A DEEP TECH APPROACH TO MAKE NYC STRONGER, FAIRER, AND MORE RESILIENT

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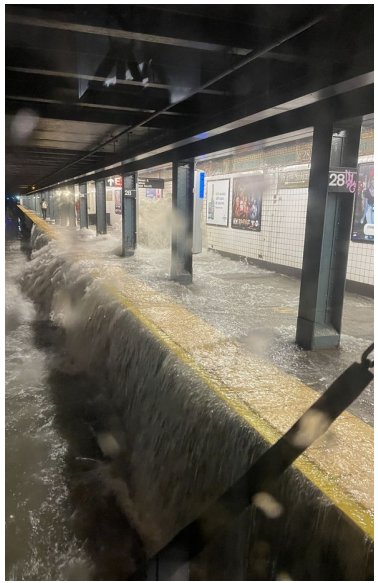
STRONGER

Addressing Urban Flooding in NYC: Smart Stormwater Management

NYC is seeing an increase in extreme rainfall events and flooding...



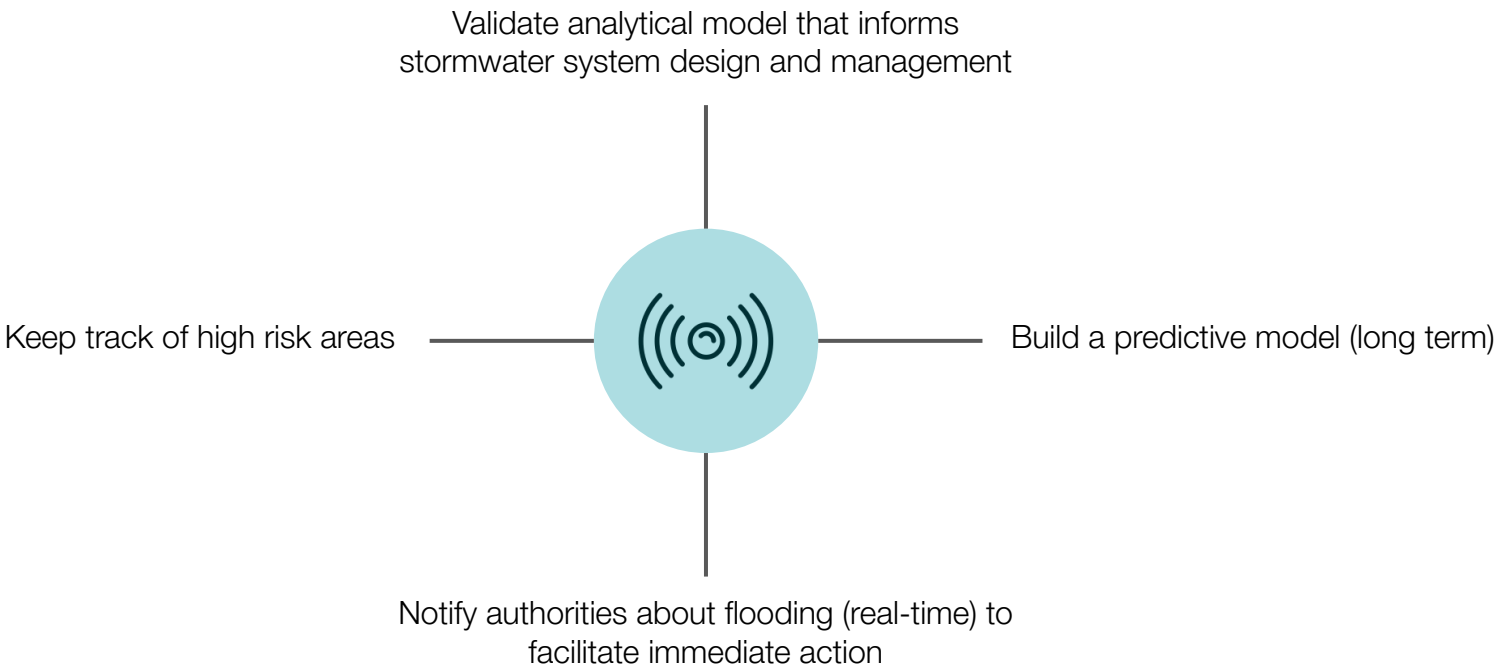
NYC subway crews recount frightening flood from Ida: 'I've never seen anything like it'

40+ killed by the heavy rains and flooding in the New York region due to Hurricane Ida

Source: https://www.nytimes.com/2021/09/02/nyregion/ida-new-york-flood.html, https://www.nydailynews.com/new-york/ny-subway-flooding-20210902-pna74vuvzjdxzm4laqy66d64ga-story.html

General strategy: An IoT approach to addressing urban flooding

We want to leverage the power of sensors for real-time tracking of water levels, flows, and quality in pipes



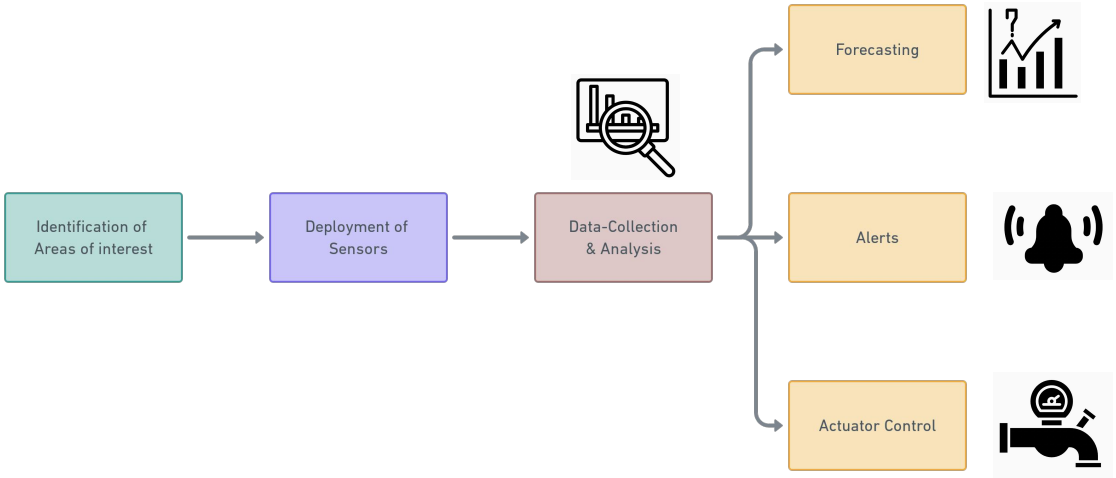
Cloud-based control system components

General strategy

Additional layers

- ➔ Addition of smart stormwater controllers
- ➔ Water quality monitoring
- ➔ Forecasting feature

Proposed Solution: Sensors deployed in underground systems



Key Benefits of the Solution

Track flow and flood risk in real time

Reduced structural damage

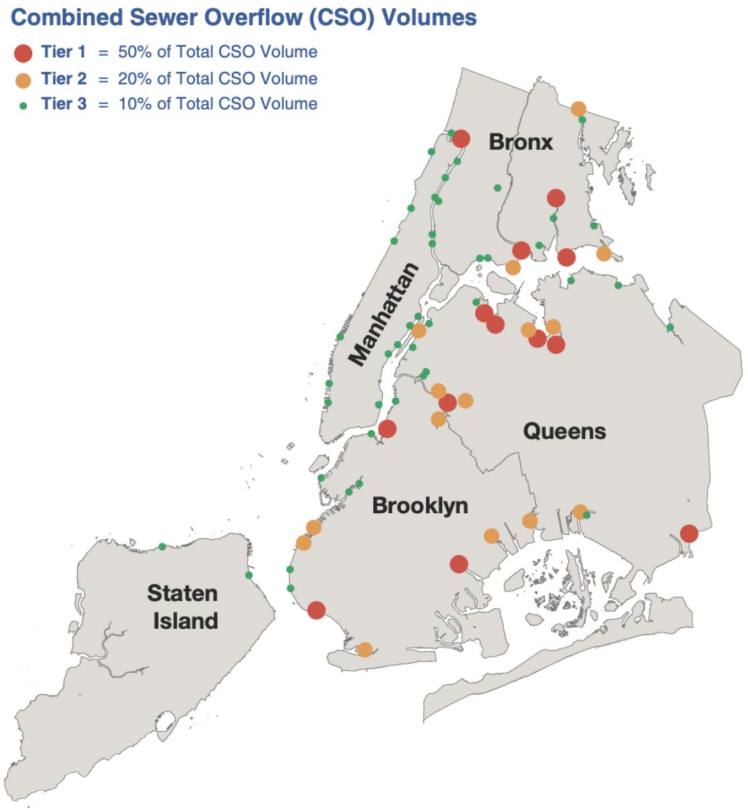
Reduced response times

Quantify urban sewage flows

Protect citizens

Design resilient and stronger communities

Implementation: Phase I (Consultation)



WHO: NYC Department of Environment Protection

TIMELINE: 2 - 3 months

Conduct a study to identify areas for sensor deployment

- Identify areas with highest risk in terms of number of overflows per year and flood risk (FEMA flood zones)
- Narrow down to a particular areas based on the risk assessment as well as accessibility and practicality
- Perhaps **Southeast Queens** is a good area to start with as an improvement project is ongoing there

Source: https://www1.nyc.gov/assets/dep/downloads/pdf/water/nyc-waterways/citywide-ltcp/ltcp_disp_nyc_cso_program.pdf, https://www1.nyc.gov/office-of-the-mayor/news/646-21/city-completes-17-3-million-sewer-street-upgrade-rosedale-queens

Implementation: Phase II (Deployment)

Using a private company cloud-based platform tool

TIMELINE: 1 year

Deploy **flow volume and water quality sensors** at outfalls

Use **tension rings or mounting plates** to ensure sensors stay in place

Real time data transmitted to cloud every few minutes

DEP team to analyze and visualize data using **dashboard**

Receive **real-time alerts** on emergency water overflows or quality disturbances


FAIRER

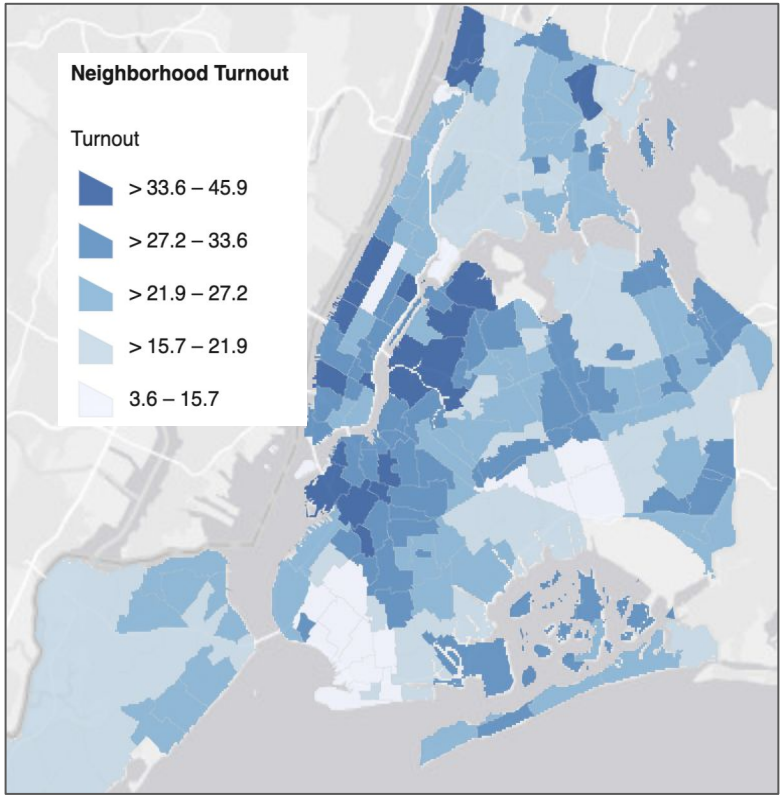
LinkVoteNYC

Addressing Equity in the Voting System

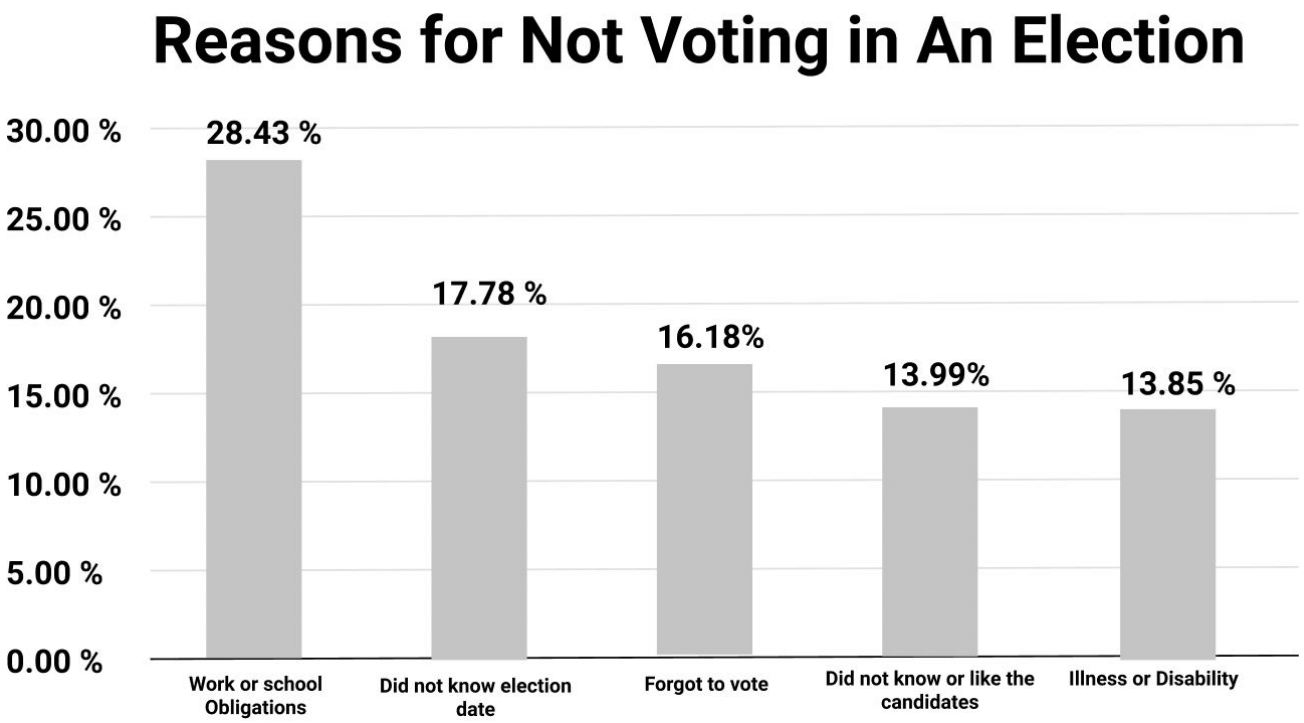
The Ground Scenario

		Primary	General	Citywide Eligible Voters	Statewide Eligible Voters
Turnout	Eligible Voters	3,353,127	4,918,052	5.3 M	12.9 M
	Voter Turnout	863,009	3,045,042		
	% Citywide Turnout	**25.70%**	**61.90%**		

2020 Election Overview



The Ground Scenario



What are we tackling?

Improving Accessibility

Educating citizens

Providing Incentives

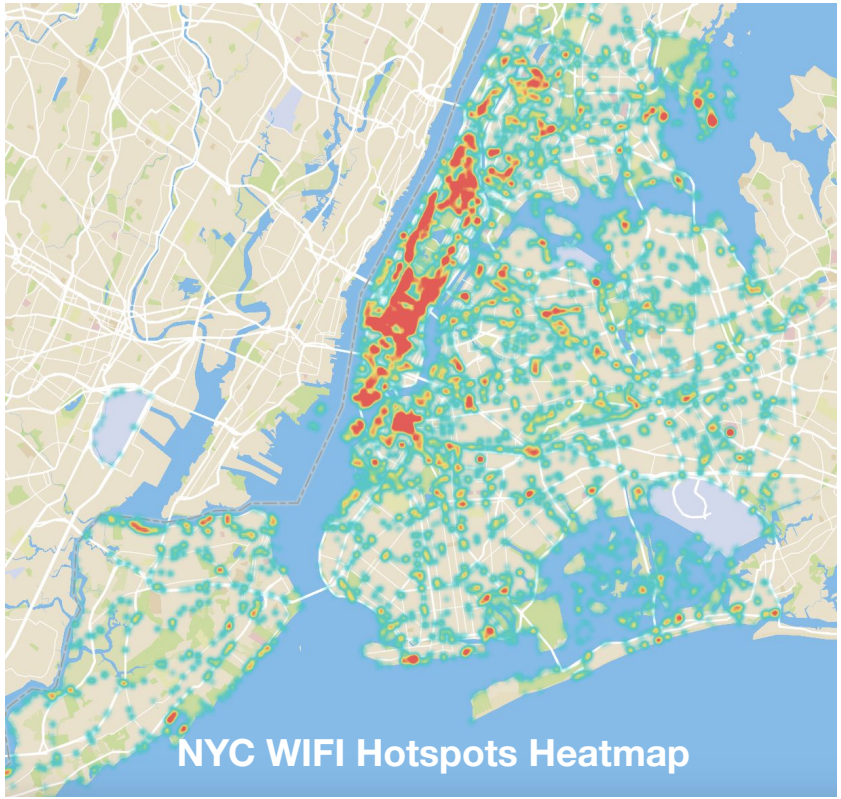
Solution #1 (Short Term)

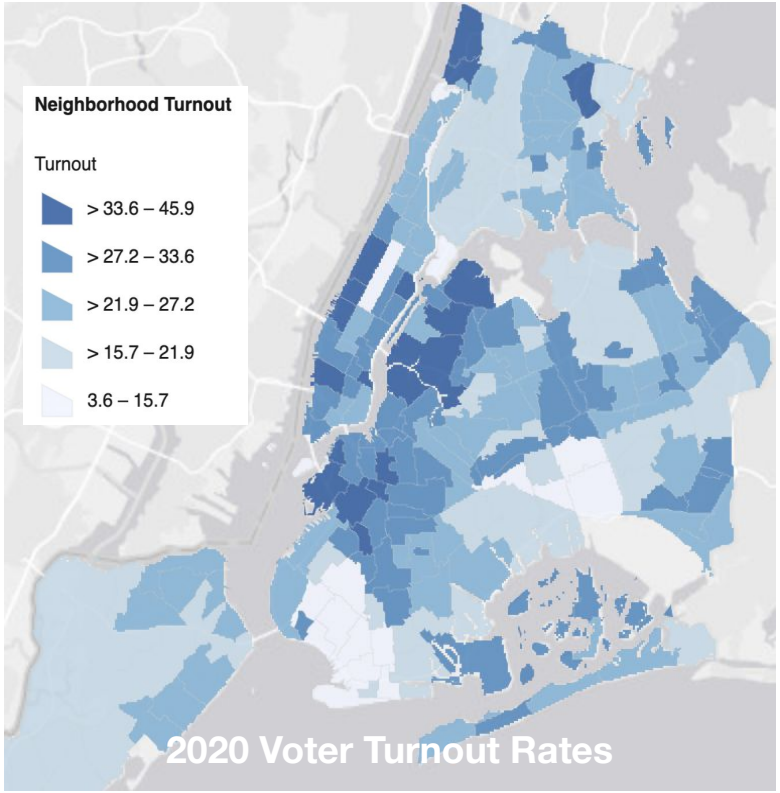
Putting the "*vote*" in LinkNYC

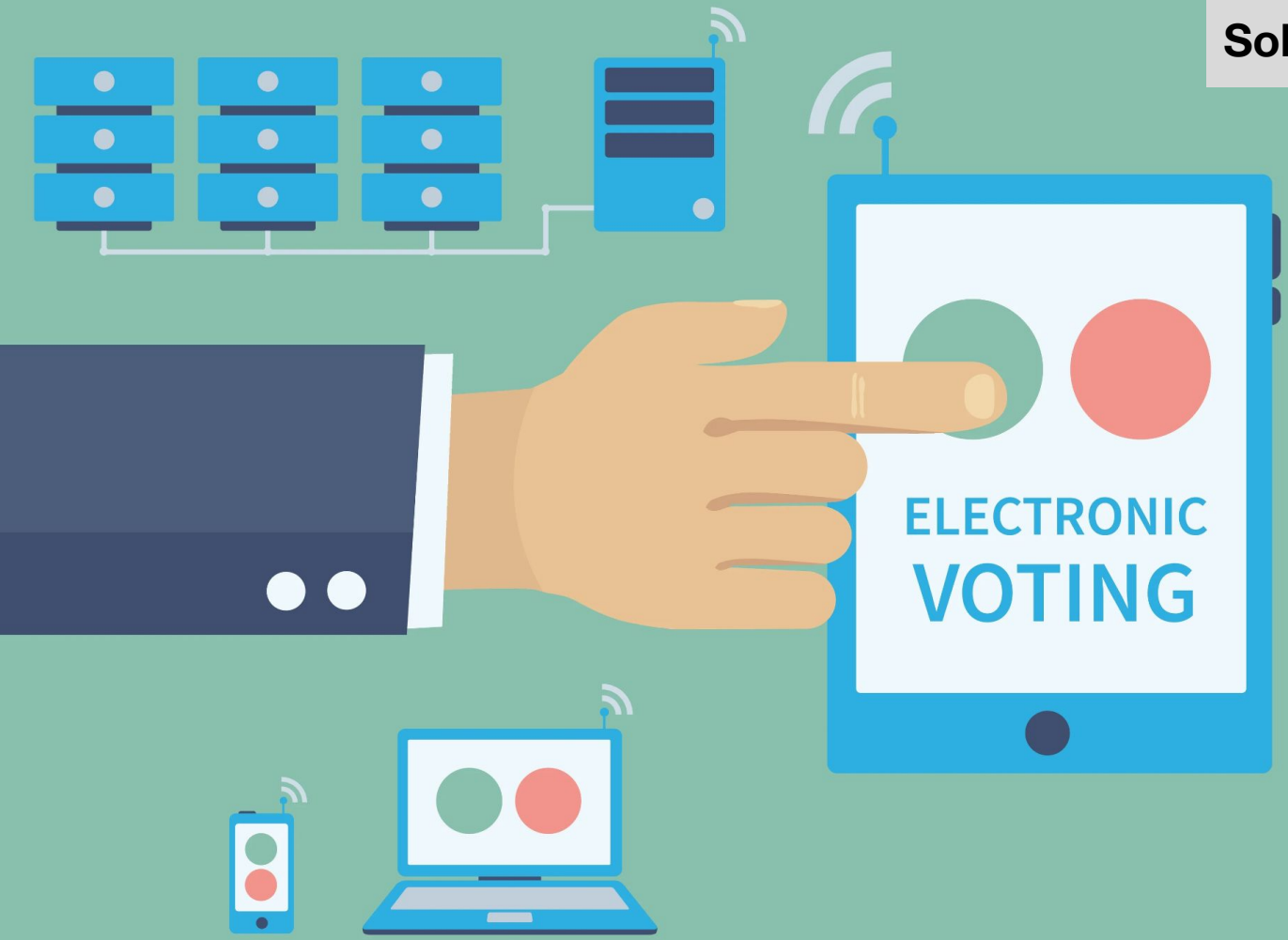
What does this mean?

Ubiquitous Voting Reminders

LinkVoteNYC - Where to deploy?







Solution #2 (Long Term)

Digital Voting System

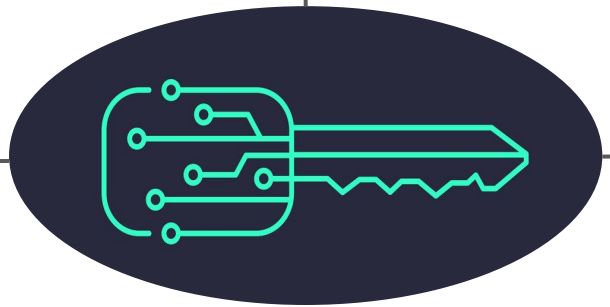
To bring equity?

Seems like a crazy idea...

Digital Voting System - The key to all solutions

SSN/ID

Monetary transactions

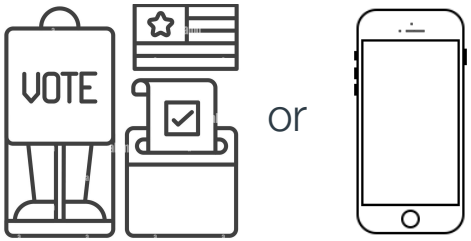


Voting

Private Unique Key

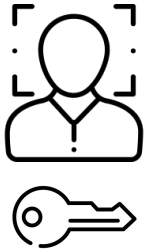
City ensures everyone has one

Digital Voting System - How does it work?



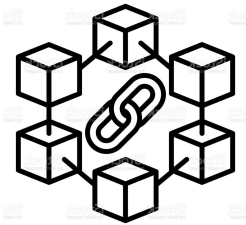
Citizens may use digital voting booths or vote via a device

Start with booths and phase in device-based voting



Register using facial recognition technology + a unique key for authorization

Additional verification steps on device



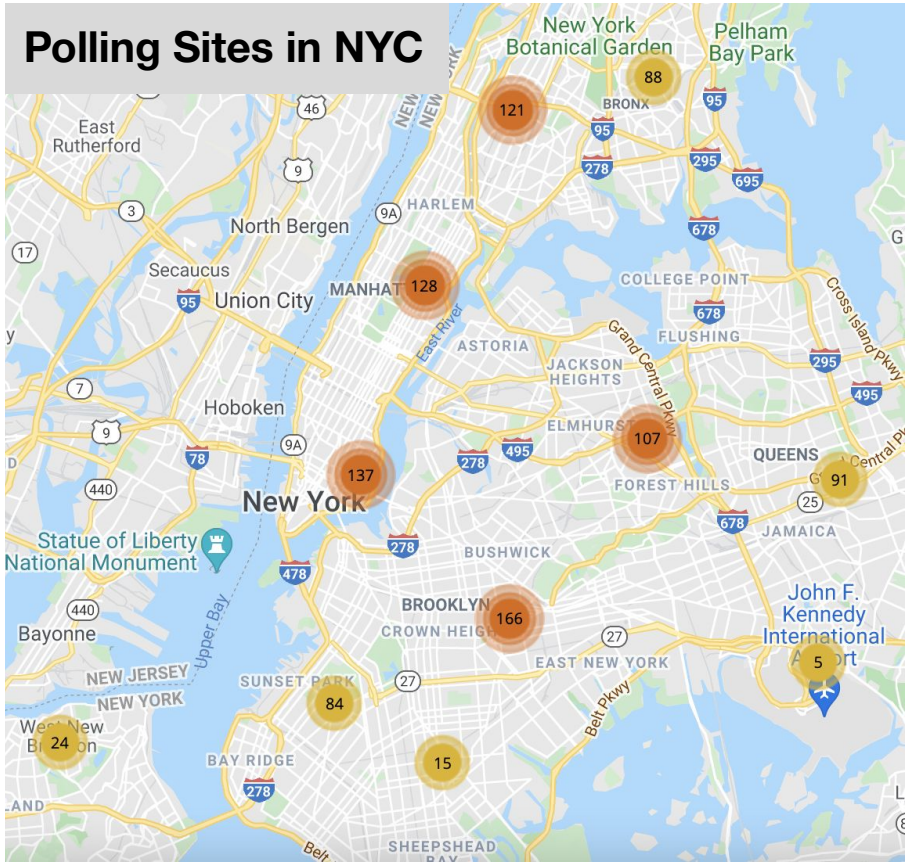
Blockchain-based backend

A very secure digital database authenticated by a large decentralized publicly accessible network

Digital Voting System - Timeline

horizon state

Polling Sites in NYC



Digitalize polling booths in Manhattan for 2025 borough president elections.

+

Beta test device-based voting for Manhattan registered absentee voters for 2025 borough elections.

↓

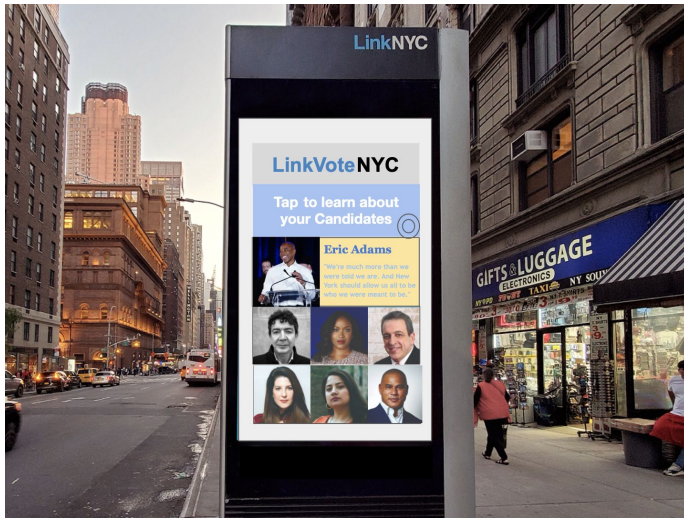
Iterate based on lessons learned.
Test out on smaller scale school board and community district elections.

↓

Scale-up citywide for 2029 mayoral elections.
Consider scaling to national elections as well.

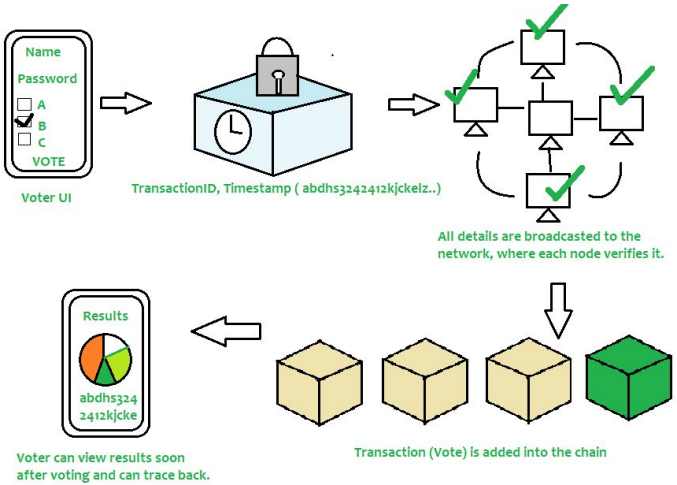
Bringing it all together

Low Tech: LinkVoteNYC Kiosks



Repurposing existing infrastructure
Tech already exists
Easy to implement
Shorter timeline

High Tech: Digital Voting System



Large-scale system level change
Tech needs to be tested
Harder to implement
Extended timeline


MORE RESILIENT

LinkEnergy

New York City's Decentralized Microgrid

THE PROBLEM

During deadly heat wave, New York utility cut power to high-risk neighborhoods

ConEd said it was unaware that the neighborhoods it blacked out during this weekend's heat wave ranked high in risk for heat deaths.

Texas could repeat its electricity crisis if extreme weather hits this winter

By Tyler Mauldin, CNN

Updated 4:00 AM ET, Sat November 20, 2021

Texas death toll from February storm, outages surpasses 100

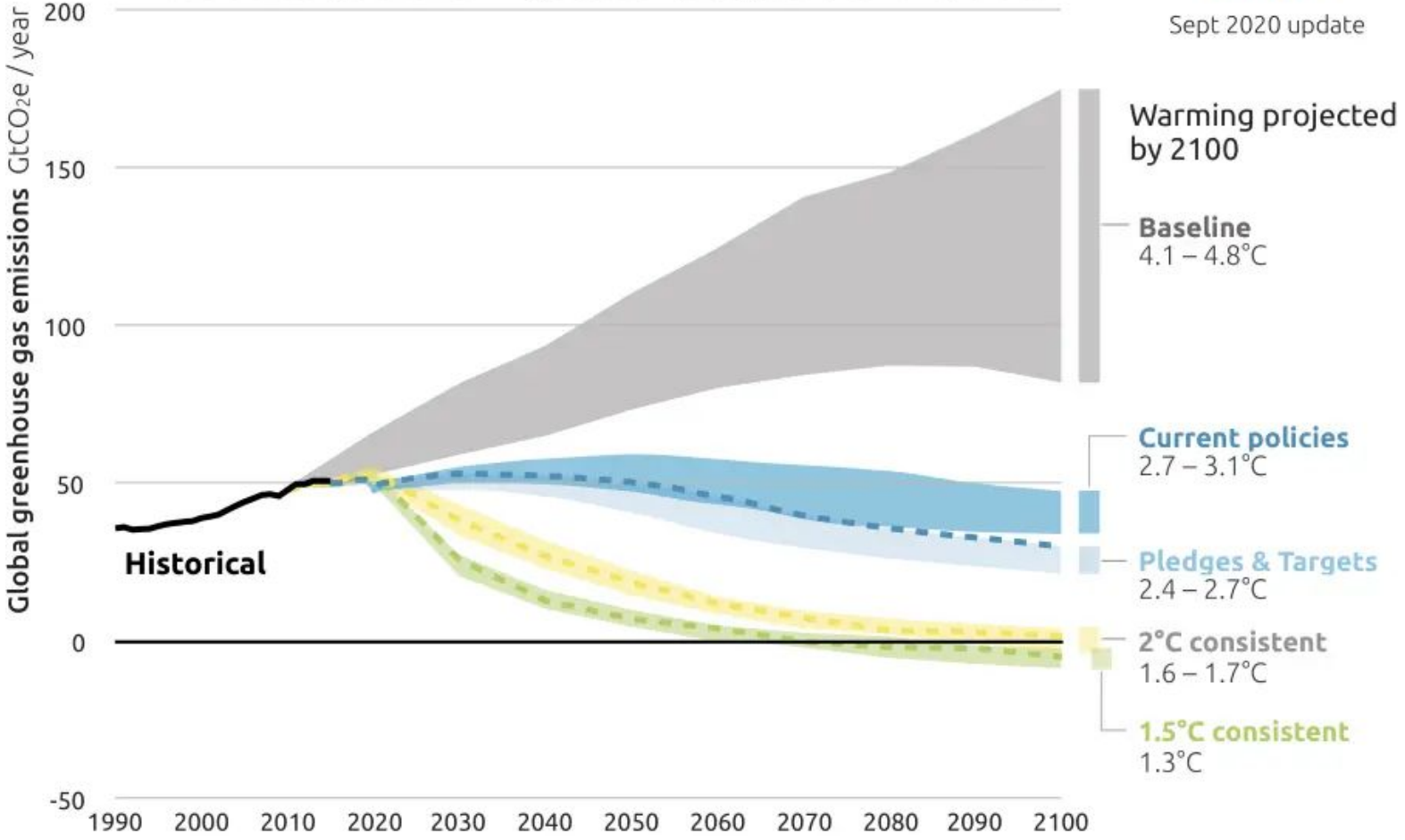
By PAUL J. WEBER and JAMIE STENGLE March 25, 2021

2100 WARMING PROJECTIONS

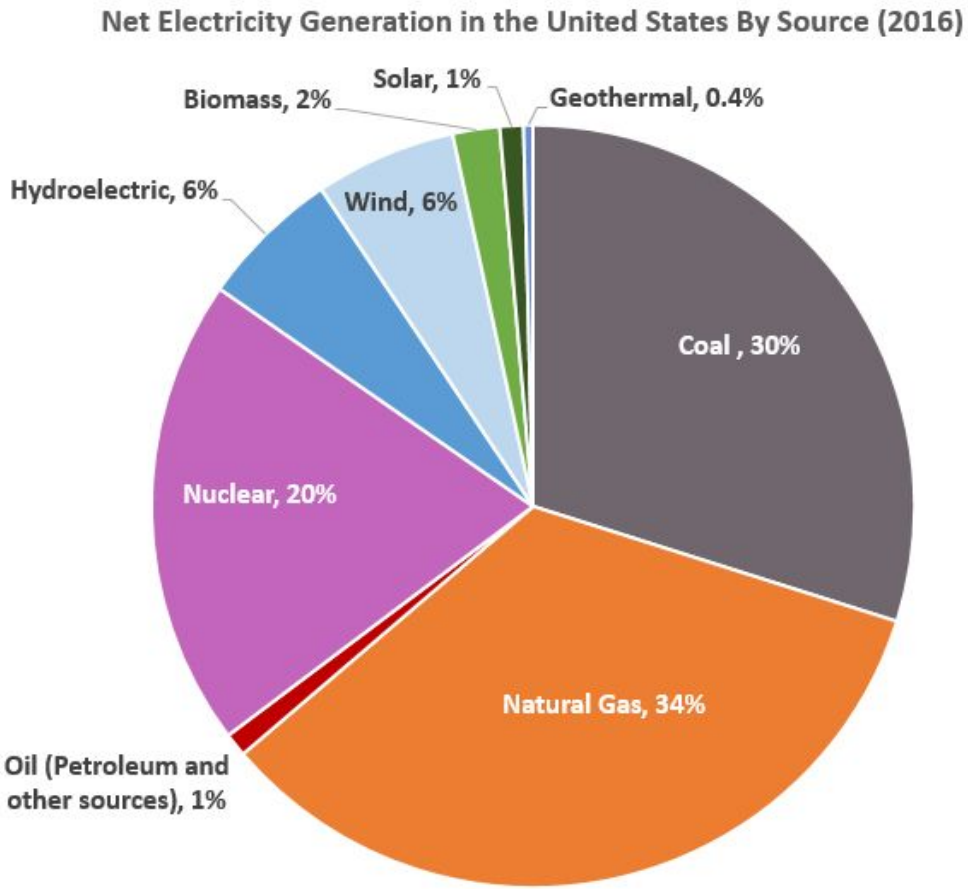
Emissions and expected warming based on pledges and current policies

Climate Action Tracker

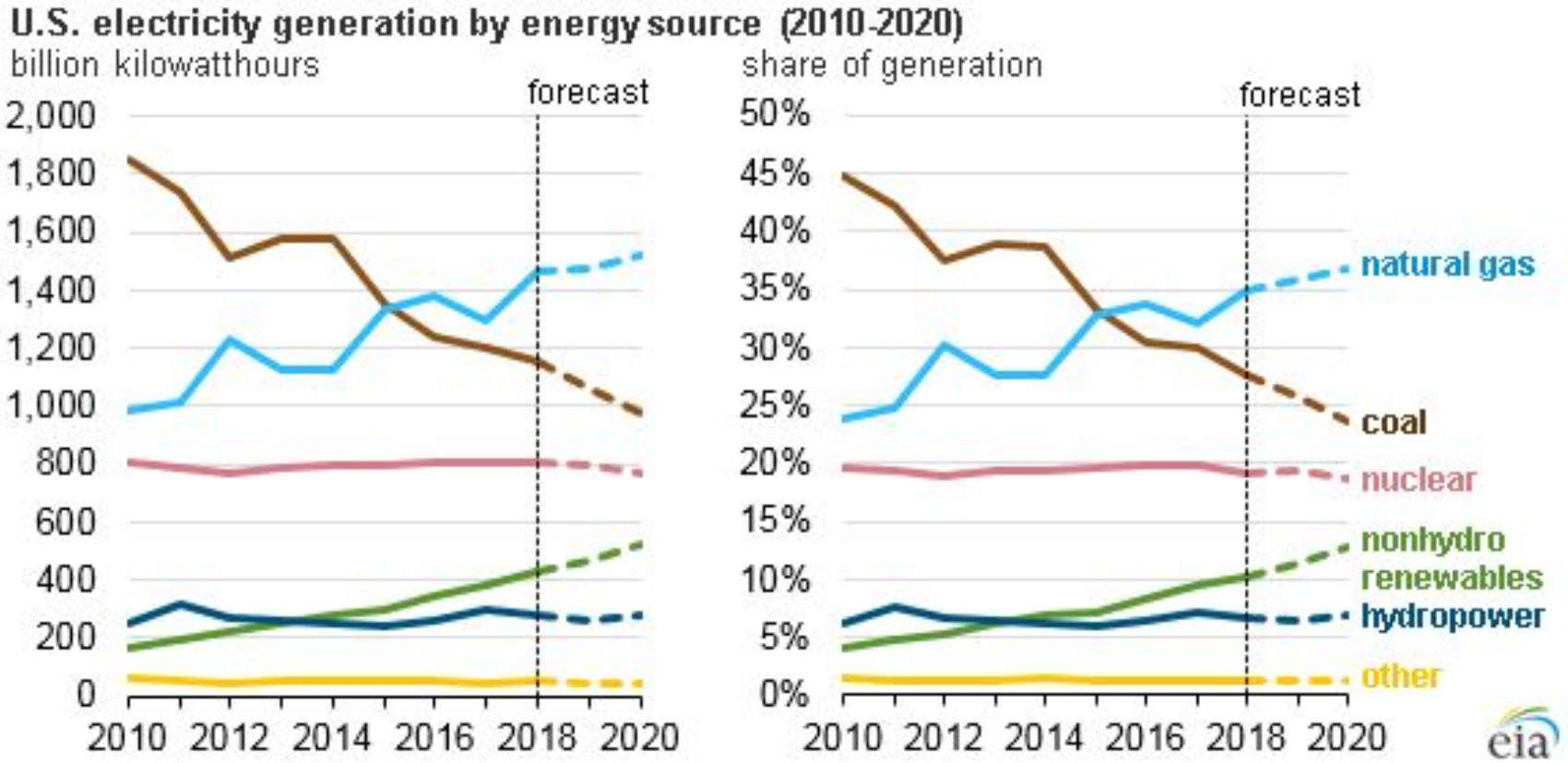
Sept 2020 update



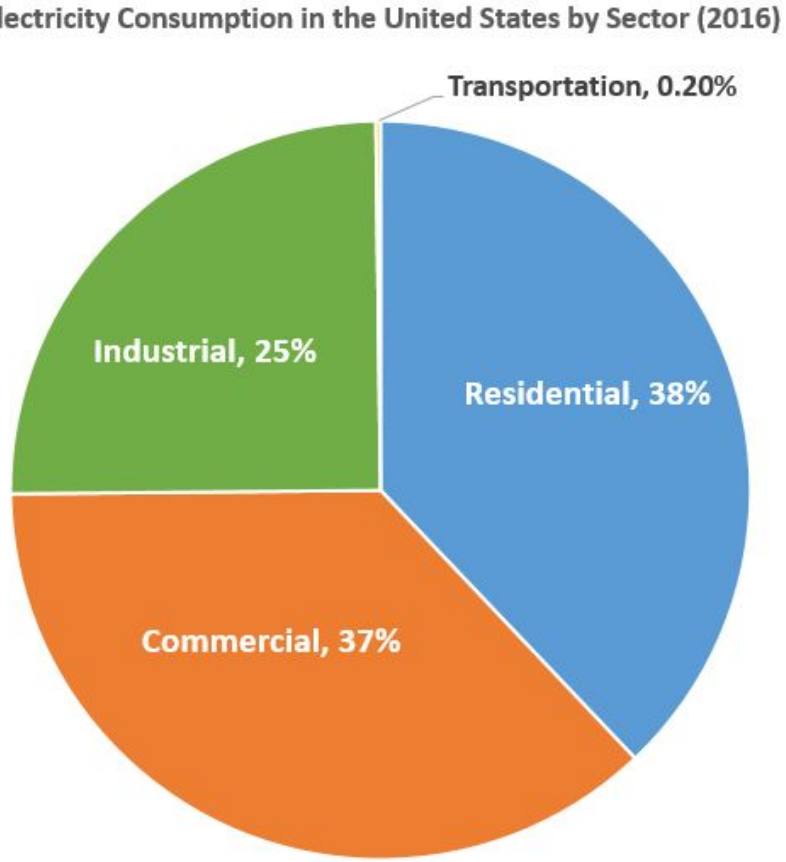
What are the most common electricity sources in the US?



Which energy sources are growing fastest?



Where is energy demand?




What’s wrong with the NYC energy grid?

A closer look at NYC: Energy Problems

Less than a quarter of the electric energy produced in New York City come from renewables

~600,000 NYC families are energy **cost burdened**, paying > 6% of their income on utilities

5,000 miles of transmission lines will have to be replaced in the next 30 years at a **replacement cost of about $25 billion**

Closing of Indian Point power plant in April 2021 increased **transmission bottleneck** from upstate NY

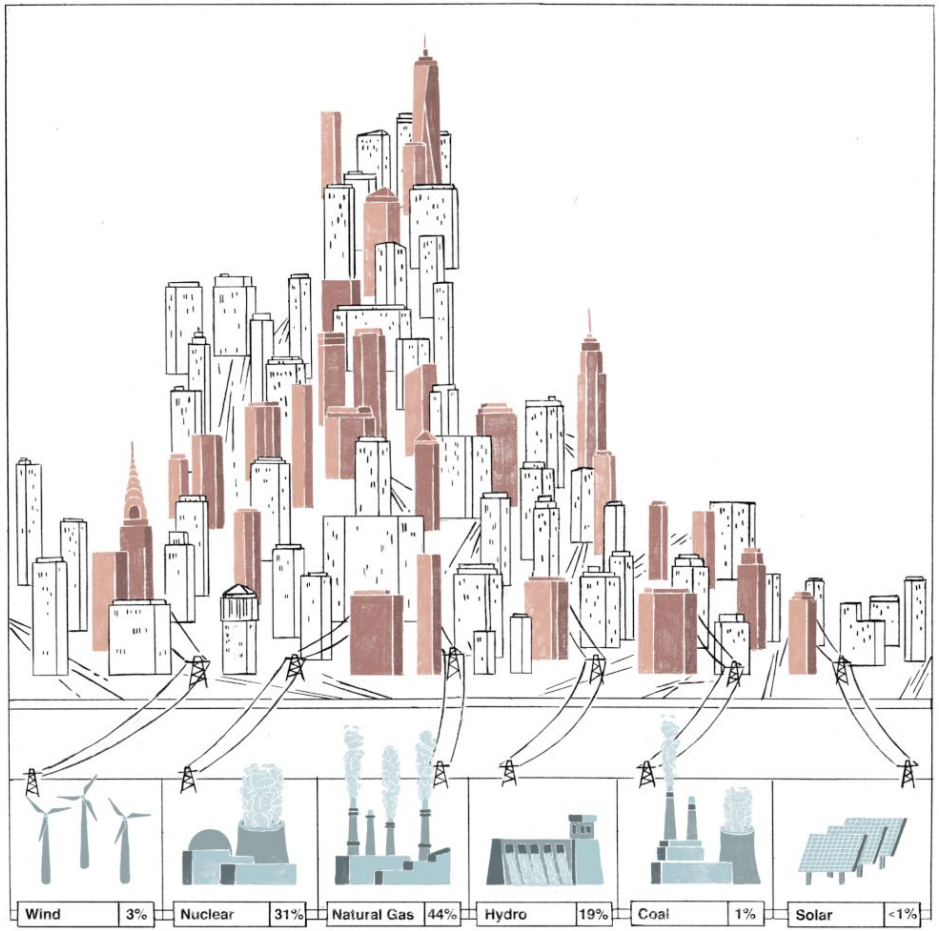
A closer look at NYC: Energy Sources

Fossil-fueled power plants

Hydroelectric facilities

Nuclear plants

Solar and wind installations



A closer look at NYC: Goals

By 2025

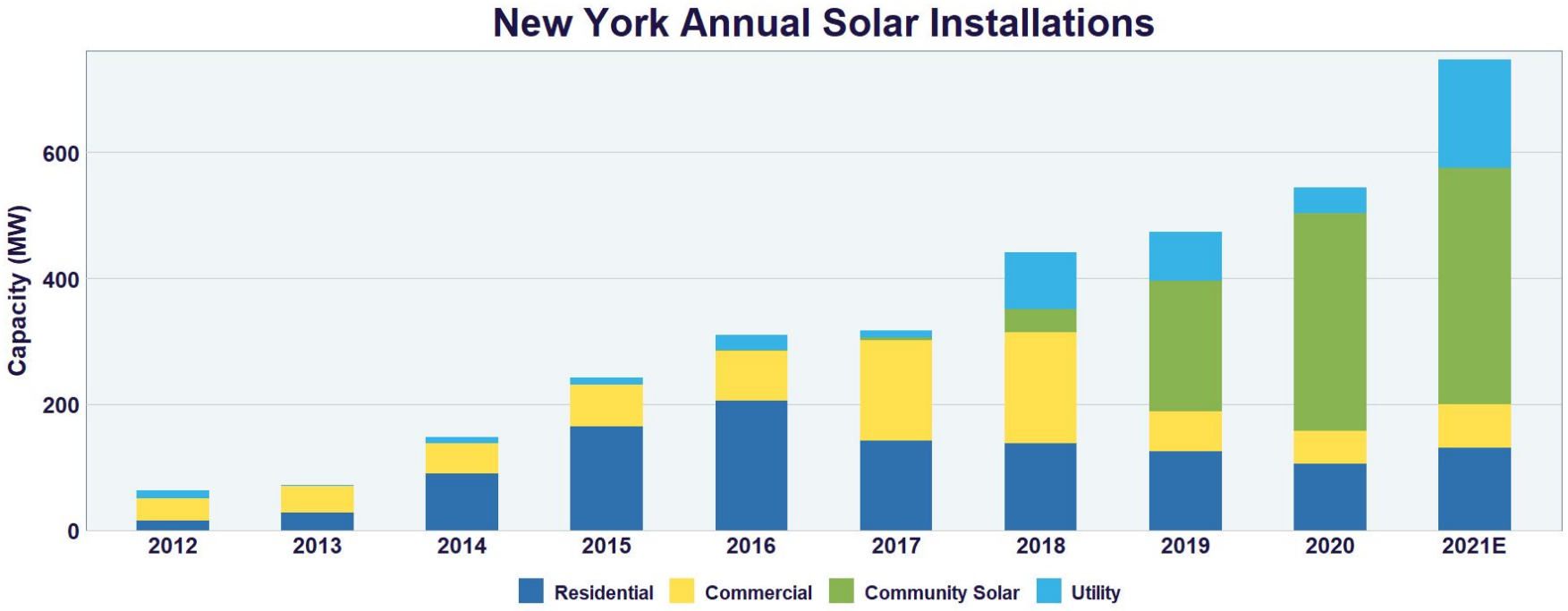
Install 250 MW of private sector solar capacity

By 2040

Transform fossil fuel dependent electricity grid into one powered 100% by zero-emissions resources

By 2050

Achieve carbon neutrality


New York Annual Solar Installations
Capacity (MW)
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021E
Residential
Commercial
Community Solar
Utility

APPROACH AND STRATEGY

ENERGY POWERS IT ALL

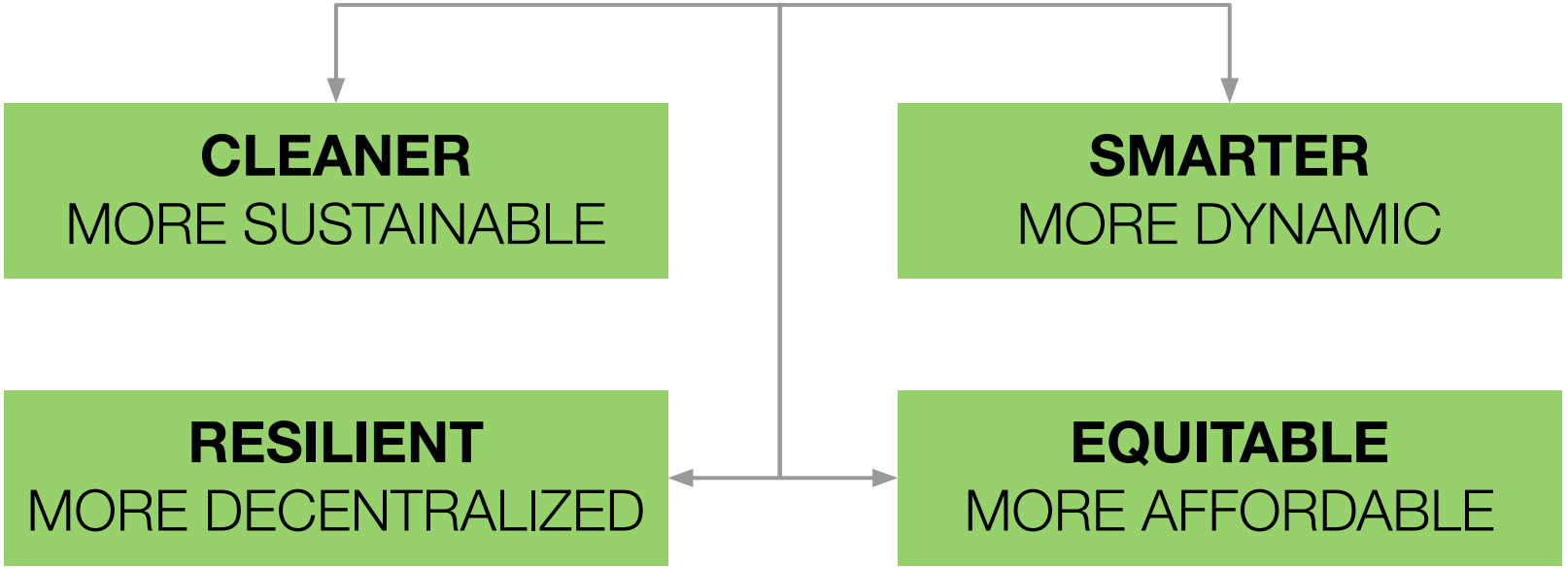
A simple plan for decarbonization

1. Clean up electricity
2. Electrify everything

But is it really that simple?

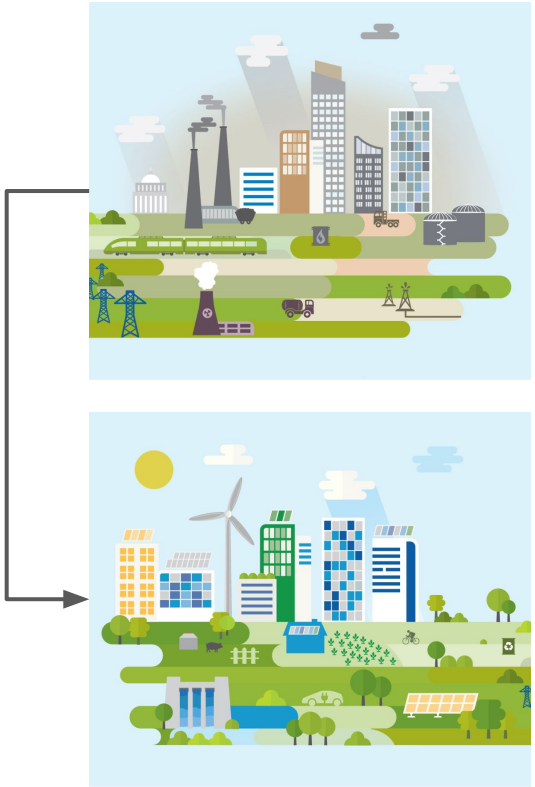
Approach and Strategy

Our core strategy focuses on transforming to energy grid to be:



Make the energy grid CLEANER

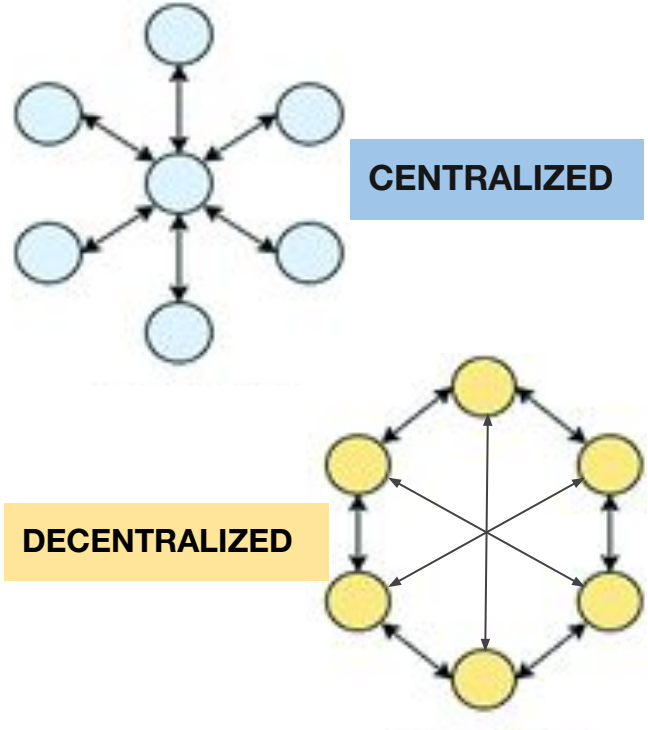
- ➔ Shift to renewable energy, no fossil fuels
- ➔ Renewables are intermittent but complementary and therefore require a decentralized grid
- ➔ NY State investing in offshore wind, solar farms, and geothermal + hydro (upstate)...but we still need more



We want to transform New York City into a **source** of clean energy instead of just a **sink** of energy

Make the energy grid SMARTER

- ➔ A cleaner grid means a more decentralized grid
- ➔ Many more sites for energy production, and many more distribution channels
- ➔ Constant back and forth between nodes of grid



We want to create a system that can **efficiently handle loads** to not ‘waste’ energy and **adjust demand to match supply**

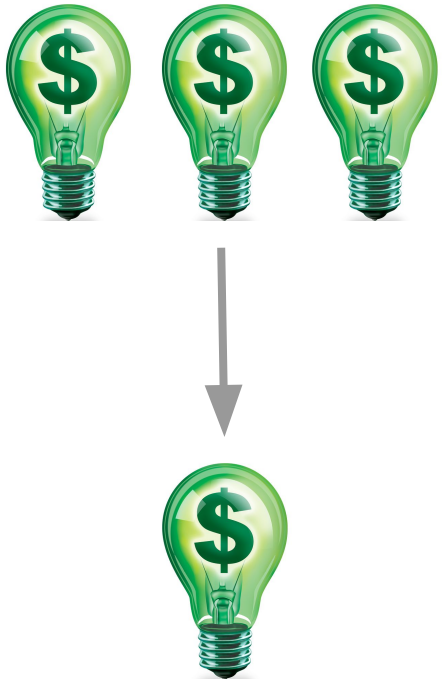
Make the energy grid RESILIENT

- ➔ We want to hedge our sources when it comes to energy production, so one failure doesn't impact the entire system
- ➔ Varied sites for production, varied sources of production

Apart from the state's system being more varied in it's sources, we want New York City to have more **autonomy** and be more **self-sufficient**

Make the energy grid EQUITABLE

- ➔ Lower energy cost, reduce energy burden
- ➔ Make energy more accessible
- ➔ Extend self-sufficiency to individual-level
- ➔ Bring environmental justice to minority communities: remove the burden of externalities of fossil fuel production



We want to make clean energy more **accessible** and **affordable** for NYC residents

Systems at Play

Hard System: Energy Grid

Agents: Utilities, other energy producers, energy consumers

Nodes: Power plants, energy farms, other production sites, residences, other buildings, EV charging stations, etc.

Flows: Flow of energy from site to source, flow of payments for energy cost

Network: The grid itself + all the agents

Soft System: Economics

Agents: Energy consumers + energy producers

Nodes: Financing institutions, funding programs, people etc.

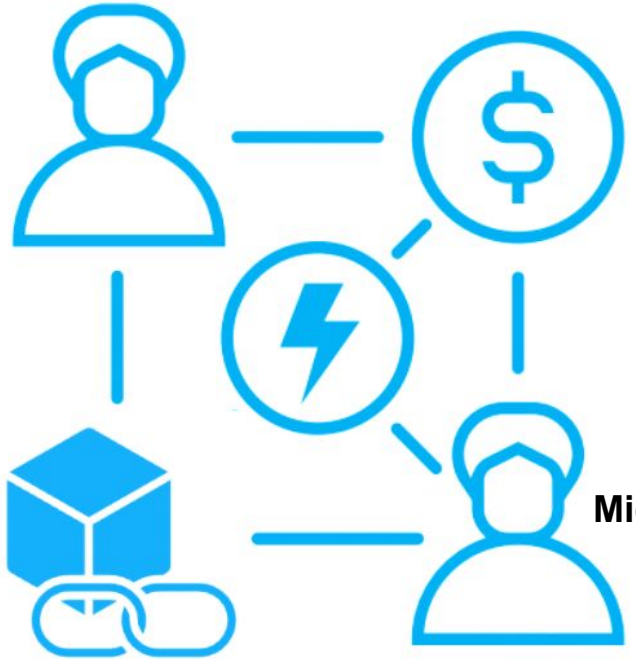
Flows: Financial transactions between consumers and producers

Network: Network of energy transactions + financial transactions

PROPOSED SOLUTION

LinkEnergy: P2P platform for energy transfer

Michael



Michelle

What is it?

Our peer-to-peer (P2P) model creates an online marketplace where *prosumers* and consumers can transfer energy, without an intermediary, at their agreed price

Key Characteristics of our Platform

Community is outfitted with the ability to transact energy

Residents transfer excess energy produced to a consumer within their community

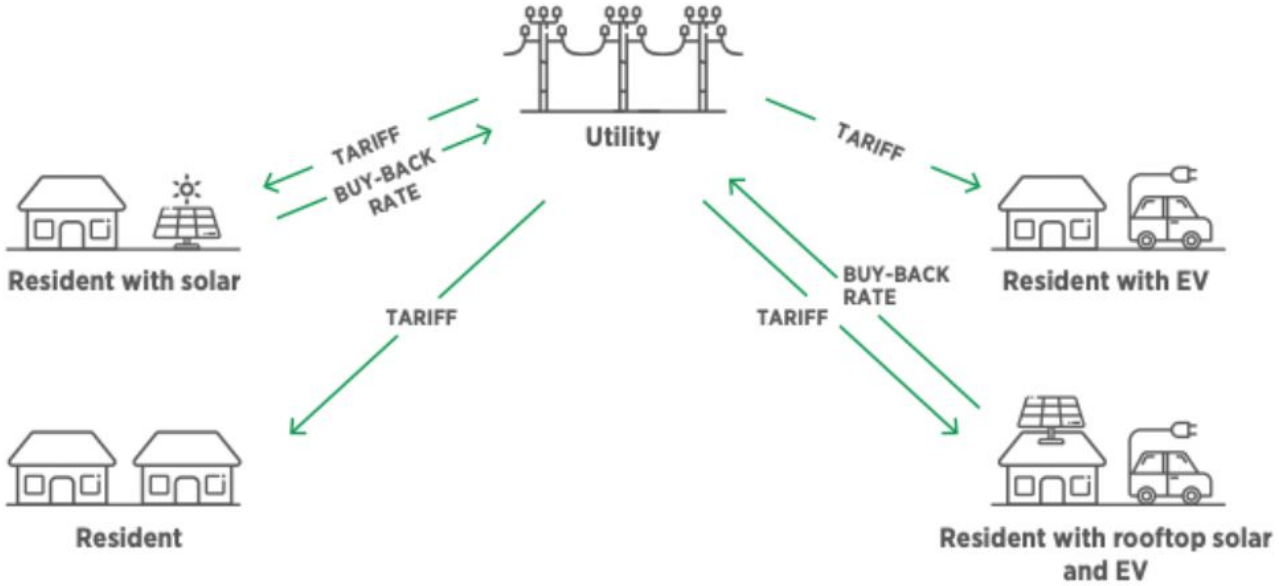
Platform handles all transactions - No Human Intervention

Transactions are stored on the blockchain

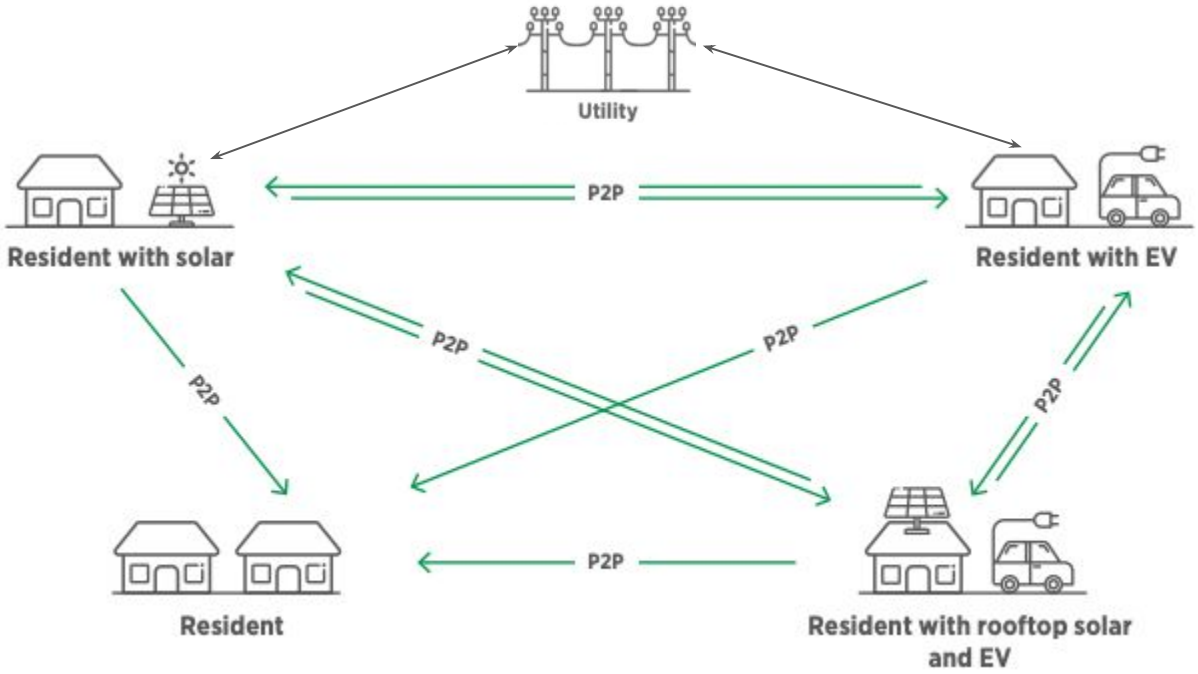
Pricing is predefined through a contract

System is maintained by a network operator

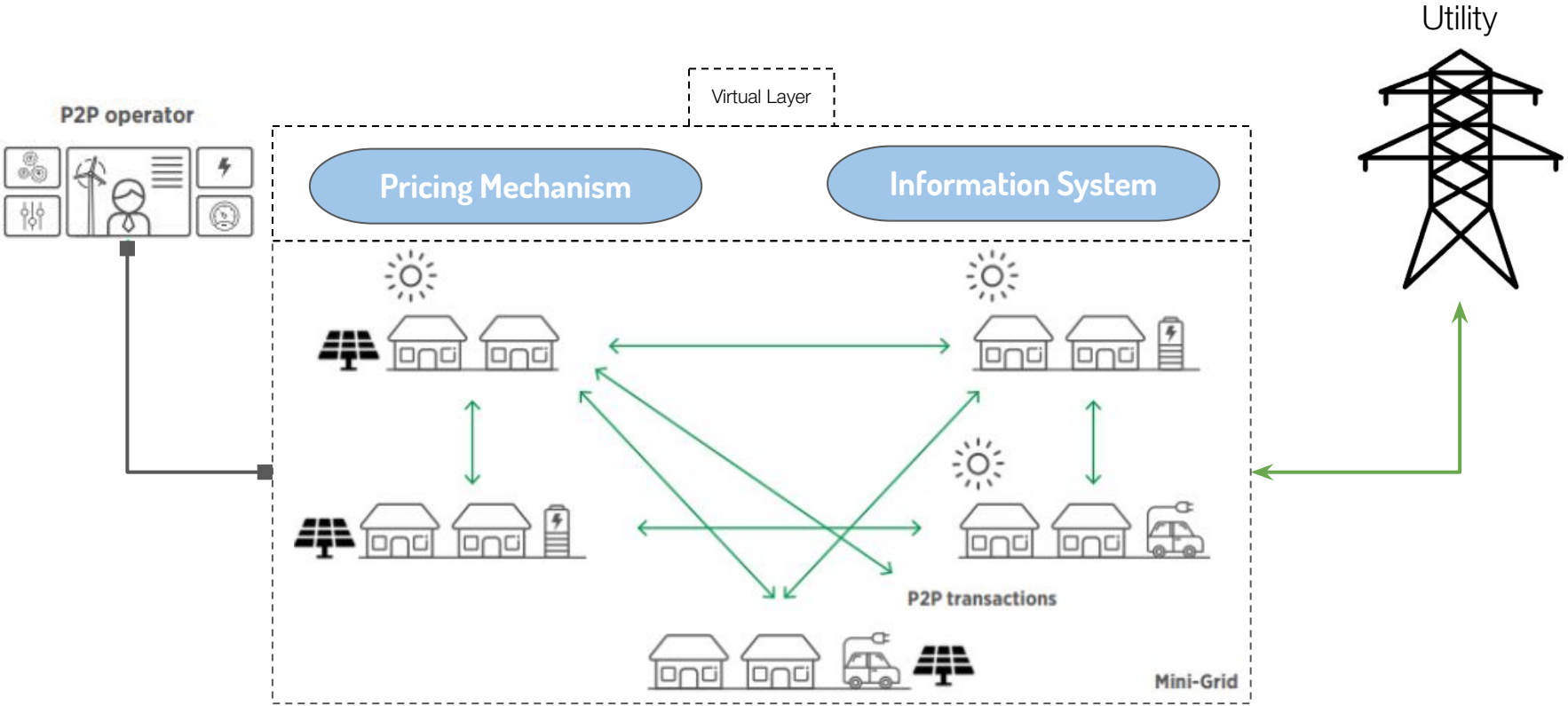
How is it different?



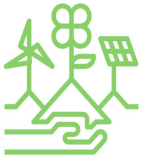
How is it different?



Stakeholders and Usage



How does it help?



Higher renewable power deployment and flexibility

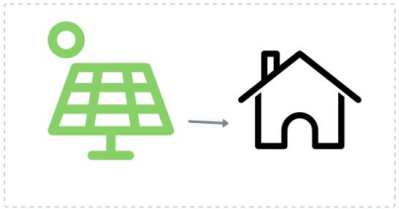
Balancing and congestion management

Sustainable and resilient communities

Improved energy access

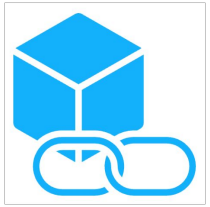
TOOLS + TECHNOLOGIES

Components of LinkEnergy



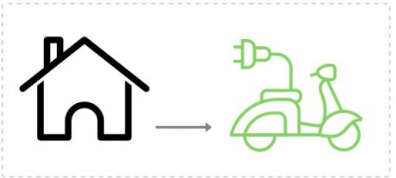
Prosumer

Smart Meter



Blockchain back-end

LinkEnergy App



Consumer

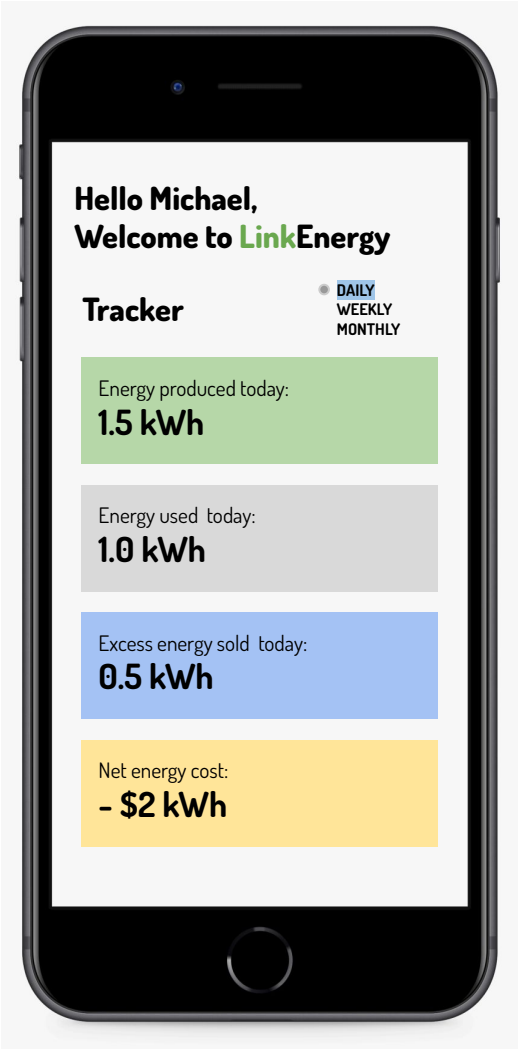
The LinkEnergy App

Users can track:

- ➔ Energy production and consumption
- ➔ Financial savings and cost

The app collects data and makes the system “smarter” as more people use it

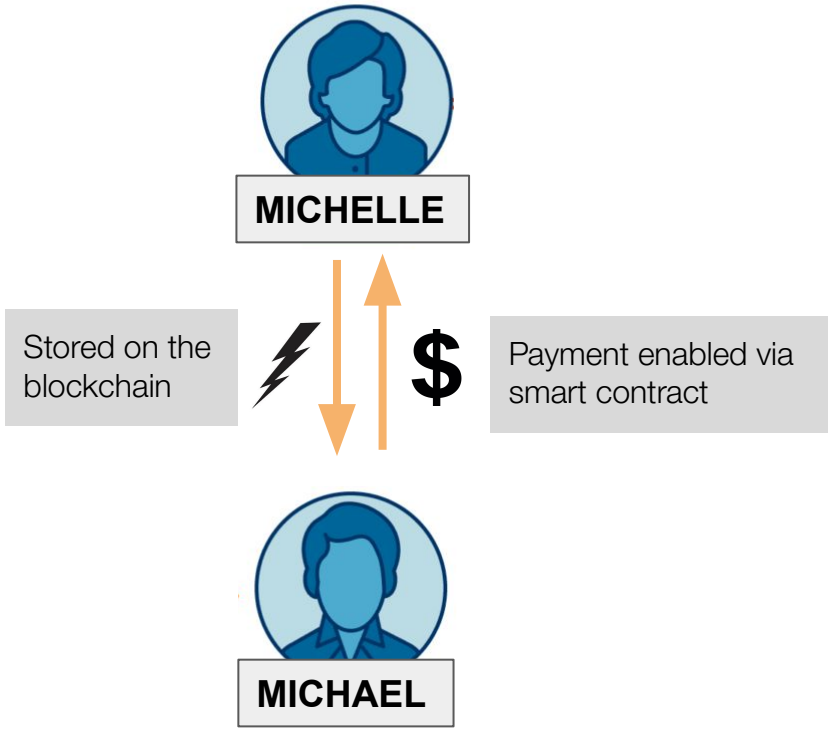
- ➔ Allows for overall demand planning and optimization
- ➔ Suggests demand shifting to non-peak times to match supply



Blockchain as an energy ledger

How can blockchain help facilitate energy transactions?

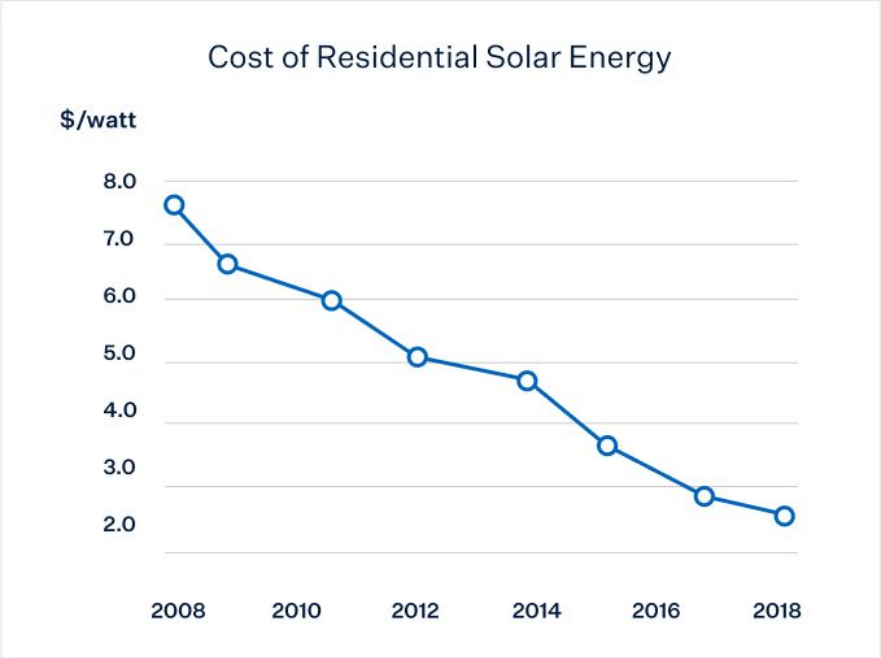
- ➔ Blockchain technology enables a network that is decentralized, secure, immutable, and distributed
- ➔ This network can act as a ledger to record such decentralized energy transactions
- ➔ It allows us to automate the process of buying and selling via **smart contracts**
- ➔ The user does not have to do anything beyond setting up their system and joining the network, they can choose to validate transactions if they wish to



IMPLEMENTATION

Financing the transition: Background

- ➔ Average cost of installing a solar energy system = 15,000 after incentives
- ➔ Cost has decreased over 20% in the last 5 years and continues to reduce
- ➔ Residential solar is easy + low cost to maintain
- ➔ Electricity from fossil fuels costs between ~33 cents per kilowatt-hour
- ➔ Solar energy costs average between ~5 cents per kilowatt-hour and are trending down



Financing the transition

A **mortgage** is really a time machine that lets you have the tomorrow you want, today.

So why don't we leverage the innovative capital financing strategies that have underpinned America's finest economic engine: **loans**?

Introduce a **"climate loan"** - a low interest financing option that helps consumers afford the transition to self-sufficient clean energy.

Mobilize public-private partnerships with green **banks** and commercial **banks** to set up a **loan financing system**

Leverage **funding** programs like **Tier 4** of **NYSERDA's Clean Energy Standard**, which focuses on increasing the penetration of renewable energy in NYC (up to $15.6 billion investment)

Inspired from Rewiring America

Partner with city, state, and non-profit organizations

NY-SUN:

Incentives and Financing: to make going solar more affordable (especially disadvantaged community)

Education: providing homeowners and renters the solar information needed

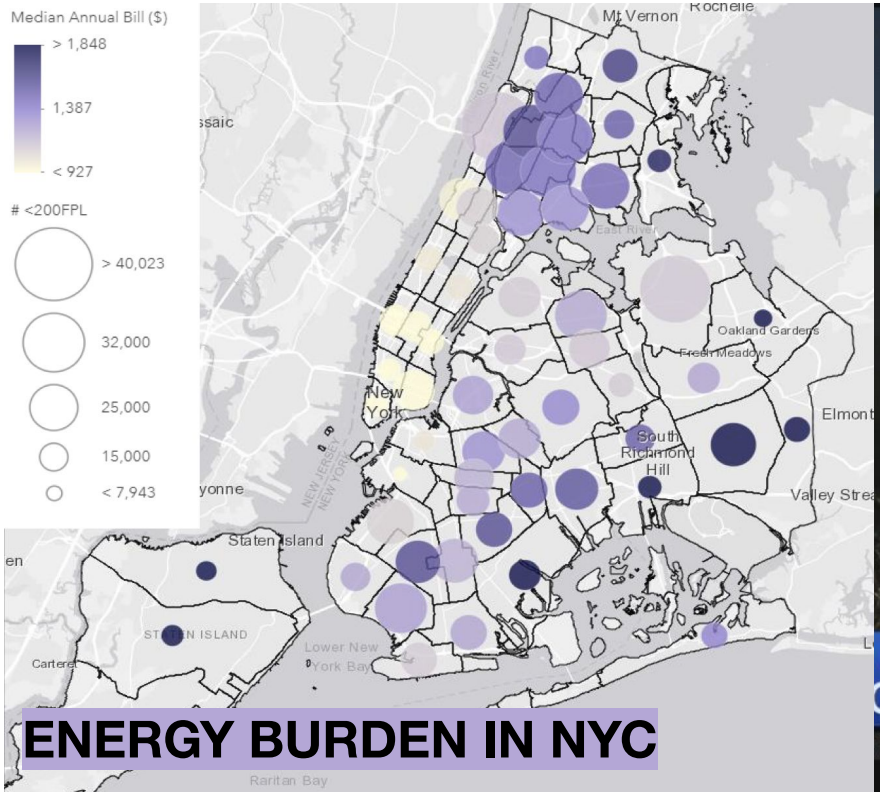
NYC Mayor's Office:

Local Government Resources: providing training, tools, and assistance to help local communities identify beneficial renewable energy policies, mitigate barriers, and create at home solar programs

NYC Mayor's Office of Climate Resiliency

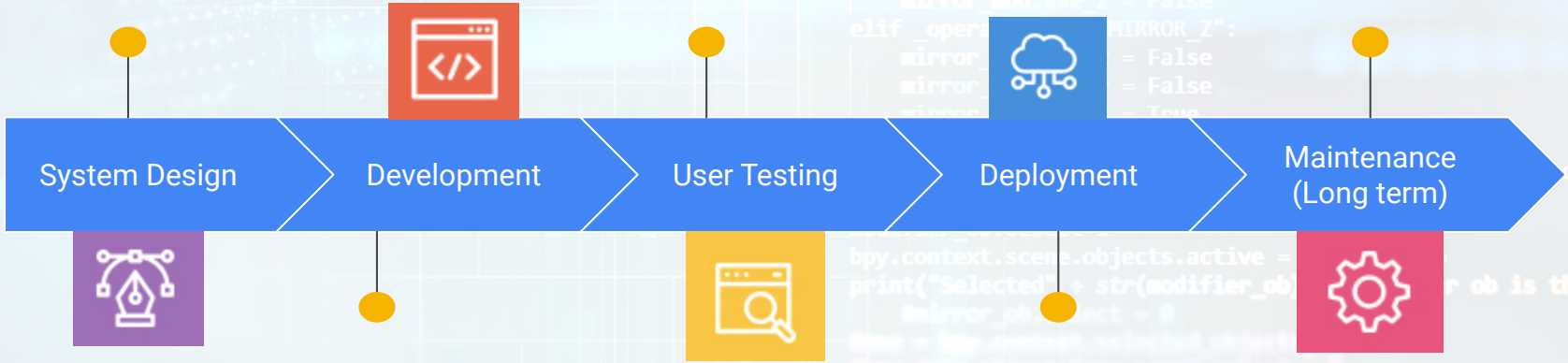
NYC Mayor's Office of Climate and Sustainability

Where to deploy first?



Souce: Report on Understanding and Alleviating Energy Cost Burden in New York City - August 2019

Implementation of P2P Energy Platform



Overall Implementation Timeline

Phase 1: Planning and Policy

Feasibility analysis, financing & funding, permits & licencing.
(8 to 12 months)

Phase 2: Technical Development

Collaborate with software company and solar panel providers to develop the automation platform. Including technical testing.
(8 to 12 months)

Phase 3: Pilot Testing

Test the automation platform by installing some units in some selected households, then expand to larger neighborhoods and communities in Bronx.
(12 to 24 months)

Phase 4: User-base Expanding

Iterate based on lessons learned and scale-up to allow sign up borough-wide.
(Long term continuation)


Impact


Thank You

Tools and technologies notes

Context : What do we need to implement our platform? Any vendors ?

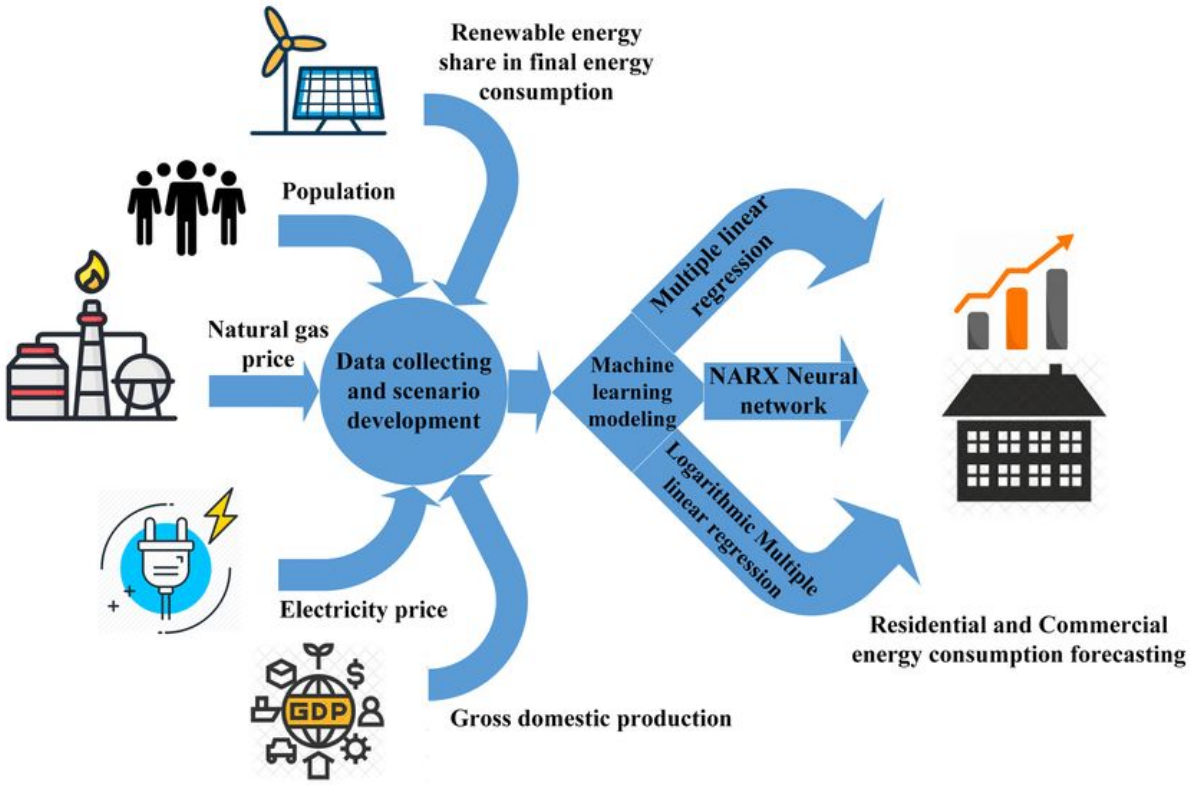
Technical requirements? (hardware - smart meters, cables etc ,software - our platform)

Communication occurs on the blockchain

How can we automate energy transfer from one home to another

Data analytics - Forecasting demand and supply models

Data Analytics: Demand Planning and Optimization



Work Distribution

Problem definition and analysis - Jenny

Approach and strategy - Eesha

Proposed solution/product and how it addresses the problem - Sarang

The technology/tool most appropriate to address the problem - William

How you would implement and deploy your proposal-Ruoyu Zhou, Panda

Links and notes

https://www.technologyreview.com/2017/10/16/148584/how-blockchain-could-give-us-a-smarter-energy-grid/

Energy production in NY State : https://www.eia.gov/state/analysis.php?sid=NY

https://www.nytimes.com/interactive/2017/02/10/nyregion/how-new-york-city-gets-its-electricity-power-grid.html - > Outdated(2017)

https://www.urbangreencouncil.org/sites/default/files/state_of_the_nyc_grid_urban_green_council.pdf - Recent

https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jul/IRENA_Peer-to-peer_trading_2020.pd - good (overview of p2p grid network and requirements for a community)

Extra notes:

- Community solar as an extension of this program for those that can't have solar on their roofs (ex. In manhattan)
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Implementation notes

Steps to reach a p2p energy trading platform

- Identify disadvantaged communities who face blackouts

OR

- Identify prime communities to deploy solar panels in NYC
- Financing
- Pilot tests
- Large scale implementation
- Policies for Stakeholders

Implementation notes

P2P utility trading platform? An App? Renewable

Solar panel deployment? Installation?

Stakeholders (gov, residents, companies), Policies (stipend, tax deduction for renewable energy), Finance (funding, cost of fixed cost, system software development)

Technical requirements, Infrastructure: solar panel (installation, operation, maintenance), automation system (implementation, user testing , maintenance);

Roadmap, timeline (Long term, short term, estimated process by...years)

- First implement the policies, depend on the policy.

Policy notes

- Policies for renewable energy
- Access to capital - how to setup renewable energy sources in homes for those who can’t support upfront costs
- How do we encourage decentralized power generation?
  - Solar is already cheaper than the grid - upfront costs higher
  - Infrastructure is needed
- Policies on how residents use and supply energy

Policy: Climate Leadership and Community Protection Act (CLCPA)

1. Obtain 70 percent of its electricity from renewable sources by 2030 (and that the electric sector be emissions-free by 2040)
2. Add 6,000 MW(megawatts) of distributed solar (the type that normally goes on rooftops) by 2025 (a doubling of the current amount)

Stakeholders

Government

NYC Tier 4 Award for renewable energy solicitation to run our project and initialize consumer loans.

Policy: Tier 4 – New York City Renewable Energy

Approved projects to deliver solar, wind and hydropower from upstate New York and Canada to NYC.

It will deliver $8.2 billion in economic development, including investments in disadvantaged communities.

Finance: Maintenance

Once installed, a solar energy system is easy to maintain and low in cost.

Electricity from fossil fuels costs between 5 and 17 cents per kilowatt-hour.

Solar energy costs average between 3 cents and 6 cents per kilowatt-hour and are trending down.