OAK RIDGE National Laboratory

DOE Bioenergy Technologies Office (BETO) 2019 Project Peer Review

6.3.0.2 - Bioenergy Knowledge Discovery Framework (KDF)

March 5, 2019

Analysis and Sustainability

Aaron Myers

Oak Ridge National Laboratory

ORNL is managed by UT-Battelle, LLC
for the US Department of Energy

U.S. DEPARTMENT OF ENERGY

Goal Statement

- The Bioenergy KDF is designed to connect researchers, industry, and sponsors to share information and build on existing knowledge within the bioenergy research community. While making high-value data and information easily accessible (ex. Billion-Ton 2016, Sustainability Standards, Regional Feedstock Partnership, etc.) through an interactive web-based architecture.

Quad Chart Overview

Timeline

- Start: FY2007
- Merit Review Cycle: FY2018 – FY2020
- 75%

	Total Costs Pre FY17**	FY 17 Costs	FY 18 Costs	Total Planned Funding (FY 19-Project End Date)
DOE Funded		$262K	$184K	$450K

- **Partners: Code Journeymen, NREL, INL, PNNL, ANL, ORNL**

Barriers addressed

- At-C Data Availability Across Supply Chain
- At-G. Social Acceptance and Stakeholder Involvement

Objective

Bring the latest relevant bioenergy data to research community, industry, and the public.

End of Project Goal

Provide a well maintained, up-to-date, bioenergy data repository for archival and sharing with stakeholders.

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
  - Biomass Scenario Model
- Optimize access to high priority data, models, and information
  - Ex. Billion-Ton 2016, Sustainability Standards, Sun Grant Initiative (SGI Data)

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 bi-monthly teleconference to track progress, discuss direction, and strategize for new capabilities
- 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

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

2 – Approach (Technical)

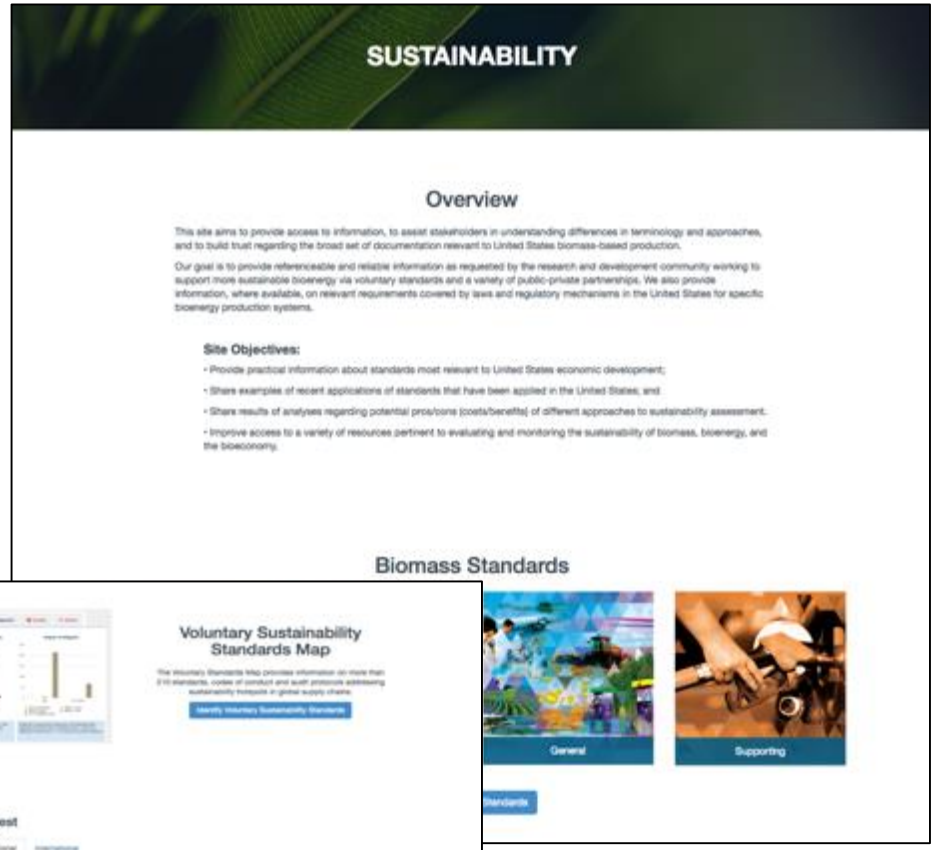
- Building from and customizing existing open source software to create a Government owned web-based collaboration framework for knowledge management and data visualization
- Using well established software development paradigms to collect user requirements and implement them in a easy to use functional 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
  - Information becoming stale or out of date and incomplete or inaccurate metadata
- Success Factors
  - Relevant, up-to-date content
  - Easy access to priority content and data
  - Engagement from user community

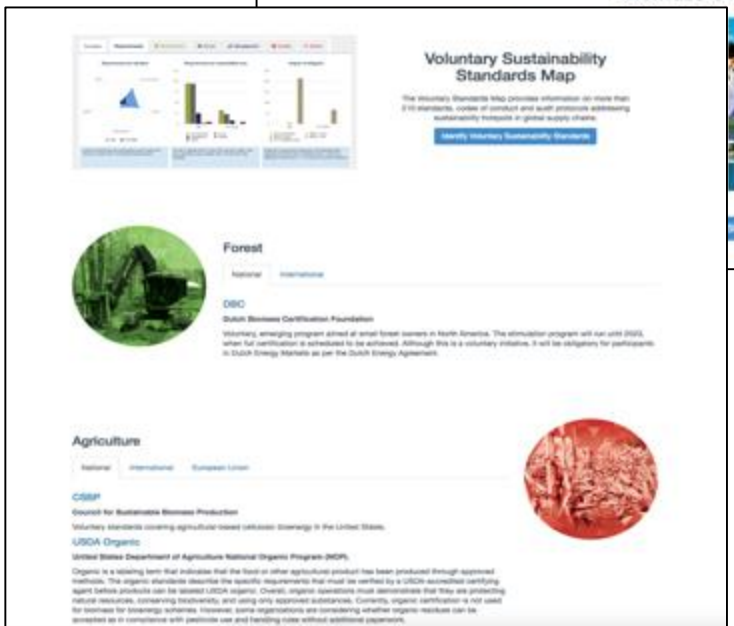
3 – Technical Accomplishments/ Progress/Results

- Key Topics Page
  - Easier access to key pages
  - Ability for BETO to promote new content and data
  - Common user interface with Billion-Ton Pages
  - Includes:
    - Billion-Ton 2016 Vol 1 and Vol 2
    - High Octane Fuel Study
    - Billion-Ton Update
    - Sustainability Standards
    - Sun Grant Initiative Data

3 – Technical Accomplishments/ Progress/Results

- Sustainability Standards Page
  - Provide access to information, to assist stakeholders in understanding differences in terminology and approaches, and to build trust regarding the broad set of documentation relevant to United States biomass-based production.
  - Highlight Related Tools
  - 2,200 page views since June 2018

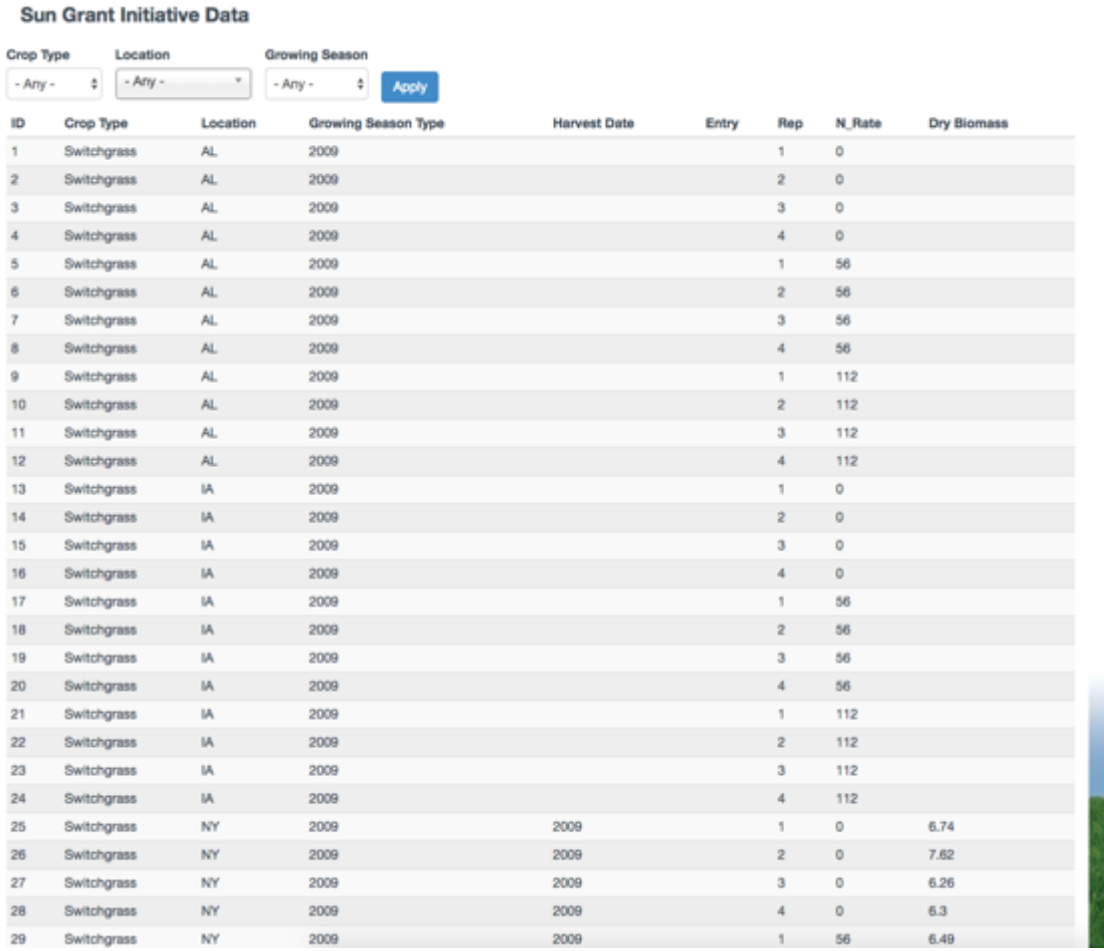




OAK RIDGE National Laboratory

3 – Technical Accomplishments/ Progress/Results

- Sun Grant Initiative Data
  - Data exploration and download
  - Access to raw and summarized data
  - Link with INL Biomass Library
  - Released January 2019



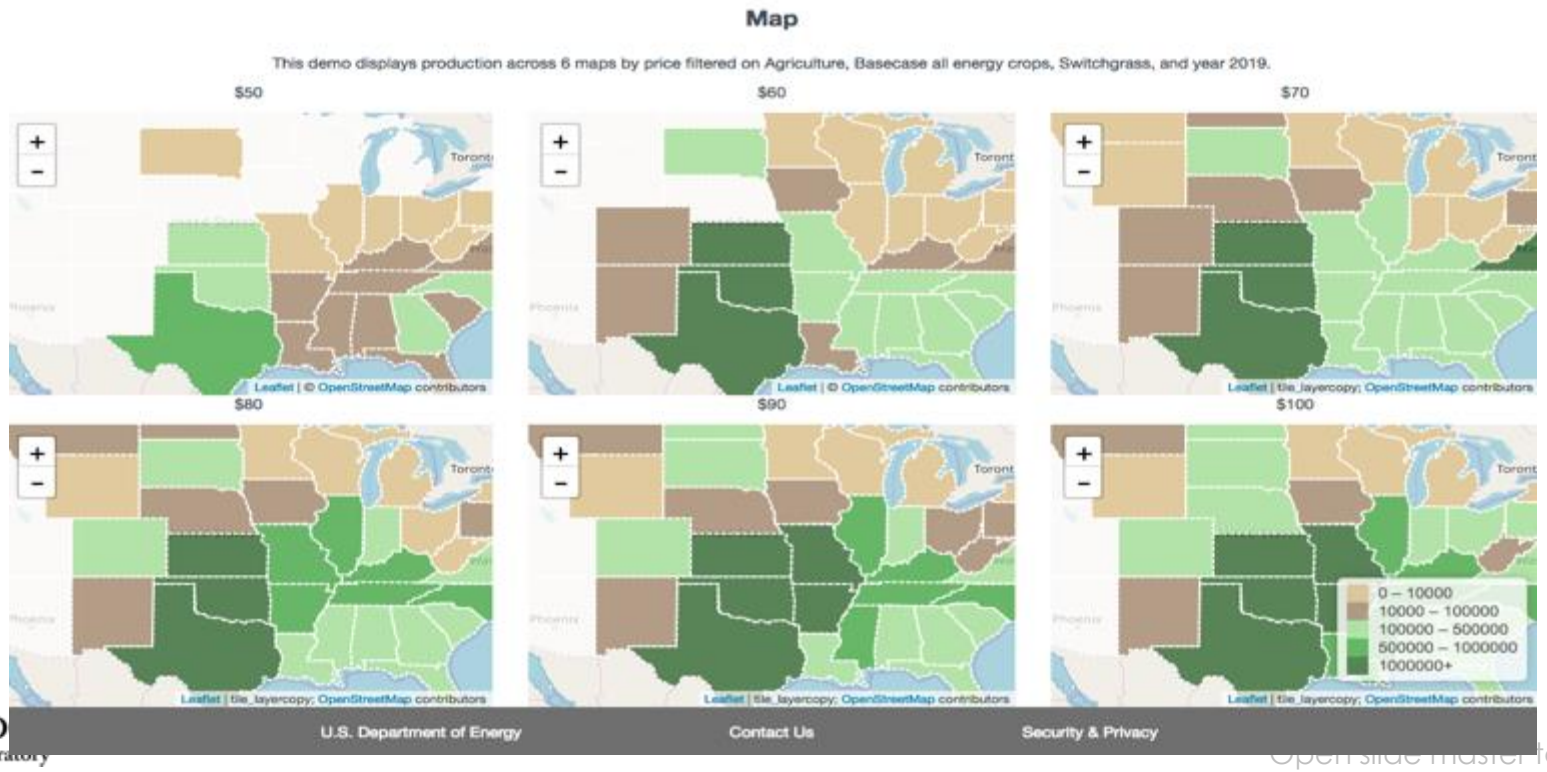
Sun Grant Initiative Data

Crop Type: - Any - | Location: - Any - | Growing Season: - Any - | Apply

ID	Crop Type	Location	Growing Season Type	Harvest Date	Entry	Rep	N_Rate	Dry Biomass
1	Switchgrass	AL	2009			1	0	
2	Switchgrass	AL	2009			2	0	
3	Switchgrass	AL	2009			3	0	
4	Switchgrass	AL	2009			4	0	
5	Switchgrass	AL	2009			1	56	
6	Switchgrass	AL	2009			2	56	
7	Switchgrass	AL	2009			3	56	
8	Switchgrass	AL	2009			4	56	
9	Switchgrass	AL	2009			1	112	
10	Switchgrass	AL	2009			2	112	
11	Switchgrass	AL	2009			3	112	
12	Switchgrass	AL	2009			4	112	
13	Switchgrass	IA	2009			1	0	
14	Switchgrass	IA	2009			2	0	
15	Switchgrass	IA	2009			3	0	
16	Switchgrass	IA	2009			4	0	
17	Switchgrass	IA	2009			1	56	
18	Switchgrass	IA	2009			2	56	
19	Switchgrass	IA	2009			3	56	
20	Switchgrass	IA	2009			4	56	
21	Switchgrass	IA	2009			1	112	
22	Switchgrass	IA	2009			2	112	
23	Switchgrass	IA	2009			3	112	
24	Switchgrass	IA	2009			4	112	
25	Switchgrass	NY	2009	2009		1	0	6.74
26	Switchgrass	NY	2009	2009		2	0	7.62
27	Switchgrass	NY	2009	2009		3	0	6.26
28	Switchgrass	NY	2009	2009		4	0	6.3
29	Switchgrass	NY	2009	2009		1	56	6.49

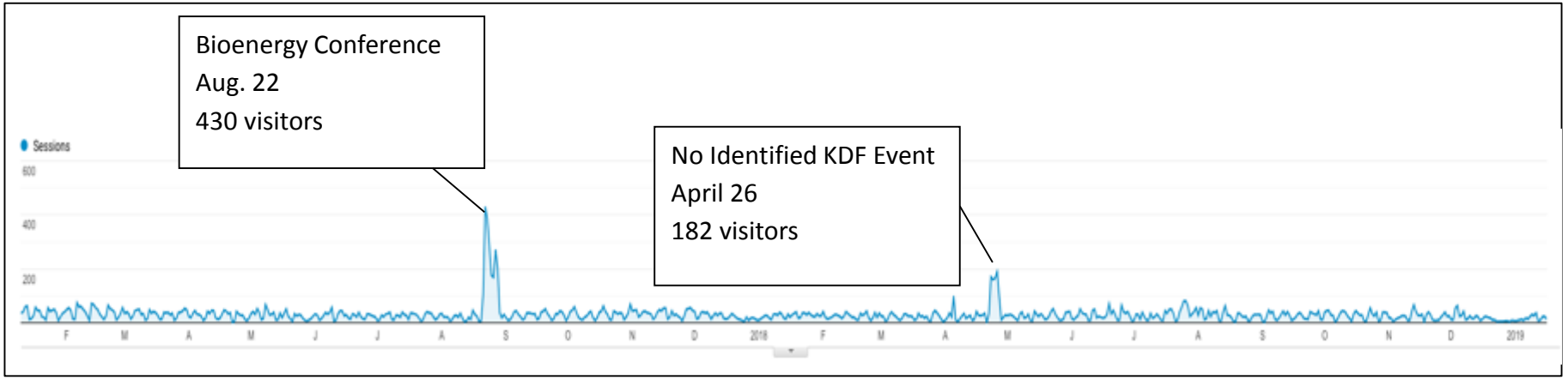
3 – Technical Accomplishments/ Progress/Results

- Focused Map Based Visualizations
  - Lessons learned from current Map
  - Focus capabilities to allow user to dive into specific data
  - Not trying to recreate GIS



3 – Technical Accomplishments/ Progress/Results

- Site Analytics Review
  - KDF has a steady user base
  - Spikes in Visitors after major releases/updates with new capabilities
  - 34% (-5%) found the KDF from a search, 40% (+13%) went directly to home page, 26% (-6%) were referred from another site (Direct users tended to stay longer vs Referred Users)



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
- Access to Billion-Ton 2016 Data and Visualizations
- Quick access to Key Topics (Sustainability Standards, High Octane Fuel Study, Sun Grant Data and other BETO funded research and analytics results
- Technology developed and lessons learned from the KDF can be extended to other research domains within the Department of Energy

5 – Future Work

- Software updates and enhancements
  - Released regularly
  - As capabilities become production ready
  - Upgrade to Drupal 8 to reduce operations and maintenance costs
- Provide capability for BETO and other researchers to moderate and curate data
- Finalize SGI and Biomass Resources Library data link
- Update and release map capabilities as standalone tools
- Integration of BioSTAR Tool
- Increase Community Engagement Activities

Summary

- **Approach**
  - Design and develop a robust, collaborative informatics framework
- **Technical Accomplishments**
  - Sustainability Standards
  - System Upgrades
  - Content Curation
  - Initial SGI/Biomass Library Link
- **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**
  - Create new standalone map tools
  - Access to shared data/information
  - Increase Community Engagement
  - Link SGI and Biomass Library Data

Additional Slides

Responses to Previous Reviewers' Comments

- How valuable the specific tools and information provided by the Bioenergy KDF are to users.
- To understand costs, an assessment of the longer-term maintenance needs and potential options to ensure sustainability would be valuable, including options to scale up the site to be a broader platform across, and potentially beyond, BETO

Publications, Patents, Presentations, Awards, and Commercialization

- "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 SFWD and for Energy-Water Nexus KDF