

BIOCHAR

Achieving a Successful Biochar Industry by 2015: Outcome of the IBI 2010 Board Retreat

OVERVIEW

The IBI Board¹ engaged in a facilitated board retreat in September, 2010 focused on organizational effectiveness and the development of a new strategic plan. With funding provided by the David and Lucile Packard Foundation, IBI contracted with professional organizational facilitators to prepare for and conduct the retreat, and provide limited follow-up. In preparing for the retreat, the facilitators undertook a series of interviews with IBI staff, Board members, and select members of the IBI community to glean information on the organization, its stated and perceived roles and impacts in the biochar community, and future directions. Based on this, the facilitators described positive and negative features, processes and feedback loops within the organization, and developed a retreat agenda to define and address these issues, and to help determine a future direction on which to develop a strategic plan. The facilitators then took the Board through an introspective review of the biochar field, and IBI's role in it, followed by a brainstorming session to describe a successful future for the industry. The Board chose a 5-year horizon as the timeframe for describing this future, and from that, a strategic plan is being developed. This document describes and in some cases expounds on that process. Some elements of IBI's role that will form the basis of the strategic plan were described by the Board at the retreat, and are included here.

DOCUMENT OUTLINE

Achieving Successful Outcomes by 2015: What is success, and how do we get there, and what is IBI's role in achieving that success?

- What are the current knowledge gaps in the biochar field?
 - Research (Science and Technology)
 - Policy
 - Projects
- What does success look like for the biochar field in 2015, and what is needed to achieve this success?
- What is IBI's role in achieving this success?

IBI is drafting a strategic plan to describe how it will fulfill this role in the coming years.

SYNOPSIS

What Success Looks like for Biochar Industry in 2015

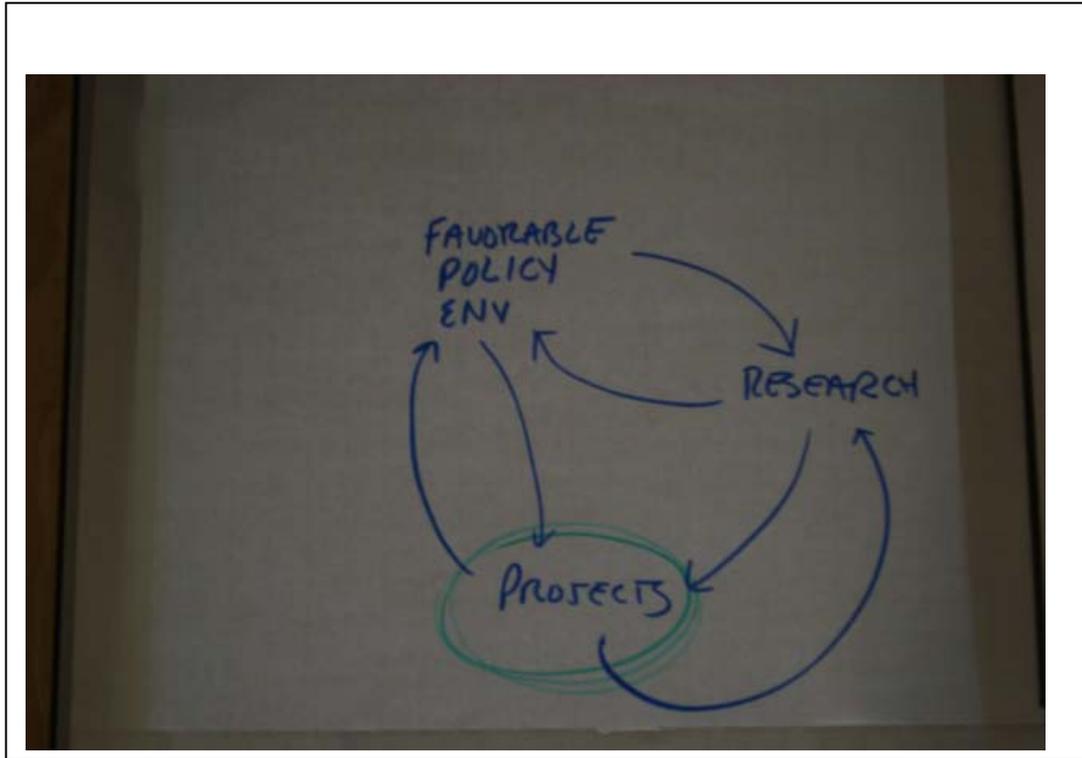
Multiple value streams for biochar have been realized, and global biochar markets (including some niche markets) are solid and growing. Demand exists for biochar as a soil amendment, and biochar is being produced, used, bought and sold. The price of biochar and biochar systems is sustainable, its value is understood, quantified and monetized, and the cost-benefit ratio is positive. Biochar standards and metrics have been established for commercial utilization of biochar. Adequate testing and certification of biochar materials and systems is available to provide necessary market assurances that allow commercialization to flourish.

¹ At the time of the retreat all 2010 IBI Board Members were present: Ellen Baum, Stephen Joseph, Johannes Lehmann, and David Wayne.

METRICS FOR SUCCESS

What areas are most critical to successful development of the biochar field?

Three interdependent areas are identified as critical to the successful development of the biochar industry: (1) science and technology research; (2) policy development; and (3) project development.



An adequate research base is critical for policy and project development, which in turn are necessary for project and business development. A robust base of peer-reviewed, published research on biochar materials and biochar production and utilization systems is needed to develop supportive policies for biochar utilization and commercialization. Applied research and interpretive analyses are needed to inform and drive the development of supportive policy environments and policies in order to commercialize biochar and biochar systems globally, as well as to develop market supply and demand that will sustain profitable biochar businesses.

Economic data, cost-benefit analyses, and full life cycle assessments (LCAs) of biochar systems are important to develop appropriate business models. An increased knowledge base of the value of biochar for potential buyers, such as the agricultural sector, is needed. Agricultural producers will require data, including metrics, on the agronomic value of biochar additions to their soils or crops. Information is needed to demonstrate that the addition of biochar at specified amounts will increase crop yields, reduce inputs, provide ancillary benefits, and otherwise enhance income.

Standards are needed to provide market assurances. Buyers and potential investors in biochar and biochar production technologies do not have adequate information on which to base decisions, and don't know who to believe in the current marketplace.

2010 Status and Knowledge Gaps

As underpinnings to sufficient progress in policy and project development, knowledge gaps in scientific and technology research and development are identified as critical to understand and define.

Scientific Research

Scientific progress in the field has burgeoned in the past five years. Continued momentum and additional research on biochar materials and production and utilization systems is required, including on stability, impacts and mechanisms, economics, functions, and predictive capacities.

- Additional research on the impacts of biochar systems to soil methane and nitrous oxide emissions are particularly needed, including from soil, avoided emissions from landfills, emissions during production, and from application of biochar to soils
- Additional research on biochar stability, which directly impacts climate mitigation and adaptation potential, is needed to promote the acceptance of biochar in climate policy arenas, including at international (e.g. UNFCCC), national, and sub-national levels.
- Relative analyses of the replacement of some organic material by biochar are needed to predict the impact of organic matter on soils, whether left to decompose, or some portion is removed and converted to biochar, and added back to the soil.
- Both basic and empirical research are required to develop predictive capacities related to specific biochars (based on feedstocks and production parameters), and the agronomic effects/performance impacts of biochars as soil amendments. This will necessarily require a better mechanistic understanding of how and why biochar works.
- There is a need to establish agronomic and economic metrics for the use of biochar, including how much to add to soils, and costs and benefits.

Technology Research and Development

Technology research and development for biochar production is sorely lacking, and:

- is uncoordinated and inconsistent, with no defined agenda, and is largely driven by individual and private interests;
- is largely in the private sector domain, with limited or no academic or public sector investments (note that the U.S. DOE disbanded its pyrolysis program in the past several years, particularly as it relates to biochar production);
- results are thus largely proprietary, and not available in public domain or to IBI (for aggregation and business case/business model development);
- relative to GHG emissions is lacking. Full systems GHG analyses, including on: biochar production → biochar transportation → biochar application → impact on soils and crop production, are lacking;
- additional information on biochar's contribution through soil improvement to long-term sustainability of feedstocks used for both biochar and bioenergy production is required;
- well-documented case studies are needed to develop net GHG analyses and economic models of biochar systems, which can inform policy development, and the development of commercial tools for biochar systems to operate in markets, including protocols for market-based carbon trading of biochar systems.

2015 Vision of Success for the Field of Biochar

Overview: Biochar is a commercially viable global industry.

IBI 2010 Board Retreat Outcome.docx

- **Viable biochar companies exist.** Self-sustaining companies, not dependent on government or public funding, exist in sufficient numbers to constitute a viable commercial biochar industry. Biochar is being commercially bought and sold, including in international markets.
- **Commercial and political recognition exists of biochar as a valuable product and technology, and there is commercial demand for biochar.** Biochar is recognized as a valuable product for agricultural utilization, waste disposal, and as a specific climate mitigation and adaptation tool, and is included in standard agricultural practices (like chemicals and compost, and as an alternative to agricultural burning). For example, waste industries and the mining industry use land to produce biochar as a carbon offset, giving social and environmental license to continue to operate. Organic and recycling industries also see biochar as an adjunct product that is safe, beneficial, and economical. There is a proliferation of value-added (*value identified*) biochar products with established economic and agronomic metrics for commercial utilization. The competing uses of biochar is assessed and understood
- **The capability of biochar to improve semi-arid soils** in tropical developing countries is established and recognized by their governments and development agencies.
- **International climate change agreements recognize biochar.** International and domestic GHG trading programs specifically qualify biochar as a carbon offset technology, and projects are underway and receiving credits.
- **Positive consumer awareness of biochar exists.** Biochar branding of products includes ‘carbon-negative’ tags, and is mirrored by consumer awareness of biochar and its benefits.
- **China invests in biochar.** The Chinese government invests in biochar systems, and drives the GHG and biochar agendas, which prompts additional uptake by other countries. Production equipment prices drop radically, resulting in \$350k/T/hr units that produce thermal energy and biochar char.
- **All major countries have regional biochar initiatives (RBIs).**
- **IBI Standards and IBI Certification for biochar and biochar systems are successfully incorporated into the marketplace:** IBI Biochar Product Standards are published for commercial biochar materials in developed and developing country contexts, and a successful IBI Biochar Certification program is operating, whereby biochar producers are having materials tested per IBI standards. IBI Standards for biochar systems are published for biochar systems operating in developed and developing country contexts, and the IBI Biochar System Certification Program is also operating, allowing project developers to use the IBI seal of approval certifying that projects meet specific established and published standards. Producers and project developers are registering their product in the IBI Virtual Marketplace, which is supporting commercial activity (buying, selling of materials, technologies, and systems/project development).

The Biochar Success Story: The State of the Research Arena in 2015

- **Targeted research and demonstration to fill the research gaps is funded, underway.**
 - International institutions and centers of excellence for biochar research and practical demonstration have been established in critical geopolitical areas.
 - Continued proliferation of research results leads to continual production of published results in the literature, and to a broad array of geographically and crop-diverse field trials, particularly large-scale field trials.
 - Biochar system pilot and demonstration projects have been established in geographically diverse locations, at various viable scales, and utilizing an array of feedstocks and production technologies.

- Long-term field trials with fit-for-purpose biochar are underway, including at least one per country, globally; and one per state, in the US and Australia.
- Funding opportunities for research and commercialization are at \$50M/year (US) and \$500M/year (globally).

The Biochar Success Story: The State of the Policy Arena in 2015

- **Climate Change Mitigation and Adaptation Policies.** Collaborative multilateral/bilateral efforts focused on climate change mitigation and adaptation efforts exist between governments. This progress results in favorable national and sub-national policies to mitigate climate change, which in turn bolsters investor and consumer confidence in climate mitigation technologies and carbon markets, which continue to grow. Biochar is acknowledged by the UNFCCC as a mitigation and/or adaptation tool within the agricultural sector, encompassing all relevant applications with GHG benefits.
 - **Food security is recognized as a critical component of climate mitigation and adaptation efforts.** A focus on agricultural intensification (producing more food on existing agricultural land) is adopted as a means of addressing food security. Increased financing for food security policies and initiatives includes concepts of biosecurity² and energy conservation and efficiency, and a role for biochar is clear.
 - **Supply chain initiatives (SCI) continue to proliferate.** SCIs continue, with a focus on reducing the GHG, energy, and natural resource footprints of agricultural production systems, creating incentives for the incorporation of biochar systems.
- **Barriers to biochar systems are identified, removed.** Old/existing policies and regulations that impede the development of cost-effective biochar systems are identified, analyzed, and changed or otherwise adapted to aid in biochar project deployment and commercialization.
 - **Biomass feedstock policy constraints and opportunities are articulated.**
 - **Funding for biochar projects increases globally.** Successful pilot and demonstration projects prove commercial viability of biochar systems. Companies invest in biochar production equipment; biochar products are commercially available in stores.
 - **Organic associations accept and promote the use of biochar.**
 - **The perceived and actual value of biochar increases.**

The Biochar Success Story: The State of Biochar Projects in 2015

- **Biochar projects underway successfully demonstrate the value and benefits of biochar.** Successful biochar systems are available, with documented business models, including: economic analyses showing cost-benefit of biochar systems; agronomic uses and impacts are defined, including appropriate metrics for utilization; environmental impacts are defined and articulated, including waste biomass and land remediation utilization opportunities and constraints. Evidence of success includes, crucially, adoption and implementation of the business models by new players.
- **Adequate, cost-effective production technologies are available.** The public and private sectors are investing in projects, and proliferation of projects increases technology deployment and

² Pyrolysis and gasification technologies can aid in food-related biosecurity outbreaks or incidents where pathogens are a threat. For instance, potential zoonotic outbreaks that require animals/carcasses to be safely disposed could be aided by mobile systems, or if closely situated, stationary systems. Climate change is anticipated to increase the incidence and transfer of such threats, as can global trade and terrorism.

reduces associated costs, further satisfying the demands and requirements of additional prospective investors.

- **A biochar project tracking system is established and functioning.** A tracking system identifies early adopters and classifies them into useful categories, identifying biochar production and utilization systems that can be replicated. A profile or set of criteria is developed to 'rate' projects, including, for instance: economics, scale, location, favorable policy environment, etc. Data is compiled and evaluated to derive lessons learned, develop business models, and identify material, equipment and technology for review and potential certification.
- **Early biochar system adopters have been recruited to enhance technology transfer, uptake by others.** Early biochar system adopters have been identified, and their impetus, requirements, satisfaction, and outcomes have been defined and packaged as educational and promotional materials to aid in outreach to additional potential adopters, particularly within the agricultural, waste, and land remediation fields. Some of these early adopters are recruited to provide peer-to-peer counseling and training.
- **Biochar System Franchise Models are available.** Specific business case models that match a project type to a technology and utilization system result in biochar system franchise models being developed by the private sector and marketed to address specific waste utilization or biomass feedstock availability issues. For example, a recommended biochar system for hog manure, or for corn stover, is developed and packaged, including licensing agreements and/or a full system "kit".
- **A biochar project network is established and functioning.** The biochar project network identifies key people and organizations interested in specific roles for establishing and implementing promising biochar projects, with an aim towards creating linkages to foster success. The roles include:
 - finance (including partnerships with donors, funders)
 - Implementation (including consulting or training for agronomic or technology needs)
 - monitoring and documentation (including research and academic institutions)
 - replication (including business).

BIOCHAR'S FUTURE: A PROJECT FOCUS

Based on this vision of success, it was determined that of the three identified key areas in the biochar field – research, policy, and projects – a project focus was most essential to achieving biochar industry success by 2015. Project development is more event-driven and opportunistic, while research is ongoing. Policy development is currently hampered by a lack of project development, but continued success in the research and project arenas will increase the focus on and aid in policy development. Without successful implementation of projects, at all scales, and the accompanying ability to develop business models and metrics, progress in the field will continue to proceed unevenly.

IBI's Role in the 2011-2015 Timeframe: A Project Focus

How IBI can help support development of a successful biochar industry by 2015

IBI Role in Research

IBI maintains strong 2-way connections with the science and technology research community, serving as an information platform and helping to identify knowledge gaps and drive the research agenda by:

- **Expert workshops:** convening specialized invitation-only expert workshops to focus on specific areas or issues requiring development, driven either by a specific agenda or satisfying a particular need (focus on outcome); and

- **Conferences:** participating in regional conferences and sponsoring or affiliating on an annual basis with certain international conferences.
- **Website development:** Better develop IBI website, including specific portals for researchers:
 - Bring biochar principles to first page of website, and make them easier to share and export (as a pdf);
 - Define IBI role in the research arena;
 - Explicitly identify what researchers (and other categories of users) can and cannot find on the IBI website;
 - Maintain research summary maps identifying who is doing what, where, to help connect people, programs, resources, and skill sets;
 - Maintain an updated research gaps matrix.
- **IBI Advisory Committee:** Utilize the IBI Advisory Committee to create “critical commentaries” that help inform standard setting opportunities at national levels. One example:
 - **Standards for commercial use:** establish distinctions between characteristics of biochar used in research/academia, versus defining important characteristics for commercial use, including accessible, cost-effective tests appropriate for marketing.
- **Interpret research findings:** Interpret research information for the non-biochar community, including policymakers and funders, to elicit appropriately supportive responses and actions.

IBI Role in Policy

IBI provides the policy interface to the growing biochar field, seeking to guide and aid in the development of positive policies, programs, and regulatory environments that promote biochar project development. This will include marketplace and climate mitigation opportunities that can benefit the development of a successful biochar industry.

- **Identify policy levers:** Identify appropriate international, national, and sub-national policy levers and develop appropriate strategies to influence them.
 - Focus on critical regulatory agencies and issues (e.g., USEPA, USDA, Chinese and Australian government, Global Alliance on Agricultural Greenhouse Gases) with a role in project development.
 - Identify regions and projects with favorable policy environments and seek to capitalize on these environments to promote project development, e.g. Chesapeake Bay watershed improvement policies and activities, UNFCCC progress on agricultural mitigation and adaptation issues.
 - Identify policies, legislation under development where supportive language or provisions may be added or tweaked to benefit project development.
- **Policy documentation, information:** Act as a (passive) information clearinghouse for identifying and documenting international, national, sub-national policies that impact projects or project development, including by creating barriers or promoting opportunities.
- **Develop collaborative networks:** Develop strategic relationships in critical international, national, and sub-national bodies, governments, or organizations with the goal of creating collaborative networks to promote supportive policy and regulatory environments.
- **Trade association development:** Continue to monitor the commercial biochar industry for critical mass to support a biochar trade association (or associations).
 - Develop distinctions between international, national trade associations and singular goals and objectives.
 - In the absence of a trade association, provide equivalent opportunities to biochar industry and project developers, e.g., congressional fly-in’s to educate lawmakers,

policymakers; briefings and hearings on issues critical to the industry; opportunities to attend UNFCCC, other conferences as IBI participants.

IBI Role in Projects

Given that IBI has identified a “project lens” as a focal point through which it will operate in the future, it is important to define and specifically identify what is meant by a Biochar Project, specify what IBI’s role will be in projects and project development, and establish the criteria by which IBI will select projects to support. Note that IBI’s Board has previously established a policy that *IBI will not implement or manage projects*, but will rather work to facilitate, promote or otherwise support their development. Further work is required to establish exactly what this role is – and likely requires business expertise not currently housed within IBI.

- **Defining a biochar project:** IBI envisions that it will be necessary to define projects, and thus project boundaries, for many reasons, including for purposes of delineating analyses, economics, outcomes, certification, IP, etc. A project encompasses the entire biochar system – the full spectrum of activities from production through to utilization -- sometimes described as “end-to-end”, “cradle-to-grave” or “cradle-to-cradle.” A biochar project includes feedstock production, procurement, and utilization, as well as technology procurement, operation, inputs and outputs, through to biochar production and utilization, including transportation and application to soils.
- **IBI’s role in projects:**
 - **Develop criteria for project selection:** IBI must identify important criteria by which to select projects for support or promotion. For instance:
 - **Financially attractive:** Identify projects or project types that are attractive to funders, financiers, or industries with a distinct need. For example, projects that answer an existing market demand, such as land remediation for the mining industry, or biomass waste utilization for an industry or sector that can also utilize the biochar. Alternatively, funding is already available to address an environmental concern, but biochar has not been presented as a possible solution.
 - **Data production:** the project will produce data to support and create positive feedback loops for business development (economics, business models) research (empirical evidence) and policy applications and development (proof of concept).
 - **Application:** the project offers replication and application in other areas or settings that are promising and attractive (e.g. deals with a waste issue or other environmental issue, or meets additional critical needs and outcomes, such as health impacts from indoor cooking).
 - **Testing:** the project will collect and share necessary data as appropriate with IBI and the research, business, and policy communities.
 - **Commercial viability:** the economic business case for the project is promising, likely to be commercially viable without subsidies or supports, and provides adequate returns on investment.
 - **Social viability:** the project will be socially and culturally appropriate and sensitive in the region in which it is based, include indigenous and local populations in development and implementation, and not raise opposition of these populations.
 - **ID suitable projects**

- Of the project pool, which projects meet the IBI criteria?
 - Do some projects that do not meet the criteria merit further investment or development?
- **ID project types that IBI should promote**
 - Frame project opportunities that merit development.
- **Project facilitation, support and development**
 - **Identify sources of project funding or connect existing funding with a biochar system approach**
 - **Business plan development**
 - Frame the opportunity, define underlying need
 - Develop specific project strategy
 - Financial plan and analysis
 - Process flow/priorities
 - Decision-making authority
 - Develop a marketing strategy
 - Help to facilitate the establishment of clear intellectual property (IP) boundaries for projects. As an example:
 - Person/entity that produces biochar owns the IP;
 - Person/entity that utilizes the biochar owns it for utilization;
 - Data that comes out of the project is in the public domain (it will be necessary to clearly define what is and what is not included), and will be posted by IBI on its website. This is a critical opportunity for IBI to bring value to members and the biochar community.
 - Prior to the publication of IBI biochar product and systems standards and certification, support testing and labeling efforts for products and systems to facilitate marketing and commercial activity.
 - Determine funding for first stage of project
 - Establish contract or Memorandum of Understanding (MOU)
 - Define roles, responsibilities
 - Implementation facilitation based on MOU
 - Project evaluation: what worked and what didn't
 - This is a critical IBI role, and data collection needs will be specified up front to ensure proper documentation for evaluation
 - Data and analyses will be made available to the public and to (paying?) IBI members
 - It is not IBI's role to hire project consultants – that is the role of the project developer.