The Consortium for Advanced Wood-to-Energy Solutions (CAWES) conducted a survey to rank issues and knowledge gaps that must be addressed to advance markets for torrefied wood. This report provides the top ranked responses across five major areas of interest and need.
Consortium for Advanced Wood-to-Energy Solutions: Purpose

The Consortium for Advanced Wood-to-Energy Solutions (CAWES) was initiated by the U.S. Endowment for Forestry and Communities, the Georgia Southern University Herty Advanced Materials Development Center, and the USDA Forest Service to serve as an open-platform collaboration of institutions in the public and private sectors representing green energy, forest management, research and development, philanthropy, and private industry. The purpose of CAWES is to advance sustainable, scalable, distributed wood-to-energy solutions that stimulate forest restoration and rural economic development through research, development, and deployment of commercially-viable advanced wood-to-energy solutions.

Issues & Knowledge Gaps: Ranking of Priority Needs

CAWES held its kick-off meeting in Atlanta, GA, August 26 - 27, 2014. As follow-up to that meeting, the Steering Committee committed to conducting surveys and/or requests for information in three areas:

1. Ranking of priority issues and knowledge gaps;
2. Status review of capabilities for research, development, and demonstration capacity and equipment; and,
3. Requests for “expression of interest” from potential public and private institutions who might serve as production partners.

This report provides a summary of the top rankings of issues and knowledge gaps in five different major categories of need (see Table 1). To view the original survey and listing of all potential issues and gaps, see Appendix A.

TABLE 1 – Ranking of Priority Needs in Five Major Categories

<table>
<thead>
<tr>
<th>CATEGORY OF NEED</th>
<th>PRIORITY 1</th>
<th>PRIORITY 2</th>
<th>PRIORITY 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion &amp; Densification</td>
<td>Conversion — Technology and equipment selection</td>
<td>Densification — Need to demonstrate the densification of torrefied wood at scale</td>
<td>Conversion—Product definition: Energy pellets or bricks, biochar, activated carbon, etc.</td>
</tr>
<tr>
<td>Feedstock Supply &amp; Logistics</td>
<td>Availability of raw material</td>
<td>Cost of raw material</td>
<td>Sustainability of resource</td>
</tr>
<tr>
<td>Markets &amp; Economics</td>
<td>Development of a credible marketing study</td>
<td>Development of a “generic” business plan</td>
<td>Need for offtake agreements with customers</td>
</tr>
<tr>
<td>Regulatory &amp; Social</td>
<td>Social—Retaining the social license to remove and utilize woody biomass and hazardous fuels</td>
<td>Social—Development of a credible life cycle inventory and LCA for energy consumption and GHG emissions</td>
<td>Regulatory—Use in Customer facilities and its impact on permitting and other operational issues</td>
</tr>
<tr>
<td>Finance</td>
<td>Pro forma business case that includes CAPEX/OPEX per ton of capacity &amp; relevant financial performance measures (ROI/ROCE)</td>
<td>Need for credible marketing studies for targeted products: torrefied wood, biochar, and activated carbon</td>
<td>Access to capital</td>
</tr>
</tbody>
</table>
In addition to ranking the range of issues in each category of need, respondents were provided the opportunity to suggest other issues and knowledge gaps warranting attention. Responses were as follows:

**Conversion & Densification**
- Product safety in handling and transport

**Feedstock Supply & Logistics**
- Financial modeling
- Integrated assessment using all listed criteria
- Appropriate sizing of facility or sourcing plans (e.g. rail) to extend reach

**Markets and Economics**
- Impacts of product safety requirements on manufacturing cost

**Regulatory and Social**
- Safety regulations for manufacturing, handling, and storage

**Finance**
- Safety regulations for manufacturing, handling, and storage

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**Becoming a CAWES Partner**

CAWES is focused on bringing the best minds in private development, government, academia, and conservation together to accelerate appropriately-scaled commercialization of wood-to-energy technologies. CAWES members will receive non-exclusive, royalty-free access to all intellectual property developed by the Consortium with opportunities for intellectual property-protected work under special agreements. The challenges and knowledge gaps identified by CAWES partners will form the foundation for funding priorities and benchmarks.

The founding partners seek the participation of any institution – whether public or private – that shares a commitment to addressing the challenges and opportunities torrefaction presents. CAWES partner organizations will make an entity-appropriate annual financial contribution and serve on the CAWES Steering Committee or one of two other CAWES advisory boards. The CAWES consortium will meet quarterly.

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**For More Information:**

The Endowment serves as the Consortium administrative/financial manager. For more information contact:

Carlton Owen
President & CEO
U.S. Endowment for Forestry and Communities
[carlton@usendowment.org](mailto:carlton@usendowment.org)
864-233-7646
Appendix A

Purpose & Directions

The Consortium for Advanced Wood-to-Energy Solutions (CAWES) is developing a 24-month work plan to determine the validity of torrefied wood as a market-based tool to aid in addressing forest health and rural job creation needs in America’s more challenged forest-rich areas. At the kick-off workshop in Atlanta on August 27 the participants developed extensive lists of challenges and knowledge gaps that might be necessary to address in order to advance the overall objective.

PLEASE take just 10-12 minutes to complete this brief survey NOW IF AT ALL POSSIBLE. All responses need to be in by NOON EDST, September 15.

We ask that you review the lists and identify in order of priority importance what you believe are the most important (#1 is highest priority) issues to be addressed in each of the five categories listed. Please rank ALL choices on each page.

*NOTE: On each page, the dropdown boxes next to the priority options will be initially blank. When you input your first ranking, the survey will then automatically populate the rest of the rankings boxes on that page. THESE RANKINGS WILL LIKELY NOT BE IN THE ORDER THAT YOU WANT. You may still edit the ranking in any box after the survey populates the boxes. The survey will adjust in real time to any rankings you input by shuffling the order of priorities on the page. Please make sure that before you move on from a particular page all priorities are ranked in the order that you want.
## Feedstock Supply & Logistics

- Resource–Availability of raw material
- Resource–Consistency (guarantee) of raw material supply
- Resource–Cost of raw material
- Resource–Feedstock type and variability and impacts on downstream processing and product quality
- Resource–Use of low-value biomass from forest and rangeland (e.g. juniper) restoration operations
- Resource–Sustainability of resource
- Logistics–Choice of business model, specifically choice of distributed vs centralized production model and facility size
- Logistics–Timber harvesting
- Logistics–Hauling infrastructure and the distance from resource supply to the facility

### Any other priorities related to this topic area:
Conversion & Densification

- Conversion--Product definition: Energy pellets or bricks, biochar, activated carbon, etc.
- Conversion--Technology and equipment selection
- Conversion--Raw material quality, such as type, species and blends, moisture content, ash content, etc.
- Conversion--Torrefied wood bulk and energy densities
- Densification--Need to demonstrate the densification of torrefied wood at scale
- Densification--Product qualifications, such as Life Cycle Analysis, Environmental Product Declarations, ISO or other standards of uniformity/consistency of quality
- Densification--Special shipping/transit needs for torrefied products
- Conversion & Densification--Online, realtime monitoring of process and product quality
- Conversion & Densification--Pilot scale demonstration facility availability for producers and users that can be used as a test bed for both product and process validation
- Conversion & Densification--Identification of worker safety issues, such as exposure to dust and dust handling
- Conversion & Densification--Development of facility engineering studies to determine mass and energy balances

Any other priorities related to this topic area:
### Markets & Economics

- Markets & Economics--Development of a ‘generic’ business plan
- Markets & Economics--Development of a credible marketing study
- Markets & Economics--Need for offtake agreements with customers
- Markets & Economics--Competition from alternative woody biomass uses, such as wood chips, pellets and CHP
- Markets & Economics--Product standards and acceptance in place
- Markets & Economics--Understanding storage requirements and impact on product performance
- Markets & Economics--Need for test runs in electric utility and CHP facilities

**Any other priorities related to this topic area:**
## Regulatory & Social

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Retaining the social license to remove and utilize woody biomass and hazardous fuels</td>
</tr>
<tr>
<td>Social</td>
<td>Development of a credible life cycle inventory and LCA for energy consumption and GHG emissions</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Production facility compliance with regulatory agencies (OSHA, EPA)</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Use in Customer facilities and its impact on permitting and other operational issues</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Understanding and addressing ENGO and public concerns such as carbon neutrality, sourcing from public lands, impact of residual material removals on soil quality</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Quantifying the impact of biochar amendments on soil quality</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Determining and addressing certification needs and product standards</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Determining and addressing special maritime regulations on transport of torrefied products</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Need to address unlevel playing field specifically subsidies in place for competing products</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Need for an Executive Order to test product in federal power generating facilities</td>
</tr>
</tbody>
</table>

**Any other priorities related to this topic area:**
**Finance**

- Planning--Development of a clear pro forma business case that includes CAPEX/OPEX per ton of annual installed capacity as well as relevant financial performance measures (ROI/ROCE)
- Planning--Access to capital
- Planning--Need for credible marketing studies for targeted products: torrefied wood, biochar, and activated carbon
- Planning--Targeted site selection criteria to optimize federal, state, local incentives
- Planning--Clear and consistent communication/product plan
- Planning--Need to compare/contrast with coal/natural gas, etc., and make sure the examples are regionally specific and tied to specific fuel type (e.g. lignite vs. anthracite)
- Planning--Clear assessment of economies of scale
- Funding--Clear assessment of sources of equity finance
- Funding--Clear assessment of sources of debt finance (e.g. government loan guarantees)
- Funding--Understanding mechanisms for developing joint ventures with end user
- Funding--Understanding how to engage TIMOs/REITs as investors to create new market outlet for low value wood
- Regulation--Expanding liquid fuels incentives to cover solid fuels
- Regulation--Relaxing regulations on investment of personal retirement savings in controlled businesses

**Any other priorities related to this topic area:**