



# Gasification of Biomass and Waste – Recent Activities and Results of IEA Bioenergy Task 33

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[task33.ieabioenergy.com](http://task33.ieabioenergy.com)



# Outline

- IEA Bioenergy
- IEA Task 33
  - Scope
  - Participating Countries
  - Meetings and Public Workshops
  - Special Projects and Reports
  - Web Site



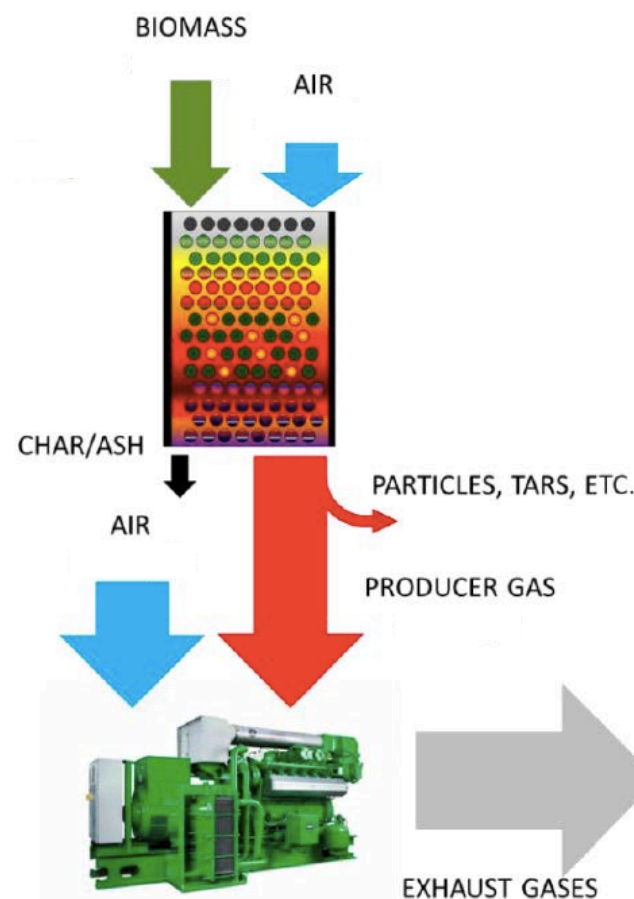
## Task 33 Scope

### ➤ Objectives

- Promote commercialization of biomass and waste gasification
- Monitor, review and exchange information on gasification research, development, and demonstration
- Encourage cooperation among member countries and industry

### ➤ Audience




- Policymakers
- Technology providers
- End users
- Researchers
- General public





# IEA Bioenergy Participants

## IEA Member Countries

 Australia	 Estonia	 Ireland	 New Zealand	 Sweden
 Austria	 Finland	 Italy	 Norway	 Switzerland
 Belgium	 France	 Japan	 Poland	 Turkey
 Canada	 Germany	 Republic of Korea	 Portugal	 United Kingdom
 Czech Republic	 Greece	 Luxembourg	 Slovak Republic	 United States
 Denmark	 Hungary	 The Netherlands	 Spain	

## Other Member Countries

 Brazil
 Croatia
 European Union
 South Africa



## Task 33 Membership



Austria

Reinhard Rauch

TU Vienna



Denmark

Morten Hansen

EA Energianalyse a/s



Germany

Thomas Kolb

KIT



Italy

Donatella Barisano

ENEA



The Netherlands

Berend Vreugdenhil

ECN



Norway

Judit Sandquist

SINTEF



Sweden

Lars Waldheim

Waldheim Consulting



Switzerland

Martin Rügsegger

ETECA



USA

Kevin Whitty

University of Utah



# Meetings and Workshops

## ➤ Meetings

- Task 33 business meetings twice per year
- Reporting to IEA Bioenergy Executive Committee twice per year

## ➤ Workshops

- Open to public
- Topics relating to biomass and waste gasification
  - Technical issues
  - Markets, policy, implementation
- Usually 1 day workshop plus a half-day excursion/tour





# Recent and Upcoming Workshops

May 2015	Ponferrada, Spain	Symposium on Renewable Energy and Products from Biomass and Waste
Oct 2015	Berlin, Germany	IEA Bioenergy Conference Session “Commercial Success of Biomass Gasification”
May 2016	Trondheim, Norway	Aviation Biofuels through Biomass Gasification
Oct 2016	Lucerne, Switzerland	Gas Sampling, Measurement and Analysis in Thermal Gasification Processes
May 2017	Innsbruck, Austria	Small Scale Gasification for CHP
Oct 2017	Skive, Denmark	Fluidized Bed Gasification of Biomass

Workshop reports available  
on Task 33 website:  
[task33.ieabioenergy.com](http://task33.ieabioenergy.com)





## Special Projects

### ➤ Recently completed

- Fact sheets on biomass gasification
- Performance test code white paper
- Status report on biomass gasification development

### ➤ In progress

- History of biomass gasification and lessons learned
- Gasification of waste
- Biomass gasification for CCUS
- Gasification-based renewable energy hybrid systems
- Hydrogen generation through biomass gasification
- Fuel pretreatment for gasification applications
- Valorization of byproducts from small scale gasification





# Fact Sheets

➤ 1-2 page targeting general public

➤ Eight topics

- What is gasification?
- Gasification in numbers
- Biomass as gasification feedstock
- Selection of gasification technology
- Indirect co-firing
- Producer gas as engine fuel
- Syngas for biofuels
- Contaminants in producer gas

➤ Available on task web site

**WHAT IS GASIFICATION?**

Gasification is a high-temperature process in which a solid fuel (e.g. coal, biomass, waste) is converted into a combustible gas, called **producer gas** or **syngas**. Gasification takes place at high temperatures (700-1500°C), and heat or small amounts of air or oxygen are added to supply the energy needed for the gasification process.

**KEY OF GASIFICATION**

70-80% of the energy contained in the initial solid fuel is transferred to the chemical energy of producer gas (remaining 20-30% accounts for heat and losses).

**ADVANTAGES OF GASIFICATION**

- Versatility of applications of syngas: fuel gas (power/heat production), synthesis of fuels and chemicals.
- Higher electrical efficiencies (gas engines at small-scale, combined cycles at large scale) than Rankine steam cycles (combustion).
- CHP applications allow parallel production of heat and power at maximum efficiency (whereas power efficiency is lower in a combustion Rankine cycle).
- Easier removal of N, S, and Cl compounds from producer gas.
- Possible integration with CO<sub>2</sub> capture and storage at large scale.

**APPLICATIONS OF SYNGAS:**

- Production of heat, power, mechanical energy, etc. (engines, turbines, fuel cells).
- Synthesis of biofuels: methanol, ethanol, synthetic natural gas, hydrocarbon fuels.

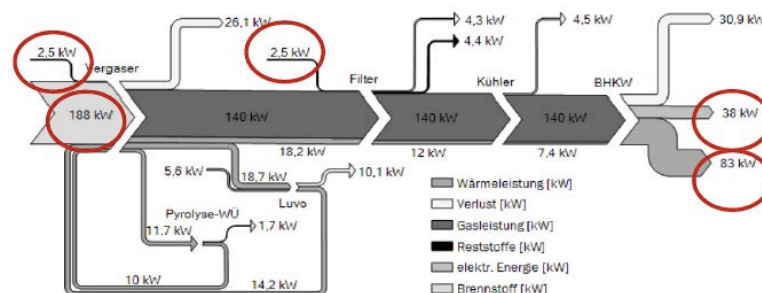
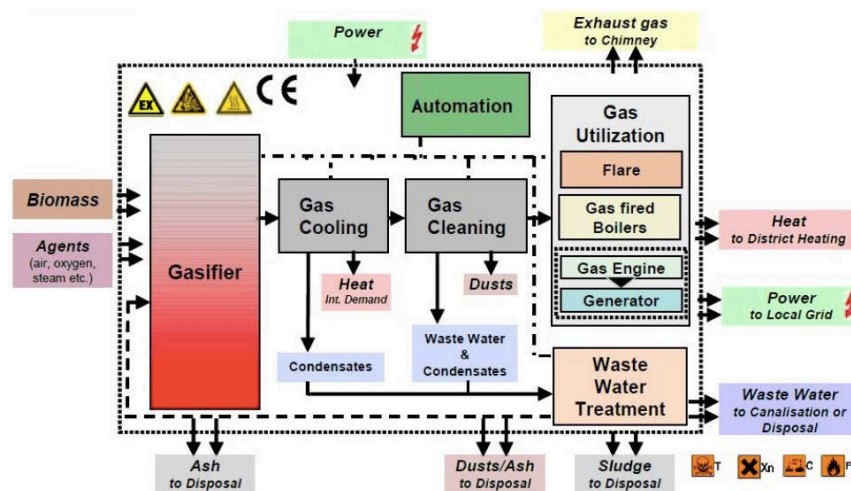
**CLASSIFICATION OF GASIFICATION PROCESSES**

- Temperature:** High-T (fuel ash melts), low-T (below ash melting point).
- Pressure:** Atmospheric, pressurized.
- Fuel supply:** Autothermal (heat provided by the combination of part of the fuel, autothermal (heat added from external source)).
- Technology:** Fixed/moving bed, fluidized bed, entrained-flow...



# Performance Test Code White Paper

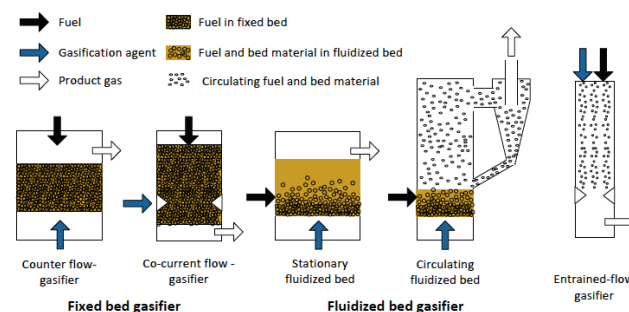
- Focus on small scale CHP plants
- Procedure for establishing performance metrics
- Considers both technical and management aspects
- Example contract and performance test report
- Available on Task website



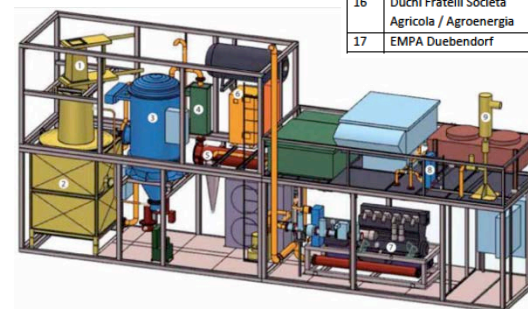


# Status Report on Biomass Gasification

- Comprehensive overview of status of biomass gasification
  - Background of gasification and state of the art
  - List and index of gasification facilities
  - Highlights of significant facilities
  - Considers industrial as well as smaller-scale systems
- Updated every triennium
- Report available on task website



Nr.	Owner	Name	Status	Page
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# Fuel Pretreatment for Gasification Applications

- T33's contribution to inter-task project "Fuel pretreatment of biomass residues in the supply chain for thermal conversion"
- Proposed to consider case study of how fuel pretreatment could enable or improve feeding of waste to gasification system, relative to existing reference case
- Overall project results in several individual case studies of opportunities presented by fuel pretreatment for combustion, pyrolysis, gasification, etc.





# Biomass gasification for CC(U)S

- Analysis of how biomass gasification can contribute to CCS and CCUS
- Consideration of implementation strategies and worldwide potential
- Collaboration with other IEA Bioenergy activities regarding BECCS
- Report due 2018

## IEA Bioenergy

### Applicable Bio-CCUS concepts for member states 2030 – 2050

#### Technological and financial aspects of Bio-CC(U)S

Time: 10 May 2016, 10.00 – 16.30

Venue: Miljøstiftelsen Bellona

Visiting address: Vulkan 11, 0178 Oslo, Norway

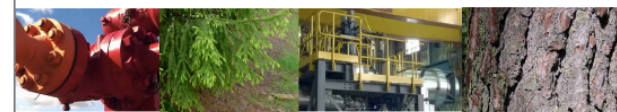
You are warmly invited to the first IEA Bioenergy Task 41 workshop on Bio-CCUS. The workshop will be the first in a series of four workshops and hosted by Miljøstiftelsen Bellona. The workshop includes a site visit to the CO<sub>2</sub> capture test facility at the Oslo Municipality Waste to Energy Plant at Klemetsrud.

The workshop aims to give an update on the status of national plans and roadmaps for Bio-CCUS in member states and to identify the national possibilities and potential first business cases on a technical and economic level. We will also discuss the role of Bio-CCUS in EU towards 2030 and 2050. The event will give an excellent opportunity to get an updated status update on Bio-CCS activities and possibilities, and to highlight and disseminate work on Bio-CCUS which could contribute to increased awareness of the topic among stakeholders.

To register for the event, please use the following link:

<https://ssl.eventilla.com/event/e8U>

Registration is open until 2 May 2016. For further inquiries, please do not hesitate to contact Antti Arasto ([antti.arasto@vyti.fi](mailto:antti.arasto@vyti.fi)) or Kristin Onarheim ([kristin.onarheim@vyti.fi](mailto:kristin.onarheim@vyti.fi)).



IEA Bioenergy



# Web Site: [task33.ieabioenergy.com](http://task33.ieabioenergy.com)

- Task info and scope
- Event information
- Workshop reports and presentations
- Publications and special project reports
- Contact information
- Facilities database

**Task33** Gasification of Biomass and Waste

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### Overview of the task

The objectives of Task 33 are to monitor, review and exchange information on biomass and waste gasification research, development, and demonstration and to promote cooperation among the participating countries and industry to eliminate technological impediments to the advancement of thermal gasification of biomass and waste. The ultimate objective is to promote commercialisation of efficient, economical, and environmentally preferable biomass and waste gasification processes, for the production of electricity, heat, and steam, for the production of synthesis gas for subsequent conversion to chemicals, fertilisers, hydrogen and transportation fuels, and also for co-production of these products.

Participating countries: Austria, Denmark, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland and USA

Task Leader: Prof. Kevin Whitty, University of Utah, USA

Operating Agent: Mr Jim Spaeth, US Department of Energy, Washington, DC, USA

The Task Leader directs and manages the work programme. A National Team Leader from each country is responsible for coordinating the national participation in the Task.

### Work Scope, Approach and Industrial Involvement

The scope of work for the current triennium is built upon the progress made in the previous triennia. In the previous years, information exchange, investigation of selected subtask studies, promotion of