Center for Buildings, Infrastructure and Public Space
New York City Housing Authority Study

Under the guidance of Prof. Feniosky Peña-Mora and Adjunct Assoc. Prof. Rick Bell

Research Team: Vignesh Nandha, Pavan Kantharaj, Daili Peng, Haihang Gui, Felipe Paniagua, Misha Mohan, Rain Li, Vijay Mallangi, Tanushri Ganesh

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Background and Introduction

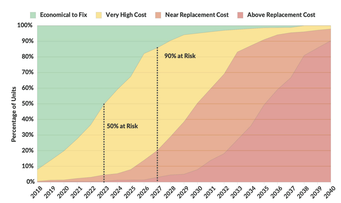
A Snapshot of NYCHA's Portfolio

Source:- [1] NYCHA 2018 Fact Sheet

- Provides affordable housing for 583,358[1] residents of NYC
  - Through leasing - 392,259 Residents
  - Section 8 vouchers - 191,099 Residents
- 8% of the rental housing stock in NYC is owned by NYCHA
- 60% of NYCHA's buildings were built before 1970s

Projection of NYCHA Capital Needs over the next two decades

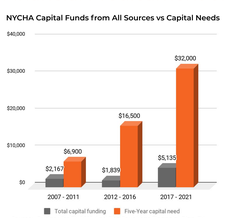
The graph on the right side represents the percentage of deterioration of NYCHA's housing stock for years 2018 - 2020.
By 2027 we can see that 90% of the NYCHA units will have a very high cost of repairs. It is evident that the time is of essence and greater the delay more expensive it will become to fix the issues.



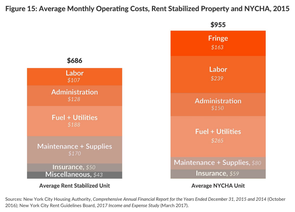
Note: Assumes construction costs and replacement costs grow at 4 percent annually and capital needs grow at an average annual rate of 10.6 percent, which was the annualized rate of growth between the 2011 and 2017 physical needs assessments.

Sources: CBC staff analysis of New York City Housing Authority, 2017 Physical Needs Assessment and Development Data Book 2017 (December 2017).

Financial Predicament of NYCHA



Source:- Budget for FY 2018 And The Four Year Financial Plan FY 2019-2022, 2017 Physical Needs Assessments, 2011 PNA.



Sources: New York City Housing Authority, Comprehensive Annual Financial Report for the Years Ended December 31, 2015 and 2014 (October 2016); New York City Rent Guidelines Board, 2017 Income and Expense Study (March 2017).

Current Status

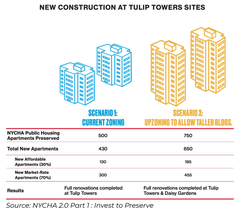
NextGen NYCHA

- In May 2015, Mayor Bill de Blasio announced NextGeneration NYCHA
- 10-year strategic plan to improve NYCHA housing and operations

NYCHA 2.0

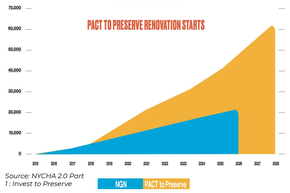
- 10-year plan to resolve $24 billion need for vital repairs
- Renovations of 175,000 units
- Objectives -
  - Pact to Preserve (RAD and PACT)
  - Build to Preserve
  - Transfer to Preserve

1.Build to Preserve



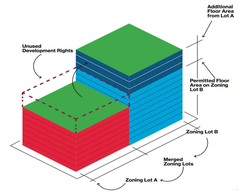
Source: NYCHA 2.0 Part 1 : Invest to Preserve

2.Pact to Preserve



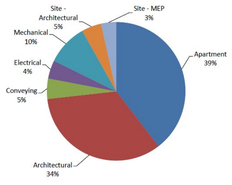
Source: NYCHA 2.0 Part 1 : Invest to Preserve

3.Transfer to Preserve



Source: NYCHA 2.0 Part 1 : Invest to Preserve

Findings - Physical Needs Assessment



Source: Physical Needs Assessment - STV & AECOM (JV) - 2017

Need 1: Apartments

1. Kitchen renovation

Energy saving refrigerator (Haier)

- Extra cost for changing refrigerator: -$214,914 (2193 apartments)
- Total electricity cost saved: + $92,720
- Payback period of 3 years

	Top-mounted freezer model	Bottom-mounted freezer model	Haier BCD-226SDCZ
Basic Cost	$350- 600	$800-1200	$448
Energy Cost (per Year)	472 kWh	551 kWh	219 kWh
Electricity Cost (per Year)	$78.87	$92.07	$36.59

Source: Report of U.S. Energy Information Administration, 2013

2. Bathroom renovation

Integrated bathroom design

- Extra Cost: $95 per system
- Water saving: 1.3 gallons per toilet per day, about 474 gallons annually by an average of 2.57 users

Name	Days of install	Meter read (gallons)	Number of persons using toilet	Avg daily water saving(gal)	Avg daily water saving per person(gal)
TS	29	60	4	2.07	0.52
BC	53	100	2	1.89	0.94
ES	50	200	4	4.00	1.00
JC	83	40	2	0.48	0.24
MB	87	20	2	0.23	0.11
AW	91	40	2	0.44	0.22
JS	70	140	2	2.00	1.00
Average	6.61	85.71	2.57	1.3	0.58

Source: Field Study of the AQUS Water Saving Device

3. Piping system renovation

Hot water insulation

- Reduce heat loss and can raise water temperature 2-4 degrees Fahrenheit
- Material Cost: $1.2 - $3.5 per ft
- Energy Saving: $9.5[1] million in total for NYCHA

[1] Physical Needs Assessment (PNA) 2017: Potential annual savings with energy conservation measures

Savings	Energy (MMBtu/year)	Money ($000/year)
Hot water & Steam pipes insulation	1,206,614	9,519

Source: Physical Needs Assessment - STV & AECOM (JV) - 2017

Contrast between 1965 and now in a typical NYCHA Apartment

Source: The New York Times

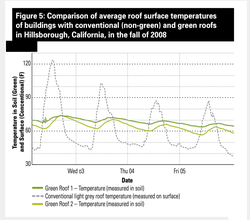
Need 2: Architectural

Roofs at NYCHA - Disadvantages

- Coal Tar Roofs
- Warm roofs lead to:
  - Increase in building temperature
  - Change in wind patterns
  - Loss of roof life due to expansion and contraction
  - High heating and cooling expenses
- Total roof area (all NYCHA developments): 2.7 Million Sq. Ft equivalent to built up area of Empire State Building

Stuyvesant Town–Peter Cooper Village

Source: https://www.greenroofs.com/2019/04/18/april-18-2019-new-york-passes-mandatory-green-roof-legislation/



Source:NRDC Report June 2012 R:12-06-B, Looking Up: How Green Roofs and Cool Roofs Can Reduce Energy Use, Address Climate Change, and Protect Water Resources in Southern California

Green Roofs

- Depending on the accessibility and structural capacity of roof we either can go with a simpler sedum green roof or a more extensive green roof
- Green roof maintained by community, students, residents
- Partnerships -
  - Green City Force - Americorps (Volunteers)
  - Brooklyn Grange (Expertise)
  - Chefs, Restaurants (Customers)
  - Royal Waste Services (Composting)
- Mitigates -
  - Urban Heat Island Effect
  - Stormwater Runoff
  - Extend Roof Life

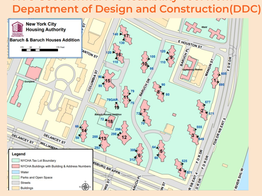
Need 3: Mechanical Systems

NYCHA's 3rd largest need, estimated at $ 3.1 Billion.
Heating plants are the major concern area which require about $ 1.33 Billion.
Around 744 boilers have Remaining Useful Life (RUL) of 5 years or less.

Proposed Solution: Geothermal System for Heating and Cooling

It is a clean and efficient renewable energy technology used to heat and cool a home. It takes advantage of the relatively constant temperature of the earth's interior using it as a source or sink for heat. When cooling, heat is extracted from the building and dissipated into the earth; when heating, heat is extracted from the earth and pumped into the space.

NYC Geothermal Pre-feasibility Tool from Department of Design and Construction(DDC)



Geothermal System	Standing Column Well	Closed Loop	Open Loop**
Geological and Technical Suitability (Yes/No)	Yes	Yes	Yes
Potential Capacity (Tons)	13,980	7,534	4,194
Full System Feasible (Yes/No)	Yes	Yes	No
Hybrid System Feasible (Yes/No)	N/A	N/A	No
Carbon Footprint Reduction (Tons CO2e)	5,339	5,385	
Annual Cost of Carbon ($)	726,065	732,306	0
Annual Potential Savings with Geothermal System ($)	1,503,196	1,525,660	0
Projected Incremental Payback with Carbon Credit (Years)	21	7	
Projected Incremental Payback without Carbon Credit (Years)	30	10	

NOTE: The City's critical infrastructure, such as water tunnels, shafts, or appurtenant facilities are regulated by the New York City Department of Environmental Protection ("DEP"). DEP is in the process of promulgating rules to require that any boring, drilling or excavation to a depth of 50 feet in the borough of the Bronx or north of 135th Street in the borough of Manhattan or to a depth of 100 feet in any other location / borough in New York City first be reported to DEP. Please send written notification of intention to drill or excavate to: Chief of Site Connection and Plan Review, Bureau of Water and Sewer Operations, 9605 Horace Harding Expy, 3rd Floor, Flushing, NY 11368-4100

Social Benefits:

- LEED Certification for geothermal system, translates to better health of the building occupants
- Reduces stress on the community due to budget cuts and rise in fuel prices in the future

Financing:

NEW YORK STATE OF OPPORTUNITY. NYSERDA — $26.5 M for cutting edge renewable technology

U.S. DEPARTMENT OF ENERGY — $14.5 M to Advance Geothermal Drilling Technologies

RGGI Inc. — Raised $3.1 B through auctions for investment in energy efficient technologies

Diversco energy — Geothermal Utility Model where they Design, Build, Own and Operate the system

Need 4: Conveying System

Reported Malfunctions

- 70 East 108th Street - Elevator breakdown at least four times a month
- Brooklyn 177 Sands Street - Elevators out of service for 6 days
- 400,000-plus public housing residents at greater risk of elevator accidents.

Reasons for Malfunctions

- 10 mechanics - inspect 3000 plus elevators - unskilled mechanics
- Training given only for 3 days
- Managerial issues more than technical issues

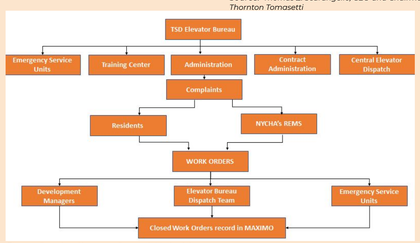
Audit Report - Findings

- Response to reported outages needs improvement
- Preventive Maintenance not consistently performed
- Reporting outages date and performance measure

Social Benefits

- Train unemployed NYCHA residents as mechanics[1]
- Mechanics trained at NYCHA Training Center
- Monthly Elevator Feedback
- App + Customer Service
- Encourage staircase use

Source: [1]Thomas Z. Scarangello, CEO and Chairman, Thornton Tomasetti



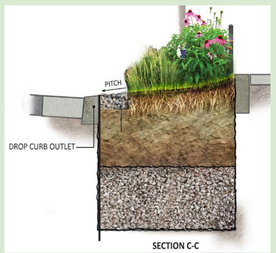
Source: Based on Singapore Research Methodology

Need 5 : Site – Architectural, Mechanical, Electrical

- Floodable Parks and Floodwalls
  Improve flood resiliency, landscaping, and community development
- Bioswales and Porous Sidewalks
  Increase flood resilience (can drain 80,000 gallons/sqft. a year) while embellishing sidewalks [2]
- LED Technology and Solar Energy
  Reduce energy consumption, utility expenses (up to $32 M/yr) , and carbon footprint (up to 38,000 metric tons/yr) [3]

[2] Calculated with data from to the Department of Environmental Protection of New York City.
[3] Calculated with data from to the Department of Energy of the United States.

Landscape resilient project: Yanweizhou park in the city of Jinhua City, China. (Landezine, 2015)



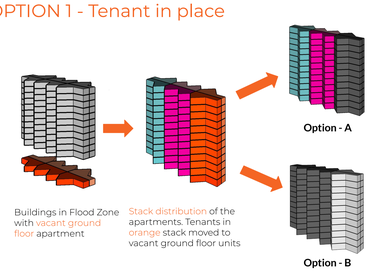
Bioswale (Environmental Protection NYC)

Queensboro Bridge citibike station.

Logistics and Phasing

NYCHA has a vacancy rate of 0.6% and there is a trust deficit between NYCHA and its tenants as the tenants fear they will be displaced during the renovations. We have tried to address these concerns in the proposed solutions.

OPTION 1 - Tenant in place



- The two gray stacks are renovated first
- After that the pink stacks are renovated
- The cycle continues till the whole campus is finished

- The light grey stack acts as hospitality suite
- Residents return to their apartment each evening
- Units in the dark grey stacks are renovated simultaneously

OPTION 2 - Tenant in Onsite Modular housing

- Prefabricated, hence quick installation time
- Can be installed in Parking lots - Temporary
- More modular units, faster the renovation - So, Issue of Cost vs Time
- Units can be shifted to other campuses, so the effective cost comes down over time
- Preserves the social and community networks of the tenants as they are onsite