
</table>

**NET PROFIT:** $166,531

**$62,531 TO CDC OPERATIONS**
2024 (cont’d)

**SOLAR INSTALLATION ON 10 HOMES**
- COST: $50,000, NO LOAN REQUIRED

**BORROW AGAINST EXPECTED INCOME FROM 29 PANELS OVER 15 YEARS**
- LOAN: $569,238

**RENOVATION**
- LOAN: $198,000 (+ $4,950 IN INTEREST)
- SELLING PRICE: $150,000
- PROFIT: -$48,050

**INFILL**
- LOAN: $371,238 (+ $9,281 IN INTEREST)
- SELLING PRICE: $600,000
- PROFIT: $219,481

**NET PROFIT: $166,531**

$43,197 (33 homes)

$86,531 TO CDC OPERATIONS
2024 (cont’d)

<table>
<thead>
<tr>
<th>Solar Installation on 10 Homes</th>
<th>Cost: $50,000, No Loan Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrow Against Expected Income from 29 Panels Over 15 Years</td>
<td>Loan: $56,9238</td>
</tr>
</tbody>
</table>

**Net Profit: $166,531**

**$86,531 to CDC Operations**

2025

<table>
<thead>
<tr>
<th>Solar Installation on 16 Homes</th>
<th>Cost: $60,000, No Loan Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrow Against Expected Income from 41 Panels Over 15 Years</td>
<td>Loan: $802,476</td>
</tr>
</tbody>
</table>

**Net Profit: $377,462**

**$177,462 to CDC Operations**
After 5 years of this, the CDC is then capable of financing the model which we are proposing at the block scale.
By owning over 62 solar arrays, the CDC has the capability to borrow against these for 1.2 million dollars, which is the maximum loan from Reinvestment Fund’s Clean Energy Fund. This supports 2 infills and 2 renovations. After operations costs, this leaves the CDC with a profit of over 200 thousand dollars to do with what they wish. Excess profit can be used to bankroll an additional renovation, provide solar to 40 more homes, used as a safety net or for debt forgiveness, or could go into other community improvements.

**TYPICAL DEVELOPMENT MODEL**

BORROW AGAINST EXPECTED INCOME FROM 62 PANELS OVER 15 YEARS
LOAN: $1,200,000 (REINVESTMENT FUND MAXIMUM LOAN)

2 RENOVATIONS
LOAN: $596,000 (+$9,900 IN INTEREST)
SELLING PRICE: $300,000
PROFIT: -$105,900

2 INFILLS
LOAN: $424,476 (+ $18,592 IN INTEREST)
SELLING PRICE: $1,200,000
PROFIT: $458,962

**OPTIONS FOR PROFIT USE**

RENOVATION
COST: $198,000, NO LOAN REQUIRED
SELLING PRICE: $150,000
PROFIT: -$48,000

SOLAR INSTALLATION ON 46 HOMES
COST: $230,000, NO LOAN REQUIRED

EXTRA PROFIT & PAY RAISES FOR CDC UP TO: $233,000

UTILITY DEBT FORGIVENESS IN THE FACE OF A CRISIS OR HARDSHIP UP TO: $233,000, OR ENERGY FOR 167 HOMES

OTHER NEIGHBORHOOD IMPROVEMENTS BIOSWALE, CLEANUPS, MURALS, ETC. UP TO: $233,000

PROFIT: $333,062
- 100,000 FOR CDC OPERATIONS = 233,062 YEARLY NET PROFIT

THIS 2:2 RATIO CAN BE CONTINUED INDEFINITELY, FUNDED EACH YEAR THROUGH THE MAXIMUM LOAN OF 1,200,000 FROM REINVESTMENT FUND’S CLEAN ENERGY FUND & NETTING $233,062.
This business model encourages mixed income neighborhoods of net zero housing that utilize passive strategies, reduce the burden on the electric grid, and eliminate the need for the aging combined sewer system through an advanced water model. Our business plan proves that financing this is not only feasible, but the system nets more profit each year as solar spreads across the neighborhood, giving the CDC a safety net and allowing them to adjust this model block by block. This has the potential to inspire other development corporations across the city and even the country to implement this as a new model for regenerative development in low income communities.
THANK YOU.