

# Sustainable Organic Waste Management” Biochar System Design And Business Model Evaluation in Orange, MA.



IPRO 350  
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# Presentation Outline

- Problem Statement
- Project Approach
- Objectives
- Team Structure
- Background
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- Conclusion

# Problem Statement

The outsourcing of manufacturing jobs and the increased urbanization of the service sector has seriously harmed small towns across the USA.

- Economic demise
- Crumbling infrastructure - diminishing tax base
- Aging population

# Project Approach

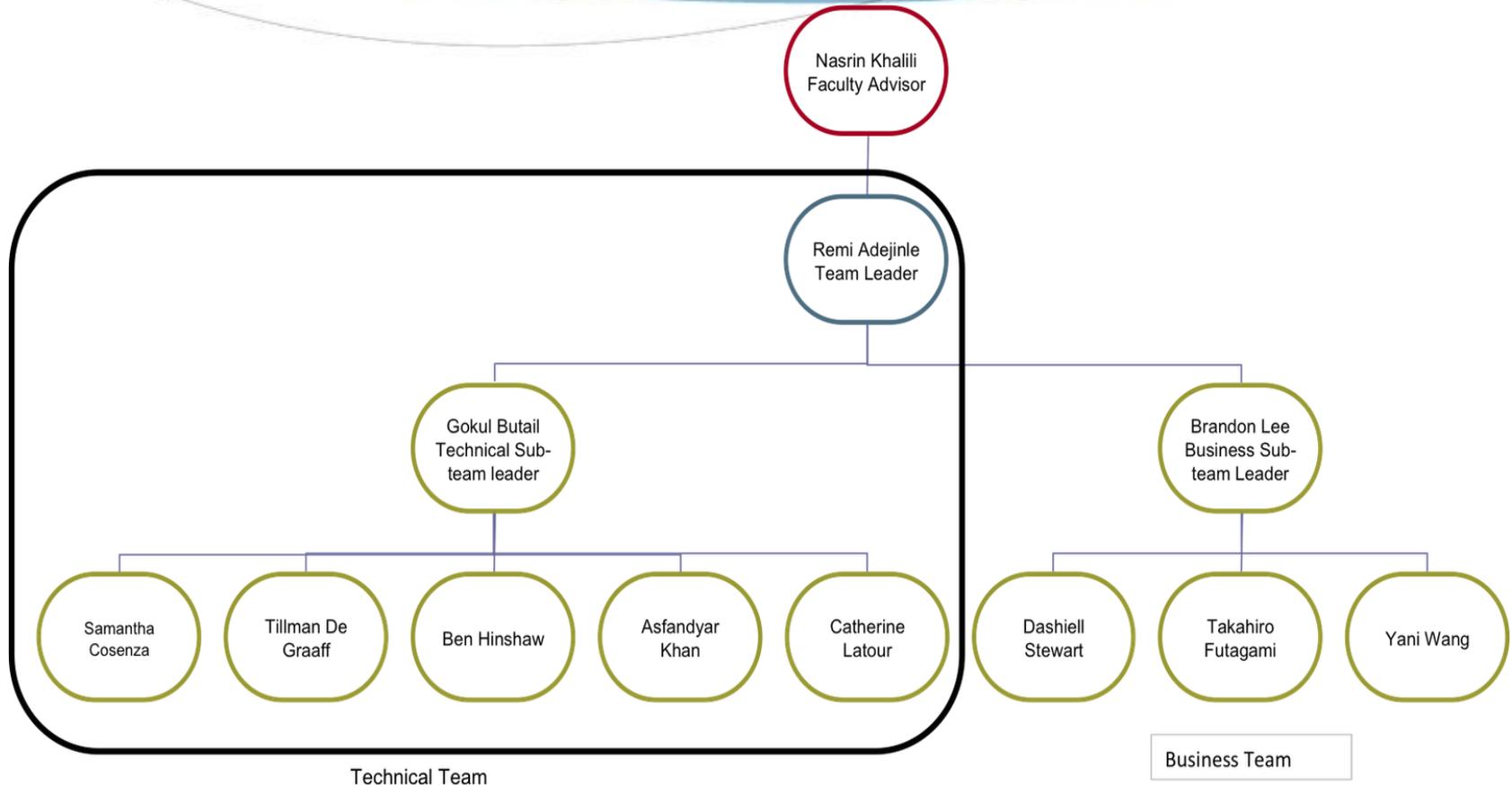
- Match Orange, MA resources with IIT expertise
- Creation of Business Opportunities and Jobs in Small Towns of America
  - via Development of Sustainable Organic Waste Management Strategies.

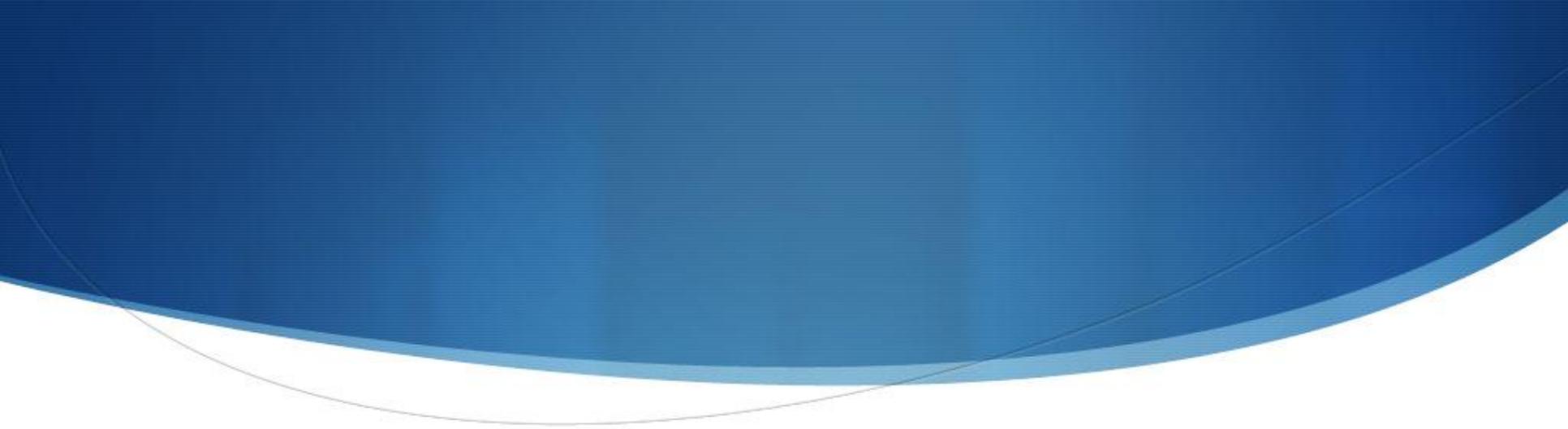


# Objectives

- Evaluate existing technologies for the disposal of municipal, farm, and household wastes
- Propose alternative sustainable technology that is preferable to the status quo
- Gather information about available waste relevant to business planning
- Conduct analysis on the costs and profitability of the design
- Develop a commercialization plan

# Team Structure





# Background

# Orange: Current Organic Waste Management Models

- Households and Small Businesses Haul their Waste to a Recycling Center
- There is Limited Waste Management programs
- Farms Dispose of Their Organic and Farm Waste locally
- Municipal Wastewater Sludge is Incinerated off site



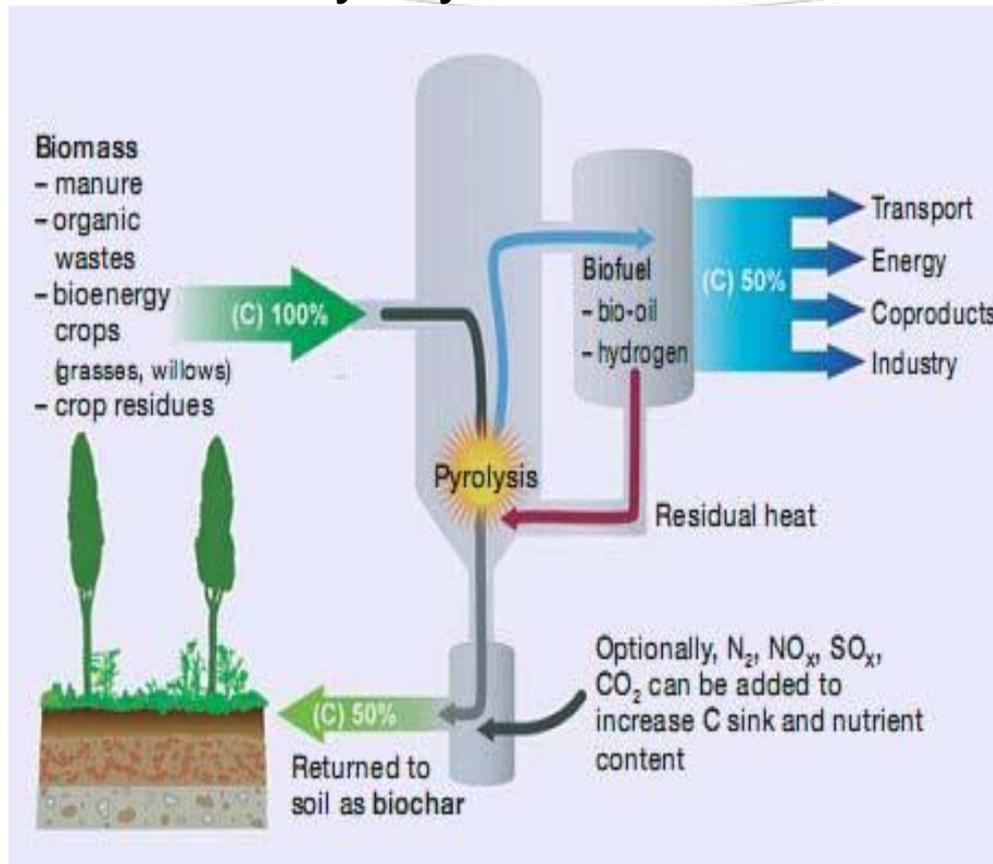
# What is Biochar?

A soil amendment that combats global warming and improves Agricultural Sustainability and Environmental Impacts

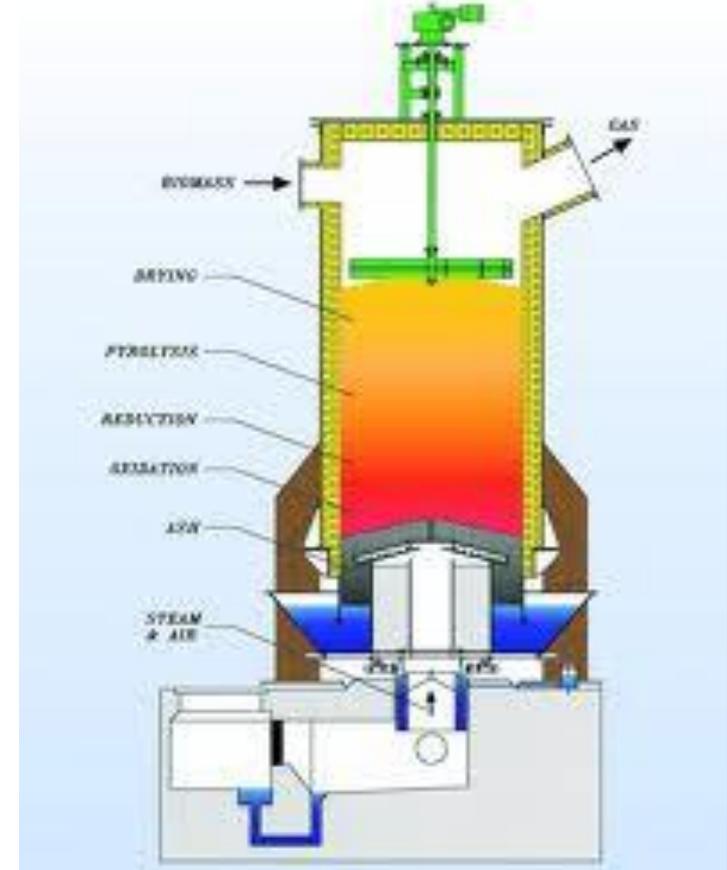


# How is it produced?

## Pyrolysis



## Gasification



# What are the uses?

- Excellent soil amendment and fertilizer
- Disposal of Organic Waste
- Reduces the use of nitrogen fertilizers which are harmful to aquatic organisms
- Sequesters carbon in the soil
- Byproducts include biofuel (can be refined and sold) and syngas (fuels the process)



# Centralized System

- \$50,000 and up
- Waste are processed at a central location.
- Recovers biochar and biofuel which can be processed and sold.
- Can also generate heat and electricity.
- Can bank and sell carbon credits

# Centralized System

Pros: Enhances economy by creating job, developing infrastructure and creating a revenue source for the town. Government funding may be available.

Cons: Expensive to purchase, install and maintain. Requires more technical expertise, legal regulations, transport of raw materials, products and byproducts.

# Decentralized System

- \$200-\$500
- Household units
- Produces mainly biochar
- Functions as a stove or grill
- Used based on personal need

# Decentralized System

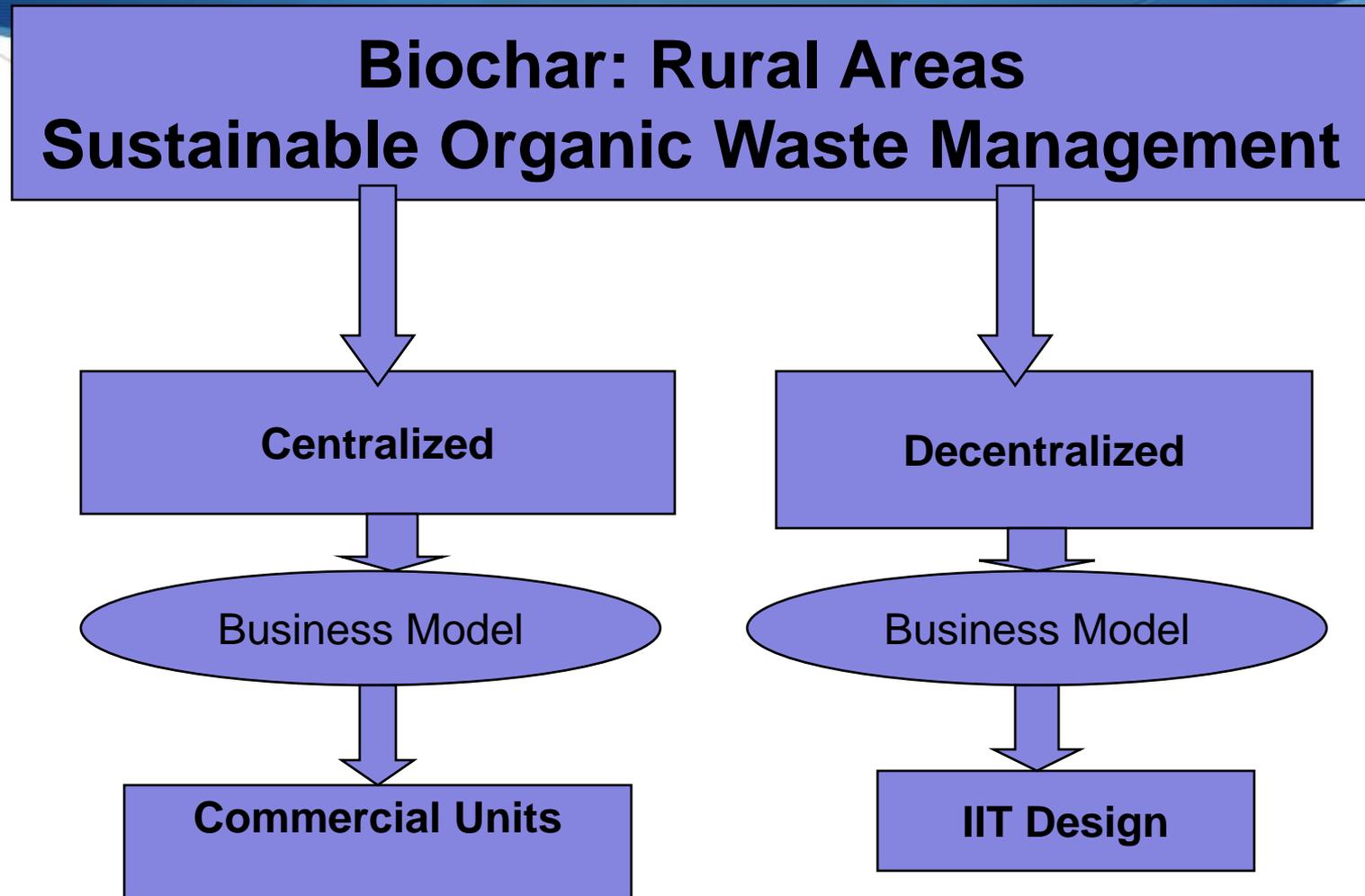
Pros: Cheap, easy to manufacture, simple enough to understand, portable

Cons: Economic effect is difficult to measure, does not generate income, less efficient, carbon credit and electricity generation is unlikely.

# Biochar Unit IPRO 350



# Commercial Options



# Orange, Massachusetts

## Biochar Feed and Operation Model

- **Potential Feeds Organic Waste:** Municipal sludge, farm waste, wood waste
- **Commercial Models:**
  - **Decentralized system** - the farmers in Orange benefit and can improve their crop yields and thus their profits.
  - **Centralized system** - would benefit Orange by improving the economy and producing energy

# Qualitative Cost and Benefit Assessment

Project/ Alternatives	Costs		Benefits			
	Capital	Operations	Jobs	Energy	Soil Amendmen t	Total
Landfill	-10	-10	8	6	0	-6
Incinerator	-10	-7	5	8	0	-4
Composting	-3	-2	2	0	5	2
Biochar- Centralized	-4	-1	1	8	10	14
Biochar- Decentralized	-1	0	0	4	7	10

# Future Studies

- Collect Local Data
- Characterize Produced Biochar from Different Combination of Waste feed
- Evaluate Impact of Using Biochar on Soil. And Potentials for Energy Recovery
- Carbon Markets Monetization

# Conclusion

- Biochar is best known sustainable organic waste management method
- Can ultimately be a mass method of reducing green house gases
- Can possibly replace the need for fertilizers in the future

# Thank You

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