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Final Presentation

Capstone Project: Town & Gown | DSNY

Under the guidance of:
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Project Objectives and Vision

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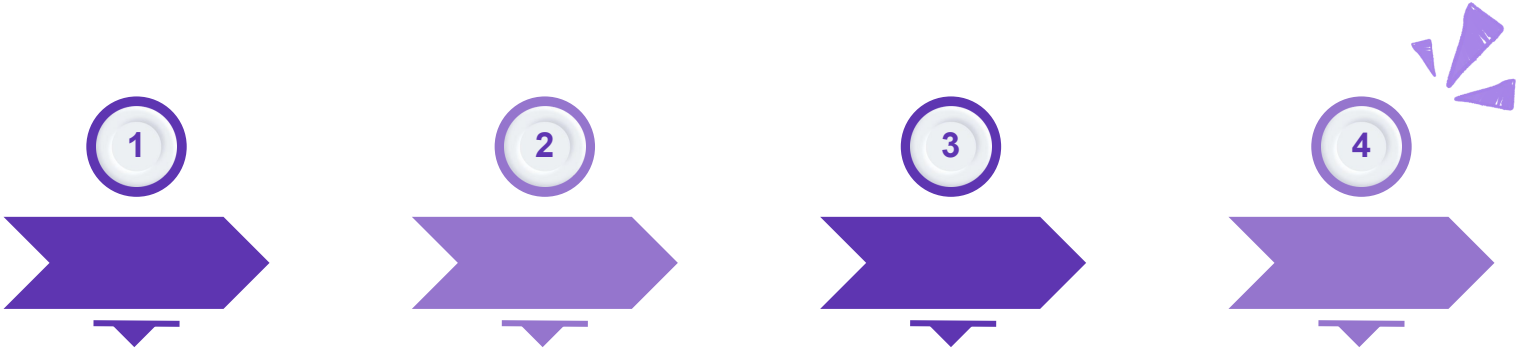
Project Completion Summary

As we conclude our project with DSNY's vision, our project focused on what is realistic and impactful by December. Specifically, we have completed:



Technology Assessment

Conducted a technology assessment of pyrolysis equipment currently available, focusing on suitability for DSNY's needs (feedstock type, scale, cost, and operational considerations)

Market Analysis

Performed a biochar market analysis, mapping out potential buyers and uses in NYC, such as landscapers, parks, or construction materials.

Air Quality Concerns

A new scope was introduced in the early stages of the project to address air quality concerns over pyrolysis and conduct a biochar market analysis

Reports and Recommendations

Delivered integrated recommendations to help DSNY decide how to move forward with equipment piloting and biochar commercialization

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Pyrolysis Equipment

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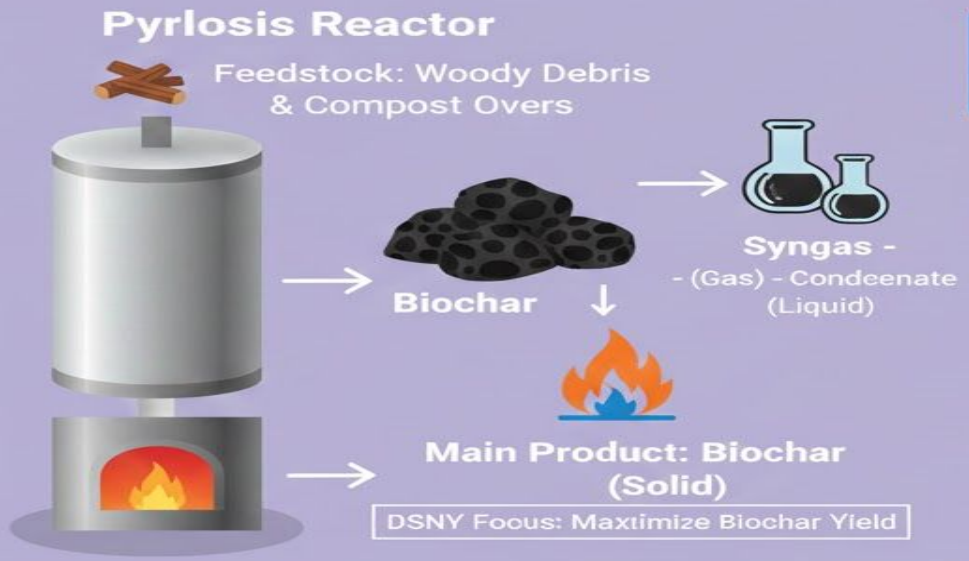
What is Pyrlosis?

DSNY Pyrlosis Project: Process & Relevance



Relevtance to DSNY Operations

- Feedstocks: Wody Debris & Compost Overs
- Feedeits: Volume Reduction
- **Benefits**: Volume Stable Carbon (Biochar), Usable Energy

Technology Selection Flow: From Feedstock to Shortlist

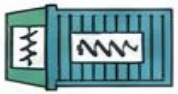
Input

Woody Debris & Compost Overs
(Feedstook)

DSNY Operational Constraints & Lessons Learned

- Non-Permanent Installation
- Modular & Plug-and-Play
- Safe, Reliable Operation
- Feedstock Preparation Critical

Biochar
(Final Product)



Containerized Screw/Auger Reactor

Mobile/Skid-Mounted Carbonization Plant

Mobile Batch/ Retrort System

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Biochar Market Analysis

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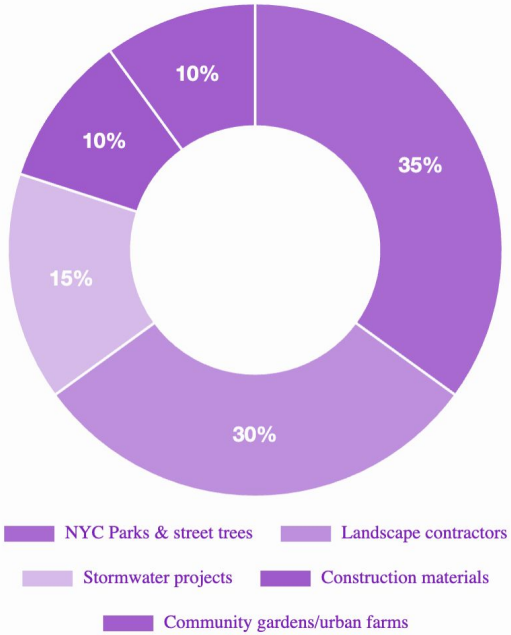
What the market looks like

- **Potential NYC uses:** Parks & street-tree planting mixes, municipal landscaping, green infrastructure/stormwater media, urban agriculture & community gardens, construction materials (blended into cement/asphalt), and remediation (PFAS mitigation).
- **Key local buyers & partners:** NYC Parks, DSNY (internal reuse), large landscapers/contractors, community orgs (e.g., Big Reuse), universities and research centers.
- **Market scale & price signals:** stakeholders note biochar's long-term value (carbon, soil benefits); low-end price examples reported around ~$1,000/tonne (varies by quality and form). Use cases that mix biochar with compost likely have higher adoption potential.
- **Barriers in NYC:** product quality/specification needs, regulatory/permitting uncertainty (emissions,NY DEC), limited large-volume buyers today, and cost of production vs. buyer willingness to pay.



Potential buyers/ vendors

Vendor	Proximity/Role	Primary Market Focus	Key Differentiator & Spec Data	Ideal for DSNY Biochar
NY Carbon	*Local Producer (Hudson Valley, NY)*	Compost, Landscaping, Stormwater, Building Materials, Carbon Sequestration.	Certification: NOFA-NY approved for USDA Organic use. Feedstock: Clean wood-cuts. Role: Local buyer/collaborator with established regional distribution channels.	High-Volume Bulk Sales & Collaboration
Standard Biocarbon	*Regional Producer (Maine/New England)*	Engineered Soils, Landscaping, Turf, Environmental Remediation, Carbon Sequestration.	Organic Carbon: >90% (Highest fixed carbon). Ash Content: <2% (Extremely low). Purity: Tested for PFAS, PAHs, Dioxins. Role: Major professional/industrial bulk buyer.	High-Value, High-Purity Bulk Sales
CharGrow	*National Supplier*	Soil Mixes, Erosion Control, Landscaping, Turf, Vegetable Gardens, Composting.	Certification: Exceeds IBI Standards and NOP Standards. Particle Size: 3mm minus. Process: Slow Pyrolysis (~850°F) for stability. Role: Bulk ingredient buyer for their blended soil products.	Ingredient Buyer for Blended Products
Bio365	*Regional Supplier (NY Presence)*	Horticulture, Turf, Tree Applications. Primary focus on finished soil media.	Product: Uses bioCORE™ (high-temp, low-ash biochar) as an ingredient (1-7% by volume) in OMRI-Listed, prepared soil mixes. Role: Direct, dedicated ingredient buyer.	Raw Biochar Ingredient Sales
American BioCarbon	*National Supplier*	Soil Amendment, Water Filtration, Hydroponics, Carbon Sequestration.	Key Spec: Biochar suitable for water filtration (high surface area/porosity) and carbon sequestration (high stability/fixed carbon). Role: Diversified end-user for both environmental and agricultural markets.	Remediation & Carbon Sequestration Sales

Air Quality Research

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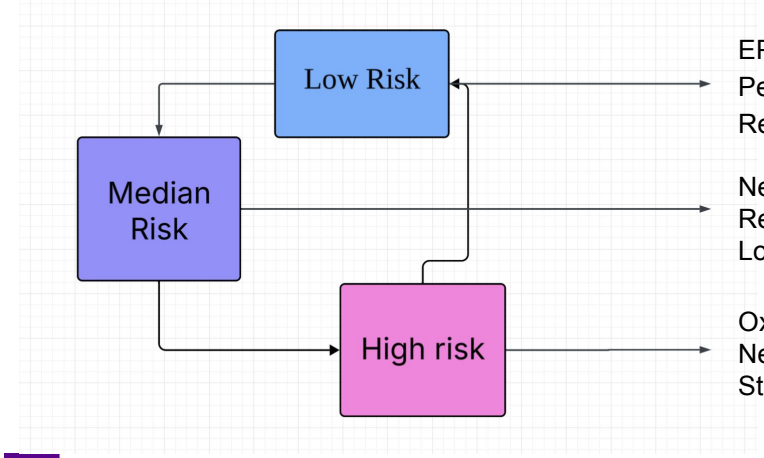
Air Quality Concerns – Biochar & Pyrolysis

- **Emission control is critical** to ensure compliance with EPA and local air-quality standards.
- When regulatory pathways are well defined and prior feedback is positive, **permitting risk is relatively low**.
- **New or emerging technologies** often require additional documentation and performance validation before approval.
- If **oxygen enters the reactor**, unintended combustion may occur, leading to **temporary emission spikes** that must be carefully managed.
- Systems rely on **filters and scrubbers** to capture particulates and neutralize acidic gases.
- **Continuous monitoring and stable reactor control** are required to maintain safe and compliant operation.



EPA feedback is positive, showing the system meets air-quality standards.
Permitting is straightforward with minimal extra documentation.
Reliable and ready for faster deployment.

New systems need more testing and documentation for approval.
Regulators may require pilot data and emission reports.
Longer review time but offers innovation potential.

Oxygen leaks can cause combustion and emission spikes.
Needs tight control, stable temperature, and good filters.
Strong monitoring ensures safety and compliance.

Final Recommendations

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Recommended Pilot Program Design & Monitoring Flow

Further Directions & Next Steps

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Collaboration with Future Labs

- Partner with **Future Labs** to support applied research and technical validation
- Conduct **biochar characterization and performance testing** for priority use cases
- Leverage academic and lab resources to support **data generation for DSNY decision-making**

Scaling the Project with DSNY

- Use capstone findings as a **foundation for pilot implementation**
- Identify **additional DSNY sites** suitable for deployment
- Develop a **phased scale-up strategy** from pilot to multi-site operations
- Position the project as a **replicable, citywide waste-to-biochar model**


Thank You!
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