

DOE Bioenergy Technologies Office (BETO) 2015 Project Peer Review

Bioenergy Knowledge Discovery Framework (KDF)

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Analysis & Sustainability

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Goal Statement



- **Creation and enhancement of geo-spatial, temporal decision support system to connect researchers, industry, and sponsors to share information and build on existing knowledge within the bioenergy research community. Make high-value data and information easily accessible (ex. Billion-Ton)**

Quad Chart Overview



Timeline

- FY 2008
- FY 2017
- 75%

Budget

| | Total Costs FY 10 –FY 12 | FY 13 Costs | FY 14 Costs | Total Planned Funding (FY 15) |
|--------------------------------------|--------------------------------|----------------|----------------|--|
| DOE Funded | \$4,900K | \$565K | \$509K | \$200K |
| Project Cost Share (Comp.)* | 0 | 0 | 0 | 0 |

Managed by UT-Battelle
for the Department of Energy

Barriers

- At-C Data Availability Across Supply Chain
- At-A Comparable, Transparent, and Reproducible Analysis
- St-B Consistent and Science-Based Message on Bioenergy Sustainability

Partners

- Partners
 - None
- Other interactions/collaborations
 - NREL, INL, PNNL, ANL, ORNL
- Non-technical project management partners
 - BCS

1 - Project Overview



- **Provide access to bioenergy knowledge, data, and tools via a single access point**
- **Build on an open-source, customizable, and scalable infrastructure**
- **Bring bioenergy researchers and stakeholders together**
- **Bring private content to the public**
 - Legislative Library, Biomass Scenario Model
- **Optimize access to high priority data, models, and information**
 - Ex. Billion-Ton Update, Sun Grant Field Trial Data, Biomass Scenario Model

2 – Approach (Technical)



- **Building from and customizing existing open source software to create a Government owned web-based collaboration framework for knowledge management and data visualization**
- **Using well established software development paradigms to collect user requirements and implement them in a easy to use functional application**
- **Challenges**
 - User engagement and acceptance of web-based data storage and distribution
 - Identify domain tools and data needed to extend the current state of bioenergy research

2 – Approach (Management)



- **Team Structure**

- KDF System Development – ORNL
- Content Management/Graphics – BCS
- Media – BCS

- **Weekly Meetings**

- KDF Development Team and BCS Graphics, Media, and Content Teams have weekly teleconference to track progress, discuss direction, and strategize for new capabilities
 - INL (Biomass Resource Library) – Still in development phase

- **Quarterly Updates**

- BETO Check-Ins: Quarterly conversations with BETO about project status, recent updates and deliverables
- Reports: KDF Development Team summarizes progress, issues, challenges overcome, and upcoming focus in Quarterly Report

- **Collaboration**

- Work with other labs to facilitate new capabilities
 - NREL (Biomass Scenario Model) – Released Oct. 2015

2 – Approach (Management)



- **Community Engagement**
 - Interacting with the KDF team to develop novel capabilities and ensure access to data
 - Establishment of stakeholder engagement plan and focus groups to guide technical development tasks and priorities
- **Data Access**
 - Easy access to critical bioenergy data and information
 - Most relevant data is quickly accessible
- **Challenges**
 - Information becoming stale or out of date
 - Incomplete or inaccurate metadata
 - Consistent cycle of new information to help pull users back to the KDF

3 – Technical Accomplishments



- **Redesigned KDF**

- Researcher focused capabilities
- Call to action and easy to access how-to
- Simplified Navigation
- Improved content organization
- Integration of Feedback from focus groups and stakeholder meetings
- Featured Research directly on the Home Page

- **Released Sept. 2013**

The screenshot shows the homepage of the Bioenergy Knowledge Discovery Framework (KDF). The header includes the KDF logo, the text "BIOENERGY KNOWLEDGE DISCOVERY FRAMEWORK", and "U.S. DEPARTMENT OF ENERGY". Navigation links for "OVERVIEW", "TOOLS & APPS", "MAP", and "BIOENERGY LIBRARY" are visible. A search bar and social media icons are also present. The main content area features a green banner with a video player and a "What Would You Like to Do?" section with four interactive buttons: "CONTRIBUTE DATA", "FIND DATA", "VISUALIZE DATA", and "FIND TOOLS & APPS". Below this is a "Featured Content" section with a card for a "Social Aspects of Bioenergy Sustainability Workshop Report" and a "LEGISLATIVE LIBRARY" section. A "News" section at the bottom left shows a recent article from February 23, 2015, titled "BioEnergy Bytes - Domestic Fuel". An "Events" section at the bottom right indicates "No Upcoming Events".

3 – Technical Accomplishments



Geographic Information Science and Technology

- **Bioenergy Legislative Library (Released Feb. 2014)**
 - 1,085 page views since release
 - 10th most viewed page on KDF
- **Pull from database maintained by BETO**
- **Information not easily found by researchers and public before being accessible on KDF**

Bioenergy Legislative Library

Home

Legislators

Related Bills

Committees

Welcome to the Bioenergy KDF Legislative Library

The Bioenergy KDF Legislative Library allows users to search for information about both passed and pending legislation relevant to the production and use of biofuels in the United States. To get started, click on the "Legislators," "Related Bills," or "Committees" tabs above, or images below, and browse the database for information about the representatives, groups, and legislation that interest you.

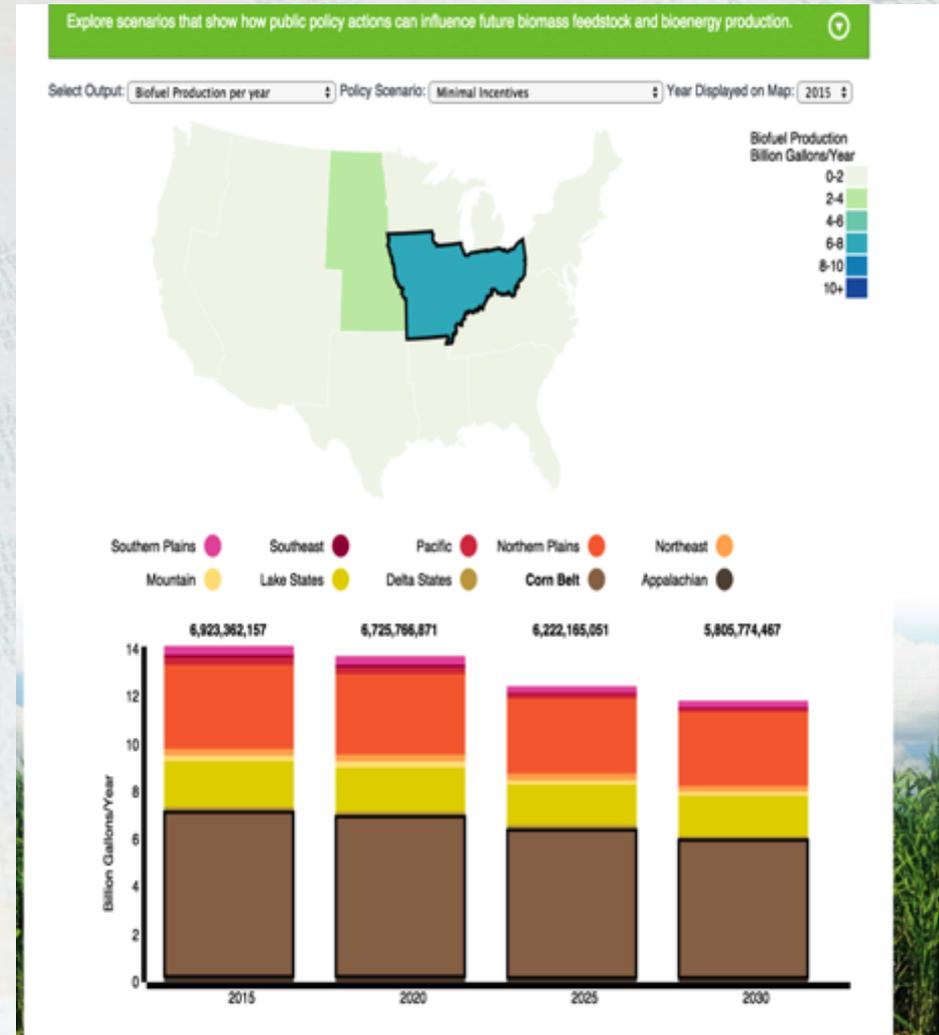


3 – Technical Accomplishments



Geographic Information Science and Technology

- **Biomass Scenario Model (Released Oct. 2014)**
 - 767 Page Views since release
 - 13th most viewed page
- **Collaborating closely with NREL to identify appropriate data and visualizations for display on KDF**
- **Pull data for existing NREL Open Geospatial Consortium (OGC) Standard Services**
- **Provide researchers with better understanding of data returned from Biomass Scenario Model**



3 – Technical Accomplishments



Geographic Information Science and Technology

- **DOE-Funded Research Page (Released Oct. 2014)**
 - 91 page views
- **Highlighting KDF Content that has been funded by Department of Energy**
- **Quickly assess search results for DOE-Funded Data**
- **Coordinated with BETO projects to increase deliverables to KDF as milestones.**

Home >

Content Funded by the U.S. Department of Energy

This page features KDF content that was created from research funded by the U.S. Department of Energy (DOE).

**Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply**

This report, generally referred to as the Billion-Ton Study or 2005 BTS, is an estimate of "potential" biomass available within the contiguous United States based on assumptions about inventory production capacity, availability, and technology.

Tags: billiontonstudy, feedstock, production

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**Evaluation of Potential Land Competition Between Open-Pond Micro Algae Production and Terrestrial Dedicated Feedstock Supply Systems**

National biomass feedstock assessments (Perlack et al., 2005; DOE, 2011) have focused on cellulosic biomass resources, and have not included potential algal feedstocks. Recent research (Wigmosta et al., 2011) provides spatially-explicit information on potential algal biomass and oil yields, water use, and facility locations. Oak Ridge National Laboratory and Pacific Northwest National Lab are collaborating to integrate terrestrial and algal feedstock resource assessments. This poster describes preliminary results of this research.

Tags: algae, biomass, competition, land, microalgae, terrestrial feedstock

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**Incorporating Bioenergy into Sustainable Landscape Designs—Workshop One: Forestry Landscapes**

The Bioenergy Technologies Office hosted a workshop on Incorporating Bioenergy into Sustainable Landscape Designs on March 4-6 in partnership with Oak Ridge and Argonne National Laboratories. Landscape design offers a promising means for sustainably increasing bioenergy production while maintaining or enhancing other ecosystem services.

Tags: landscape design, sustainability, woody biomass, workshop

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**Biomass Scenario Model Scenario Library: Definitions, Construction, and Description, 2014**

Understanding the development of the biofuels industry in the United States is important to policymakers and industry. The Biomass Scenario Model (BSM) is a system dynamics model of the biomass-to-biofuels system that can be used to explore policy effects on biofuels development. Overview of the complexity of the model...

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3 – Technical Accomplishments



- **Metadata Enhancement and Cleanup**
 - Metadata – information summarizing content on the KDF (Title, Summary, Publication Date, etc.)
 - Ensure content is up-to-date and accurate
 - Reach out to PI if needed
 - Results of this effort will be released July 2015
- **Identified and corrected inaccurate metadata and non-functioning for 150 map layers and 104 documents, publications, and web links**
- **Fixing this data will help researchers find the information they seek and ensure the KDF has the best available data**
- **New sources identified for linking with other archival resources**

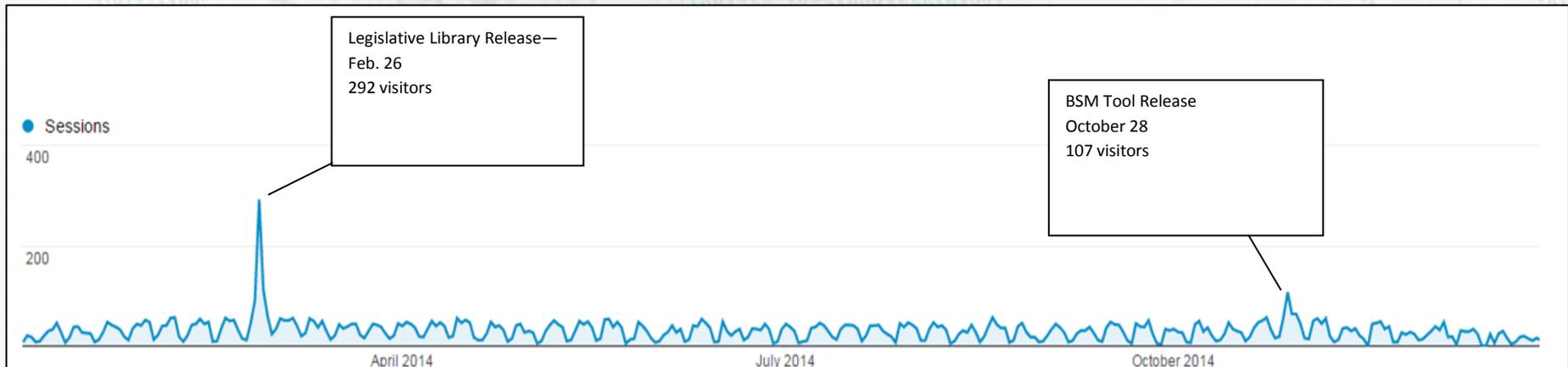
3 – Technical Accomplishments



Geographic Information Science and Technology

● Site Analytics Review

- KDF has a steady user base
- Spikes in Visitors after major releases/updates with new capabilities
- Users stay longer on the site with a purpose (ex. Exploring a new feature)
- 44% found the KDF from a search, 32% went directly to home page, 24% were referred from another site (Referred users tended to stay longer)



4 – Relevance



- **The fundamental objective of the KDF is to provide researchers with access to the tools, data, and information needed to help further research**
- **Brings together data from across the supply chain**
- **Helps prevent duplication of existing research**
- **Allows for transparent, comparable, and reproducible analysis**
- **Provides a mechanism for disseminating a consistent science-based message**
- **Technology developed and lessons learned from the KDF can be extended to other research domains within the Department of Energy**

4 – Relevance



- **User Growth**
 - 1,260 users
 - Growth of 307 users since last peer review
- **Community Engagement**
 - Average 100 page views/day
- **Cost Savings**
 - Billion-Ton Data Exchange: ~\$1,348,000
 - KDF Content in general: Further research required
 - How much does a single page view cost or save?
 - How to quantify difficult vs. easy to find data?
 - How to quantify data quality? Does it cost more if the data is inadequate?
 - Cost savings for other DOE investments into KDF like capabilities?

5 – Future Work



- **Software updates and enhancements**
 - Initial release July 2015
 - Updated release from user feedback September 2015
- **Finalize integration of Digital Object Identifier (DOI) generation**
 - DOI is a unique alphanumeric string assigned by a registration agency to identify content and provide a persistent link to its location on the Internet.
- **Integration with other data repositories**
 - Data.gov, DataONE, etc.
- **Biomass Resources Library data integration**
- **Facilitate release of Billion-Ton 2016 data and visualizations**
- **Research Return on Investment (ROI) of the KDF**

Summary



- **Approach**
 - Design and develop a robust, collaborative informatics framework
- **Technical Accomplishments**
 - Legislative Library
 - Biomass Scenario Model Tool
 - DOE-Funded Resources
- **Relevance**
 - Providing access to most up-to-date Bioenergy Data
- **Success Factors**
 - Most relevant publication/data are accessible
 - KDF is stable, dynamic and updated
 - Active user communities
- **Future Work**
 - Architecture Upgrades/Enhancements
 - Incorporate new models
 - Access to shared data/information
 - DOI generation
 - Evaluation of ROI for KDF



Additional Slides

Responses to Previous Reviewers' Comments



- **The KDF does not become a silo itself.**
 - The KDF has identified new sources of information and is exploring methods for syncing data among different system
 - Ensure methods for users to not just put information into the KDF but also various methods to retrieve (web services, RSS Feeds)
- **Additional work needed to enhance ease of use, searchability, and data documentation.**
 - The efforts of FY15 are seeking to address these very aspects and resolve issues identified since the last review.
- **Adopt a “sustainability plan” for maintaining the KDF past the life of the project**
 - Many of the background enhancements in FY15 will support this long term sustainability. Also, developing user engagement and steering committees will help to keep the KDF targeted towards user needs.

Publications, Patents, Presentations, Awards, and Commercialization

Geographic Information Science and Technology



- **"Bioenergy KDF: Enabling Spatiotemporal Data Synthesis and Research Collaboration"**
 - Second place for best paper at the ACM SIGSPATIAL Conference, November 4–7, 2014 in Dallas, Texas.
- **The underlying architecture developed for the Bioenergy KDF is supporting a similar capability for DOE NFST**

KDF: Return on Investment

Geographic Information Science and Technology



Billion-Ton Interface

Potential savings to Program
from *Billion-Ton Study* interface
on KDF: ~\$1,348,000

- **Overview Page: 18,000 views**
- **Dynamic Maps: 3,350**
 - Potential savings: \$670,000 (1 hour of scientist's time @ \$200/hr)
- **Canned Maps: 2,560**
 - Potential savings: \$128,000 (15 min of scientist's time @ \$200/hr)
- **Full Downloads: 2,000**
 - Potential savings: ~\$100,000 (15 min of scientist's time @ \$200/hr)
- **Custom Downloads: 3,000**
 - Potential savings: ~\$450,000 (45 min of scientist's time @ \$200/hr)
- **Researcher Time: reduced to 1 hour per week**
- **There have been 9,000 additional views of just the map, which can be used to generate dynamic maps.**