



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



## DOE Bioenergy Technologies Office (BETO) 2015 Project Peer Review

3.1.3.2

Fire Standards Codes and Prevention in IBR's

March 25, 2015

Demonstration and Market Transformation

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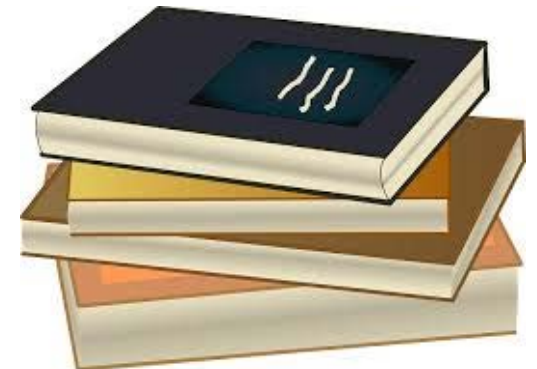
Maggie Davis

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# Goal Statement

## Enable the scale-up of a commercial-scale biomass industry through the development of harmonized codes and standards to:

- Ensure the safety of people and assets
- Reduce risk and improve insurability
- Clarify market expectations for sustainability
- Reduce costs for biomass industries



# Quad Chart Overview

## Timeline

- 2013
- 2017
- 45% complete

## Budget

|  | Total Costs<br>FY 10 –FY<br>12  | FY 13<br>Costs | FY 14<br>Costs | Total<br>Planned<br>Funding<br>(FY 15-<br>Project End<br>Date |
|--|---|----------------|----------------|---|
| <b>DOE<br/>Funded</b>                      |   | \$340,528      | \$325,125      | \$1,952,000   |
| <b>Project<br/>Cost Share<br/>(Comp.)*</b> | Informal cost share estimate - \$60,000<br><i>Estimate includes industry staff time, travel cost,<br/>and biomass for fire testing through March 2015</i> |                |                |   |

## Barriers

- Im-E - Lack of or inconsistent industry standards and regulations
- St-A - Scientific consensus on bioenergy sustainability
- Im-C - Lack of understanding of environmental/energy tradeoffs

## Partners

- Collaborations
  - Antares
  - Genera Energy, LLC
  - Abengoa
  - POET
  - DuPont
  - Idaho National Laboratory
  - American Society of Agricultural & Biological Engineers
  - ADM
- Subcontractor - Vista Consulting

# 1 - Project Overview

## Task 1 - Fire codes and standards for biomass-handling facilities

- Assemble and lead the Biomass Industry Panel on Codes and Standards (BIPCS) to review fire codes and standards and prepare change proposals to clarify and improve application to industry practices
- Develop science-based best management practices for outdoor biomass bale storage

## Task 2 – Standard for sustainability assessment

- Assist industry and other federal agencies develop an ASTM international standard for sustainability assessment

# 2 – Approach (Technical)

## Major Challenges

Successful code change proposal to correctly classify herbaceous feedstocks in NFPA sprinkler design tables

Developing BMPs to reduce fire risk in outdoor biomass bale storage for a wide range of feedstocks with limited test data

Identify best practices that will promote science-based assessment

Standardizing the assessment of sustainability for a wide range of biomass feedstocks

## Critical Success Factors

- Commodity classification tests at certified lab to collect data required by NFPA 13 technical committee to add commodities to Sprinkler Systems standard
- Develop models to test storage design
- Statistical approach to extrapolate test data based on biomass physical and chemical characteristics (e.g., moisture, density)
- Develop standard that avoids unfair bias or trade barriers, while permitting fair and consistent comparisons
- Standard applicable to entire supply chain and be relevant for any bioenergy products, co-products derived from biomass, and end-uses (engine types).

# 2 – Approach (Management)

## Major Challenges

## Critical Success Factors

Industry involvement

- Strong industry involvement in activities of the Biomass Industry Panel on Codes and Standards (BIPCS) and ASTM committee

Navigating the processes for change proposals to relevant codes and standards

- Engaged subcontractor with extensive expertise in development of building and fire codes and standards

Developing consensus in large, diverse committee

- Apply lessons learned in previous ISO standard development activity

# 3 – Technical Accomplishments/ Progress/Results

## Formation of the Biomass Industry Panel on Codes & Standards

Formalized committee with approval of bylaws in July 2014

### Objectives

- Develop code change proposals to reduce risk and better reflect current knowledge of biomass properties and biomass handling and storage systems
- Develop training and reference materials for engineers and code reviewers
- Develop science-based best management practices for outdoor biomass bale storage
- Currently meets monthly by phone and 1-2 times annually in-person

**2014-2015 Chairs**

Erin Webb, ORNL

Scott Cedarquist, ASABE



**ABENGOA**

**POET**



**ANTARES**  
Group Incorporated



# 3 – Technical Accomplishments/ Progress/Results

## Successful change proposals for the 2015 International Building and Fire Codes

### Clarify that biomass is NOT a hazardous material

1. Renumber *Chapter 52: Combustible Fibers* from Section V: Hazardous Material to Section III: Special Occupancies and Operations portion of the code book
2. Move *Combustible dusts, grain processing, and storage* section of IBC to a more appropriate location given that biomass does not fully meet the definition of a hazardous material
3. Allow biomass feedstocks that are housed in facilities designed to control for conditions that create a fire or explosion hazards NOT to be classified as hazardous materials
4. Clarify *Combustible Fibers* chapter by adding information about appropriate control of ignition sources and by cross referencing guidelines for outdoor storage of loose fibers with other chapters that more clearly address risk control measures



100% success rate for IBC and IFC proposals.  
***Virtually unheard of!***



# 3 – Technical Accomplishments/ Progress/Results

## Successful change proposals for the 2015 International Building Code

### Design of biomass storage piles

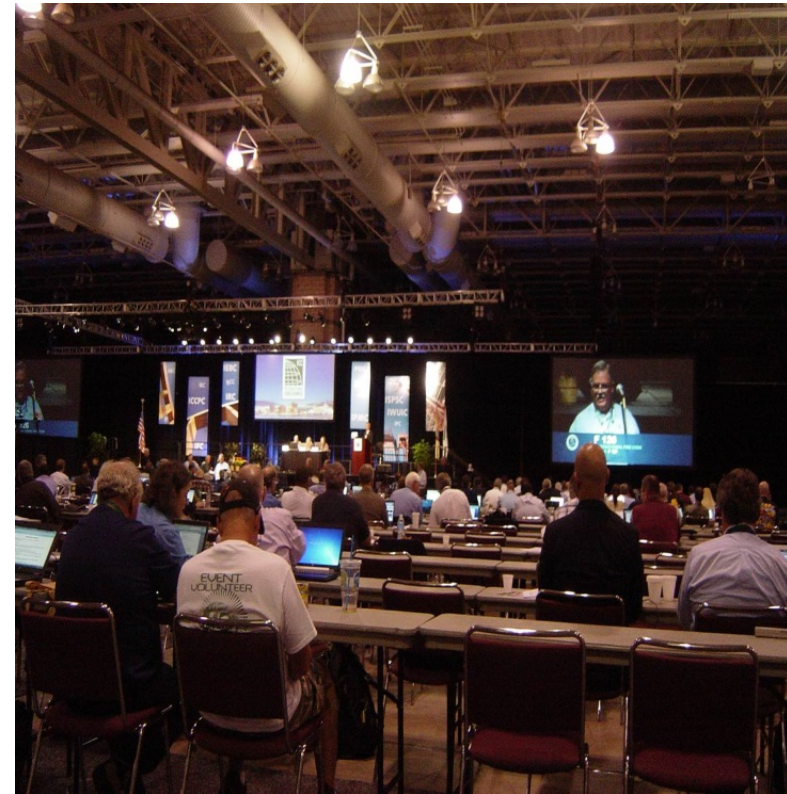
5. Added text to provide guidance for high-piles exceeding 25-ft in height, 150-ft width, and 250-ft in length. Revision allows for larger pile provided certain design stipulations are met.

### Add bioenergy feedstocks to wood chapters

6. Expand scope of *Chapter 28: Lumber Yards and Woodworking Facilities* to include agro-industrial facilities and solid bulk biomass

### Sprinkler design

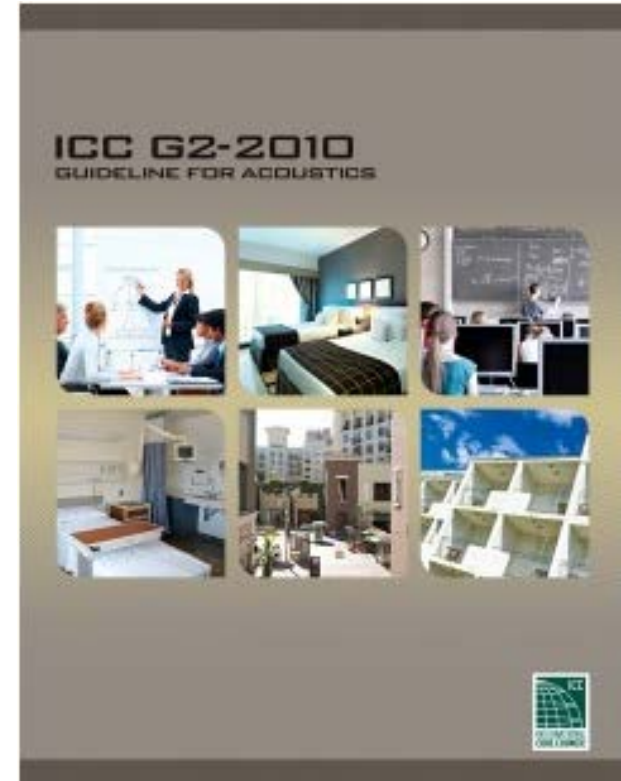
7. Add biomass categories to Class III commodities list for automatic sprinkler protection



# 3 – Technical Accomplishments/ Progress/Results

## Proposed ICC Guideline Publication for Biomass

- Proposal submitted to International Code Council (ICC) to develop a Guideline Publication for Biomass
- Topics
  - Overview of biomass supply systems and conversion
  - Review of IFC, IMC, and IBC code application
  - Selecting and applying applicable codes for proposed facility
  - Highlight other applicable codes (fire or mechanical code)
  - Other resources to aid engineers or code official when dealing with biomass facilities
- Proposal submitted in Fall 2014. Currently in discussion with ICC officials.



ICC Guidelines are used to assist Code users and reviewers in applying relevant Codes.

# 3 – Technical Accomplishments/ Progress/Results

## Commodity classification testing of herbaceous feedstocks



- Goal: Add herbaceous biomass feedstocks to the National Fire Protection Association *Standard for the Installation of Sprinkler Systems* (NFPA 13)
- Why? To streamline sprinkler design for biomass-handling facilities and reduce design and development costs
- NFPA 13 technical subcommittee requires commodity classification tests performed at a certified laboratory



### Tests scheduled for Spring 2015

- Corn stover (rectangular bales)
- Corn stover (round bales)
- Switchgrass (rectangular bales)

# 3 – Technical Accomplishments/ Progress/Results

## Assessing fire risk in outdoor biomass storage

Per request of industry partners, the BIPCS is developing an R&D plan to assess fire risks in outdoor bale storage yards for herbaceous biomass

- First step, adapting models for fire in building and forests
- Commodity classification test data to be used as a base case for validation
- In initial planning phase for a research/outreach event with an actual bale stack fire (FY16)



Corn stover, Nevada, IA  
(photos from: <http://nevadaiaowajournal.com>)



Corn stover, Moscow, KS  
(photo from: <http://biobasedchems.blogspot.com>)



Switchgrass, Vonore TN  
(photo from: <https://news.tn.gov/node/8576>)

# 3 – Technical Accomplishments/ Progress/Results

## Developing new ASTM sustainability assessment standard

ASTM Technical Committee E48 Bioenergy and Industrial Chemicals from Biomass

- Sub-Committee E48.80 “Sustainability in Biomass” approved a new work item: *“Sustainability criteria for Biomass and Biomass Products”*

Per industry partner requests

- ORNL forms part of an initial work group
- Will help identify additional team members and outline content

Approval of work item #27810 by ASTM subcommittee

- ✓ Reflects market relevance for industry
- ✓ Fulfills initial “go/no-go” milestone)



# 3 – Technical Accomplishments/ Progress/Results

## Considering US industry needs for sustainability assessment

New standard will be designed to fill gaps that threaten future US export markets for bio-products

- Clear guidance for implementing more consistent sustainability assessment
- Avoid bias and trade barriers
- Be applicable to the entire supply chain
- Be relevant for any bioenergy products, or co-products derived from biomass, and end-uses (engine types)

**“If you’re not at the table, you’re on the menu!”**



Source: <http://biomassmagazine.com/articles/6258/forest-certification-opportunity-and-challenge-for-the-wood-pellet-industry>

# 3 – Technical Accomplishments/ Progress/Results

## Leading standard-development team

- Task at hand: Jump-start efforts
  - Apply lessons learned from the ISO process (over 140 committee members and three years of effort) and leverage support from partners
- Tech transfer: leverage BETO research
  - Relevant definitions, best practices;
  - promote science-based approach
  - clear guidance for implementing sustainability assessment



Standardized measurement protocols: e.g., Soil Organic Carbon

## 4 – Relevance

**Engage industry in proactively addressing fire risks while not overburdening industry**

**Risks of fires (real and perceived) for commercial-scale biomass-handling facilities has emerged as a barrier to the developing bioenergy industry**

**Science-based codes and standards developed in this project will reduce risk to people and assets and improve insurability of biomass facilities**



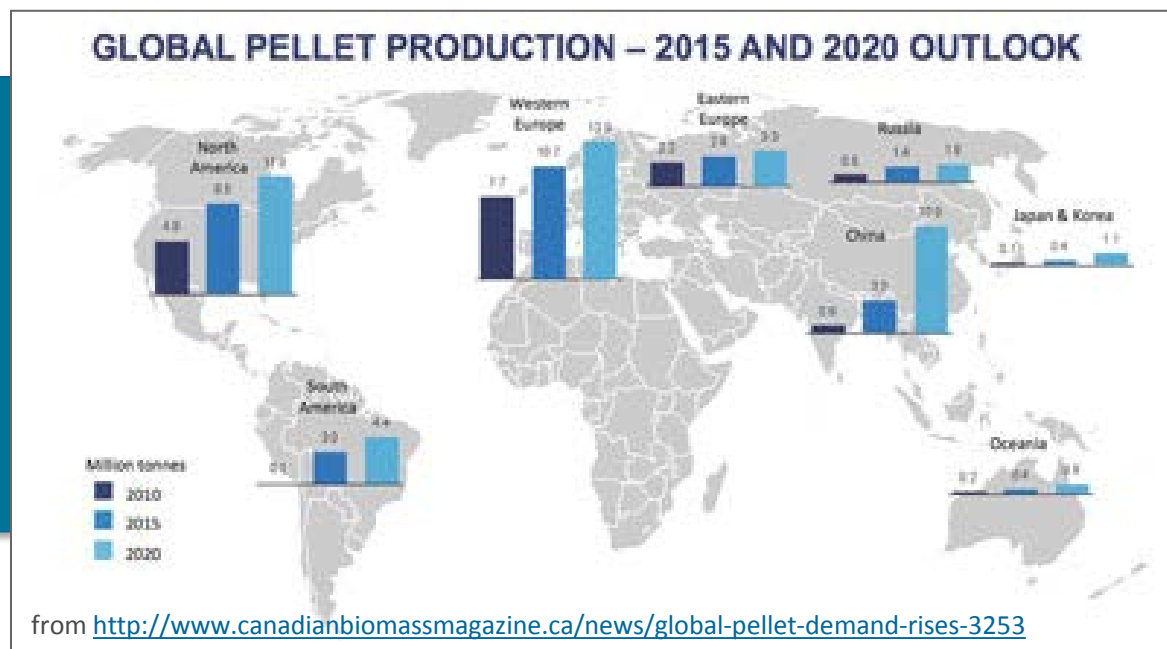


# 4 – Relevance

## Working with industry and other federal agencies to standardize bioenergy sustainability assessments

- Responding to industry requests, filling gaps, and supporting more consistent assessment of the sustainability of bioenergy supply chains
- Effective standards
  - Provide a more stable foundation for trade and investment
  - Reduce deployment barriers and transaction costs
  - Incentivize continual improvement based on consistent measurement of performance supporting informed decisions for adaptation and better practices

Renewable energy targets and sustainability metrics determine European demand for biomass pellets



# 5 – Future Work

- **Comprehensive review of 2015 *NFPA 1 – Fire Code* to identify inconsistencies with recent changes to the IBC and IFC**
  - Code change proposals developed as necessary to harmonize relevant codes and standards
- **NFPA 13 Sprinkler Standard**
  - Complete commodity classification testing at UL (Spring 2015)
  - Using data from UL tests, develop proposal to include herbaceous bioenergy feedstocks into NFPA 13 commodity classification tables for sprinkler design
- **Modeling outdoor biomass bale storage for development of BMPs or standards**
  - Develop models of fires in outdoor bale yards to assess impacts of factors such as stack size, stack spacing, orientation with respect to wind, etc.
  - Participate in industry-led research and outreach event to collect data on an actual bale stack fire
- **Contribute to writing and guiding the peer review of standard for sustainability assessment**

# Summary

- **Assembled and leading the Biomass Industry Panel on Codes and Standards to develop science-based codes and standards aimed at reducing fire risk for biomass industries:**
  - 7 successful code change proposals included in the 2015 International Building Code and International Fire Code
  - Proposed ICC Guideline to assist engineers and code reviewers apply codes to biomass-handling facilities
  - Preparing for commodity classification tests at UL
  - Planning R&D activities to address fire risk in outdoor bale yards
- **Contributing to development of new ASTM standard to identify best practices that will promote science-based assessment of bioenergy sustainability**
  - Apply lessons learned in previous ISO standard development process to guide writing and review of new standard