Wood Energy Financial App: Is your woody biomass heating project feasible?

The webinar starts at 2:00 PM(Eastern Time)

Presenter(s): Dr. Dennis Becker & Gregg Mast

Moderator: Helene Cser

IBSS Southeastern Partnership for Integrated Biomass Supply Systems

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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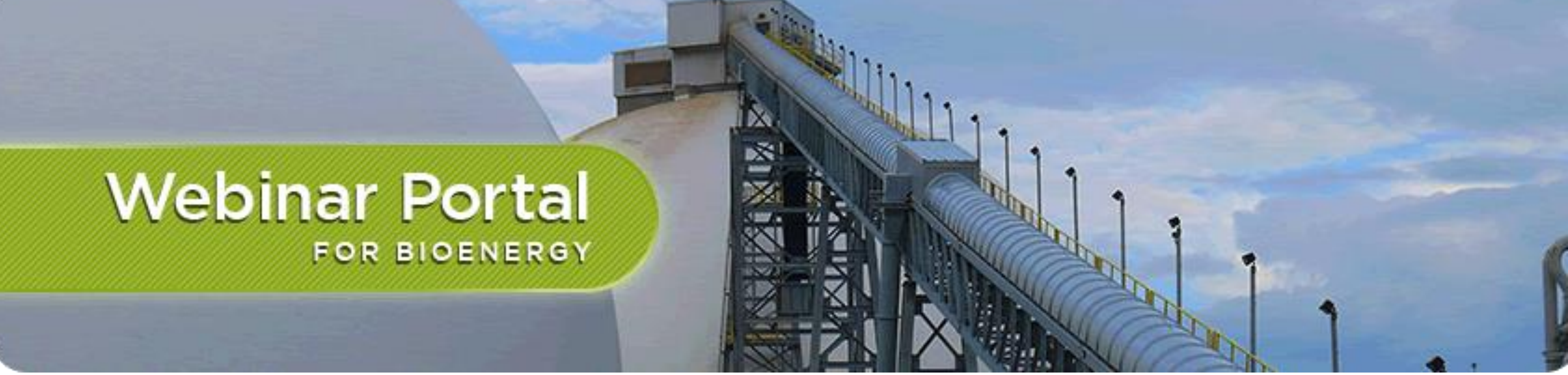

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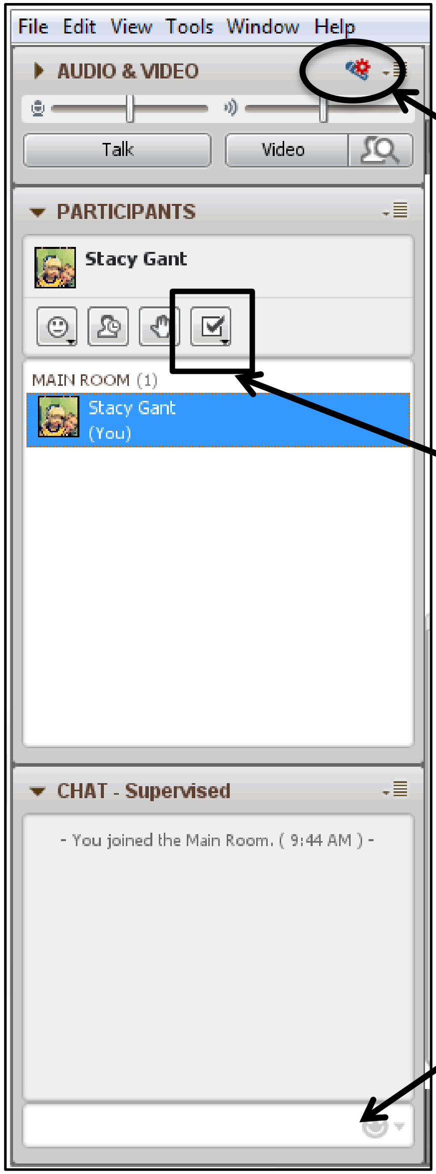

Orientation

1. Audio Setup Wizard – Allows you to ensure your audio is set up properly.

2. Polling - Allows you to answer yes/no questions and respond in a multiple choice format

3. Chat - If the chat says "Supervised," be aware that the presenter/moderator can see all messages, even those marked private.

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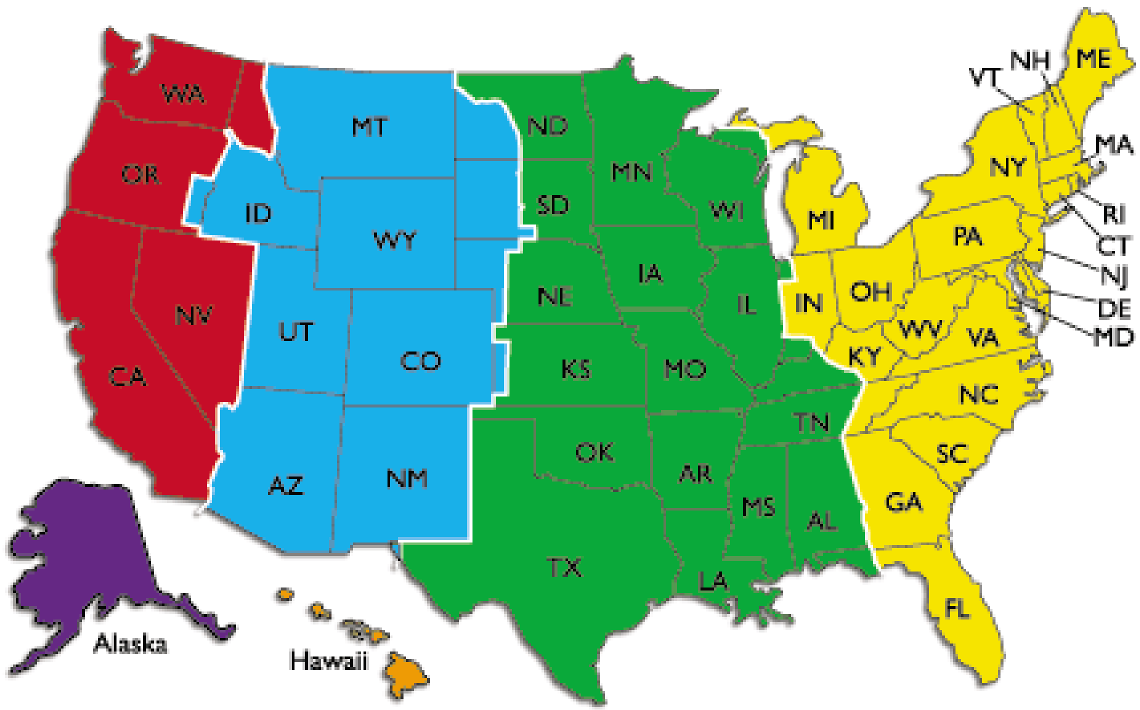

Dennis R. Becker

Dr. Dennis Becker is an Associate Professor of Natural Resource Policy at the University of Minnesota in the Department of Forest Resources. He received a Ph.D. in Natural Resource Sciences from the University of Idaho in 2002, was a Resources For the Future Fellow, Fulbright Fellow, and post doc with the USDA Forest Service, Pacific Northwest Research Station. He is the author of numerous scientific papers in leading scholarly journals. His research focuses on forests and environmental policy with an emphasis in biomass utilization, community energy systems, forest carbon accounting, and social impact assessment. Dr. Becker is the current Chair of the Society of American Foresters national Committee on Forest Policy, Board of Directors for the Biomass Thermal Energy Council, and is the undergraduate major coordinator for the Environmental, Science, Policy and Management program at the University of Minnesota. He serves as an auditor for third-party forest certification, and conducts policy analysis for various congressional, legislative, agency, and stakeholder inquiries in the US and abroad.

United States Department of Agriculture
Forest Service

Department of FOREST RESOURCES
University of Minnesota

Wood Energy Financial App

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Forest Service

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Research Station
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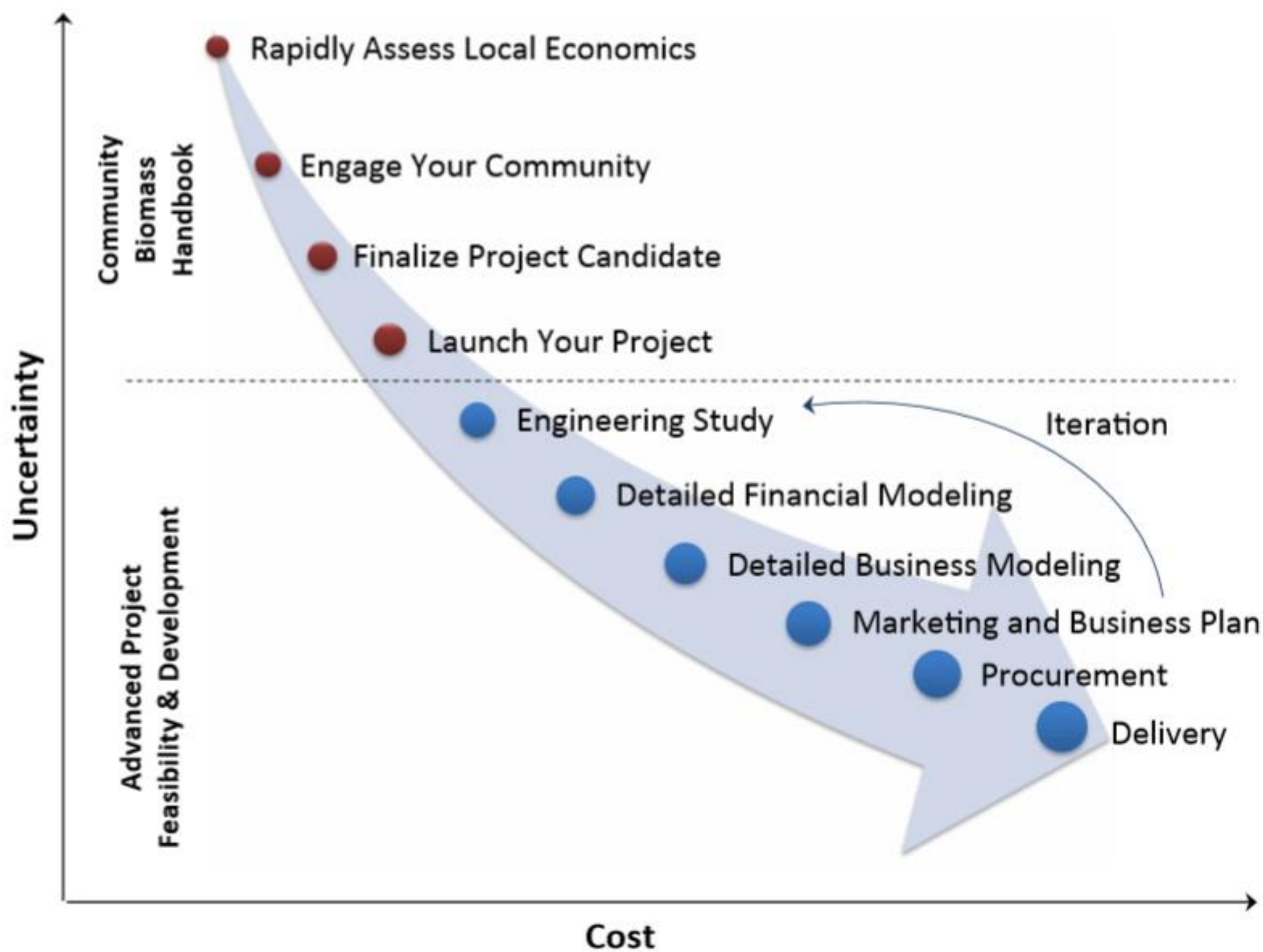
Becker, D.; Lowell, E.; Bihn, D.; Anderson, R.; Taff, S.

Project Development Lifecycle



Modified from: International District Energy Association

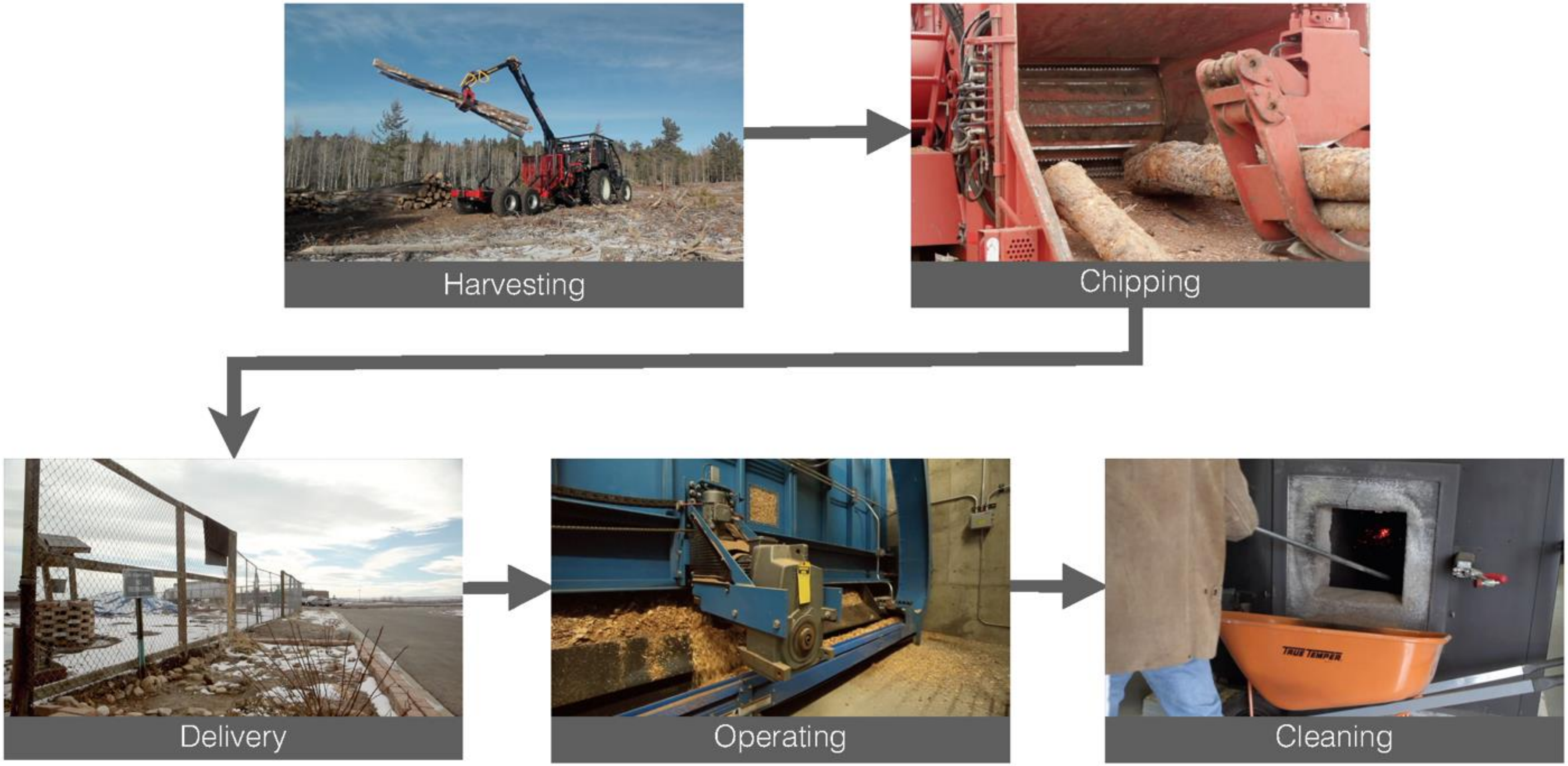
CHAPTER 1

Introduction

Is Biomass Heating Right for You?

Sometimes, a biomass heating project can be justified on purely financial grounds. These are the exceptions. Most projects work because of the significant noneconomic benefits they provide their owners. That is why many biomass heating projects are located at colleges and schools, public buildings, and facilities run by nonprofit organizations.

When done correctly, a biomass heating system can provide local jobs, reduce carbon emissions, and improve forest health by offsetting the cost of prescribed forest health treatments that may not otherwise be affordable. If these benefits are valuable to your community, heating with biomass can be a very good decision.



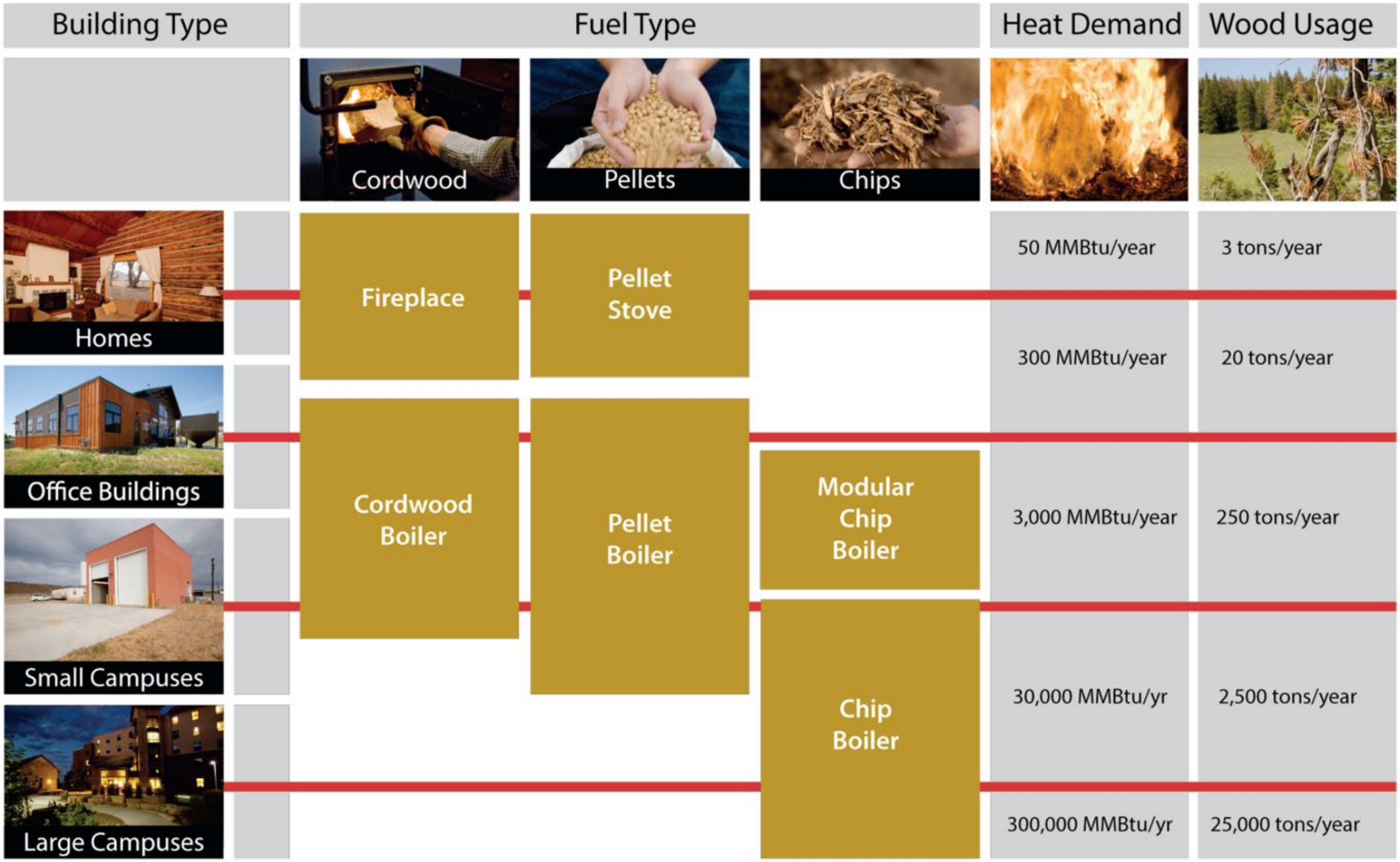
This is the forest-to-ash life cycle for a typical wood chip boiler system. This isn't your grandfather's fireplace!

(Tap on a video image to play – use spread gesture for full screen.)

CHAPTER 3

Technology That Works

Size Determines Choices



This chart provides a **rough** idea about which technologies are most appropriate for your application. It is not a design tool.

Cordwood

Cordwood fuel needs the least amount of processing and the smallest amount of capital to both process and burn. Modern cordwood boilers are clean, efficient, and affordable. The capital investment is low, but the labor requirement is high. However, if you have a wood supply and staff that can feed the boilers several times a day, this can work for you.

Wood Chips

Wood chips are the workhorse of the biomass world. Small working wood chip systems start at 1 MMBtu/hr and can be quite large. System complexity and maintenance are similar to coal-fired systems. If you're heating 50,000 square feet or more, this may be the right system for you.

Wood Pellets

Wood pellets are the most processed, most uniform type of biomass fuel. They are also the easiest to use, but the most expensive to buy. The small uniform size of pellets is similar enough to grains such as corn, that the same processing equipment (augers, bins, etc.) can be easily adapted. Their uniformity allows for more efficient transport, and they can be an ideal fuel for small projects or facilities more than 100 miles from a biomass source.

Wood Chip Technology

A 15-MMBtu/hr wood chip system – a ChipTec gasifier and a Hurst boiler – provides most of the heat and hot water for the North County Hospital in Newport, Vermont. The system also provides steam to an absorption chiller to help cool the hospital in the summer.

Initially, the system generated electricity, but that part of the system has since been shut down owing to maintenance and economic reasons.

The system cost about $1.5 million installed, with an estimated payback period of 11 years.

CHAPTER 4

Biomass Supplies That Work

The Right Source of Biomass Fuel

Reliable Access to the Biomass Resource

Weather, fire, and policy can temporarily or permanently disrupt your biomass supply chain. Or, if your biomass is a byproduct of a sawmill, changes in regional and global economics can affect cost and availability. Short-term and seasonal disruption that prevents harvesting can be mitigated by storage – either at your site or at an intermediate location. Diversifying your supply sources is also critical for long-term success.

Affordable Transportation

Transportation is often the single major contributor to the cost of your delivered fuel. Distance between the resource and your site is obviously a big factor, but the size of your onsite storage affects the truck size, as do road conditions, legal weight limits, and access in the forest.

High moisture content means you are paying to haul water to your facility instead of fuel. That water will either be removed when the biomass dries, or evaporated when the biomass burns, wasting valuable energy.

High-Quality Delivered Fuel

If your biomass fuel is **cordwood or wood chips**, its moisture content is the most important factor. Generally, drier is better, but some boilers need a minimum moisture content, otherwise they will produce a lot of smoke. It's also important to keep wood chips free of contaminants like rocks and dirt that can damage your boiler.

If your biomass fuel is **wood pellets**, the main challenge is keeping the pellets from falling apart. That means keeping them dry and not subjecting them to a lot of handling and vibration.

What is an MMBtu?

This is a common unit of energy used in the United States.

For our purposes, an MMBtu is a very convenient way of comparing apples to oranges – or gallons of propane to tons of green wood.

The two Ms are the roman numerals M for 1000 (as in millennium, not mega). So MM is 1000 times 1000 or, 1 million. Btu is the abbreviation for British thermal unit, the amount of energy it takes to heat 1 pound of water, 1 degree Fahrenheit. So an MMBtu is 1 million Btus, enough energy to heat 1 million pounds of water 1 degree Fahrenheit.

Comparison of Energy Costs by Fuel Type

Fuel	Assumed Unit Price	MMBtu/Unit	$/MMBtu
Wood chips (30% moisture content)	$50/ton	10.5/ton	**$4.76**
Natural gas	$5/MMBtu	—	**$5.00**
Wood pellets (8% moisture content)	$200/ton	14.5/ton	**$14.54**
Propane	$2/gallon	0.091/gallon	**$21.91**
Heating oil	$4/gallon	0.14/gallon	**$28.57**
Electricity	$0.10/kWh	0.0034/kWh	**$29.31**

Energy (Moisture) Content

The good news is that the energy content of biomass does **not** depend very much on the species of wood. The bad news is that it varies greatly with moisture content (also called water content). Biomass fuel from wood is made up of wood fiber and water. The wood fiber contains energy. The water is like an energy-consuming parasite, so generally, the less of it, the better.

Moisture Content - Wet or Dry?

The amount of water in biomass is called the moisture content. There are two common ways of defining moisture content, wet basis and dry basis.

Wet basis moisture content is used extensively in the paper industry, the biomass community, and in this handbook. However, for other wood industry products, dry basis is commonly used. Make sure to clearly state which definition is being used.

Wet basis moisture content:

$$MC_{Wet} = \frac{Weight_{Wet} - Weight_{Dry}}{Weight_{Wet}}$$

Dry basis moisture content:

$$MC_{Dry} = \frac{Weight_{Wet} - Weight_{Dry}}{Weight_{Dry}}$$

Where MC = moisture content.

Moisture content of biomass fuel affects energy in two ways.

The primary impact is simply that the higher the moisture content, the lower the wood fiber content.

The wood fiber part of biomass contains about 16 MMBtu/ton of recoverable energy. If your biomass has a moisture content of 30%, that means you only have 70% energy-containing wood fiber. So, in this case, the energy content of your wood fiber is 11.2 MMBtu/ton (16 MMBtu x 70%).

The secondary impact is that energy is needed to boil off the water during combustion. Energy is consumed creating steam, but biomass boilers do not recover that energy, which is exhausted into the environment through the chimney or smokestack. This wasted energy can be significant.

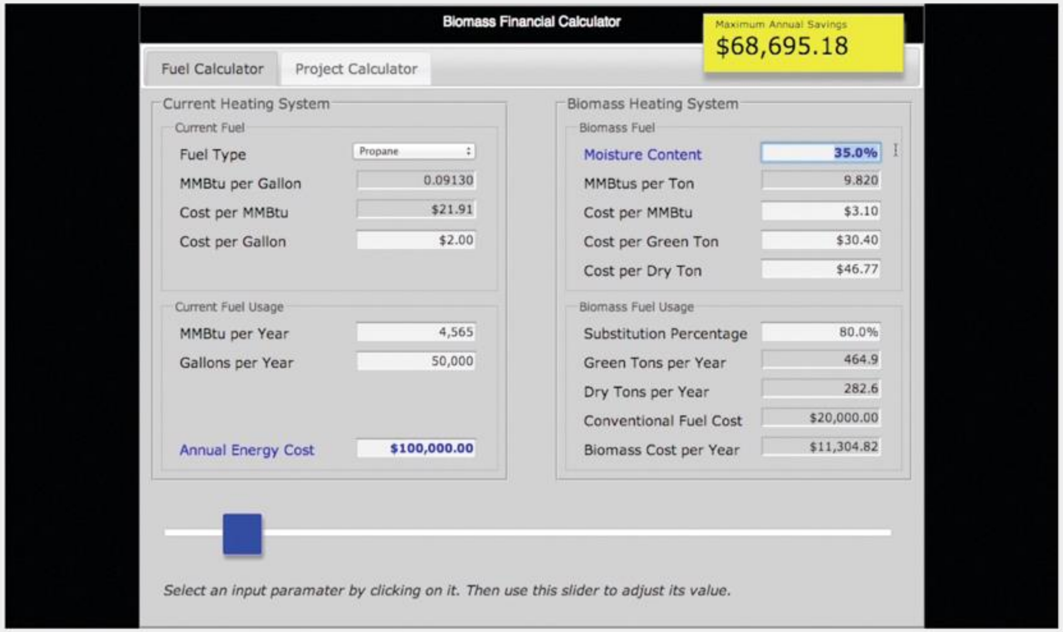
It takes about 2.23 MMBtus to boil 1 ton of water from room temperature (68° F) into steam. So, 1 ton of biomass with a moisture content of 30% will **consume** 0.67 MMBtus just to evaporate the water.

Energy = energy in wood fiber - energy to evaporate water

10.53 MMBtu = 16 MMBtu x 70% – 2.23 MMBtu x 30%

CHAPTER 6

Rapidly Assess Local Economics



Wood Energy Financial App demonstration and training video

With the Wood Energy Financial App, making a meaningful estimate of the financial viability of a potential wood heating project can be quick and simple.

User inputs are organized into three tabs found across the top of the app, which will guide you through fuel cost calculations, capital investment options, and estimated financial feasibility. By simply moving the slider bar at the bottom of the calculator, you can quickly make comparisons and analyze "what-if" scenarios (for example, varying the cost of propane, biomass moisture content, or assess possible financing options).

To get started, watch the demonstration video above. To launch the app, just tap the icon on the right. The next few pages walk you through examples and specific steps to calculate financial feasibility.

Tap to launch app

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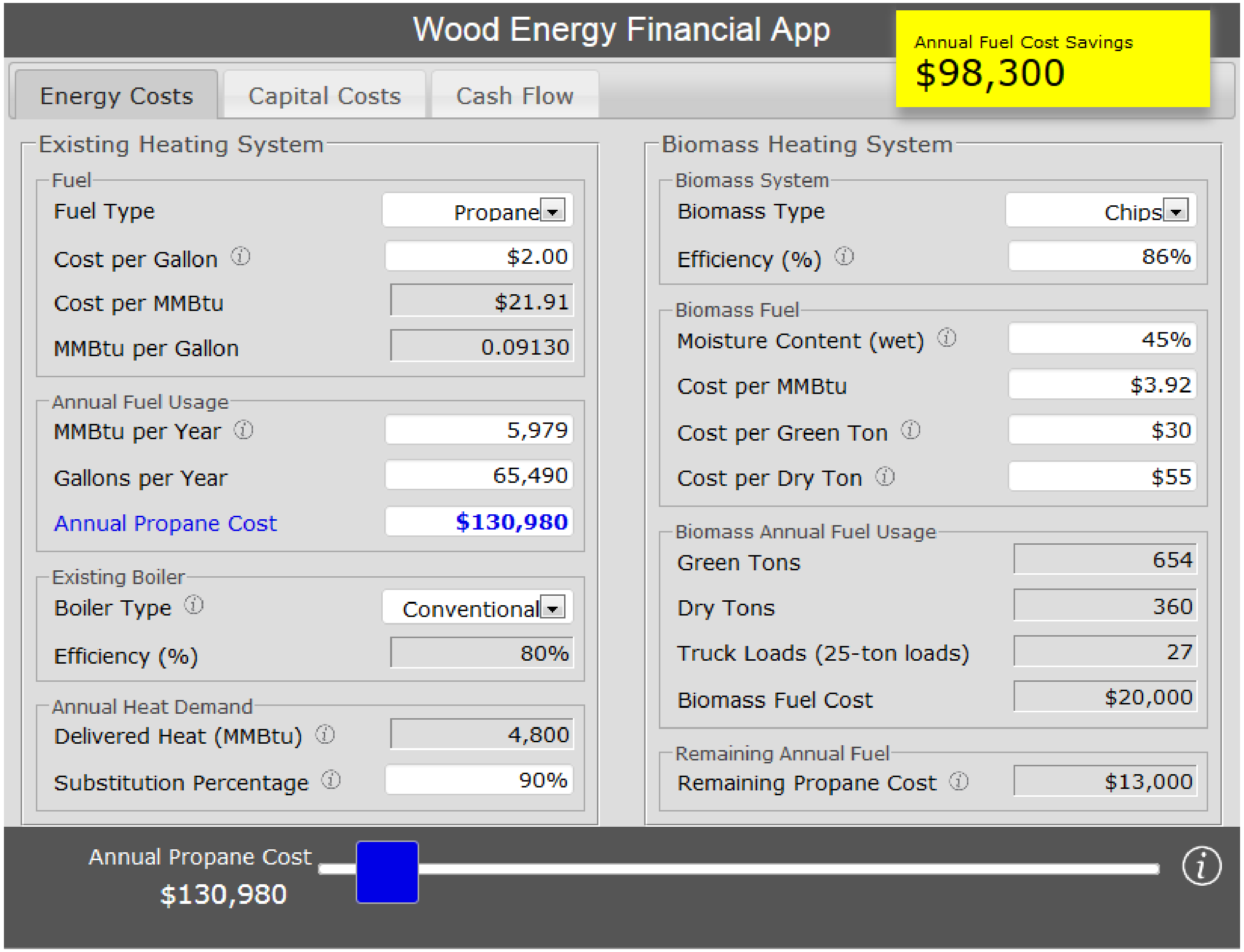


App compatible with the following browsers:

Internet Explore 10.0 (and above); Firefox 27.0 (and above); Safari (any version), Chrome (any version)

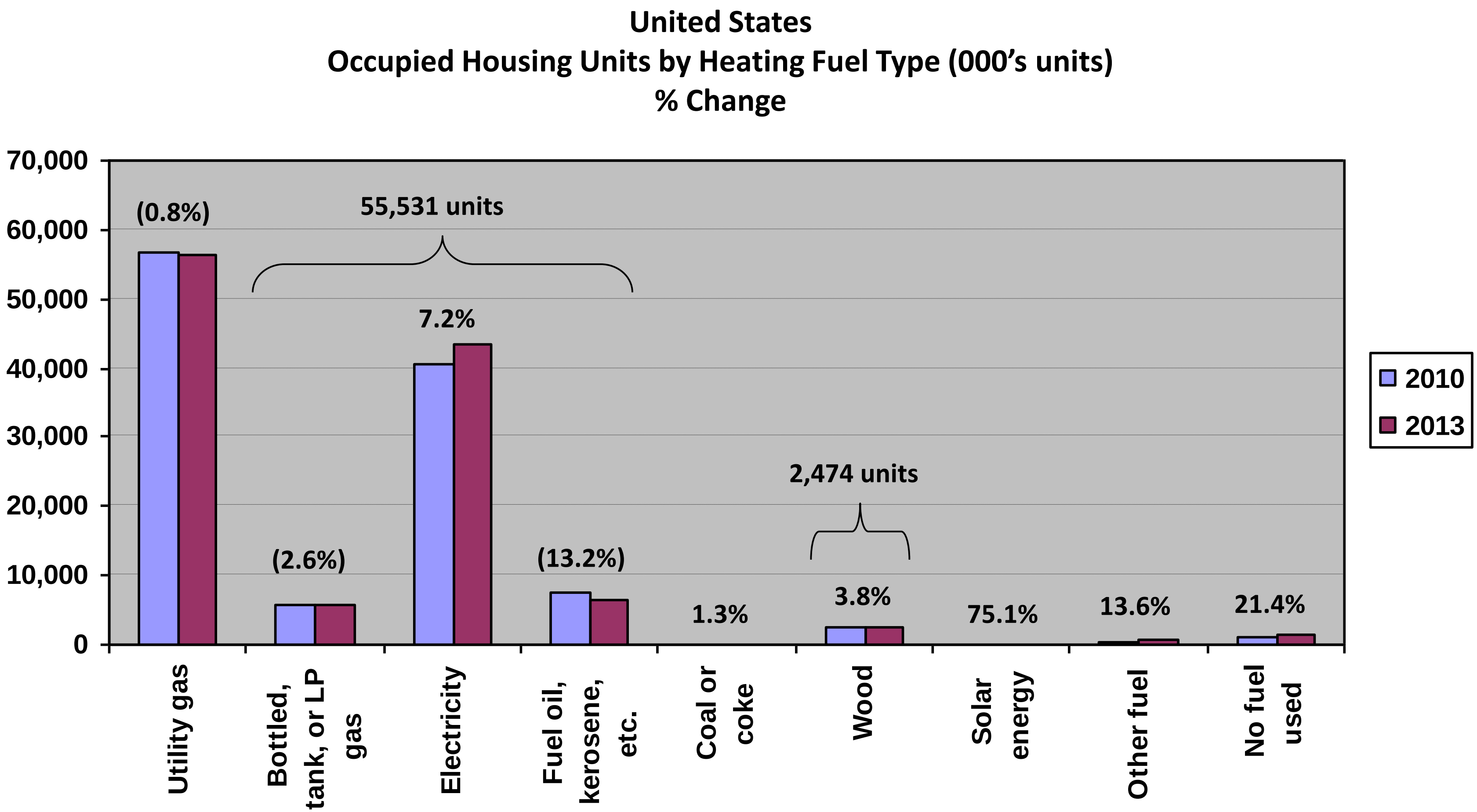
Gregg Mast

Mr. Mast is founder, president and CEO of Earthtech Energy, Inc., a Minneapolis-based consulting firm specializing in biomass energy development. He leads and directs consulting services for private sector technology and project developers, municipal utilities, colleges, universities and government agencies. Mr. Mast brings over 10 years of professional experience in biomass project development, feedstock resource analysis, feasibility and financial analysis and fuel risk management in the sector areas of biobased thermal, combined heat and power (CHP), advanced biofuels and renewable chemicals. He possesses deep expertise in the economic, marketing, financial, environmental and policy aspects of biomass energy. Mr. Mast has also served as Vice President of The BioBusiness Alliance of Minnesota where he was responsible for developing a long-term strategic direction for Minnesota in the areas of renewable energy and renewable materials. Early on in his career, he worked in a variety of corporate finance and management capacities, including at Allianz Life, a wholly-owned subsidiary of Allianz SE and Target Corporation. Mr. Mast received a B.A. from the University of Minnesota, Twin Cities, and a M.B.A. from the Opus College of Business at the University of St. Thomas.

Wood Energy Financial App
Sample of Suggestions for Future Enhancements

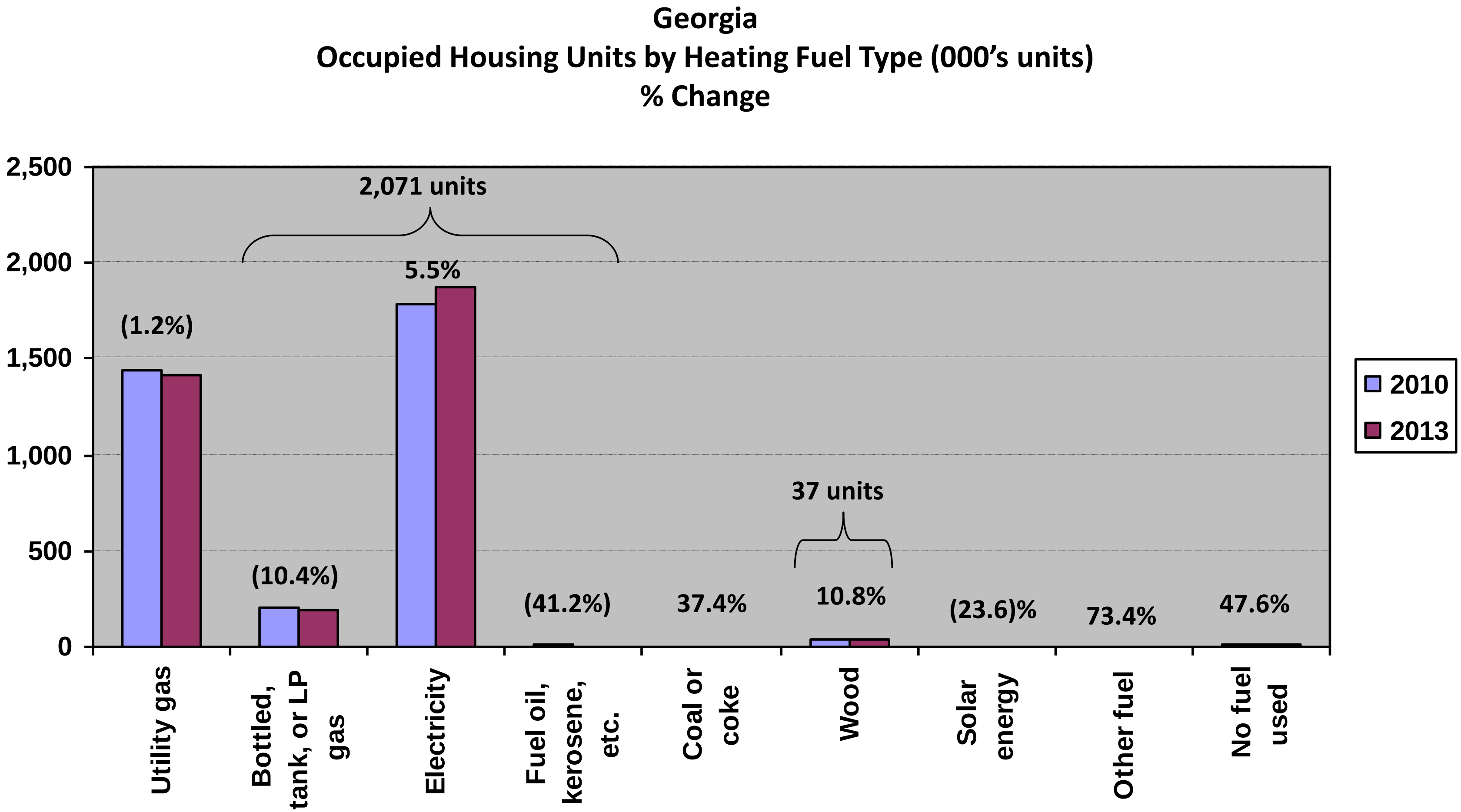
- Ability to analyze cordwood and combined heat and power (CHP) systems
- Estimate building size approximation (sq. ft) per MMBtu
- Capture fuel escalation rates for life cycle cost
- Allow user to input capital costs based on specific regional experience, cost factors and project histories
- Increase transparency and include expanded descriptions of assumptions and calculations
- Make available visible outputs, charts and detailed cash flow and financial reports
- Keep it simple and intuitive
- Improve appearance
- Make the app portable across various platforms
- Expand outreach and training on its use

Opportunity for Biomass Heat?



Source: U.S. Census Bureau, 2010 & 2013 American Community Survey

Opportunity for Biomass Heat?



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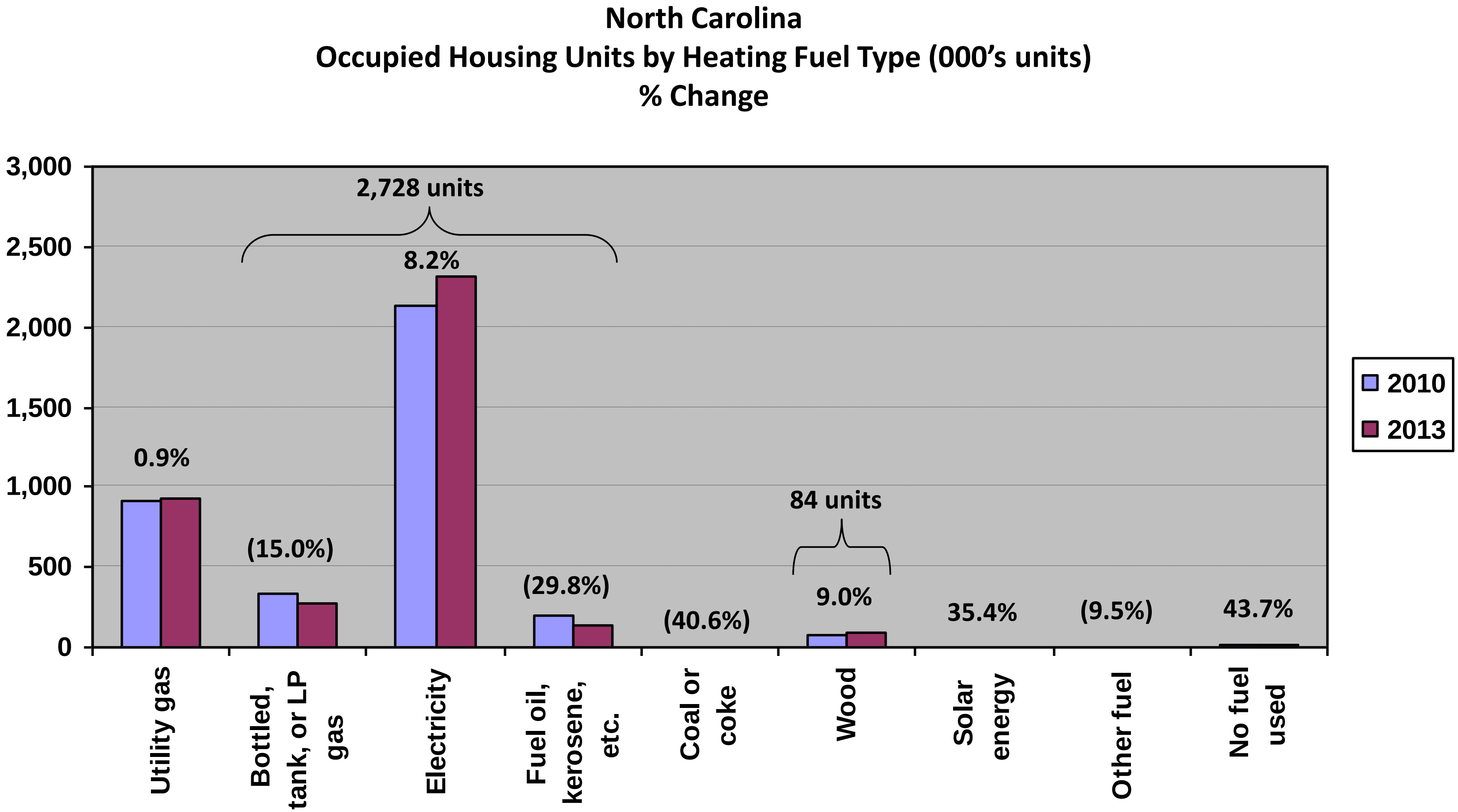
Opportunity for Biomass Heat?



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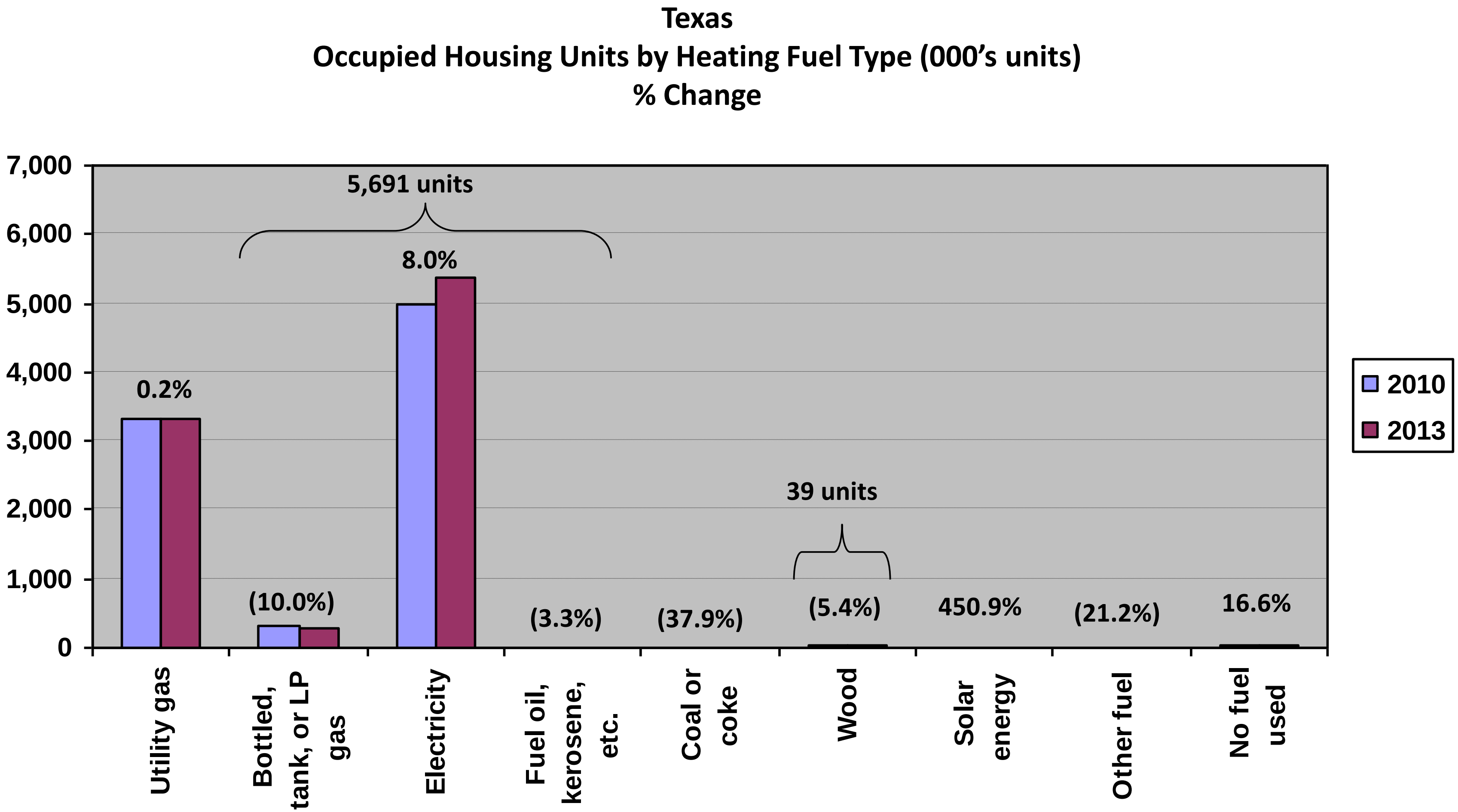
Opportunity for Biomass Heat?



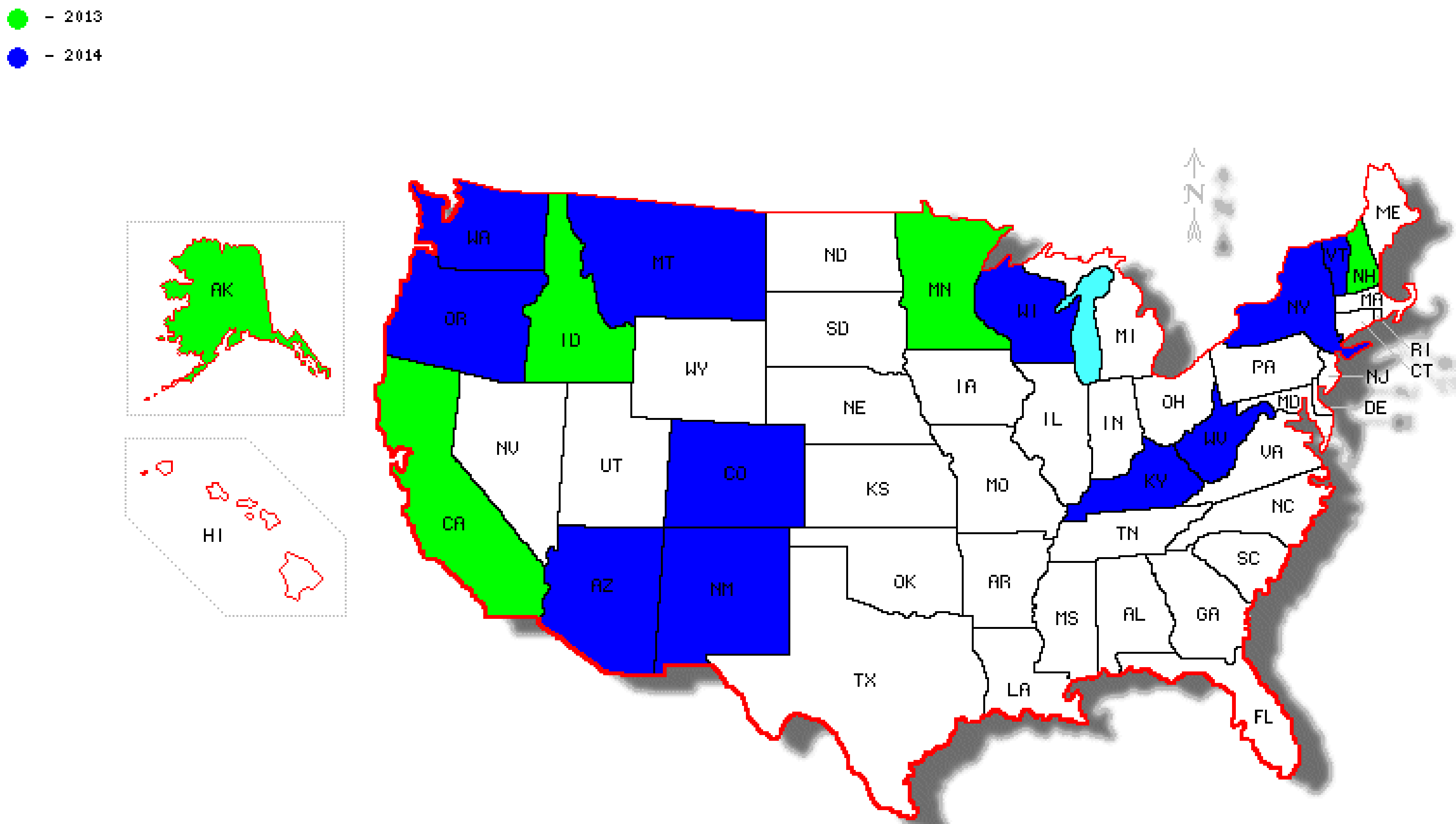
Source: U.S. Census Bureau, 2010 & 2013 American Community Survey

Occupied Housing Units by Heating Fuel Type, 2013
% of Total

	Occupied Housing Units (000's)	Utility gas	Bottled, tank, or LP gas	Electricity	Fuel oil, kerosene, etc.	Coal or coke	Wood	Solar energy	Other fuel	No fuel used
United States	**116,291**	**48.3%**	**4.8%**	**37.4%**	**5.5%**	**0.1%**	**2.1%**	**0.1%**	**0.5%**	**1.1%**
Georgia	**3,547**	**40.1%**	**5.2%**	**53.0%**	**0.2%**	**0.0%**	**1.0%**	**0.0%**	**0.1%**	**0.4%**
North Carolina	**3,757**	**24.6%**	**7.5%**	**61.4%**	**3.7%**	**0.0%**	**2.2%**	**0.0%**	**0.1%**	**0.4%**
Texas	**9,111**	**36.4%**	**3.2%**	**59.1%**	**0.1%**	**0.0%**	**0.4%**	**0.0%**	**0.1%**	**0.5%**

Source: U.S. Census Bureau, 2013 American Community Survey

US Forest Service
Statewide Wood Energy Teams (FY 2013 & 2014)



http://na.fs.fed.us/werc/swet/

Source: diymaps.net (c)

Statewide Wood Energy Teams
Areas of Focus

- Promote the viability and utilization of woody biomass as a cost effective option for heating and/or combined heat and power (CHP)
- Assist interested stakeholders throughout the project development lifecycle, i.e., concept to comprehensive feasibility and detail engineering
- Target displacement of fossil-based heating systems (primarily fuel oil and propane, some coal and natural gas) with cordwood, chip and pellet systems across a range of system sizes and locations
- Mobilize collaborative working groups to develop tools, resources and discuss biomass heating options while sharing and disseminating best practices (market and policy-based)
- Support the development and growth of the woody biomass value chain

Questions and Discussion

Moderated by Helene Cser

United States Department of Agriculture
Forest Service

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Thank You For Your Participation!

A recording of this webinar will be available at:
http://www.forestrywebinars.net/previous-webinars

Upcoming webinar!
October 16, 2014
An introduction to OpenLCA and the USDA LCA Commons
http://go.ncsu.edu/openlca