2013 DOE Bioenergy Technologies Office (BETO) Project Peer Review

International Sustainability and Standards (ISO)

and Brazil collaborations

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Technology Area: Analysis & Sustainability

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U.S. DEPARTMENT OF ENERGY

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Goal Statement

Project

- Build ***international consensus*** around criteria, definitions and measurement methods required to assess bioenergy sustainability
- Focus for FY12-14: Support International Organization for Standardization (ISO) Standard 13065, "***Sustainability Criteria for Bioenergy***"
- Strategic collaborations – Brazil

Support BETO and EERE Goals to -

- Build scientific capacities to define, measure and assess the sustainability of bioenergy options
- Reduce risks and uncertainties and facilitate market stability and growth
- Lower transaction costs and barriers for emerging bioenergy markets
- Accelerate tech transfer, adoption of clean bioenergy technologies
- Prioritize partnerships with key countries for high impact (EERE)

Quad Chart Overview

Timeline

- Project start: FY 2009 (ISO start FY 2011)
- Project end date: FY 2015
- Percent complete: 75%

Barriers

- ST-A ***Scientific consensus*** on bioenergy sustainability
- ST-D Indicators and ***methodology for evaluating sustainability***
- AT-A Lack of ***comparable, transparent and reproducible analysis***

Budget

Funding received

- FY11: $205k
- FY12: $158k
- FY13: $100k

Years funded / Average $/year:

- 5 / $145k

Partners

- ISO - collaborations with over 40 national and international organizations
- Other labs and research centers: ANL, NREL, PNNL, GLBRC, BESC, CTBE…
- US agencies: USDA [FAS, USFS, ERS], State Department, USAID
- International organizations (IEA, FAO) and standards initiatives (RSB, GBEP)
- Private sector, trade groups, national standards bodies

Funding partner: Michigan Tech University (MTU) via National Science Foundation PIRE-Sustainable Bioenergy and RCN- Sustainable Bioenergy projects

Project Context

- 2004-08: Legislative initiatives in US (RFS, EISA), California (LCFS) and EU (RED)
  - Thresholds for GHG emissions, sustainability
  - Inconsistent definitions and measurement
  - Indirect effects and land-use change uncertainties

- 2009-2010: flurry of activities on sustainability
  - GBEP, ISO, CSBP, RSB… many certification initiatives launched
  - International Workshop on LUC & Bioenergy (ORNL, 2009)
- Recognition –
  - "International engagement is essential" to achieve U.S. policy objectives for clean, renewable energy resource development
  - Uncertainties about sustainability affect social acceptance and global market access with implications for next generation biofuels
  - Strategic opportunities (e.g., Brazil, International Standards)

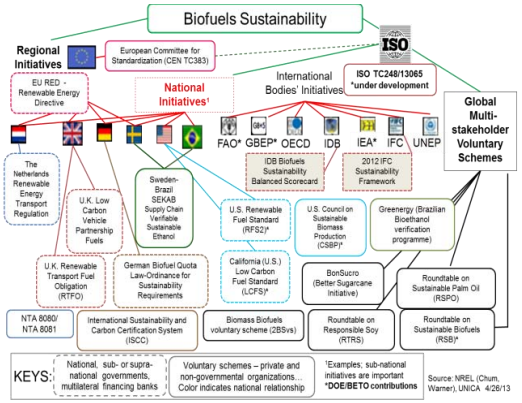
Project Historical Overview

Initial Objectives (2009) were broad

- Build alliances among global stakeholders to identify key constraints (workshops, networks)
  - Specific multi-scale analyses and collaborations
  - Research and consensus to resolve barriers
- Develop sustainability principles, criteria and global standards
- DOE analyses, reviews, and outreach (international issues)

Many standards and certification initiatives

- Alignment on principles of sustainability
- Not on definitions, methods, comparability

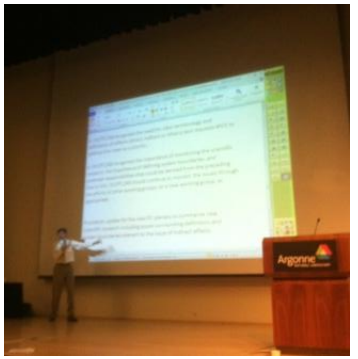


Studies highlight

- Consistent measurement needed to identify, verify "best practices"
- Implementation limited by procedures and indicators too
  - Numerous
  - Costly
  - Variable
  - Broad
  - Difficult to measure
- High transaction costs and uncertainty due to different, evolving schemes in different markets – disadvantageous for bioenergy relative to fossil
- International Standards are needed for consistent indicator measurement

1. Approach – teamwork and selective focus

1. **Accelerate tech-transfer**
   - Contribute scientific expertise
   - Enhance impact of 'latest, greatest' research results
   - Synergy across labs, platforms, agencies
   - Technically sound, peer-reviewed



2. **Strategic focus: *prioritize based on criteria***
   - High impact: Influence key decisions, policies, reports
   - Efficient: identify and fill gaps
   - Partnerships with greatest mutual rewards
   - Integration of sustainability in bi- and multi-lateral dialogue

3. **Leverage resources and partnerships to expand impact**
   - Joint research and analysis (Brazil, universities)
     - Synthesis across projects/disciplines
     - Optimize available resources
   - Targeting high-level processes (e.g. ISO, IPCC…)

1. Approach (2) – management plan

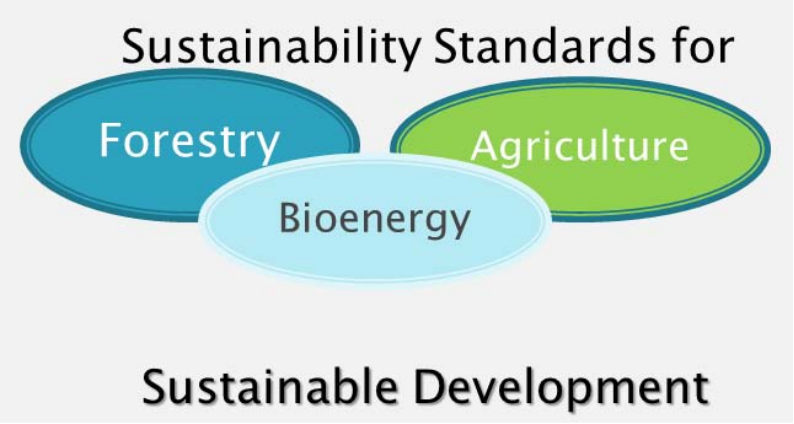
4. **Key Milestones defined, monitored**
   - Milestones reviewed/updated in Annual Plans
   - Adapted to partner resources, schedules (ISO, IPCC, IEA…)
   - ISO process prioritized (2012-2015) per criteria
     - Rigid timeline/tasks
     - see supplemental slides

5. **Work plans, decision points and deliverables**
   - Monthly-weekly calls, reports, reviews, meetings
   - Coordination among lab teams, agencies, partners
     - E.g. ANL (GREET), NREL (TEA, certification schemes), Canada (standards), Brazil (ISO, indicators),
     - ORNL multi-disciplinary team (social, economic, environmental…indicators)

6. **Risks and alternatives assessed** (ISO example)
   - Coordinated US leadership
     - “Cover the bases” on multiple work groups
     - Fill strategic gaps (e.g. ILUC)
   - Backup plans at multiple levels (e.g., plenary, voting, overall result)

Approach: Why ISO?
- meets criteria, making a difference

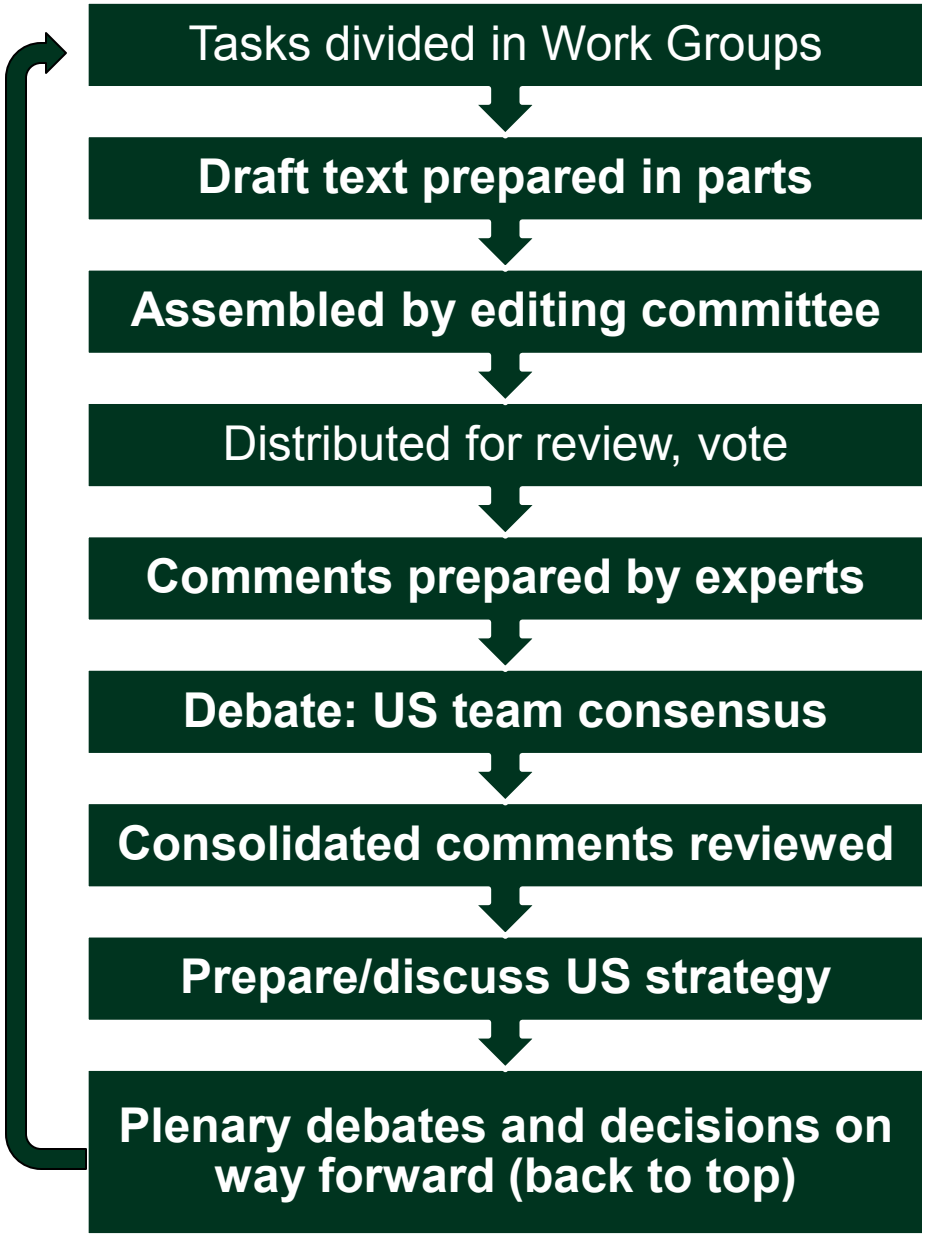
- Tremendous potential global impacts
  - 163 member countries
  - Over 19,000 published International Standards
- Rio 1992: Series of Environmental Standards (ISO 14000)
  - 250,000 users
  - Applied in 155 countries
- Social Responsibility (ISO 26000, 2006)
- ISO 14064:2006 and ISO 14065:2007 standards
  - Provide an internationally agreed framework for measuring GHGs
  - So that " a tonne of carbon is always a tonne of carbon "
- Rio+20 ISO commitment to foster Sustainable Development
  - Economy +
  - Environment +
  - Social Responsibility +
  - Millennium Development Goals



Source: http://www.iso.org/iso/rio_20_forging_action_with_agreement.pdf

2. Technical Accomplishments (1)
Support ISO Process

- Iterative process
- Based on consensus
- Substantive contributions made to 3 iterations thus far
  - Contributed to over 70 ISO international webinars in past 24 months
  - Prepared and submitted over 100 written comments in development of 1st CD
- 2 or 3 more iterations to come (depends on results of voting)
- Our key contribution: “Science-based approach”
- Nine ISO progress reports prepared and submitted on behalf of DOE team



2. Technical Accomplishments (2)
Progress – ISO "Sustainability Criteria for Bioenergy"

Examples:

1. **Fill strategic gaps**
   - Leadership roles
     - Serve on Chair's Advisory Group
     - Lead international Editing Committee
   - Work Group 4 (indirect effects) – initially leaderless, obstructing progress
     - Organized partners
     - Facilitated solution (Argentina, Canada, US)
     - Serving as Secretariat
     - RESULT: WG4 tasks completed – critical decisions on "indirect effects"
2. **Essential decision support** – covering the bases to overcome technical issues
   - Principles and Indicators work split among multiple sub-groups
     - US team organized to maintain presence at key decision-points
   - Resolutions to address scope, vision (science-based measurement methods versus certification thresholds)
   - Contribute to all active Work Groups "If you're not at the table,…"
3. **Tracking progress**: 15 of 17 work plan targets met

   (see supplemental slides for full list)

2. Technical Accomplishments (3) –
Examples: AOP targets for International-ISO (ORNL)

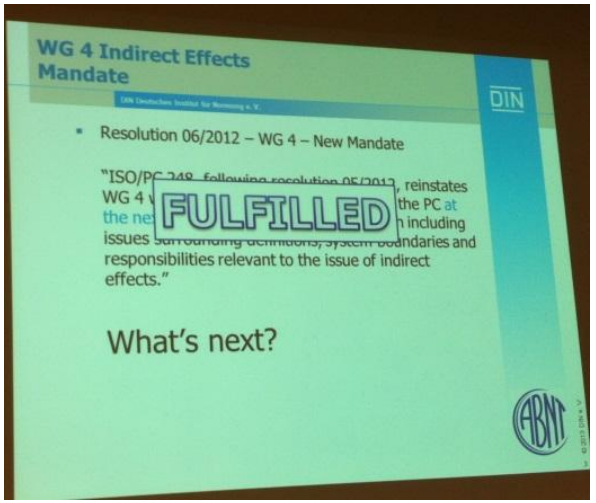
	Key Milestones and Deliverables FY13	Plan	Q2 Status
Q1	Serve as Chair and lead an Editing Committee to resolve key issues… to produce first Committee Draft (CD)	11/2012	100%. 1st CD distributed
Q2	Represent best available science and U.S. policy goals in discussions of comments received and developing a way forward…as official U.S. Delegates to ISO	2//2013	100%. Reported via ISO Update Report #9
Q3	Respond to CD comments and facilitate process to achieve consensus language for methods required for consistent calculations…for bioenergy pathways.	6/2013	On target – contributing to multiple work groups, calls
Q4	At least three written reviews will be submitted in support of strategic DOE goals related to global/international issues	9/2013	On target – two IEA reviews; FAO; BETO webinar

2. Technical Accomplishments (4)
Results: ISO and Indirect effects example

4. "State of the science on indirect effects" (ISO PC248 Work Group 4):

- "Indirect land-use change" (ILUC) and food security
  - Potential "show-stoppers"
    - Strong lobbies
    - "Science-based" is our motto
- Facilitated process to review state of science
  - Over 80 publications - annotated bibliography
  - Literature supports conclusions of work group report:
    - "the science on indirect effects is nascent and rapidly evolving"
    - "Uncertainty" remains central ILUC theme

*The standard will consider the **measurable** effects that are under the control of the economic operator and **caused by** the process being analyzed*



2. Technical Accomplishments (5)
Results – ISO science-based approach examples

5. Substantive research applied to draft criteria, methods and guidelines for GHG quantification

6. Scientific approach defined, promoted
   - ✓ *Systematic methodology based on evidence*
   - ✓ *Measurable, reproducible, verifiable*
   - ✓ Clarify accounting for fossil and biogenic carbon
   - ✓ Methods for detection of soil carbon change
   - ✓ Life-cycle assessment methods

7. Two working drafts and first Committee Draft of ISO 13065 (sustainability criteria for bioenergy) developed, edited, reviewed

2. Accomplishments / Results: Brazil Collaborations (6.5.1.3) "Sustainable production pathways and land-use change analysis"

- **Strategic Energy Dialogue (SED). The world's two largest biofuel producers develop joint plans, research cooperation to**
  - Improve quality and comparability of analyses
  - Generate results that support the development of best practices
  - Contribute to the global growth of clean and sustainable bioenergy markets
  - Support enduring scientific linkages for enhanced research and institutional capacity

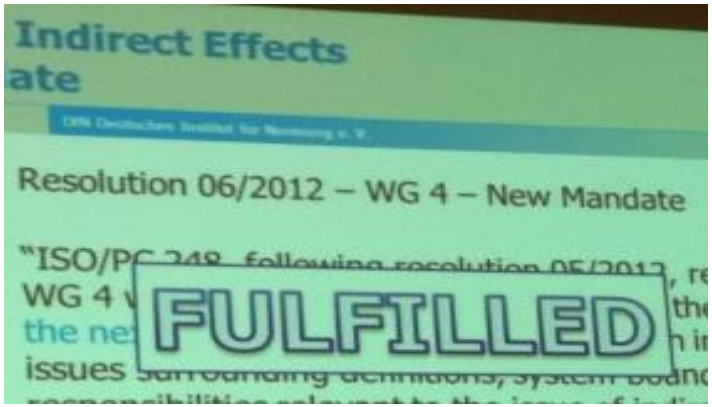
- **Multi-scale collaborations to guide decisions toward more sustainable bioenergy production in Brazil, the U.S., and around the world**
  - Compare and improve data, measurement procedures, costs and benefits of selected indicators (e.g., soils)
  - Analysis of competing land uses, markets
    - LUC dynamics
  - Strengthen analytical basis for identifying, assessing and continual improvement - "best practices"

2. Accomplishments / Results: Brazil Collaborations (6.5.1.3) "Sustainable production pathways and land-use change analysis"

Examples – Mutual interests / Mutual Benefits

- Bilateral exchanges on sustainability issues contribute to
  - Building consensus on key ISO resolutions
  - California Low Carbon Fuel Standard, LUC Work Group
  - Global Sustainable Biofuels / Latin America, Caribbean Africa (GSB/LACAF) initiatives – ***multiplying research resources, impacts***
- LUC modeling collaborations (supplemental slide)
- Brazil partnerships and collaborations involve:
  - Bioethanol Science and Technology Laboratory - CTBE: SED partner, sustainability indicators, socio-economic, biodiversity…
  - Institute for International Trade Negotiations – ICONE: LUC and economic analysis, standards, bioenergy markets and trade
  - The University of Sao Paulo - USP: water indicators, SWAT modeling
  - University of Campinas - UNICAMP: GSB / LACAf sustainable bioenergy projects
  - Institute of Agronomy, Campinas - IAC: soils, carbon and nutrient cycles
  - The Sao Paulo Research Foundation - FAPESP: co-funding mutual priorities
  - Two National Science Foundation projects: testing and applying practical set of indicators across the Americas.
    - Research Coordination Network
    - Program for International Research and Education on sustainable biofuels

2. Technical Accomplishments / Results – Summary



- ***Meeting the goal***, "build international consensus around criteria, definitions and measurement methods."
  - ✓ Criteria, methods and guidelines for GHG quantification – "*exemplary*"
  - ✓ Key terms defined
  - ✓ Reports on bioenergy and food security, and indirect effects
  - ✓ Consistency in defining baselines and targets for assessing sustainability of bioenergy production pathways
- *Brazil and other partnerships* ***leverage counterpart support***
  - ✓ increase learning rates
  - ✓ promote the global adoption of clean energy technologies
  - ✓ facilitate market access for US
- Science-based approach promoted throughout
- Over 15 related publications and reports
- Over 30 presentations and strategic reviews

3. Relevance to DOE Goals

Project

- ISO and other standards
- Consistent methods for calculation (GHG, LCA…)
- Define terms, approaches to address “LUC”
- Applying results from other DOE teams
- Leveraging resources via collaborative alliances

DOE Tech Platform

- Create environment conducive to biofuels production and use
- Ensure high-quality, reproducible, analyses
- Analytical tools to advance understanding of bioenergy and impacts
- Standard metrics and methods promote increasing environmental sustainability
- Convey results to wide audience

EERE-DOE

- Address key barriers for market acceptance
- Accelerate deployment of
  - Clean
  - Secure
  - Renewable energy
- Growth of clean technology adoption
- Reduce GHG emissions

3. Relevance to industry, applicability

US is global biomass leader, but sustainable production and market growth depend on effective standards. The US Head of Delegation to ISO 13065, Sustainability Criteria for Bioenergy, states

- *"The ISO standard has strategic importance for the growth of US biomass-based products industries.*
- *An inappropriate ISO standard could create barriers to trade and bioenergy market growth.*
- *The US has made substantive contributions toward science-based approaches in developing bioenergy sustainability criteria and methods for measurement.*
- *The process is far from over, and reducing efforts at this point would be a tremendous risk for the US bioenergy industry."*

Others:

The lack of a unified, widespread sustainability standard threatens the ability of U.S.-grown commodities to compete internationally.
- Commodity Classic Conference, Kissimmee FL (2013)

It is difficult to envision how ecologically sustainable scale can be achieved without such international cooperation. - Sustainable Scales Project

meeting the expectations of buyers overseas can be a significant hurdle… Dialogue on what the many approaches to sustainability offer is essential.
- Brian Kittler, Pinchot Institute

4. Critical Success Factors

Impact on environmental performance of bioenergy:

- **Reaching agreement on methods and metrics is essential to measure and continually improve environmental and economic performance**

Impact on commercial viability of biofuels:

- **Proactive engagement**
  - Builds technical capacity
  - Shares recent scientific research
  - Reduces potential conflicts associated with multiple, conflicting and overly complex standards.
- *Even if standard is delayed, process is highly beneficial*
- **Critical process factors**
  - Clarity of purpose
    - Guidance from ISO Central Secretariat
    - Maintain support for science-based measures
    - Agreement on structure, definitions, methods and data remain critical
  - Complementarity of documents
- **Back-up plans:** support for other national standard bodies building on the best available platforms

5. Future Work- Brazil

Implement agreements for cooperation:

- Develop standard measurement methods and identify *best practices* for
  - water
  - soil
  - residue management
- Maintain co-funding to participate and share in benefits from joint-research

US-Brazil Strategic Energy Dialogue

- Joint Action Plan for Sustainable Bioenergy
  - Indicators and measurement protocols – lessons learned from applications
  - Technical exchanges to accelerate research and learning (2 x year)
  - Collaborations on modeling to improve assessments of potential for sustainable feedstock production
  - Data and tools to improve analysis of changes in land cover and land-use efficiency: “beneficial LUCs”

5. Future Work (ISO)

Reach the finish line – key steps in ISO 13065 timeline to complete Standard:

Remainder of FY13

- June - Editing Committee - CD2
- Sept - Circulate for comment and voting
- US Technical Advisory Group assembles, agrees on comments, strategies

FY14

- Plenary meeting – decision point on next steps for PC
- Finalize Draft International Standard (DIS)
- Jan 2014: Editing Committee - DIS
- Feb-June: Inquiry stage - DIS voting and comments (US review, strategy)

FY15

- Possible 2nd DIS
- Final round of editing
- Target: publish International Standard by Feb 2015

Related tasks over next 2 years

- Technical publication on indirect effects lit. review (Aug 2013)
- ISO Indirect effects report update (Oct)
- Support other initiatives per resource availability and selection criteria:
  - GBEP
  - RSB (LUC)
  - FAO (LUC-Food security)
  - IEA Bioenergy
  - National bodies
  - Other "high-impact" opportunities (IPCC)

Summary (1)

Barriers to bioenergy (e.g., concern about LUC and food security) cannot be effectively addressed in the absence of consensus on Standard

- Definitions
- Criteria and methods for measurement

International standard development provides a transparent platform for building consensus around global clean energy deployment.

Challenges:

- Diverse views on purpose, content of ISO standard
- Effective incentives for adoption, compliance and continual improvement
- Demonstrating sustainability with low transaction costs and high value-added

"Additionality" builds on existing projects and frameworks to

- Respond to "windows of opportunity" to influence strategic decisions, policies and reports (make a difference)
- Build trust, cooperation and sense of teamwork
- Generate "spin-off" benefits

Summary (2)

Approach

- ✓ Supports DOE and industry strategic goals

Technical accomplishments

- ✓ Milestones
- ✓ Leveraging resources to achieve results
- ✓ Related contributions to RSB, GBEP, IEA, FAO, GSB, CARB LCFS, IPCC, CSBP…

Relevance

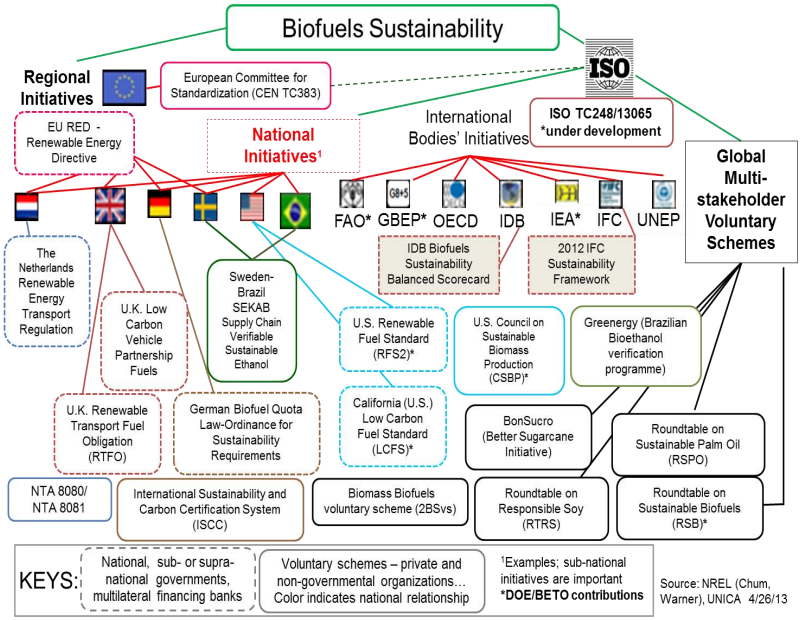
- ✓ Essential tools for market growth, trade
- ✓ Extends value of other research

Critical Success Factors

- ✓ Do not "leave the table"
- ✓ Guidance from ISO Central Secretariat – clarity of purpose
- ✓ Integration with other ISO documents

Future Work

- ✓ Final Draft International Standard and supplementary documents
- ✓ International collaborations develop new approaches, insights for
  - Cost-effective indicators
  - Incentives to optimize land management for positive effects ("beneficial LUCs")



Thank you

Center for Bioenergy Sustainability
http://www.ornl.gov/sci/ees/cbes/

CBES
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See the website for

- **Reports**
- **Forums**
- **Other presentations**
- **Recent publications**

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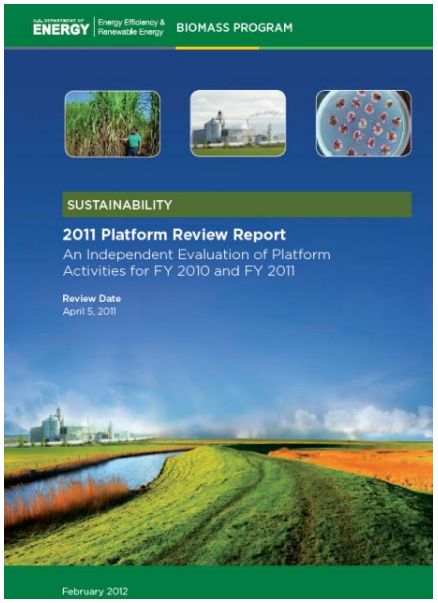


Additional Slides

ISO

GBEP
Global Bioenergy Partnership

Roundtable on Sustainable Biofuels
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

NREL

ICONE
Institute for International Trade Negotiations

CTBE
Brazilian Bioethanol Science and Technology Laboratory

novozymes
Rethink Tomorrow

GSB

CONSERVATION INTERNATIONAL

IDB
Sustainable Energy and Climate Change Initiative

Argonne NATIONAL LABORATORY

CBES
Center for BioEnergy Sustainability

Previous Reviewers' Comments

External Peer Reviewers (2011) found that international collaborations and ISO work were essential to successfully achieve DOE goals. "The US cannot develop biofuel policies in a vacuum so this international networking approach is very relevant, especially in the food vs fuel and international environmental impact of US biofuel policies context.. we can learn a lot from our international partners in the area of sustainability and it is a small investment that has the potential of huge benefits."

The 2011 Review Panel offered supportive and helpful encouragement. Two areas for improvement were identified by reviewers:

1) The "Ad hoc" nature of this project was noted and in response to that we have applied criteria to prioritize work, resulting in current focus on the ISO Standard. Response: see Approach and supplemental slides on ISO and selection criteria which directly address this comment.

2) One reviewer suggested more focus on "social" sustainability criteria and indicators, and this has been achieved (see publications and presentations). Response: Social criteria are now being adapted and tested by international partners and considered by ISO and other processes.

Other representative quotes from external reviewers in 2011 include:

"This is an exceptionally productive project that is highly leveraged for maximum impact.

The project is central to platform goals of improving sustainability of biofuels… Highly relevant

This effort represents a critical link to the broader international discussions

Given the global importance of energy and biofuels in particular - it will remain important for DOE to be engaged with international partners."

The teamwork is exceptional… promoting science based assessments of sustainability at a global scale is laudable and this project facilitates an array of critical science infrastructure pieces.

Collaborative networks that share knowledge and support consensus on sustainability will speed global deployment of clean technologies and GHG emission reductions"

Project insights, shared across global partners and scientific community, inform supportive legislation and regulations.

Related publications and reports 1

2012-13

- Dale VH and KL Kline. 2013. Issues in using landscape indicators to assess land changes. *Ecological Indicators*. http://dx.doi.org/10.1016/j.ecolind.2012.10.007
- Dale, V. H. and K. L. Kline. (2013) Modeling for integrating science and management. Chapter 8 In D.G. Brown, N. H. F. French, B.C. Reed, and D. T. Robinson (editors), Land Use and the Carbon Cycle: Science and Applications in Coupled Natural-Human Systems, Cambridge University Press.
- Papers in Special Feature of Environmental Management (February 2013) "Sustainability of Bioenergy Systems: Cradle to Grave."
  - Efroymson, RA, VH Dale, KL Kline, AC McBride, JM Bielicki, RL Smith, ES Parish, PE Schweizer, DM Shaw. 2013. Environmental indicators of biofuel sustainability: What about context? *Environmental Management.* DOI 10.1007/s00267-012-9907-5.
  - Dale VH, KL Kline, D Perla, A Lucier. 2013. Communicating about bioenergy sustainability. Environmental Management 51(2): 279-290. DOI: 10.1007/s00267-012-0014-4
  - Parish ES, KL Kline, VH Dale, RA Efroymson, AC McBride, TL Johnson, MR Hilliard, JM Bielicki, 2013. A multi-scale comparison of environmental effects from gasoline and ethanol production. Environmental Management 51(2): 307-338. DOI: 10.1007/s00267-012-9983-6
- Dale VH, Kline KL, Kaffka SR, and Langeveld JWA. (2013). A landscape perspective on sustainability of agricultural systems. *Landscape Ecology*. (DOI) 10.1007/s10980-012-9814-4 http://www.springerlink.com/openurl.asp?genre=article&id=doi:10.1007/s10980-012-9814-4
- Oladosu D, KL Kline, P Leiby, R Martinez, M Davis, M Downing, L Eaton. 2012. Global economic effects of the US biofuel policy and the potential contribution from advanced biofuels. Biofuels 3(6):703-723. http://www.future-science.com/doi/pdfplus/10.4155/bfs.12.60

Related publications and reports 2

- Kang, S., N. Singh, K.L. Kline, J.A. Nichols, N.S. Surendran, D. Wang, W.M. Post, S.D. Wullschleger, N. Singh, Y. Wei. 2013. Global simulation of bioenergy crop productivity: analytical framework and case study for a perennial bioenergy crop - switchgrass. GCB – Bioenergy, doi: 10.1111/gcbb.12047doi: 10.1111/gcbb.12047.
- Dale VH, RA Efroymson, KL Kline, MH Langholtz, PN Leiby, GA Oladosu, MR Davis, ME Downing, MR Hilliard. 2013. Indicators for assessing socioeconomic sustainability of bioenergy systems: A short list of practical measures. *Ecological Indicators* 26: 87-102. http://dx.doi.org/10.1016/j.ecolind.2012.10.014
- Dale, VH, KL Kline, L Wright, R Perlack, M Downing, RL Graham. 2011 (June). Interactions Between Bioenergy Feedstock Choices and Landscape Dynamics and Land Use. Ecological Applications 21(4):1039-1054.
- McBride, A, VH Dale, L Baskaran, M Downing, L Eaton, RA Efroymson, C Garten, KL Kline, H Jager, P Mulholland, E Parish, P Schweizer, and J Storey. 2011. Indicators to support environmental sustainability of bioenergy systems. Ecological Indicators 11(5) 1277-1289
- Kline K, E Parish, N Singh, S Wullschleger, B Preston, M Keller, LR Lynd. 2011. Collaborators welcome: Global Sustainable Bioenergy Project (GSB). GLP NEWS No. 7 (7-8). See http://www.globallandproject.org/newsletter.shtml
- Dale, VH, R Efroymson, and K Kline. 2011 (June). The land use–climate change–energy nexus. Landscape Ecol. DOI 10.1007/s10980-011-9606-2
- Kline KL, GA Oladosu, VH Dale, AC McBride 2011 (Oct). Scientific analysis is essential to assess biofuel policy effects: In response to the paper by Kim and Dale on —Indirect land-use change for biofuels: Testing predictions and improving analytical methodologies,‖ Biomass and Bioenergy 35 (2011), pp. 4488-4491. http://dx.doi.org/10.1016/j.biombioe.2011.08.011

Related publications and reports 3

- Oladosu, Kline, Davis and Marcelo Moreira (Brazil-ICONE) on “Comparison of Regions and Modeling of Land in the GTAP-DEPS and BLUM” presented to OBP and other labs via DOE-hosted webinar (May 2012)
- ISO internal reports including
  - PC248 Committee Draft (CD1) of ISO 13065 “Sustainability Criteria for Bioenergy” (2013)
  - PC248 WG4 Annotated Bibliography on State of Science for Indirect Effects of Bioenergy (Updated 2012)
  - PC248 WG4 Annotated Bibliography on State of Science for Indirect Effects of Bioenergy (Initial report, 2011)
  - PC248 WG4 Report on Indirect Effects etc.

Examples of international document reviews and presentations – pg 1

[summary from ORNL quarterly reports; reverse chronological order]

2013 Q1-2

- ORNL delivered comments to the US Department of Energy, Policy and International Affairs on a report on "Biofuels and Food Security V0 Draft" developed by a High Level Panel of Experts on Food Security and Nutrition (HLPE, FAO) to fulfill the request by the UN Committee on World Food Security (CFS) to "conduct a science-based comparative literature analysis." (January)
- ORNL submitted comments and revisions of the IEA strategic inter-task study "Monitoring Sustainability Certification of Bioenergy" (IEA Bioenergy Tasks 38, 40 and 43).
- ORNL (Kline) served as an invited panelist on international sustainability standards at the "4th International Conference on Biofuels Standards" (November) hosted by NIST in Gaithersburg, MD.
- Kline contributed to the IEA Task 38 workshop on time and emission accounting via remote (web-based) access; the workshop was in Vienna, Austria (November). Over the past year, several contributions (drafting, reviews and comments) were made for IEA Task 38 white papers related to:
    - time accounting and
    - reference case scenario specification.
- Presented "Cooperation on Sustainability Standards" for the USDOE Biomass Program public webinar (December; Kline) "Global Solutions for Global Challenges: International Collaborations to Advance Bioenergy Research." Note: Over 145 attended with registrations from many countries – Finland, Canada, the UAE, Italy, Paraguay, Lithuania, Taiwan, South Korea, Germany, South Africa, and Saudi Arabia. The presentations are posted on the Biomass website: www.eere.energy.gov/biomass/webinars.html

Examples of international document reviews and presentations – pg 2

2013 (cont.)

- ORNL (Davis and Kline) prepared three separate presentations made before the ISO PC248 plenary (Jan 2013) to review the Editing Committee Process, the WG4 Results, and Joint WG discussions of conflictive topics.
- "Bioenergy Sustainability: Addressing the Science and the Need" at the University of Queensland (January 16-17: K Kline).
- Webinar (January 31; K Kline) on "Bioenergy policy and land use change" from The University of New England in Armidale, New South Wales.
- "Sustainable Bioenergy Challenges and Perspectives" for ColPos, Tabasco, Mexico.
- Participation in the NSF Partnerships for International Research and Education (PIRE) (February) with team members from Argentina, Brazil, Mexico, and the US, to discuss project plans.
  - ORNL contributed to the PIRE Metrics subgroup with recommendations for indicators to assess sustainability across highly variable Pan American socio-ecological systems.

2012

- "Models, causal analysis and scientific methods for understanding land-use change (LUC) dynamics" at the 2012 Ecological Society of America (ESA) Annual Meeting in Portland, Oregon. Aug. (K Kline)
- "Bioenergy Sustainability: Addressing the Science and the Need" for DOE staff at July's monthly Biomass Program meeting.
- "Sustainability, Certification and Opportunities to Level the Playing Field" as invited speaker/panelist at the BIO 2012 International Convention in Boston, MA (http://convention.bio.org/). July

Examples of international document reviews and presentations – pg 3

2012 (cont.)

- Opening presentation on "The Importance of Sustainability" as an invited speaker in the “Sustainable Energy Symposium” hosted by Kansas State University. Served as an international panel discussant of ISO and other initiatives to develop standards for bioenergy sustainability. June.
- "Indicators to support sustainability assessment of energy systems and biodiversity" as an invited speaker at the World Renewable Energy Forum (WREF) (www.ases.org/conference/) in Denver, CO. May.
- Presentation on ORNL research related to land-use change and water indicators for sustainability and chaired a work session on the Water-Energy Nexus in the Pan American Research Coordination Network for Biofuels and Bioenergy Sustainability, Merida, Mexico (four year NSF-funded project led by Michigan Technological University). May.
- “GHG Time Accounting: ‘Trying to make it real, compared to what?’” for the International Energy Agency (IEA) Task 38 Expert Work Group on Bioenergy GHG emission accounting, Argonne, IL. April.
- Poster presented to the 34th Annual SIM conference in New Orleans: “Scientific Approaches for Assessing Land-Use Change” - Keith Kline, Gbadebo Oladosu, Virginia Dale, Allen McBride. Apr.
- “How to present the timing of emissions from bioenergy in LCA and GHG accounting?” and helped draft initial content for a white paper being developed on “Reference systems for evaluating climate effects of bioenergy” as an outcome of the Expert Working Meeting of IEA Task 38 at Argonne. March.

Examples of international document reviews and presentations – pg 4

2012

Sustainability Symposium organized in conjunction with the 2012 National Biodiesel Conference in Orlando, Fl., Presentation on “Land-Use Change Analyses and Improving Land Management” (Feb.).

2011

- “Bioenergy and issues of sustainability” to the December monthly meeting of the Environmental Protection Office (EPO), ORNL.
- “Bioenergy, Sustainability Science, and Standards” to a delegation from the Nissan Motor Company, Ltd. Visit to National Transportation Research Center.
- “Perspectives on Land-Use Change Analyses” to open a Session on “Land-Use Change and GHG Emissions – New Data, New Approaches & Estimation Questions” at the Coordinating Research Council (CRC) Lifecycle Analysis Workshop, at Argonne National Laboratory. Oct.
- ORNL scientists made four presentations at the International Energy Agency (IEA) Joint Task 38/40/43 Workshop on "Quantifying and managing land use impacts of bioenergy" in Campinas, Brazil. (Kline presented☺
  - “Top Ten Steps to Improve Quantification of Land-Use Change Effects of Bioenergy Systems”
  - “Moving Forward: Policies to Improve Land Use & Address Social Concerns”
  - Plenary comments and summary “Challenges to Certifying Sustainable Bioenergy Production” [Why certification may not work for bioenergy; what needs to occur for it to work]

Examples of international document reviews and presentations – pg 5

2011

- “The Standards Process and the Importance of Participation: A review of the work of WG4 and the Indirect Land Use Change Issue” in a multi-sector forum hosted by the Instituto Argentino de Normalización y Certificación (IRAM) in Buenos Aires, Argentina. (Sept 2011)
- “A review of Opportunities and Synergies Between Food Security and Reduced GHG Emissions,” for the workshop on “The Role of Commodity Roundtables & Avoided Forest Conversion in Subnational REDD+” in San Diego, California.
- “Indicators to support environmental sustainability of agricultural production and bioenergy crops" at the Brazilian Bio-Energy Science and Technology (BBEST) Conference in São Paulo, Brazil. (Aug 2011)
- Global Bioenergy Partnership (GBEP): Provided comments to DOE’s Office of the Biomass Program to forward to R.Balian at the State Department regarding the United States Department of Agriculture’s (USDA) reworking of the indicators for the Global Bioenergy Partnership (GBEP). [Efroymson, McBride]
- ORNL participated in 33rd Symposium on “Biotechnology for Fuels and Chemicals,” Seattle, WA. Robin Graham gave a presentation titled “Indicators to Support Environmental Sustainability of Bioenergy Systems” that was developed by Virginia H. Dale, Allen C. McBride, Latha M. Baskaran, Mark E. Downing, Laurence M. Eaton, Rebecca A. Efroymson, Charles T. Garten Jr., Keith L. Kline, Henriette I. Jager, Patrick J. Mulholland, Esther S. Parish, Peter E. Schweizer, and John M. Storey.

Examples of international document reviews and presentations – pg 6

2011 (cont.)

“Bioenergy, Land-Use Change and Food Security” underscoring the opportunities for bioenergy to address multiple development goals in a webinar sponsored by the National Biodiesel Board. Over one hundred people and classrooms registered for the webinar which targeted graduate students and “Next Generation Scientists.” The webinar received print and radio coverage.

Other Intermittent, ongoing contributions over past two years to other standards, international cooperation

- RSB: Since 2011, review comments and suggestions provided on multiple draft documents for the Roundtable on Sustainable Biofuels; Kline served as an expert on the RSB Indirect Impacts Expert Group (IIEG) http://rsb.epfl.ch/lang/en/iieg
- CSBP: From 2011-2013, ORNL participated in frequent conference calls and provided expertise on multiple task forces for the US Council on Sustainable Biomass Production (CSBP), including contributions to indicators and forestry teams.
- GBEP: Since 2011, Oladosu, Kline and other collaborators on international projects have provided comments to DOE on draft documents, proposed training events, and draft indicator methods associated with Global Bioenergy Partnership (GBEP). Detailed comments were provided in multiple iterations on land use (indicator 8) and economic indicators proposed for "Change in Income," "Gross Value Added" and "Net Economic Contribution." ORNL also suggested several alternatives to a proposed sub-indicators.
- Periodic briefings for BETO such as, “Updates: ISO PC-248 Sustainability Criteria for Bioenergy and Perspectives on Land-Use Change Analyses” to staff at DOE Office of Biomass Programs DOE-OBP-Sustainability (Ranyee Chiang, Alicia Lindauer, Kristen Johnson) and EERE-International (Dan Birns, Rob Sandoli, Helena Berger).

Acronyms

- **Direct funding partners:**
  - (MTU-NSF grant) Michigan Technological University - National Science Foundation grants for (a) “Sustainability, Ecosystem Services, and Bioenergy Development Partnerships across the Americas” (Program in Research and Education (PIRE)) and (b) Research Coordination Network on Bioenergy in the Americas (RCN-Bioenergy)
  - (GSB) Global Sustainable Bioenergy Project (internal UT/Battelle ORNL funding)
  - (FAPESP-LACAF) Sao Paulo Science Research Foundation (FAPESP Brazil) – Latin America, Caribbean and Africa sustainable biofuels project (LACAf)
- **Collaborators:**
  - (ANL) Argonne National Lab
  - (ISO) International Organization for Standardization
  - (PC 248) ISO Project Committee 248 on sustainable bioenergy
  - (NREL) National Renewable Energy Lab
  - (IEA) International Energy Agency
  - (RSB) Roundtable for Sustainable Bioenergy
  - (GSB) Global Sustainable Bioenergy Project
  - (GBEP) Global BioEnergy Partnership
- Subcontractor:
  - (ORISE) Oak Ridge Institute for Science and Education

Acronyms

- **Additional project coordination with:**
  - **(PNNL) Pacific Northwest National Lab**
  - **(GLBRC) Great Lakes Bioenergy Research Center**
  - **(USAID) United States Agency for International Development**
  - **(USDA) United States Department of Agriculture**
  - **(FAS) USDA Foreign Agricultural Service**
  - **(USFS) United States Forest Service**
  - **(ERS) USDA Economic Research Service**
  - **(EPA) United States Environmental Protection Agency**
  - **(UNICAMP) University of Campinas, Brazil;**
  - **(USP) University of Sao Paulo, Brazil,**
  - **(ICONE) Institute for Trade Negotiations, Brazil**
  - **(ADM) Archer-Daniels Midland**
  - **(CTBE) Brazil Research Center for Bioethanol Technology**

Supplemental Slide: Project Milestones (history)

Status of Milestones and deliverables for FY13

	Milestones and Deliverables	Planned Completion	Status (as of March 2013)
Q1 DL -15	Serve as Chair and lead an Editing Committee to resolve key issues and complete a first Committee Draft (CD) Standard: First CD of ISO 13065, "Sustainability Criteria for Bioenergy" is produced and distributed (November, 2012)	11/1/2012	100%. - CD draft was produced and distributed. Results reported via ISO Update #8
Q2 DL -16	Represent best available science and U.S. policy goals in discussions of comments received and developing a way forward to complete a revised version of ISO 13065 on bioenergy sustainability by serving as an official U.S. Delegate in the ISO Project Committee 248 Plenary meetings. Report on meeting and results (Feb, 2013)	2/15/2013	100%. - Kline and Davis served as official U.S. Delegates and results reported via ISO Update #9
Q3 DL -17	Respond to review comments on first CD and facilitate process to achieve consensus language for methods required for consistent calculation of baselines and targets for bioenergy pathways. A revised Committee Draft Standard for ISO 13065 is distributed (June)	6/15/2013	On target – ORNL will continue to participate in WGs 1, 2, & 3 meetings during April-June
Q4 DL -18	At least three written reviews and comments will be submitted in support of strategic DOE goals related to global/international issues (cumulative, by Sept, 2013)	9/30/2013	On target – IEA comments 11/17 and 3/04; HLPE FAO comments 1/15; BETO webinar (International) 12/05

Supplemental Slide: Project Milestones (history)

Status of ORNL Milestones and deliverables for FY11-12

	Milestones and Deliverables	Planned Completion	Status (as of Dec-2012)
6.5.8.2.DL.2	Progress report #1 on BETO-supported input to ISO PC 248	12/30/2010	100% complete –delivered to BETO ahead of schedule
6.5.8.2.DL.3	Contribute to ISO/PC-248 by providing substantive comments to at least three sections of the proposed criteria and guidelines for GHG analysis	3/30/2011	100% as documented in ISO progress updates #2 and #3 delivered to BETO
6.5.8.2.DL.4	Serve as official U.S. Delegate in the ISO Project Committee Meeting (PC248 – Frankfurt)	6/30/2011	100% complete as documented in Trip Report delivered to BETO
6.5.8.2.DL.5	Draft standard for GHG methods (revised based on comments) with substantive Lab contributions	6/30/2011	100% First draft and first revision completed as product of May PC meeting
6.5.8.2.DL.6	Report #4 on BETO-supported input to ISO and next steps required to support related BETO sustainability goals	8/30/2011	100% complete (Update #4 delivered to BETO along with revised draft work plans)
6.5.8.2.DL.7	Review and revise (per BETO guidance) a minimum of three draft documents on sustainability and LUC such as those developed by GBEP (sustainability indicators), RSB and IEA. Review comments submitted to BETO	9/30/2011	100% - Exceeded target; at least six reviews completed for GBEP, IEA, GSB, RSB and others; collaborations are ongoing in response to partner needs and BETO requests. ***See CBES*** reports for all reviews.
6.5.8.2.DL.8	Contribute to WG4 leadership and results by developing WG4 work plan and criteria for documentation of indirect effects to guide other Work Groups	9/30/2011	100%. ORNL (Kline) contributed to WG4 leadership and drafted work plans and criteria (WG4-N0001) to guide WG efforts (***See ISO Updates*** 4-5).

Supplemental Slide: Project Milestones (history)

Status of ORNL Milestones and deliverables for FY11-12

	Milestones and Deliverables	Planned Completion	Status (as of Dec-2012)
6.5.8.2.DL.9	Serve as WG4 Secretary and contribute to "Sustainability Criteria for Bioenergy" (draft ISO 13065) working draft doc.	9/30/2011	100% - ORNL (T.Hall, M.Stevens) fulfilled WG4 Secretariat role receiving kudos from co-chairs for their support; KKline, GWang, MStevens contributed to the development of the current working draft document (***ISO Updates*** 1-6).
6.5.8.2 DL-10	Provide substantive contributions to ISO PC-248 WG2 for the criteria and guidelines for GHG quantification: a revised draft Standard (Chapter 6 GHG Methods) is distributed; this milestone promotes consistency when setting baselines and targets for bioenergy production pathways.	12/30/2011	100%. (ANL and ORNL) Contributions made and revised draft distributed in November
6.5.8.2 DL-11	Provide technical and managerial leadership in ISO/PC-248 Work Group 4 to differentiate and address direct and indirect effects in the draft Standard; report on indirect effects is distributed to full PC-248 addressing a key barrier to completing an international Standard on sustainability for biofuels	3/30/2012	100%. ORNL played major role in facilitating discussion, reaching consensus, drafting and finalizing the report to PC-248

Supplemental Slide: Project Milestones (history)

Status of ORNL Milestones and deliverables for FY11-12

	Milestones and Deliverables	Planned Completion	Status (as of Dec-2012)
6.5.8.2 DL-12	Serve as a U.S. Delegate in the ISO Project Committee plenary meeting on "Sustainability Criteria for Bioenergy" and facilitate development of metrics and methods that are required for consistent calculation of baselines and targets for bioenergy pathways.	6/30/2012	100%. ORNL and ANL; M. Wang hosted; Kline and Davis served as delegates; all three made substantive contributions. See ISO updates #6 and #7 from ORNL for more information.
6.5.8.2 DL-13	Respond to comments, review, and complete revisions to produce a revised draft standard (ISO 13065 WD2+) including proposed methods and metrics required for consistent calculation of baselines and targets for GHG emissions associated with bioenergy production pathways. An updated draft ISO 13065 WD chapter on GHG will be distributed for review and comment.	9/30/2012	100%. WD2 completed. However, further comments were received and revisions and improvements continue.
6.5.8.2 DL-14	In addition to ISO documents, at DOE request, review and revise at least three additional documents to help build awareness and consensus on bioenergy sustainability in support of international EERE and BETO goals (e.g. sustainability indicators in GBEP, IEA, or others): written comments submitted.	9/30/2012	>100% +. Reviews and comments submitted on at least five documents related to international sustainability and standards, including GBEP, IEA, the Global Sustainable Bioenergy Project (GSB) and the Roundtable for Sustainable Bioenergy (RSB).

Example of Brazil milestone completed: "Comparison of Regions and Modeling of Land in the GTAP-DEPS & BLUM" (9/30/12)

- **Overview:**
  - Global Trade Analysis Project (GTAP)-Dynamic Energy Policy Simulations (DEPS): a global general equilibrium model consisting of 33 sectors and 18 regions of the world (developed by Oladosu at ORNL)
  - Brazilian Land Use Model (BLUM) is a partial equilibrium model, Brazil only: more detail in number of agricultural commodities, integrates sugar and ethanol

- **Background:**
  - Ongoing collaborations with ICONE (began in 2010)
  - Purpose:
    - to evaluate the prospects for interactions among the two models
    - to determine how to translate inputs/outputs from one model to the other in simulating the effects of biofuel production on land use change in Brazil

- **Comparison results:**
  - Land-use allocation in GTAP-DEPS and BLUM models are based on the same economic principles.
  - Differences in the land modeling are due to specification choices and the availability of data at different scales.
  - Fundamental differences between general and partial equilibrium models have important effects on final results.
  - *The land specification in both models do not considers other primary causes for initial deforestation so more effort is required.*

Why ISO? Applying selection criteria

Criteria used by ORNL for prioritizing opportunities to address issues related to International Bioenergy Sustainability (to be discussed as example for selection of ISO opportunity):

- Build on strengths of existing projects, agreements, and frameworks
  - Expands impacts and demonstrates utility of results from other research portfolios
  - Identify important new opportunities
- Address mutual goals and priorities (prerequisite: support US policy goals)
  - Additionality: DOE contributions that "Make a difference"
  - Working with partners to leverage resources and amplify mutual benefits (saving 2 birds with 1 conservation $)
- High Impact: Influence strategic decisions, policies and programs
- Can be managed within budget/resource constraints
- Effectively respond to "windows of opportunity" and
- Expand and solidify a sense of teamwork among international partners
- Fulfill proper role of government
- Strategic and enduring economic benefit to US: "Why it matters to America" – supports global market competitiveness
- **International:** Prioritize partnerships with key countries that provide the greatest opportunities to increase learning rates, promote the global adoption of clean energy technologies, and ease foreign market entry for U.S. firms.
- **Communications and Outreach**: Prioritize activities that help ensure key information is accessible, reliable, and delivered through multiple channels (ISO standards reach the world).

Background: The role of international standards

International cooperation on standards can:

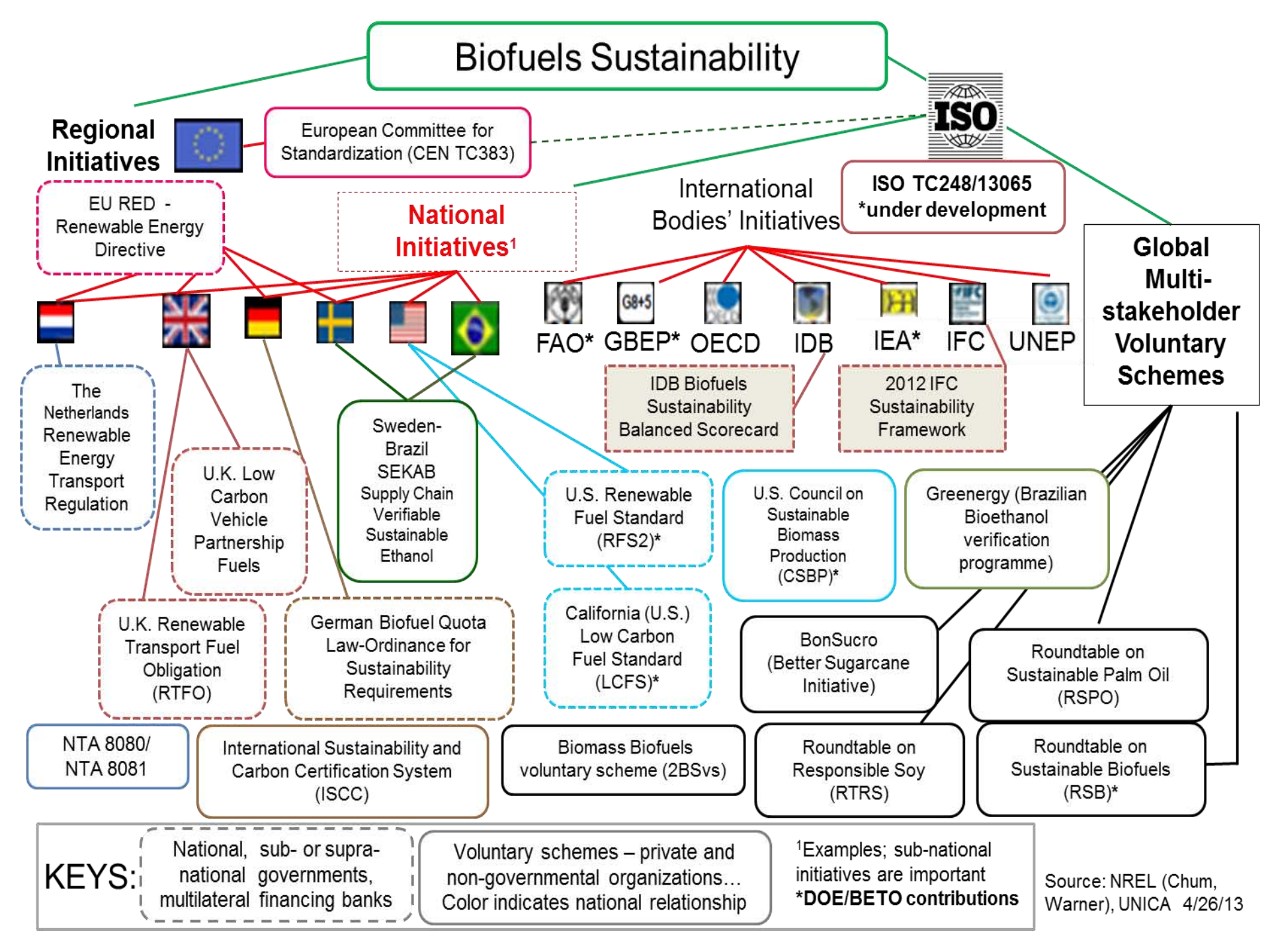
- ✓ Provide objective information in a common language
- ✓ Accelerate deployment of new energy technologies
- ✓ Reduce global climate forcing
- ✓ Create confidence among parties
- ✓ Accelerate growth of export markets for clean energy products and technologies

International standards do not determine sustainability or ensure a product or process is "sustainable"

Slide adapted from KL Kline presentation for EERE webinar, "Global Solutions for Global Challenges: International Collaborations to Advance Bioenergy Research"

ISO PC 248 timeline for completing standard

Action Item	Deliverable	Responsible	Duration	Start	End
Preparatory stage (April 2010 to Sept 2012): two rounds of working drafts					
Development of 1st Working Draft (WD)	1st Working Draft	PC 248 experts	10 months	30 Apr 2010	28 Feb 2011
Editing/Commenting on 1st WD	Comments	PC 248 experts	1 month	15 Mar 2011	15 Apr 2011
Plenary meeting in Frankfurt to discuss/review way forward				***16 May 2011***	***20 May 2011***
Development of 2nd Working Draft (WD)	2nd Working Draft	PC 248 experts	6 months	20 May 2011	31 Jan 2012
Editing/Commenting on 2nd WD	Comments	PC 248 experts	1 month	15 Feb 2012	16 Mar 2012
Plenary meeting in Chicago, US to discuss/review way forward				***16 April***	***20 April 2012***
Development/Editing of Committee Draft (CD)	1st CD1	PC 248 experts	5 months		7 Sep 2012
Committee stage (Sept 2012 – January 2014): two rounds of Committee Drafts					
Commenting and voting on CD	Comments, voting	PC 248	3 months	7 Sep 2012	7 Dec 2012
4th Plenary meeting in Sippy Downs, Australia to discuss/review way forward					***21 Jan 2013***
Development and editing of CD2	CD2	PC 248 experts	3,5 month		21 May 2013
Commenting and voting on CD2	Comments, voting	PC 248	3 month	5 Jun 2013	5 Sep 2013
5th Plenary meeting in Stockholm, Sweden					***30 Sep 2013***
Preparation and editing of DIS	DIS	PC 248 experts	3 months		30 Jan 2014
Enquiry stage (Jan 2014- Oct 2014 – target): one round of DIS (but could require two rounds of DIS)					
Commenting and voting on DIS	Comments, voting	ISO P-members	3 months	1 Apr	30 Jun 2014
6th Plenary meeting in ___ (tbd) to discuss/review comments and way forward					***1 Aug 2014***
Finalisation and editing of FDIS	FDIS	PC Secretariat	2 months		31 Oct 2014
Approval stage (Nov 2014 – Jan 2015) One round of comments and voting.					
Commenting and voting on FDIS	Comments, voting	ISO P-members	2 months	1 Nov	31 Dec 2014
Handling of comments received		ISO CS	1 month	1 Jan	31 Jan 2015
Publication of International Standard	ISO 13065	ISO/CS			**Feb 2015**


Biofuels Sustainability
Regional Initiatives
European Committee for Standardization (CEN TC383)
ISO
ISO TC248/13065 *under development
EU RED - Renewable Energy Directive
National Initiatives[1]
International Bodies' Initiatives
Global Multi-stakeholder Voluntary Schemes
FAO*
GBEP*
OECD
IDB
IEA*
IFC
UNEP
IDB Biofuels Sustainability Balanced Scorecard
2012 IFC Sustainability Framework
The Netherlands Renewable Energy Transport Regulation
U.K. Low Carbon Vehicle Partnership Fuels
Sweden-Brazil SEKAB Supply Chain Verifiable Sustainable Ethanol
U.S. Renewable Fuel Standard (RFS2)*
U.S. Council on Sustainable Biomass Production (CSBP)*
Greenergy (Brazilian Bioethanol verification programme)
U.K. Renewable Transport Fuel Obligation (RTFO)
German Biofuel Quota Law-Ordinance for Sustainability Requirements
California (U.S.) Low Carbon Fuel Standard (LCFS)*
BonSucro (Better Sugarcane Initiative)
Roundtable on Sustainable Palm Oil (RSPO)
NTA 8080/ NTA 8081
International Sustainability and Carbon Certification System (ISCC)
Biomass Biofuels voluntary scheme (2BSvs)
Roundtable on Responsible Soy (RTRS)
Roundtable on Sustainable Biofuels (RSB)*
KEYS:
National, sub- or supra-national governments, multilateral financing banks
Voluntary schemes – private and non-governmental organizations… Color indicates national relationship
[1]Examples; sub-national initiatives are important
*DOE/BETO contributions
Source: NREL (Chum, Warner), UNICA 4/26/13