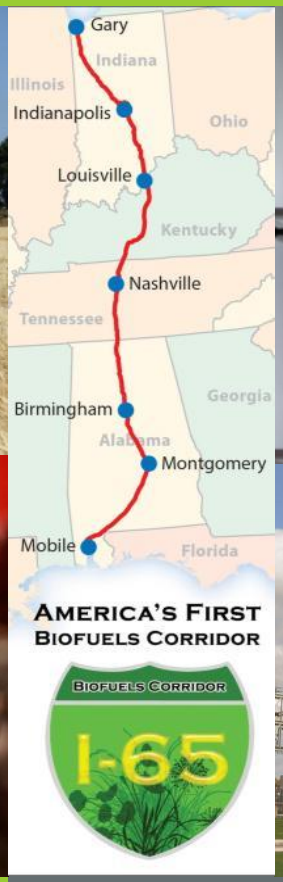
BIOENERGY TECHNOLOGIES OFFICE

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Cookstoves Peer Review Session Introduction

March 26, 2015

Elliott Levine

Technology Manager

Demonstration & Market Transformation

Global Alliance for Clean Cookstoves: The United States Commitment

On September 21, 2010, Secretary of State Hillary Rodham Clinton announced the **Global Alliance for Clean Cookstoves**, a public-private partnership led by the United Nations Foundation, which focuses on creating a thriving global market for clean and efficient household solutions.

The U.S. Department of State, U.S. Environmental Protection Agency (EPA), U.S. Department of Energy, U.S. Department of Health and Human Services – Centers for Disease Control and National Institutes of Health, and the U.S. Agency for International Development (USAID), all of whom are founding partners of the Alliance, have forged an unprecedented government effort to mobilize financial resources, top- level U.S. experts, and research and development tools to help the Alliance achieve its target of '100 by 20,' which calls for 100 million homes to adopt clean and efficient stoves and fuels by 2020.

United States Commitment – $50.82 million over the next five years

- **Department of State/U.S. Agency for International Aid and Development (USAID) – $9.02 million**
- **Environmental Protection Agency (EPA) – $6 million**
- **Department of Energy (DOE) – $10 million**
  - DOE will contribute $10 million over the next five years and conduct research aimed at addressing technical barriers to the development of low emission, high efficiency cookstoves through activities in areas such as combustion, heat transfer, and materials development.
- **Department of Health and Human Services (HHS)**
  - National Institutes of Health (NIH) –$24.7 million
  - Centers for Disease Control (CDC) – $1 million

Cookstoves Workshop Results led Directly to Subsequent R&D Solicitation (Phase 1)

- **DOE conducted Cookstoves workshop (January 2011)**
- **Key Findings from Workshop and Report (May 2011)**
  - At least 90% emissions reductions and 50% fuel savings are appropriate targets.
  - No single solution will adequately address the cookstove challenge.
  - Technical R&D should guide and be guided by field research and implementation programs.
  - The cost and performance tradeoffs associated with the use of processed versus unprocessed fuels should be explored.

DOE Solicitation and SBIR Opportunity Announced in 2012 (Phase 1)

- **Goal:** To increase the viability and deployment of renewable energy technologies through research, development, and tools that lead to clean and efficient biomass cookstoves.
  - Meet or surpass highest levels of stove performance (90% / 50% *)
  - Low-cost and affordable
  - Use the biomass fuels in indigenous areas
  - Durable and safe
- **Topic 1: Development of innovative cookstove designs that allow users to burn wood or crop residues more efficiently and with less smoke than open fires and traditional stoves.**
  - Applied R&D for cookstove products with devices such as fans, sensors and controls for improved performance
- **Topic 2: Improved understanding of combustion physics and heat transfer research as applied to cookstove designs.**
- **Topic 3: Development of design tool for stove design and manufacturing**

* Cut particulate emissions by 90% and reduce fuel use by 50%

Each Project Selected Offered Technical Improvements Leading to Performance Enhancements (Phase 2)

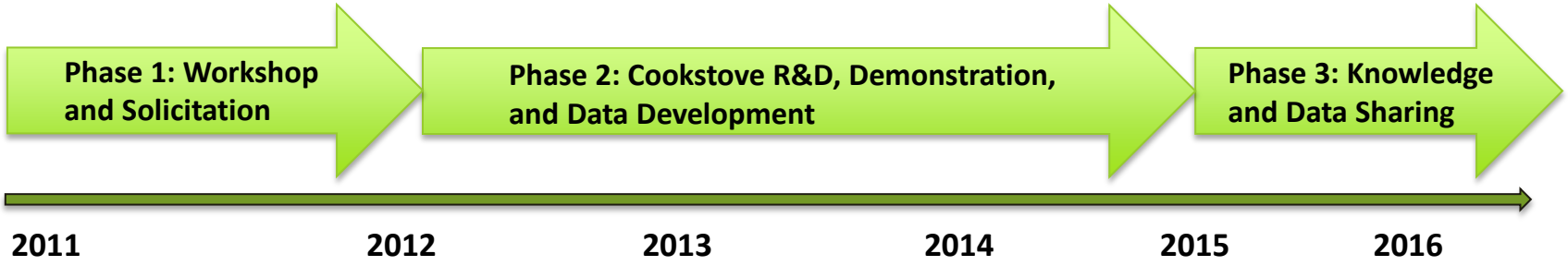
Seven projects – all are still in progress and are largely 3-year projects.

- **Five Competitively based projects from DOE solicitations:**
  - **Aprovecho (Oct 2013 – Sept 2015):** Development of high-performance Tier-4 biomass cookstoves.
  - **BioLite (Feb 2013 – Dec 2015):** Development of a clean burning and reliable "combustion core" using BioLite's advanced fan technology.
  - **Colorado State University (Feb 2013 – Jan 2016):** Development of a computational combustion model to assist in stove design.
  - **University of Washington (Sept 2013 – Sept 2016):** Development of a commercially viable, manufacturing ready, natural draft cookstove that will exceed ISO Tier-4 criteria.
  - **Research Triangle Institute (RTI) (Jan 2013 – Dec 2014):** Development of an affordable add-on device to enhance biomass cookstove performance.
- **Two National Laboratory Projects:**
  - **ORNL:** Combustor material durability.
  - **LBNL:** Developing advanced biomass research-grade cookstove.

Characterizing the Projects

- **Developing low-cost, durable stoves that achieve stringent efficiency and emissions goals (advanced-stoves)**
  - **Aprovecho** (developing 6 different prototype stoves for different countries)
  - **Biolite, LLC** (TEG powered stove in an adaptable chimney stove hearth
  - **LBNL** (a research cookstove with manipulation of turbulence, flow and flame zone)
  - **Research Triangle Institute** (self-powered air injection device for enhanced performance)
  - **University of Washington** (integrated CFD model with field tested and user accepted stove design)
- **Understanding the engineering science for advanced stoves**
  - **Colorado State University** (physics associated with combustion emissions and heat transfer leading to computational model)
  - **LBNL** (a research cookstove with manipulation of turbulence, flow and flame zone)
- **Identifying stove designs to meet local cooking needs**
  - **Aprovecho** (multiple promising designs)
  - **ORNL** (corrosion and material alloys and coatings)
- **Identifying the nuances of successful stove dissemination and field performance**
  - **All**

Cookstove R&D Leading to Adoption



- **Phase 1: Workshop and Solicitation**
  - Determination of key barriers and technical R&D areas.
- **Phase 2: Cookstove R&D, Demonstration, and Data Development**
  - Nine currently funded projects that are contributing research, development, and tools that will lead to clean and efficient biomass cookstoves.
- **Phase 3: Knowledge and Data Sharing**
  - Promote technology transfer, commercialization and collaboration –facilitate adoption.
  - Dissemination of results, technologies, and lessons learned.
    - Organize and participate in open, high-quality conferences, webinars and gatherings for the cookstove community to share knowledge of improvements in cookstove design, development, and use.
    - Assist with training in lab test protocols and use of necessary equipment.
    - Prototype testing and comparison of results.
    - Perform Life-cycle analyses emissions from alternative stove fuels over the entire supply chain.
    - Organize workshop on Stove Use Monitors (SUMs)—State Of The Art (SOTA) and key needs.
    - Identify other markets where new cookstove technology can be embedded-heating stoves.
  - Institute peer reviewed research and publications.

What Else is Needed to Achieve Large Scale Impact?

- Sustained efforts are needed to fully understand new engineering science that makes stoves low-cost, and durable and added technology improvements to achieve stringent efficiency and emissions goals (50%/90% improvements respectively over the baseline).

- This new engineering science will need to be internalized by many dozens of stove designers to develop a variety of new stoves that meet a variety local cooking needs. So, substantial and sustained technology transfer efforts will need to continue.

- Sustained rigorous research is essential to understand the nuances of successful stoves dissemination and field-performance. Current top-down methods of stoves dissemination have very limited insights into what actually works, what doesn't, and why.

Peer Review Process

Cookstoves Session Agenda

Day 4: THURSDAY, MARCH 26, 2015

TIME	COOKSTOVES TECHNOLOGY AREA		
	Project Title	Organization	Presenter
9:45 a.m.–10:05 a.m.	Cookstoves Introduction	*U.S. DOE-BETO*	*Elliott Levine*
10:05 a.m.–10:50 a.m.	Thermoelectric-Enhanced Cookstove Add-On (TECA) for Clean Biomass Cookstoves	*Research Triangle Institute International*	*David Stokes*
10:50 a.m.–11:35 a.m.	Achieving Tier 4 Emissions and Efficiency in Biomass Cookstoves	*Colorado State University*	*Morgan DeFoort*
11:35 a.m.–12:20 p.m.	Heart of the Hearth: Making the Popular Clean, not the Clean Popular	*BioLite LLC*	*Ryan Gist*
12:20 p.m.–1:20 p.m.	LUNCH		
1:20 p.m.–2:05 p.m.	Multidisciplinary Design of an Innovative Natural Draft, Forced Diffusion Cookstove for Woody and Herbaceous Biomass Fuels	*University of Washington*	*John Kramlich*
2:05 p.m.–2:50 p.m.	Technology Innovations to Improve Biomass Cookstoves to Meet Tier 4 Standards	*Aprovecho Research Center*	*Dean Still*
2:50 p.m.–3:35 p.m.	An Affordable Advanced Biomass Cookstove with Thin Film Thermoelectric Generator	*LBNL*	*Ashok Gadgil*
3:35 p.m.–3:50 p.m.	BREAK		
3:50 p.m.–4:35 p.m.	Combustion Materials Durability Relationships for Improved Low-Cost Clean Cookstoves	*ORNL*	*Tim Theiss*

Cookstoves Session Reviewers

COOKSTOVES	
REVIEWERS	
Ranyee Chiang (Lead Reviewer)	Global Alliance for Clean Cookstoves
Jim Jetter	U.S. Environmental Protection Agency
John Mitchell	U.S. Environmental Protection Agency
Jacob Moss	U.S. Department of State
Sheila Moynihan	EERE International

Review Criteria

2015 Evaluation Criteria

1. Project Overview

- Description of the history, context, and high level objectives of the project.

2. Project Approach

- Describe overall technical approach using one slide and management approach using one slide.
- Emphasize the structure of your approach including management approach, use of milestones for monitoring progress, and any unique aspects of your approach; de-emphasize discussion of equipment used.
- Describe critical success factors (technical, market, business) which will define technical and commercial viability.
- Explain the top 2-3 potential challenges (technical and non-technical) to be overcome for achieving successful project results.

Review Criteria (Continued)

3. Technical Progress and Accomplishments

- Describe progress made in meeting project objectives and following the project management plan.
- Describe the most important technical accomplishments achieved
- Benchmark the progress versus previously reported results (if applicable).
- Benchmark the accomplishments against the technical targets (if applicable).

4. Project Relevance

- Describe how project accomplishments contribute to increasing the viability and deployment of renewable energy technologies through research, development, and tools that lead to clean and efficient biomass cookstoves.
- Demonstrate how the project considers applications of the expected outputs.

5. Future Work

- Explain what it is you plan to do through the end of the project with emphasis on the next 16 months (through September 30, 2016).
- Highlight upcoming key milestones.
- Address how you will deal with any decision points during that time and any remaining issues.

Overall Impressions (Not Scored)

– Please provide an overall assessment of the project based on the above criteria. These comments will be featured in the Final Peer Review Report.

Criteria Weighting System

The Criteria Weighting System has three categories based on the current stages of the projects.

1. Sun-Setting Projects: Projects completed by March 2015.
2. New Projects: Projects that have start dates that occur since April 1st, 2014.
3. Existing Projects: All other projects.

Scored Criteria	Sun-Setting Projects (completed by March 2015)	New Projects (since April 2014)	Existing Projects (everything else)
Overview	5%	5%	5%
Approach	15%	25%	20%
Accomplishments/ Progress	50%	10%	30%
Relevance	30%	25%	25%
Future Work	0% (no slide)	35% (2–3 slides)	20%

Project Scoring Criteria

Superior		Good		Satisfactory		Marginal		Unsatisfactory	
10	9	8	7	6	5	4	3	2	1
All aspects of the criterion are comprehensively addressed. There are significant strengths and no more than a few—easily correctable—weaknesses.		All aspects of the criterion are adequately addressed. There are significant strengths and some weaknesses. The significance of the strengths outweighs most aspects of the weaknesses.		Most aspects of the criterion are adequately addressed. There are strengths and weaknesses. The significance of the strengths slightly outweighs aspects of the weaknesses.		Some aspects of the criterion are not adequately addressed. There are strengths and significant weaknesses. The significance of the weaknesses outweighs most aspects of the strengths.		Most aspects of the criterion are not adequately addressed. There may be strengths, but there are significant weaknesses. The significance of the weaknesses outweighs the strengths.	

Thank You

Contact Information:

Email: elliott.levine@ee.doe.gov

Office Phone: 202-586-1476