PLANNING AND ZONING & HISTORIC COMMISSION AGENDA

Thursday, June 1, 2023

6:30 PM

East Dundee Police Station, 2nd Floor Meeting Room

115 E. 3rd Street, East Dundee, IL 60118

CALL TO ORDER

ROLL CALL / DECLARATION OF QUORUM

APPROVAL OF MINUTES

1) Draft Minutes from the May 04, 2023 Meeting

PUBLIC COMMENT

NEW BUSINESS

1) **Special Use Permit Application With Conditions to Allow Biochar Solid Waste Treatment Operations, as Described in Section 157.065(A)(1)(l)(3), located at 569 Rock Road Drive, East Dundee, IL 60118 (PIN 03-25-200-015) in the M-2 Limited Manufacturing District**

OTHER BUSINESS

ADJOURNMENT

CALL TO ORDER:
Chair Brunner called to order the Planning and Zoning & Historic Commission ("PZHC") meeting on Thursday, May 4, 2023, at 6:00 pm.

ROLL CALL:
Commissioners Feck, Krueger, Steneck, Brunner, and Reyes-Brahar were present.

Commissioners Myers and Scarpelli were absent.

Also present: Assistant to the Village Administrator ("ATVA") Franco Bottalico.

APPROVAL OF MINUTES:
1. Planning & Zoning and Historic Commission Meeting Minutes dated April 6, 2023.

Motion to approve the April 6, 2023 meeting minutes with revisions to the attendance order, and minute dates corrected by Steneck/Reyes-Brahar.
5 Ayes (Feck, Krueger, Steneck, Brunner, and Reyes-Brahar). 0 Nays. Motion Carries.

PUBLIC COMMENT: None

NEW BUSINESS: None

OLD BUSINESS:

Live Entertainment
Chair Brunner opened the continued discussion regarding live entertainment. ATVA Bottalico advised that staff added the amendments to the allowable uses table for the business districts as discussed at the previous April meeting regarding this topic. Staff also included "S" special use designation for Brew Pubs and Taverns with live entertainment and "S" special use designation for a restaurant with a drive-thru in the B-1 Business District. Lastly, staff suggested a restaurant with live entertainment be a special use in the B-4 automotive business district rather than a "P" permitted use designation.

Staff also included an existing restaurant definition from the code for the PZHC's review. Additionally, staff compiled definitions from other local governments to create a definition for "live entertainment" and "tavern" for the PZHC's consideration to recommend to the Village Board.

When deliberating if the word "outdoor" should be added before "live entertainment" in the allowable uses table, the PZHC agreed that by doing so it would limit the Village's discretion to review all live entertainment special use applications such as ones with indoor live entertainment. The PZHC agreed not to add the word "outdoor" to the allowable uses table in order to have the ability weigh-in on safety concerns, noise concerns, building construction methods and materials, and the layout of all applicable businesses who wish to have live entertainment and they can do so via the special use process. Chair Brunner asked to highlight these reasons why for the Village Board's review.

ATVA Bottalico recommended that the PZHC review with leniency the existing business who would need to come before the PZHC for a special use permit because their business offers live entertainment; essentially stating it is not the individual business' fault and they now have an existing established business model.

However, ATVA Bottalico did advise that ultimately the discretion lies with the Village Board as far as conditions go.

The PZHC had a brief discussion on fines for loud noise and if the fines escalate for repeat offenses. The PZHC also commented to use uniform language as a condition of live entertainment special use recommends when it comes to repeat offenses of noise ordinance violations for future applications.

Motion to recommend Village Board approval of the allowable use table text amendments and two definitions in the Zoning Code as presented by staff, and motioned to have staff review the noise ordinance fine schedule and future live entertain condition language to refer to by Steneck/Feck.
5 Ayes (Feck, Krueger, Steneck, Brunner, and Reyes-Brahar). 0 Nays. Motion Carries.

Motion to have the existing businesses who have live entertain to come into compliance with the new text amendments via a more lenient condition section and process due to their existing status by Krueger/Steneck.
5 Ayes (Feck, Krueger, Steneck, Brunner, and Reyes-Brahar). 0 Nays. Motion Carries.

Banquet Hall Discussion:
Chair Brunner opened the continue discussion on banquet hall facilities. ATVA Bottalico stated he added the existing banquet hall definition from the code to the memo, and he added it as a "S" special use in the B-1, B-2, B-3, and B-4 Businesses Districts.

Chair Brunner read aloud comments forwarded to the PZHC by absent Commissioner Scarpelli which states to make the existing banquet hall less descriptive and more open to cover any type of banquet halls as best as possible. Commissioner Scarpelli also noted that banquet halls should be allowed in the "M" manufacturing districts.

The PZHC discussed if it was appropriate to have a banquet hall in the "M" Manufacturing Districts. The PZHC agreed that since hotels / motels are permitted there, it would be appropriate to permit banquet halls as a special use as well as these two uses compliment each other.

Motion to recommend Village Board approval of the allowable use table text amendments for banquet halls to be a "S" special use in the B-1, B-2, B-3, B-4, M-1, and M-2 zoning districts, and to amend the definition of banquet hall in Chapter 116 to be less restrictive by Feck/Steneck.

ADJOURNMENT:
Motion to adjourn the PZHC meeting at 7:45 pm by Kreuger/Reyes-Brahar.
Motion carries by voice vote.

Respectfully submitted,
Franco Bottalico, ATVA

Memorandum

To: Planning and Zoning & Historic Commission

From: Franco Bottalico, Assistant to the Village Administrator

Subject: 569 Rock Road Drive – Special Use Request for Solid Waste Treatment

Date: June 1, 2023

Action Requested:

Staff recommends the Planning and Zoning & Historic Commission ("PZHC") recommend approval to the Village Board for a special use permit with conditions to allow biochar solid waste treatment operations, as described in Section 157.065(A)(1)(l)(3), located at 569 Rock Road Drive, East Dundee, IL 60118 (PIN 03-25-200-015) in the M-2 Limited Manufacturing District.

Background and Summary:

The Village received an application for a special use permit from Molly Senter and Michael Veney of Davey Tree Expert Company (Applicant"), located at 569 Rock Road Drive ("Property") to install and operate a stationary pyrolysis rotary drum unit ("PRD") on a concrete pad in an enclosed structure for their proposed process to convert woody biomass into biochar. The PRD method is the breaking down of material by using heat.

According to the Rochester Institute of Technology in New York ("RIT"), biochar is a carbon-rich material that is made from biomass through a thermochemical conversion process – in this case in East Dundee, through the proposed PRD. The attached article from the RIT website states that organic waste, such as the woody biomass waste that is on-site at Davey Tree, can be converted into energy or a new type of material such as liquid, gas, or solid materials. In the Applicant's proposed method, the end product would result in solid material known as the biochar, which would be a fine-grained type of charcoal that can be used as a soil enhancer in which the Applicant intends to sell by wholesale. The biochar is a highly sought after commodity used in landscaping, agriculture, concrete, water treatment, and medical applications according to the Applicant.

In their normal day-to-day business, the Applicant produces woody biomass waste as part of their operations. Currently, this woody biomass is treated and grinded and turned into mulch. By installing a PRD to transform this woody biomass into biochar, the Applicant states the research shows this to be a more environmentally-friendly process and will produce a cleaner and more sustainable end product. The Applicant will be procuring the PRD through Biomass Energy Techniques who will provide installation support and training to the Applicant's team on

an ongoing basis. The Applicant has also hired a consultant, Complete Solutions Consulting, to guide and support the Applicant.

The PRD unit is designed to run 24/7 and will be shut down 1 to 2 days per month for routine maintenance. According to the Applicant, during a site visit at a separate location, the machine's sound emanating from it did not interfere with their conversations while standing three feet from the PRD unit.

The Applicant states that the PRD will meet all environmental performance standards as required by the Illinois Environmental Protection Agency ("IEPA") and they are in the process of preparing a joint construction and lifetime operating permit application utilizing Weaver Associates as their consultant. Staff has reached out to the IEPA and inquired if this requires a permit. The IEPA contact person has advised that a review is underway and will reach out to the Village by mid- to late-June 2023.

Staff Recommendations:

The PZHC recommend a special use permit to allow biochar solid waste treatment operations, as described in Section 157.065(A)(1)(l)(3) with the following conditions:

1) All local, state, and federal laws and regulations are followed;
2) It is the Applicant's responsibility to acquire all applicable local, state, and federal permits;
3) The PRD unit has proper warning signs affixed to the exterior of the shelter housing the PRD unit, and said shelter is able to be secured from the outside by the Applicant's staff during business off hours; and
4) At 5 years of commencing the special use ordinance, the Applicant must appear before the PZHC and/or Village Board to submit a review of operations regarding the special use.

Attachments:

Redacted Application

Findings of Fact

Educational Material from Applicant

Memo from Fire Protection District

Rochester Institute of Technology Printout

P&Z File # _____

VILLAGE OF EAST DUNDEE

APPLICATION FOR DEVELOPMENT APPROVAL:
SPECIAL USE, REZONING AND VARIANCE REVIEW AND APPROVAL

This form is to be used for all special use applications (except Planned Developments) to be heard by the Village of East Dundee. To complete the form properly, please review the accompanying *Village of East Dundee Instruction Manual for Application for Development Review.* **Failure to complete this form properly will delay its consideration.**

PART I. GENERAL INFORMATION

A. Project Information

1. Project/Owner Name: Davey Tree Expert Company
2. Project Location: 569 Rock Road Drive, East Dundee IL 60118
3. Brief Project Description:
   Install and operate a pyrolosis roatary drum to process biomass generated from our operations in biochar.
4. Project Property Legal Description:
   That part of the North Half of Section 25, Township 42 North, Range 8 East of the Third Principal Meridian, described as follows: Beginning at the Southeast corner of Lot 1 in Rock Road Industrial Subdivision Unit No. 1; thence South 31 degrees 10 minutes 09 seconds West along the Westerly line of Rock Road Drive 225.33 feet; thence North 58 degrees 49 minutes 51 seconds West 759.35 feet to the Westerly line extended Southerly of said Lot 1; thence North 24 degrees 08 minutes 00 seconds East along the Southerly extension of said West line 227.04 feet to the Southwest corner of said Lot 1;thence South 58 degrees 49 minutes 51 seconds East along the South line of said Lot 787.16 feet to the point of beginning in the Township of Dundee, Kane County, Illinois.
5. Project Property Size in Acres and Square Feet: 4 Acres (approx. 174,240 square feet)
6. Current Zoning Status: M-2 Limited Manufacturing
7. Current Use Status: _____
8. Surrounding Land Use Zoning: _____
9. Zoning District Being Requested (if applicable): _____
10. Parcel Index Numbers of Property: 03-25-200-015

B. Owner Information

1. Signature: _____
2. Name: Davey Tree Expert Company
3. Address: 1500 North Mantua Street, Kent OH 44240
4. Phone Number: [redacted]

C. Billing Information (Name and address all bills should be sent to)

1. Name/Company: Davey Tree Expert Company
2. Address: PO Box 5200, Acct 165063, Kent OH 44240
3. Phone Number [redacted]

PART III. JUSTIFICATION OF THE PROPOSED SPECIAL USE

Please answer all questions but be concise and brief in your answers. If additional pages are needed to complete your answers, please be sure to include the appropriate and complete question number for each response. Applicants are encouraged to refer to drawings or other application materials as necessary to add clarity to their answers. **Applicants are also encouraged to refer to Special Use Criteria Section 157.224(C)(2) or Variances, Section 157.207(C) or Rezoning.**

IF YOU ARE APPLYING FOR A REZONING PLEASE WRITE A PARAGRAPH ON WHAT THE CURRENT ZONING IS AND WHY YOU ARE REQUESTING A REZONING

FOR A SPECIAL USE COMPLETE THE FOLLOWING, FOR VARIANCES ONLY SKIP TO PAGE #4:

1. Will the Special Use be injurious to the enjoyment of other property in the immediate vicinity for the purposes already permitted, nor will the special use substantially diminish and impair property values within the neighborhood?

The Special Use does not change the primary the operation of the property for the storing and processing of woody biomass produced in the normal course of business for Davey Tree. We do not expect the addition of Pyrolysis Rotary Drums (PRDs) to be injurious to the enjoyment of other properties or to substantially diminish and impair property values within the neighborhood.

2. Will the establishment of the Special Use impede the normal and orderly development and improvement of the surrounding property for uses permitted in the district?

The Special Use does not change the primary the operation of the property for the storing and processing of woody biomass produced in the normal course of business for Davey Tree. We do not expect the addition of PRDs to impede the normal and orderly development and improvement of the surrounding property for uses permitted in the district.

3. Have or will adequate utilities, access roads, drainage or necessary facilities be provided for?

Adequate utilities, access roads, and drainage are already located onsite. A concrete pad and structure will be installed to protect the PRDs. The driveway will be extended to circle the pad to allow for easy entry and exit of vehicles (See site map for proposed location of concrete pad, structure, and extended driveway).

4. Have or will adequate measures be taken to provide ingress and egress to minimize traffic congestion in the public streets?

We do not expect the PRDs to create additional traffic. The driveway will be extended into the property around the concrete pad and structure to eliminate the need for vehicles to back up to turn around (See site map for proposed location of concrete pad, structure, and extended driveway).

5. How is the proposed special use in harmony with the purposes, goals, objectives, policies and standards of the Village of East Dundee Comprehensive Plan, the Zoning Ordinance, and any other plan, program, or ordinance adopted, or under consideration pursuant to official notice, by the Village?

The addition of PRDs to Davey Tree's current site will expand the light industrial capabilities to process the woody biomass into biochar sequestering tons of CO_2 for 100s of years while creating a high value product for use in multiple processes including soil amendments for agriculture and landscaping concrete production, and water treatment. This upgrade to our current facility will create at least two full time jobs. The PRD will meet all environmental performance standards required by the Illinois Environmental Protection Agency.

IF YOU ARE APPLYING FOR A VARIANCE COMPLETE THE FOLLOWING:

1. From which specific standard of the Village Code is a Variance requested (include Code section number)?

2. For this site, what does the Code require?

3. What is proposed?

4. What unique circumstances have caused the need for a variance?

5. What specific mitigation measures will be used to ensure that the essential character of the area will not be altered? (Suitability of Present Area)

6. Specifically, how do the particular physical surroundings, shape, or topographical condition of the property result in a particular hardship upon the owner, as distinguished from a mere inconvenience, if the strict letter of the regulations are carried out?

7. Specifically, what conditions are present on the property that would not be applicable generally to other property within the same zoning classification? (Suitability of Zoning)

8. Other than financial return, what other purposes is the variance request based on?

9. Has the alleged difficulty been created by any person presently having an interest in the property?

10. Please give an explanation for any questions answered YES .

a.	Will the granting of the variation be detrimental to the public welfare? (Circle)	YES	NO
b.	Injurious to surround properties? (Circle)	YES	NO
c.	Impair an adequate supply of light and air to adjacent property? (Circle)	YES	NO
d.	Endanger public health and safety? (Circle)	YES	NO
e.	Substantially diminish property values within the neighborhood? (Circle)	YES	NO
f.	Conformance to the Land Use Plan? (Circle)	YES	NO

VILLAGE OF EAST DUNDEE

PLANNING AND ZONING & HISTORIC COMMISSION MEETING SCHEDULE
MEETING TIME 7:00PM
***THURSDAY EVENING UNLESS DENOTED**

Planning & Zoning petitions must be received 35 days prior to meeting date for petitions requiring Public hearings. 15 days prior when no Public hearing is required.

Historic Commission Meetings (as needed)

Applications submittals must be received & approved by the Building official for presentation to the Commission minimum of 15 days prior to meeting date.

Per ordinance, the Historic Commission must meet within 15 days of application submittal acceptance date and be dully considered by the Commission or a Certificate of Appropriateness would be deemed issued for failure to meet in the designated time.

VILLAGE OF EAST DUNDEE

APPLICATION AGREEMENT
TO PAY COSTS INCURRED AND HOLD THE VILLAGE HARMLESS

The Undersigned applicant acknowledges that the Village of East Dundee may seek advice and counsel from professional sources outside the employee staff of the Village of East Dundee in consideration of the application submitted to the Village of East Dundee by the applicant, including the services as those provided by the Village Staff, Village Attorney, Village Engineer, Planner and Fire Protection District.

The applicant further acknowledges that testimony of all witness at Public Hearings may be recorded before a court reporter and that full transcripts of the proceedings may be prepar4ed and retained by the Village of East Dundee as part of the official record concerning the said applicant and the applicant's costs.

As an express condition in making the said application and the consideration thereof by the Village of East Dundee, the undersigned, both personally and on behalf of the applicant, agrees to hold the Village harmless and agrees to pay forthwith the costs and expenses that may be incurred by the Village of East Dundee for such professional services, including the costs and expenses of recording and transcribing any testimony at Public Hearings in connection with the said application.

The owner hereby authorizes, support and consents to this request for variation, and further authorizes, agrees and consents to allow the temporary installation and display by the Village of East Dundee of Public Notice (signage) upon the subject property.

The applicant, having read this application and fully understanding the purpose thereof, declares that the proceeding statement made are true and that the information provided herein is complete to the best of the applicant's knowledge and belief.

[signature]	4-11-2023
Individually and for the Applicant	Date
1500 North Mantua Street, Kent, OH 44240	330-673-9515
Address	Phone Number

Project Description:

Install and operate a pyrolosis roatary drum to process biomass generated from our operations in biochar.

VILLAGE OF EAST DUNDEE

Affidavit of Ownership & Control

I (We), Davey Tree Expert Co. do herby certify or affirm that I am the ower(s), contract purchasers, or beneficiary(s) of the title holding trust for the aforesaid described property and hereby make application of such.

Signature: [signature]

Owner: Davey Tree Expert Company

[redacted]

SUBSCRIBED AND SWORN TO before me this 11th day of April, 2023.

[signature]
(NOTARY SIGNATURE)

NOTARY PUBLIC STATE OF OHIO
MARY ANN SCHAEFER
Notary Public
State of Ohio
My Comm. Expires
November 26, 2027

(NOTARY STAMP)

VILLAGE OF EAST DUNDEE

Affidavit & Disclosure Agreement

To cover the Village expenses relating to applications for site plans, Subdivisions, Annexations, Zoning Amendments, Special Uses, Variations and the like:

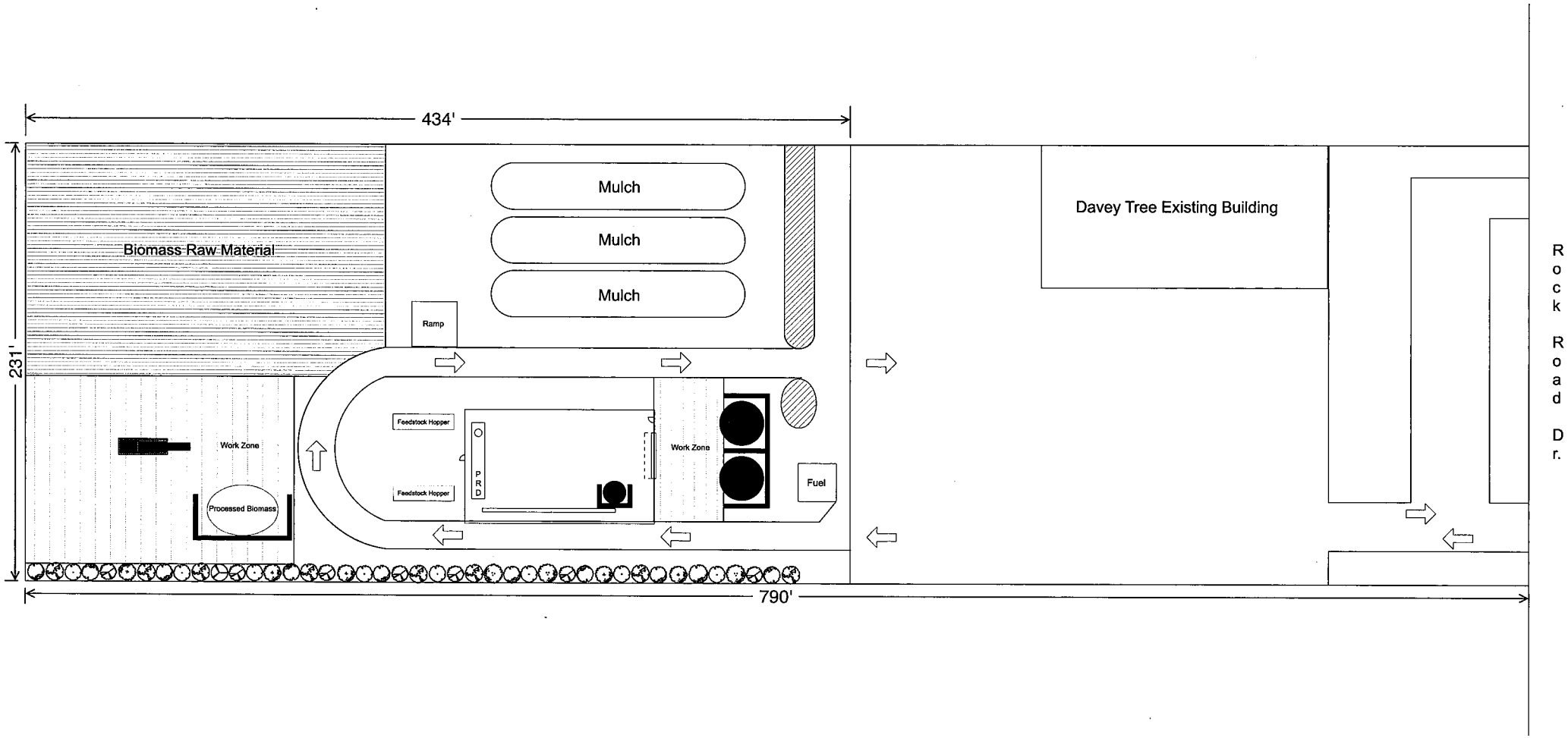
Applications shall deposit the sum required based on the type and extent of the applicants project. Any bills received by the village and any costs incurred by the Village related to the project will be billed to the applicant. Upon payment of all bills to the Village the applicant will receive their deposit back.

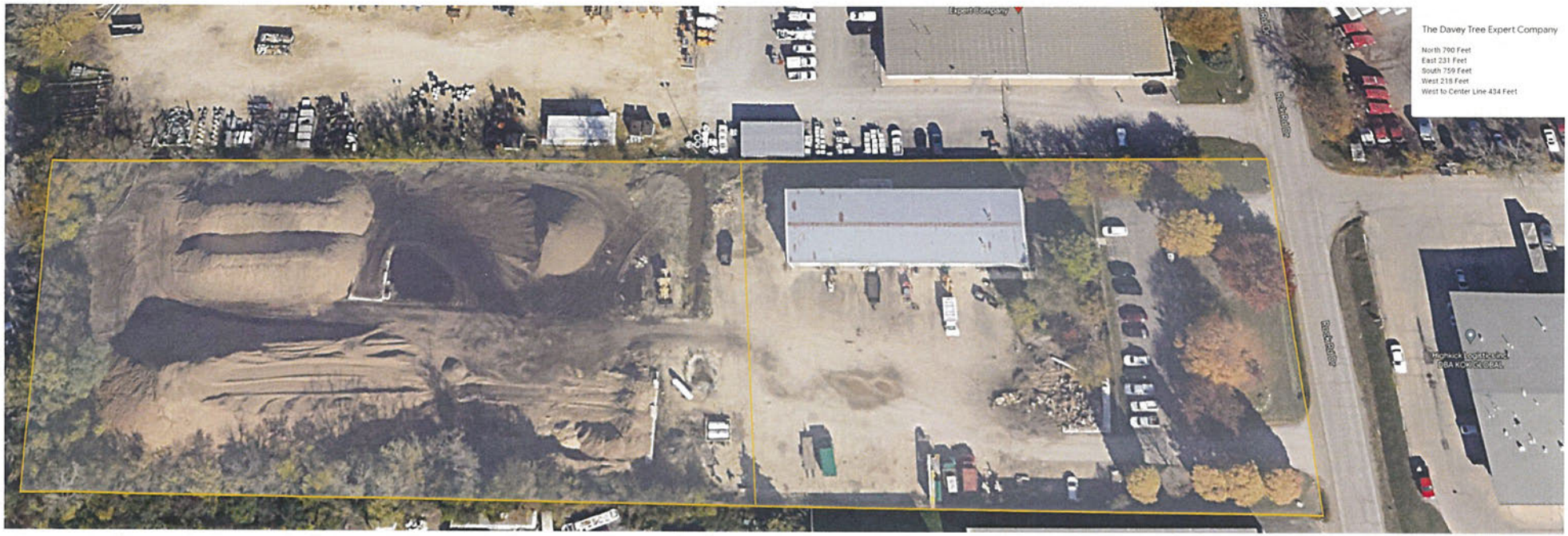
Signature: Thuy Sears

Print Name: Thuy R. Sears

Project Address: 569 Rock Road Drive, East Dundee IL 60118

That part of the North Half of Section 25, Township 42 North, Range 8 East of the Third Principal Meridian, described as follows: Beginning at the Southeast corner of Lot 1 in Rock Road Industrial Subdivision Unit No. l; thence South 31 degrees 10 minutes 09 seconds West along the Westerly line of Rock Road Drive 225.33 feet; thence North 58 degrees 49 minutes 51 seconds West 759.35 feet to the Westerly line extended Southerly of said Lot l; thence North 24 degrees 08 minutes 00 seconds East along the Southerly extension of said West line 227.04 feet to the Southwest corner of said Lot l; thence South 58 degrees 49 minutes 51 seconds East along the South line of said Lot 787.16 feet to the point of beginning in the Township of Dundee, Kane County, Illinois.


434'
231'
790'
Biomass Raw Material
Mulch
Mulch
Mulch
Ramp
Davey Tree Existing Building
Work Zone
Processed Biomass
Feedstock Hopper
Feedstock Hopper
PRD
Work Zone
Fuel
Rock Road Dr.


The Davey Tree Expert Company
North 790 Feet
East 231 Feet
South 759 Feet
West 218 Feet
West to Center Line 434 Feet

Planning and Zoning & Historic Commission Meeting

Findings of Fact – Special Use

Property Location: 569 Rock Road Drive

Hearing Date: June 1, 2023

Special Use Requested: Solid Waste Treatment

Staff has determined the below findings of fact for the PZHHC's consideration and review:

1. **The use is not injurious to the use and enjoyment of other property in the immediate vicinity for the purposes already permitted, nor substantially diminish and impair property values within the neighborhood; Circle one; Yes/No/Not Applicable (N.A.), Explain:**
   Yes.

2. **The use will not impede the normal and orderly development and improvement of the surrounding property for uses permitted in the district; Yes/No/N.A.**
   Yes

3. **Adequate utilities, access roads, drainage or necessary facilities have been or will be provided; Yes/No/N.A.**
   Yes

4. **Adequate measures have been or will be taken to provide ingress and egress so designed as to minimize traffic congestion in the public streets; Yes/No/N.A.**
   NA

5. **How is the proposed special use in harmony with the purposes, goals, objectives, policies and standards of the Village of East Dundee Comprehensive Plan, the Zoning Ordinance, and any other plan, program, or ordinance adopted, or under consideration pursuant to official notice, by the Village?** The 2002 Commercial Development comp. plan goal states: "To provide for an adequate and attractive commercial base to serve the needs of Village residents". This aligns with the proposed special use.

Based on the information contained in the application and the testimony and evidence presented at the public hearing, the Planning and Zoning & Historic Commission voted on the approval of these findings of fact and the requested special use(s) resulting in the following vote:

____ ayes ____ nayes ____ absent ____ abstain

Date: _____

Signature: _____

Chair, Planning and Zoning & Historic Commission

Illinois Biochar Group

Research & Publications

Current Research by IBG Members

Illinois Sustainable Technology Center, University of Illinois

Scientists at the Illinois Sustainable Technology Center (http://www.istc.illinois.edu) on the campus of the University of Illinois are conducting biochar studies which include: (1) production of biochar from a variety of waste biomass and testing its characteristics; (2) use of biochar as a soil amendment for sustainable agriculture; and (3) potential environmental implications associated with biochar use. For more information on ISTC's biochar research, or if you are interested in exploring biochar production at your facility or establishing collaboration on biochar research, please contact Dr. Wei Zheng (wzheng@istc.illinois.edu) or Dr. Kishore Rajagopalan (kishore@istc.illinois.edu).

National Center for Agricultural Utilization Research (NCAUR)

NCAUR is one of the four regional research laboratories in the United States for the U.S. Department of Agriculture's official research branch, the Agricultural Research Service (ARS). Biochar research here has been ongoing for nearly a decade with several targeted applications:

Dr. Steve Peterson has focused mainly on using biochar as a renewable carbon substitute for carbon black filler in rubber composites. With carbon black being sourced from fossil fuels, it is desirable to move towards renewable replacements for this material, especially with its massive market in automobile tires, belts, hoses, and seals. It is through connections in the Illinois Biochar Group that Steve has collaborated quite successfully with Biochar Options, a biochar producer in Wisconsin that excels in high-carbon and low-ash biochar.

Dr. Steve Vaughn, a horticulturalist, has studied biochar as a soil amendment in various applications such as golf greens, high-value horticultural crops, and nurseries. This

Illinois Biochar Group

Dr. Veera Boddu has been a Research Leader at NCAUR since 2015, after serving for many years as a Senior Scientist with the Environmental Processes Branch of the U.S. Army Corps of Engineers in Champaign, Illinois. Lately his research has been examining avocado pits as biochar feedstock and developing biochar-based media to filter and treat agricultural runoff water contaminated with high levels of pesticides along with nitrate and phosphate fertilizers.

Publications from all three of the above listed ARS scientists can be seen by clicking on their names above, which will take you to their official ARS webpages (scroll down to and expand the 'Publications' section).

Chip Energy, Inc.

Paul Wever (pwever@pwce.com) and Dr. Paul Anderson (psanders@ilstu.edu) of Chip Energy, Inc. continue their work on biochar production and pyrolysis furnaces.

University of Illinois-Chicago

Researchers at the University of Illinois Chicago are studying the application of biochar in site remediation projects as well as the use of biochar as a filter for stormwater drainage. Dr. Krishna Reddy recently received an NSF grant to continue his work on biochar in covers for landfills. That project is entitled "**Sustainable Biocover System for Methane Oxidation in Landfills**". Project duration Is: March 1, 2012 – February 28, 2015 (estimated). Dr. Reddy is the Principal Investigator and Dr.Jean Bogner is Co-Principal Investigator. For more information, contact Dr. Krishna Reddy.

The objective of this research project is to develop a new low-cost, practical, and sustainable soil system amended with biochar to effectively mitigate landfill methane emissions. Municipal solid waste landfills are the third largest anthropogenic source of methane emissions in the US. There is an urgent need to develop cost-effective innovative cover systems that can mitigate methane emissions from landfills. An integrated research program, consisting of controlled laboratory batch and column experiments, mathematical modeling, and a field demonstration, will be undertaken to investigate: (1) the physical, geochemical and geotechnical properties of biochars and biochar-amended soils; (2) the transport and enhanced adsorption of biochars and biochar-amended cover

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composition, methane concentrations, moisture contents, and temperatures); (5) the development of a mechanistic model for methane oxidation within biochar and biochar-amended landfill covers; and (6) the performance in a full-scale field demonstration to verify the validity of the research findings and viability of practical application. In addition, a guidance manual will be prepared for the design of biochar and biochar-amended soil cover systems for landfill applications. This project will determine the fundamental mechanisms responsible for stimulation of soil microorganisms in biochar, including the contribution of porous structure and high surface area to gaseous adsorption, moisture retention, and colonization by methanotrophic populations.

This project will result in a creative, low-cost, sustainable biochar and biochar-amended soil cover system to mitigate methane emissions at landfills and protect the environment and public health. Two graduate students will have the opportunity to gain research experience through this project in emerging field of sustainable geo-engineering. Research skills and instrumentation developed for this project will enhance classroom instruction at the undergraduate level, the graduate level, and for K-12 teachers in the "Teachers as Scholars" Program. A teaching module "Engineering with Biochar" will be developed and incorporated into the existing Landfill Engineering and Sustainable Engineering courses. The project results will be widely disseminated by: (1) organizing a workshop for practicing and regulatory professionals, (2) publishing refereed journal/conference papers, and (3) participating in the Illinois and US Biochar Groups.

Summaries & Reviews on Biochar

- **International Biochar Initiative Guidelines for Specifications of Biochars document-October 2011**
  The final draft document is now available on the IBI website and is awaiting final comments through November 15, 2011.For further information, and to see earlier drafts of the guidelines, and follow the course of development of the guidelines, please go to http://www.biochar-international.org/characterizationstandard.
- **Technical, Economical and Climate Related Aspects of Biochar Production Technologies: A Literature Review**
  Sebatian Meyer, Bruno Glaser, and Peter Quicker

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June 10, 2011
Biofuelwatch

- **Biochar Effects on Soil Biota – A Review**
  2011
  Johannes Lehmann, Matthias C. Rillig, Janice Thies, Caroline A. Masiello, William C. Hockaday, and David Crowley
  Soil Biology and Biochemistry, Article in Press, Corrected Proof.
  DOI: doi:10.1016/j.soilbio.2011.04.022
- **Biochar, climate change and soil: A review to guide future research**
  2009
  Saran Sohi, Elisa Lopez-Capel, Evelyn Krull and Roland Bol
  Corresponding author and editor: Evelyn Krull
  CSIRO Land and Water Science Report 05/09
- **U.S.-Focused Biochar Report – Assessment of Biochar's Benefits for the United States of America**
  2010
  Edited by Jonah Levine
  Contributing Authors: Christoph Steiner, PhD, Hugh McLaughlin, PhD, PE, Andrew Harley, PhD, Gloria Flora, Ronal Larson, PhD, Adam Reed, JD
  Centennial Publishing, Colorado, USA
- **Biochar for environmental management: science and technology**
  2009
  Johannes Lehmann and Stephen Joseph
  Earthscan
- **Biochar Application to Soils – A Critical Scientific Review of Effects on Soil Properties, Processes, and Functions**
  2009
  F. Verheijen, S. Jeffery, A.C. Bastos, M. van der Velde, and I. Diafas
  EUR 24099 EN, Office for the Official Publications of the European Communities, Luxembourg, 149pp.
- **A Guide to Conducting Biochar Trials**
  2009

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2010
Julie Major
International Biochar Initiative, 23 pp.

- **Potential Mechanisms for Achieving Agricultural benefits from Biochar Application to Temperate Soils: a review**
  2010
  Christopher J. Atkinson, Jean D. Fitzgerald, and Neil A. Hipps
  Plant Soil (2010) 337:1- 18
- **The Role of Biochar in Modifying the Environmental Fate, Bioavailability, and Efficacy of Pesticides in Soils: a review.**
  2010
  Rai S.Kookana
  Australian Journal of Soil Research
- **Garcia-Perez, M., T. Lewis, and C.E. Kruger. 2010. Methods for Producing Biochar and Advanced Biofuels in Washington State. Part 1: Literature Review of Pyrolysis Reactors. First project Report. Department of Biological Systems Engineering and the Center for Sustaining Agriculture and natural Resources, Washington State University, Pullman, WA. 137 pp.**
  http://www.ecy.wa.gov/pubs/1107017.pdf
- **Biochar Research Needs and Priorities: International Biochar Initiative – Updated Draft March 2010**

Most Recent Publications

- **Biochar Production for Carbon Sequestration, Report by Allyson Stoyle, Worchester Polytecnic Institute, March 15, 2011**
  https://www.wpi.edu/Pubs/E-project/Available/E-project-031111-153641/unrestricted/BIOCHAR_CO2SEQ.pdf
- **Biochar Articles from Google Scholar for 2011**
- **Using Biochar as a Soil Amendment for Sustainable Agriculture**
  June 2011
  Wei Zheng, B.K. Sharma, Kishore Rajagopalan

Illinois Biochar Group

- **Hydrologic Properties of Biochars Produced at Different Temperatures**
  March 2012
  T.J. Kinney, C.A. Masiello, B. Dugan,W.C. Hockaday, M.R. Dean, K. Zygourakis, R.T. Barnes.
  Biomass and Bioenergy In Press, Corrected Proof available online March 20, 2012.
  DOI: http://dx.doi.org/10.1016/j.biombioe.2012.01.033 .

Other Research/Publications

- **Life Cycle Analysis of Biochar Implementation**

- **Research article on biochar use (has 90 sec. podcast)** – http://earthsky.org/food/johannes-lehmann-on-turning-waste-into-a-natural-resource
- **Research articles on agricultural field trials in Canada** – http://www.blue-leaf.ca/main-en/files/BlueLeaf%20Biochar%20Field%20Trial%2008-09%20Report-1.pdf http://www.blue-leaf.ca/main-en/files/BlueLeafBiocharForageFieldTrial-Year3Report.pdf
- **Biochar RefShare database** http://www.refworks.com/refshare2?site=023461151726400000/RWWEB103579840/123851287166064000
- **Biochar Libguide** http://uiuc.libguides.com/biochar
- **Biofarms research** http://biocharfarms.org/research/
- **Biochar articles in google scholar** http://scholar.google.com/scholar?q=biochar&hl=en&lr=&btnG=Search
- **USDA – ARS links:** http://pubsearch.arsnet.usda.gov/search?q=biochar&btnG=Go%21&filter=0&as_sitesearch=ars.usda.gov&ie=&output=xmlno_dtd&client=ars_frontend&lr=&proxystylesheet=ars_frontend&oe=&btnG.x=23&btnG.y=11 http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=249148
- **International Biochar Initiative Bibliography** http://www.biochar-international.org/biblio

East Dundee and Countryside Fire Protection District

401 Dundee Ave,
East Dundee IL 60118

www.edfire.com
fireprevention@edfire.com

Davey Tree Special Use for Biochar

To: Planning and Zoning & Historic Commission (PZHC)

From: Marc Quattrocchi / Fire Prevention Bureau

CC: Chris Ranieri, Village of East Dundee Building Inspector

Date: May 18th, 2023

Re: 569 Rock Rd Dr, East Dundee, IL 60118

PZHC:

The East Dundee Fire District has been in discussions with Davey Tree, located at 569 Rock Rd Dr, regarding their proposed Bio Char Kiln. Davey Tree has been more than helpful in educating the Fire District on the proposed equipment, hazards, and operations involved. The East Dundee Fire District, along with the assistance of Davey Tree, has been in communication with multiple companies in the United States and Canada that currently utilize the Bio Char process. The East Dundee Fire District has also been in contact with the Fire Departments that cover their local operations regarding the call volume, permits, and responses pertaining to the Bio Char process.

With all information received, The East Dundee Fire District has no concerns about the proposed installation of this operation. The East Dundee Fire District will work diligently with Davey Tree to assist in proper site, building, mitigation, and operational plan requirements per the 2021 International Fire Code and local ordinances. The East Dundee Fire District and Davey Tree have discussed the requirements for the finalization of this project. This will include, but not limited to, the addition of a secured water supply to the site by way of a fire hydrant, emergency access roads, operation emergency shutdowns, and an updated Emergency Action Plan.

I am happy to answer any questions the PZHC may have regarding the Fire and Life Safety Codes as it pertains to this proposed operation.

Sincerely,

Marc Quattrocchi, Fire Marshal

RIT Rochester Institute of Technology

Golisano Institute for Sustainability

January 20, 2021

What is biochar and how is it made?

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Biochar is a carbon-rich material that is made from biomass through a thermochemical conversion process known as pyrolysis. Don't worry if that all sounds like a mouthful—read on for an introduction to thermochemical conversion with a focus on biochar. You'll learn how biochar is made and the role it could play in building a sustainable, circular economy.

The challenge of organic waste

When it comes to building a circular economy, every kind of waste is either eliminated or recycled into new valuable materials. But waste comes in all shapes and sizes—there's no single "magic bullet" for addressing every different kind. That's why scientists and policymakers call for a diversity of tools and solutions for achieving sustainable economies and societies. To understand biochar, it's worth appreciating a specific form of waste—organic waste—and the problems it poses from a sustainability perspective.

The most common types of organic waste that we encounter in our day-to-day lives are food waste, yard trimmings and clippings, and—hold your nose—sewage. While these are each different in terms of material composition and life cycle (how they are made and disposed of), they tend to present similar challenges (and, as we'll see, opportunities).

Loosely understood, any material that is immediately derived from plants and animals is organic. Another common term for this is *biomass*. Sometimes the term “biodegradable” is used to describe biomass as waste because it can be broken down into organic molecules by microscopic living things like bacteria, fungi, and microbes.

Most everything, from an old cookie to a car axle, eventually breaks down under the right conditions and with enough time. But organic materials break down much faster than inorganic ones do. Because of the fast pace with which organic matter decomposes, it presents unique challenges when it comes to mitigating its environmental impacts as waste.

When biomass degrades in a landfill or a treatment center, the potent greenhouse gases (GHGs) carbon dioxide and methane are released, among others. Methane is twenty times more potent than carbon dioxide as a greenhouse gas, though carbon dioxide remains in the atmosphere for much longer.

The value of organic waste

One of the most interesting things about biochar is that it can turn what a lot of people think is useless into something valuable. Sustainability experts call this *valorization*.

“Valorization” might sound like an overly technical word, but what it describes is actually fairly simple: returning value to wasted materials. That value might be as an industrial additive, a new product, or even as a form of clean energy. The concept of valorization redefines the very idea of waste, applying instead a more dynamic understanding of how material changes over the course of its life cycle as a product. Using different methodologies and technologies, the properties and qualities of wasted biomass can be exploited to keep materials in circulation, rather than going into a landfill or a conventional treatment facility, both of which levy a heavy toll on our resources and ecosystems. Waste valorization is an application of the principles that underpin the concept of **the circular economy**.

Thermochemical conversion is a basket term for many different technologies and methodologies. In addition to biochar production, it offers many promising pathways for valorizing different kinds of organic (and inorganic) waste for different purposes.

Thermochemically converting organic waste

Organic waste can be converted into energy or new kinds of material in highly controlled environments. By varying heat, air pressure, or oxygen levels, the properties of biomass can be transformed, resulting in liquid and gas fuels as well as solid materials with new properties. The main types of thermochemical conversion are listed below.

- pyrolysis
- gasification
- combustion

Each process requires different levels of oxygen to occur. Pyrolysis occurs when there is none. In gasification, there’s a limited amount, while combustion can’t happen without it.

Sustainable alternatives to incineration

Thermochemical conversion is a scientific discipline with a history that long predates its consideration as a sustainable pathway. Thermochemical processes, like gasification, have been applied to produce energy for more than two centuries. Coal and peat were “gasified” to fuel the first gas lamps in Victorian London, for example. Wood was gasified in Germany during both world wars to power vehicles when petroleum was unavailable. Yet, of these, the most well-known is probably incineration.

The incineration of waste—combusting or burning municipal solid waste (MSW)—remains a common practice throughout the world. Incinerating waste like MSW (which usually contains a mix of organic and inorganic materials) not only contributes high volumes of GHGs to the atmosphere, but it has been proven to release toxic gases and particles. The scientists, business innovators, and policymakers who are working to develop thermochemical conversion as a sustainable strategy for mitigating organic waste take great care to distinguish their novel work from conventional methods like incineration to achieve sustainable ends.

Common feedstocks and products

Thermochemical conversion can be applied to one or more kinds of waste, individually called “inputs” or “feedstocks.” Some common feedstocks include the following:

- food waste
- municipal solid waste (MSW)
- plastics
- sewage sludge (also known as “bio-solids”)
- agricultural by-products
- cuttings and trimmings from parks and residences

As might be imagined, every thermochemical process results in a different final product (or “output”) when applied to a different feedstock. Three basic categories of outputs are possible, depending on the combination of feedstocks and methodologies: gas, liquid, and solid products. One methodology can lead to a combination of all three product types, depending on factors like temperature, air content, and pressure.

Gas products: The gasification of wasted biomass can result in industrially valuable gas-phase products like light alkalines and olefins, typically derived from petroleum, a fossil fuel. These gases can be used directly for heat, power generation, electricity, transportation, as well as chemical and plastic production. It’s also a potential source for pure hydrogen that can be used to generate **green hydrogen energy**.

Liquid products: Liquid products can also be made through thermochemical conversion. Pyrolysis and catalytic upgrading are two methods that can be used to create bio-oil or bio-diesel from biomass. Pure hydrogen can also be produced in this way, which can be added to fossil fuels like gasoline or liquid natural gas to improve efficiency and lower overall GHG emissions. Other bio-fuels like mixed alcohols, ethanol, and methanol can also be made using this method.

Solid products: Thermochemically treating organic or inorganic waste usually leaves behind a solid material or residue. When biomass is subjected to full pyrolysis, the result is biochar. However, combinations of partial or slow pyrolysis and gasification can be applied to organic and inorganic materials to create other materials like charcoal and carbon black.

What is biochar?

A fine-grained, highly porous type of charcoal made from biomass, biochar (despite the futuristic name) has been used by humans for over two thousand years as a soil enhancer. It helped to increase crop yields while sustaining essential soil biodiversity. One of the most well-known instances of naturally occurring biochar is in the Amazon, where native peoples there used (and still use) “terra preta” in their agricultural practices.

Natural biochar occurs when vegetation is left to smolder in layers on the forest floor following a forest fire. Plant and animal matter bakes slowly in a nearly oxygen-free environment. Today, biochar can be made in much the same way using a kiln, which allows for the precise control of its internal atmosphere and temperature.

There are no roaring flames in a biochar kiln. Instead, biomass of different kinds is slowly baked until it becomes a carbon-rich char. This process is pyrolysis, which refers to the chemical decomposition of organic material when exposed to elevated temperatures in an atmosphere with restricted levels of oxygen.

Sewage, yard waste, food waste, and other types of feedstock can be used to make biochar.

Biochar as carbon capture

Combustion—when materials burn in the presence of an oxygen-rich atmosphere—releases GHGs into the air, most notably carbon dioxide. In contrast, pyrolysis leaves most of the carbon in the original biomass trapped in a solid form. If, as an example, someone were to chop up a fallen tree and put it into a kiln, most of the carbon that the tree absorbed from the atmosphere over the course of its life would stay in the resulting biochar (which would be much smaller in volume than the original amount of wood).

One ton of biochar **sequesters (stores) carbon that would have otherwise generated 3.6 tons of carbon dioxide** if left to degrade by natural processes. As a form of thermochemical conversion, biochar not only valorizes waste, but it's a very effective method for capturing carbon and storing it in a solid state that can remain stable for centuries.

Biochar as part of the circular economy

As an industrial material

A growing number of scientists and policymakers have turned to biochar as a powerful yet simple solution for addressing the climate challenges that follow from organic wastes like sewage, food, and agricultural by-products. **A recent paper** indicated that converting waste produced by China's massive corn-growing industry into biochar could reduce the sector's overall GHG emissions by 20 percent or more.

Kathleen Draper, a biochar researcher and board member of the **International Biochar Initiative (IBI)**, is a long-time advocate for new uses of biochar beyond soil enrichment. She wants to see biochar applied in many more ways, whether as an additive for construction materials like cement and concrete or as a manufacturing material that can be used to make plastics. Ultimately, Draper's research seeks to unlock biochar's full potential as a carbonate material that can be combined with others to make strong, durable composites for industrial use. If successful, such applications would valorize unsustainable waste streams while sequestering carbon.

The majority of biochar today is made from plant and animal biomass like residential plant trimmings, food processing residues, or forestry cuttings because it's used to improve soils. Researchers like Draper believe that widening what feedstocks can be used to make biochar will, in turn, open new applications. Namely, they have in mind problematic sources of waste like sewage from treatment plants. These types of biomass could be pyrolized to make bitumen, carbon fibers, and other industrial materials currently made from fossil fuels.

Researchers at the Golisano Institute for Sustainability (GIS) at Rochester Institute of Technology (RIT) have explored how biochar can be made from specific types of waste to create specific products. For example, a cross-disciplinary research team led by GIS faculty member Thomas Trabold and Scott Williams, a professor at RIT's School of Chemistry and Materials Science, **successfully created a carbon-black ink using biochar** made from cardboard. Another project saw GIS researchers and a team from RIT's Department of Packaging Science, led by Carlos Diaz, find a way to make plastic coffee cup lids using biochar made from coffee grinds. Along with colleagues at RIT and across the Rochester region, Trabold continues to investigate how activated carbon from biochar could be used in to reduce the environmental impacts of materials and products like asphalt, concrete, and tires.

Sustainable energy through pyrolysis

Much of Sweden's capital city's heating comes from something most people don't think about more than once or twice a year: yard waste. The Stockholm municipality collects sticks, leaves, and other trimmings from residences and parks to not only make biochar, but to capture a gas by-product of pyrolysis that works just the same as natural gas. The only difference is that it's not a fossil-based fuel. The biochar itself is then delivered to gardeners and farmers to help them grow healthy plants.

In addition to clean energy and a circular soil amendment, the **Stockholm Biochar Project** is achieving a third, critical goal in support of the city's plan to completely decarbonize: It is sequestering carbon from the atmosphere.

Integration with existing valorization technologies

There are already many methods for valorizing organic waste that are widely used. A major focus of current biochar research is to discover how pyrolysis and gasification can be paired with one of the most common technologies, anaerobic digestion.

Anaerobic digestion, a biochemical process used to convert food waste into energy, takes advantage of fermentation, the natural process whereby bacteria breaks down organic matter. It is used to turn waste from the food and agricultural industries into fuels like bio-gas. Effluent (or digestate) is what the bacteria cannot use. Today, effluent has limited economic value because it offers inconsistent results as an agricultural product, earning it the nickname "the waste of waste."

GIS's Trabold was curious to see if thermochemical conversion could be used to help further valorize the effluent stream. His team applied pyrolysis to it to see what happened. What they found was surprising: **The pyrolized effluent was magnetic**. With these findings, Trabold and his colleagues at GIS are now exploring potential uses for the new material within the electronics industry. If successful, this would offer a sustainable, renewable pathway to replace raw-ore mining.

Challenges

The path ahead for biochar is technically feasible and promising, but the road to full technological and market maturity is far from clear. The biggest challenges can be grouped into three areas: policy, logistics, and public perception.

Policy

The viability of any technology depends heavily on there being supportive policies in place that will allow it to develop and mature. This is especially true when it comes to thermochemical-conversion technology, a field of sustainability that is still largely in its infancy. Thermochemical processing has gained the most traction among supporters of bioenergy with carbon capture and storage (BECCS). A catch-all for "negative-emission" processes and technologies, many policymakers are turning to BECCS as an alternative to carbon-credit trading ("cap and trade") or carbon taxes when it comes to incentivizing climate-friendly economic growth.

Advocates of sustainable thermochemical conversion argue that biochar is an ideal application of BECCS because it both sequesters carbon and converts otherwise problematic waste into economic value. Other thermochemical conversion methods, like gasification, can also be combined with biochemical processes, like anaerobic digestion, as part of a BECCS strategy.

Despite this potential, biochar remains a rare feature of existing climate legislation, even those that include BECCS as a strategy. For example, New York State's ambitious Climate Leadership and Community Protection Act of 2019 (CLCPA) stipulates that the state's efforts must include bioenergy and BECCS technologies. While gasification and anaerobic digestion can be used to create low- or zero-carbon

fuels like biogas and biodiesel, CLCPA does not recognize pyrolysis as a BECCS process. Biochar champions worry that this will have a knock-on effect that will leave biochar out of any policies following from the bill when it could offer substantial benefits.

New York State has the third largest number of dairy cows in the United States and offers a strong opportunity for what some call a circular "bioeconomy." The large volume of cow manure that dairy farmers end up with—a well-known source of stress on the environment—could serve as a biochar feedstock, according to Johannes Lehmann, a professor of soil science at Cornell University who has collaborated with Trabold to draw the attention of New York's policymakers to biochar. **Lehmann has estimated** that the potential value of the economy would be $272 million for farmers and $1.3 billion for retailers. In addition, it would cut transport costs by as much $114 million while lowering GHG emissions.

Policy can also help grow markets for biochar-based products. Through targeted taxes and other incentives, governments can encourage startups and established businesses to innovate biochar products and applications.

Business, supply, and operational logistics

Today there are few facilities in operation that are designed for large-scale, sustainable thermochemical conversion. Those that do exist tend to be focused on a single method, whether it's a biorefinery for the production of biofuels or a kiln for making biochar.

Siting a thermochemical conversion facility, whatever its size and purpose, is complex. Coordinating a specific feedstock to make a type of biochar that can be used to make a particular product needs to take into account many different variables. Is the feedstock available all year? Is it heavy or difficult to transport? Where is the market demand for the output? Will that be consistent in the long term? These are just a few of the many questions planners and businesses need to ask to evaluate all the contingencies that could determine whether a site will be successful or not.

Regional geography is especially important when considering where to site facilities. Poultry manure, for example, has a high phosphorous content that can be sustainably recovered through thermochemical conversion (rather than mined). There's a market for phosphorous: Large-scale farmers rely on it for their crops. However, in a state like New York, a logistical challenge arises. The region where most industrial chicken raising happens is far from where most crop-heavy farming is done. That means a planner would need to carefully consider where a facility should be built that is practical and cost-effective, but that doesn't offset intended sustainability goals.

In the end, the potential value of biochar-based products needs to match production capacity and market demand. It's a balancing act all businesses know, but it can be especially challenging at the innovation stage of new, sustainable technologies.

A team of researchers based at Cornell's College of Agriculture and Life Sciences is working to solve this problem. They have found that flexibility and education are essential. Thermochemical conversion facilities need to be equipped with technology that allows them to be flexible in what it produces in order to offer value to consumers and businesses up and down the supply chain. In practice, this might mean producing biochar for farmers to use in their soil on the one hand, while also being able to "upgrade" it into activated carbon for more industrial purposes. The team points to an opportunity for establishing standards and best practices that will support growth of the sector and the quality of its products. Along with these developments, stringent efforts are needed to increase the public's awareness of biochar and sustainable thermochemical conversion more generally so that they can appreciate the economic and ecological benefits they offer.

Public perception of biomass

Thermochemical conversion offers unique pathways for turning otherwise impactful forms of organic waste like uneaten food, sewage sludge, and plant debris from agriculture and industry into fuel or economically valuable products. However, a barrier facing this corridor of innovation within sustainability has nothing to do with technology or science: It's the use of the word "biomass."

The use of biomass in waste-to-energy systems is by no means a new concept—and it's not necessarily a green one, either.

Biomass is a scientific term for describing how energy from the sun is captured within plant and animal matter. Radiant solar energy is stored by plants through photosynthesis, where it is converted into chemical energy as glucose. From there, the carbon in those sugars finds its way throughout our ecosystem until, eventually, it's released into the atmosphere as carbon dioxide. This natural cycling of carbon

in the earth's atmosphere is not itself a problem. It contributes to climate change only as a fraction of the many additional megatons of carbon that go into the air through the combustion of fossil fuels (which are extracted from fossilized biomass).

Direct combustion—a thermochemical conversion process—is when biomass is burned, something that humans have done for thousands of years to provide heat and to cook food. In many developing countries, burning plant material remains the principle form of energy usage. Such practices have been linked to a high incidence of respiratory illnesses due to constant exposure to fire smoke. Elsewhere, wooden biomass fuels what are called wood-to-energy power plants, where wood pellets are burned to produce power as a replacement to coal. **Biomass provided about 5 percent of the total amount of primary energy** used in the United State in 2019, the equivalent of nearly 5 quadrillion British thermal units (BTUs).

But many question the sustainability of such wood-to-energy strategies. England's Drax power plant, for example, uses pellets made in the southeastern United States, adding a considerable carbon footprint to the total life cycle of the fuel. In some cases, **wood-burning furnaces can actually have higher net carbon emissions** than coal or natural gas plants per unit of electricity. Many experts and activists have also raised concerns over the impact of wood-burning plants on human health.

Biomass encompasses a lot of different materials, from felled trees and sticks to leftover pizzas and New York City's sewage. It's clear that a **life cycle assessment (LCA)** of biomass used to create biochar would produce very different results from an LCA of a wood-pellet power plant. What matters most when talking about biomass in the context of sustainability is not so much *what* it is, but what's *being done* with it.

One thing is clear: Biochar has a clear role to play as part of the circular economy. It's an ideal solution for turning emission-heavy organic wastes into value that can drive an economy locally, nationally, and globally.

Tags

Sustainability Insights | Food | Circular Economy

About the author

Golisano Institute for Sustainability

Golisano Institute for Sustainability (GIS) is a global leader in sustainability education and research. Drawing upon the skills of more than 100 full-time engineers, technicians, research faculty, and sponsored students, it operates six dynamic research centers and over 84,000 square feet of industrial infrastructure for sustainability modeling, testing, and prototyping. Graduate-level degree programs are also offered that convey the institute's knowledge to the next generation of industry professionals.

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