

# BIOTEAM MAGAZINE

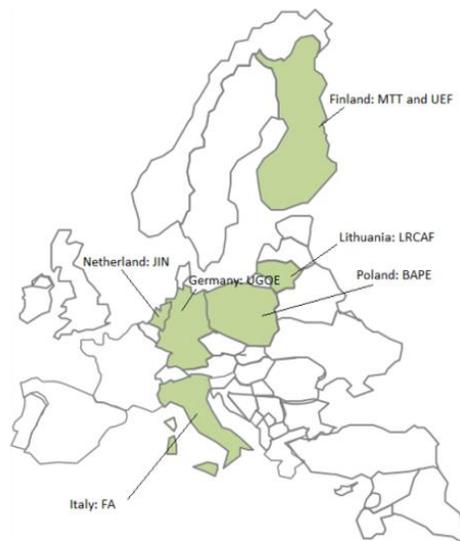
Final Report from the BIOTEAM project



**Optimizing Pathways and Market Systems for Enhanced Competitiveness of Sustainable Bio-Energy**



Co-funded by the Intelligent Energy Europe Programme of the European Union



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The BIOTEAM project started in April 2013 and ended in March 2016  
Go to [www.sustainable-biomass.eu](http://www.sustainable-biomass.eu) for more information about the project

## I. Editorial note: The challenge for policy making in a Circular (Bio-)Economy

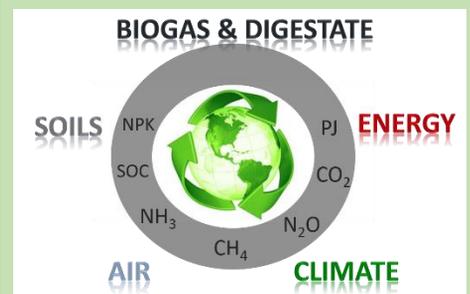
Within the BIOTEAM project the sustainability performance of bio-energy was assessed. It was found that introducing bioenergy at the expense of fossil fuels can significantly reduce GHG emissions. However, at the same time this energy transition comes with a number of 'co-benefits' and 'trade-offs'. Any given bio-energy type can thus positively and/or negatively contribute to the environmental, social and economic goals in place (e.g. air, climate, energy, soil, employment). A key observation was that the overall sustainability performance of bioenergy is highly dependent on the specific type of fossil fuel substituted.

With an increasing number of environmental and socio-economic policy goals nowadays, the key challenge is to adequately 'align' all these goals and underlying policy instruments to establish a more integrated (and synergetic) policy framework.

This is no trivial challenge within the Circular (Bio-)Economy, where new integrated business models – that also produce non-energy bio-products and services (e.g. bio-refineries, and combined biogas-organic fertilizer production) – are likely to be affected by a great diversity of policy instruments.

In this era of 'Green Growth', the need for a '**Circular Economy Proof**' policy framework has never been greater!

**'Direct support for biomass-to-energy projects has kick-started the EU bio-economy, but now there is a need to develop a more integrated and 'Circular Economy Proof' policy framework'**



Is the EU policy framework for biogas production and digestate (re-)use 'Circular Economy Proof'?

The current EU framework comprises:

- Energy & Climate Package(s)
- Clean Air Policy Package
- Nitrate / Fertilizers Directive
- Proposal for a Soil Framework Directive

## II. BIOTEAM International

Throughout the course of the BIOTEAM project the consortium members learned a lot by actively interacting with public and private stakeholders. The interactions - mediated via workshops, interviews, telephone calls, and e-mail exchanges - have proven very fruitful in creating a better understanding of the dynamics of market systems and policy making.

The BIOTEAM consortium wants to thank all stakeholders that have shared their knowledge and insights in the field of bioenergy and the broader bio-economy! But, the BIOTEAM consortium also gave something back. Here is an overview of some of the BIOTEAM International outreach activities:

- 24-05-2014; Oral presentation on **'The sustainability of bioenergy in a scenario with alternative biomass resource applications'** ([→](#)), during the 22<sup>nd</sup> EU Biomass Conference & Exhibition in Hamburg, Germany.
- 17-05-2015; Two oral presentations during the EU Sustainable Energy week, Brussels, Belgium on **'Biomass cascading in dynamic markets'** ([→](#)), and on **'Market Mapping on district heating systems – policy interactions, market barriers and economic regulation'** ([→](#)).
- 02-06-2015; Poster and oral presentation on **'Renewable energy sustainability is not self-evident and varies between countries and pathways'** ([→](#)) during the 23<sup>rd</sup> EU Biomass Conference & Exhibition 1-4 June 2015, Vienna, Austria.
- 02-12-2015; Oral presentation on **'Optimization in renewable energy planning'** ([→](#)) during a seminar at the School of the Environment in Nanjing University, China.
- 07-12-2015; Side-event at the Netherlands Climate Pavilion on **'Green Growth and Bioenergy, The risks of NOT integrating climate strategies with other development objectives'** ([→](#)) during the COP-21 in Paris, France (December) 2015.
- 16-02-2016; **BIOTEAM final event** in Brussels, Belgium. Morning session: **'Jump-start the EU Heating/Cooling Strategy, Supporting Sustainable District Heating Development in EU Member States'** ([→](#)). Afternoon session: **'Removing Barriers for Biogas in a circular agro-economy'** ([→](#))
- 15-03-2016; Oral presentation on the **'Cost-Effectiveness of Bio-Energy Support Schemes'** ([→](#)) during the Conference 'Biomass what are the best ways to use it?', Novi Sad, Serbia.

## BIOTEAM at:



The EU BC&E conference in 2014 and 2015

The Netherlands Climate Pavilion at COP21 in Paris 2015



School of the Environment, Nanjing China in 2015

COP21 - CMP11  
**PARIS 2015**  
UN CLIMATE CHANGE CONFERENCE



Biomass Conference, Novi Sad, Serbia in 2016



EU Sustainable Energy Week, Brussels, Belgium, 2015



## Vita Tilvikiene (LRCAF) on the regulation of biogas production in Lithuania

BIOTEAM Final event 16-02-2016



"Organizers of the event "Removing barriers for biogas in a circular agro-economy" indicated the barriers for biogas development in various countries. One of the most meaningful topics was the importance of the digestate treatment in agriculture. I assume that the expressed ideas should be analysed at the national or regional level in our country."

**Remigijus Bagdonas**, Ministry of Agriculture of the Republic of Lithuania

### III. BIOTEAM Local Outreach

#### Lithuania

- 04-06-2014; Poster presentation on '**Biomass bioenergy methods and technologies in the country and in Europe**' during the National Exhibition "Agrovizija 2014" in Akademija, Lithuania.
- 29-01-2015; Oral presentation and discussion during the **national BIOTEAM workshop on solid biomass** held during the annual conference of Lithuanian Research Centre for Agriculture and Forestry. Girionys, Lithuania.
- 10-03-2015; Oral presentation and discussion on '**Biomass energy development at European context**' (→) at the national workshop-conference Biogas: environmental, technological and economical aspects. Vilnius, Lithuania.

#### The Netherlands

- 19-05-2015; Guest lecture on the '**Sustainability performance of bioenergy pathways in the Netherlands**' and '**Market mapping of district heating and fibreboard production in the Netherlands**' for an Indonesian delegation of policy makers as part of the Executive course on public and private partnership practices for integration of natural resources management and renewable energy utilization in Indonesia. Amsterdam, the Netherlands.
- 09-12-2015; BIOTEAM National Expert Workshop on '**the environmental impacts of biogas produced from animal manure**', Utrecht, the Netherlands.
- Nov, 2015 to Feb, 2016; Publication of two BIOTEAM **policy briefs on district heating** in the Netherlands, via Dutch Heat Network Association (Stichting Warmtenetwerk) and Euroheat & Power Association → →
- 25-02-2016; Oral presentation on '**Sustainable manure management: the market for biogas and organic fertilizers**' during the members event of the Dutch Nutrient Platform in Groenlo, the Netherlands. →
- 09-03-2016; Oral presentation on '**Integrated Manure Management**' during the partner platform event of the Dutch Green Gas Foundation (Groen Gas NL) in Amersfoort, the Netherlands. →



Eise Spijker (JIN) on Sustainable manure management during the assembly of the Dutch Nutrient Platform on 25 February, 2016, Groenlo, the Netherlands.

<https://twitter.com/NutrientP/status/702864957315162112>



Andrzej Szajner (BAPE) talking with participants at the BIOTEAM Final Event on 16 February 2016.

On the 25 of February 2015, our Polish project partner, the Baltic Energy conservation Agency (BAPE) organized a successful BIOTEAM seminar. More info on the Polish seminar ([→](#))

### Poland

- 15-06-2014; Article on **'Bioenergy in BIOTEAM Project'**; National monthly magazine 'Czysta Energia' -'Clean energy', No 6/2014 (154)
- 20-06-2015; Article on **'Sustainability of pellet and biogas pathways'**; National monthly magazine 'Czysta Energia' -'Clean energy', No 6/2015 (166)
- 20-12-2015/20-02-2016; Publication of two BIOTEAM policy briefs on **'Development of pellet industry in Poland'** and **'Cogeneration in biomass DH systems in Poland'**, published via Association 'Energy and environment conservation' (SAPE) Poland ([→](#))
- 16-06-2015; Oral presentation and discussion on **'Sustainability parameters in pellet production in Poland and EU countries'**; 12th International Fair of Devices and Technologies for Pellet and Briquette Industry "PELLETS-EXPO & BRIQUETTES-EXPO", Bydgoszcz, Poland.
- 17-06-2015; Oral presentation and discussion on **'Sustainability parameters in biogas use in Poland and EU countries'**; 2nd International Biogas EXPO, Bydgoszcz, Poland.

### Finland

- March 2014; Article on Journal of the farmers' organization/Science supplement (Maaseudun tulevaisuus/Maaseudun Tiede 3/2014) **"Metsäenergian kestävydessä painavat myös alueelliset vaikutukset"** (**Regional impacts are crucial in the sustainability of forest energy**).
- 19-11-2014; Oral presentation and discussion on **"Sustainability of biogas"** in Bioenergy specialist seminar in Helsinki, Finland.
- December 2015 and March 2016; A series of two articles in the journal "Suomen Sahayrittäjät" (Finnish Sawmill Entrepreneurs' journal): **"Suomen päästövähennykset eivät toteudu ilman pienyrityksiä"** (**SME:s are crucial in GHG emission reductions in Finland**) (issue 4/2015) and **"Ilmaston lämpeneminen Suomessa – hyvä vai huono uutinen?"** (**Climate warming in Finland – good or bad news?**) (issue 1/2016).
- 6-5-2015; Oral presentation and discussion on **"Bioenergy sustainability assessment"** in Social Acceptability Study (SAS) Network meeting in Espoo, Finland.
- 27-1-2016; Luke blog on **"District heating prices go wild in Finland"** ([→](#)).



On 9<sup>th</sup> of April 2016 our Finnish project partners (LUKE - UEF) organized a national stakeholder workshop, where stakeholders were asked to identify a number of key barriers (and solutions) for biogas deployment in Finland. Picture shows the barriers (orange notes) and solutions (pink notes).



Dr. Lars-Peter Lauen speaking during the BIOTEAM Final event.

On the 19<sup>th</sup> of November 2015, our German project partner, the University of Göttingen (UGOE) successfully conducted the weighting workshop for the MCDA application as a side event at the 15<sup>th</sup> Bioenergy Convention held at the Trier University of Applied Science's Environmental Campus Birkenfeld (→)

## Germany

- 20-11-2014; Oral presentation and discussion at the **National BIOTEAM Workshop on the Biomethane Market Map** (→) held during the 14<sup>th</sup> Biomass Conference in Birkenfeld, Germany.
- 27-11-2014; Oral presentation on BIOTEAM during PhD (U4) workshop in a session on **"Sustainability and Resource Efficiency"** in Goettingen, Germany
- 18/19-11-2015; Oral presentation and discussion at the **National BIOTEAM Workshop on Sustainability Criteria Weighting** held during the 15<sup>th</sup> Biomass Conference in Birkenfeld, Germany.
- October 2015; Publication of the article **"Pellets haben die Nase vorn"** (pellets are a step ahead) on the Sustainability Analysis and national and international pathway assessment in the "Pelletmagazin" (pellet magazine).

## Italy

- 28-01-2015: National workshop **"Solid biomass&forestry: what is the key for sustainable development?"**, Turin, Italy (→) hosted by the Chamber of commerce of Turin, chairing of sessions and oral presentations on the BIOTEAM optimization of biomass pathways and market systems
- 10-06-2015: bringing the experience of BIOTEAM project to stimulate and chair the round table on solid biomass uses within the regional workshop **"Energy for and from your territory"**, Turin, Italy (→)
- 14-02-2014: chairing of the round table on energy from solid biomass in the national event **"Forests and Energy: data, challenges and tools"**, Turin, Italy (→)
- 29,30-10-2013: Organization of the international workshop on biorefinery for the production of energy and bio-based products (→) with oral presentation on **BIOTEAM approach to sustainability performance and market mapping of biomass pathways**.



Picture: (left) Franco Molteni

On 28 January 2015, Franco Molteni from BIOTEAM partner, Fondazione per l'Ambiente, chaired the round table session of the national event "Solid biomass/forestry: what is the key for sustainable development?", on 28 January 2015 Turin, Italy

## IV. BIOTEAM Final Event – 16 February 2016

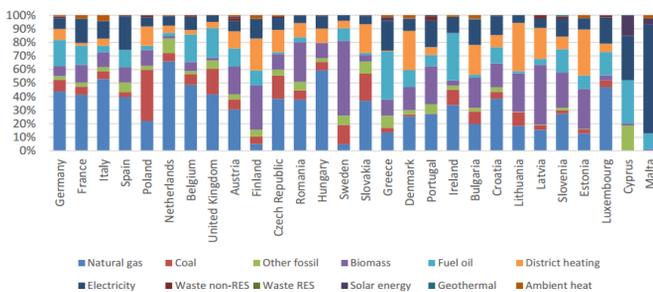
### About the event

On the 16<sup>th</sup> of February 2016, the EU co-funded [BIOTEAM project](#) came to a close. On that day the BIOTEAM consortium organized their final event. The morning session (10:30 to 13:15) focused on supporting sustainable district heating in EU Member states. The afternoon session (12:45 – 17:00) discussed the role of biogas in the European Circular Economy. About 100 participants attended the two events with 50 people attending the session on district heating and 50 people the biogas session.

### Morning session: Jump start the EU heating / cooling strategy

#### Supporting sustainable District Heating system development in EU

The EU's Heating and Cooling strategy ([→](#)), publicly announced on the same day of BIOTEAM final event, provides a framework to better integrate efficient heating and cooling into existing energy policies. The focus is on i) minimizing energy leakage from buildings, ii) maximizing the efficiency and sustainability of heating and cooling systems, iii) supporting efficiency in industry and iv) integrating heating and cooling with the electricity system. The strategy builds on the availability of existing smart technological solutions in this sector. It intends to jump-start a new integrated approach for heating/cooling into the ongoing review of relevant EU policies in the field of demand side management, energy efficiency and renewables.



[final energy consumption in the EU, 2012 – EC COM(2016) 51 final, 16.2.2016]

The relevance of this approach for EU's energy system cannot be understated. Heating and cooling, today is the single largest EU's energy sector, totalling 50% (550 Mtoe) of final energy consumption, supplied through a broad mix of technology (see graph above).

### The role of the District heating

In the technology portfolio shown above, District Heating (DH, in orange) represents 9% of the EU's heating, with a primary energy mix of about 40% natural gas, 29% coal and 16% biomass. DH was chosen as a key topic of the final event due to its versatility, the good links with renewables, incl. biomass, its ability to provide cheap (thermal) energy storage in smart communities and especially for its potential to link to dense stakeholder networks in urbanised areas.

In decarbonising urban environments, where also the local air pollutants have a serious impact on human health, DH holds a great potential to be a key strategic option in post-COP21 roadmaps. During the event presented and discussed many factors that hamper the further development of DH systems.



**“District Heating is mainly a policy and implementation problem, not a technology one”**

David Connolly, HeatRoadMapEurope 2050  
[\(→\)](#)

## The regulatory challenges

Lack of investments in some European areas on the one hand, and unfavourable price developments in some EU Member States on the other, have degraded the generally positive consumers' perception of DH. Already, the availability of different space heating solutions is increasing the technology competition at local level. The monopolistic position of the DH supplier towards connected end-users, potentially high heat prices (in absence of sound regulatory frameworks), high network costs for new systems, and finally the potential switching costs for customers, are all factors that are heavily influencing public perceptions and expectations of DH systems.

The presentations during the BIOTEAM event clearly show that the regulatory framework for DH across Europe is highly diverse. *Daniele Russolillo* (→) from Fondazione per l'Ambiente – Turin School of Local Regulation presented the challenges for the Italian energy agency. The agency is in charge of the regulation of DH services, which is organized through concession schemes at the municipal level.

*Kaija Hakala* (→) from the Natural Resources Institute Finland has shown that recent DH heat price increases are 'pushing' Finnish users towards the use of heat-pumps, geothermal, and other 'off-grid' solutions. *Vita Tilvikiene* (→) from the Lithuanian Research Centre for Agriculture and Forestry illustrated the robust price control regulation in Lithuania.

**“Internalization of DH environmental benefits could dramatically change heat price perspectives”**  
*Ingo Wagner, EuroHeat&Power*

*Paul Voss and Ingo Wagner from the Euroheat&Power Association joined the BIOTEAM final event discussion on District Heating* (→)

## The way forward to low carbon district heating

The regulatory challenges for DH are linked to the need of a 'new market model' and more integrated policy framework. The heating and cooling strategy is an important first step in this process. *Eise Spijker* (→) from Joint Implementation Network showed that in the Netherlands the economics of the entire value chain of low carbon DH systems is under pressure and that for example innovative finance is needed for heat grid investments.

Some areas in Europe are facing significant challenges for a deep decarbonisation of DH. In the case of Poland, of *Andrzej Szajner* (→) from the Baltic Energy Conservation Agency, focused on the policy paradigm shift that is needed to eventually phase-out coal, which covers 75% of DH primary energy in Poland.

**“DH infrastructure financing is key for the local public sector where barriers are relevant”**  
*Beatrix Wiedmer, CEEP Energy Task Force*

The platform discussion was really useful to gather insights from key DH stakeholders who represented operators ([EuroHeat&Power](#)), Municipalities in charge of DH ([CEEP](#)) and academic research ([HeatRoadMap Europe 2050](#)). The main lesson learnt is that the range of incentives for local DH stakeholders need to be aligned and that, even if the competition with natural gas is tough, sustainable DH is possible and desirable given the large volumes of heat currently being wasted.

The policy and implementation challenges are formidable, but low carbon district heating holds great development potential!

## Afternoon session: Removing barriers for biogas in a circular agro-economy

The biogas event built upon the strategic package on the Circular Economy, which was recently adopted by the European Commission. The strategy aims at extracting the maximum value from primary and secondary raw materials by fostering the efficient use of resources, such as biomass.

Agriculture is a key sector for further developing the Circular Economy. The sector is accustomed to biomass cascading and is driven to use resources efficiently. Biogas production fits in the Circular Agro-Economy not only as an option to increase the production of renewable energy, but also has the potential to contribute to reduce GHG and other emissions, while enabling the recycling of valuable nutrients, like phosphates, for soil fertilization.



**“Environmental benefits [of organic fertilizer production] are not monetized.”**

Chris Thornton, European Sustainable Phosphorus Platform (→)

One of the key observations during the event was that for sustained future expansion of the biogas sector, not only continued renewable energy support is needed, also recycling and re-use of soil nutrients and the production of organic fertilizers from digestate needs to be promoted. This requires a more integrated and coherent approach from policy making in the area of renewable energy, fertilizers and the environment (air, climate, water, soil).

With several EU countries putting more emphasis on enhancing the cost-efficiency of their renewable energy support schemes a stable

future role for biogas in the renewable energy portfolio's is not automatically ensured. In many EU countries there remain barriers that cause re-use or disposal of digestate to be a cost-factor for biogas.



**“An integrated approach for anaerobic digestion is needed, by linking the Circular Economy with the Energy Union.”**

Nicolas de la Vega, European Biogas Association (→)

Market actors are well aware that 'integrated investment projects', to produce organic fertilizers in combination with biogas hold great synergy potential. However, conditions for such investments are challenging within most policy and market environments where not all delivered products and (environmental) services are 'valorized'.

### Unexploited biomass resource potential remains

As a result of regulatory inconsistencies, policy barriers and marginal economics several BIOTEAM countries reported unexploited biomass resource potential. *Taija Sinkko* (→) from the Natural Resources Institute Finland indicated remaining potential for using grasses in Finland, while *Vita Tilvikiene* (→) from the Lithuanian Research Centre for Agriculture and Forestry mentioned that, due to continued decline in livestock there is an increasing agricultural potential for cultivating energy crops.

*Eise Spijker* (→) from Joint Implementation Network, pointed out the large domestic potential of using animal manure for biogas production in the Netherlands. All these three speakers referred to the unfavourable economic prospects of exploiting these resources for biogas production under current support regimes.



**"The general public perception of bioenergy from biomass creates an uncertain climate for investments."**

Ms. Dominique Dejonckheere, COPA\*COGECA (→)

### How to optimize? And what is cost-efficiency?

Lars Lauven (→) from the University of Göttingen discussed the issue of optimum plant capacities and considered the cost-effectiveness of different capacities in Germany. He observed large deviations between theoretically optimal and actual biogas plant capacities, indicating that capacities and input materials are largely dependent on the subsidy regime in place. He also concluded that handling and processing of digestate can significantly influence the economics of biogas, but that this depends on local circumstances regarding the use of (processed) digestates as fertilizer.

### Valorization of digestate for production of organic fertilizers

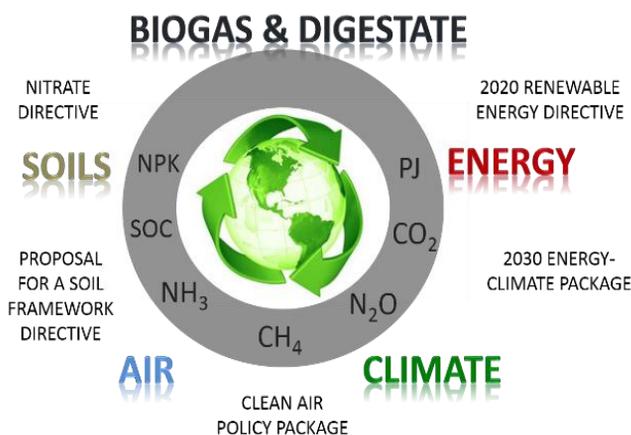
Most speakers recognized that in addition to several regulatory issues related to organic fertilizer production and use, also the economics of organic fertilizers need to improve. Also the environmental services delivered from the integrated production of biogas and organic fertilizers are not yet valued in current support structures.

Daniele Russolillo (→) from Fondazione per l'Ambiente – Turin School of Local Regulation indicated that in anticipation of national (and EU) law the Piedmont Region in Italy published a Decree with "Guidelines for the classification of digestate as by-product."

Eise Spijker (→) from Joint Implementation Network pointed out the significant methane emission reduction potential of manure digestion that is currently not financially rewarded in the Dutch feed-in support scheme (SDE+).

### Towards a more integrated, 'Circular Economy Proof' policy framework

During the platform discussion two main items were discussed. First and foremost, there is a direct need to develop quality standards, and ensure quality control and traceability of organic fertilizers. Secondly, a more coherent and integrated policy framework for the Circular Economy is needed. The elements of such a framework are all present, such as the EU's renewable energy directive, fertilizer regulations, air quality policy and the Circular Economy package (see figure below).



There was a common understanding that the various relevant policy elements are currently not yet at the right level of coherence and sometimes can even send the wrong signal to the market.

The key conclusion of the biogas event was that we need to start building a 'Circular Economy Proof' policy framework!

## V. Assessment methods used in BIOTEAM

The BIOTEAM project started with a series **Life Cycle Assessments** (LCA) of a selection of bioenergy pathways in the six BIOTEAM countries. The next step in the work plan was to develop an **inventory of policy instruments** which were considered most influential on the success (or failure) of these bioenergy pathways. These assessment were followed by a participatory stakeholder consultation process called market mapping. This enabled the project partners to better understand and describe **the dynamics of the market systems** in which the bioenergy pathways have to operate.

The final activity explored the social, economic and environmental 'optimization dilemma' to understand better what is locally regarded as the most sustainable use of biomass resources. With the help of **Multi-Criteria Decision Analysis** (MCDA) the consortium was able to explore the impact different sustainable development priorities on the preferred ranking of various (bio)energy options.

### On Life Cycle Assessments

**Method:** Life Cycle Assessments (or **LCA**) is a well-established method to assess the (environmental) impact of a certain value or supply chain. LCA's can be performed on may type of impacts. Within BIOTEAM a series of social, economic and environmental indicators were selected to assess the overall sustainability of bio-energy pathways.

**Reports:** Within all six BIOTEAM countries combined a grand total of 36 bioenergy pathways, as well as about 20 fossil energy pathways were assessed on their net impact on a total number of 18 indicators. All BIOTEAM partners made use of the Advanced Version of the report 'Harmonized Pathway Sustainability Assessment Framework' as a methodological reference guide ([→](#)).

On top of that each country also developed a Comparative Assessment (**CA**) report where a national comparison was made between all six bioenergy pathways. In addition an international comparison was made on a selection of comparable bioenergy pathways.

At the national level, the sustainability performance of the various types and forms (liquids, solids, gases) of bioenergy was evaluated and discussed; while at the international level the sustainability performance of, for example, several biogas CHP pathways were compared. To access the LCA data reports and the CA reports, see the download box on the right hand side.

## Sustainability indicators

<b>Environmental</b>	Greenhouse gas emissions
	Acidification
	Particulate matter
	Chemical usage
	Water use
	Nutrient losses
	Net energy balance
<b>Economic</b>	Land use
	Internal rate of return
	Repayment period
	Land price effects
	Contribution to national economy
	Product price difference for the end user
<b>Social</b>	Production costs
	Employment
	Effect on regional economy
	Job quality
	Property prices
	Change in environmental status and well-being
	- Noise
	- Smell
- Aesthetics	

## Bioenergy pathways

	Solids	Biogas
NL	Wood pellet co-firing in coal plants	Agro-food residues for biomethane
	Wood chips for district heating	Manure digestion for biomethane
PL	Wood pellets for domestic heating	Biogas from maize for CHP
	Biomass CHP plant	Compressed biomethane from landfills
DE	Wood pellets for domestic heating	Biogas from maize
	Biomass CHP plant	Biomethane from maize
IT	Small-scale wood chip boilers for heat	Manure and maize silage for biogas electricity
	Wood-based district heating	
	Wood chips pyro-gasification for CHP	Biogas from MSW for CHP
FI	Wood-based district heating	Biogas from wastes and residues
	Wood-based CHP plant	Municipal waste based biogas
LT	Wood-based CHP	Industrial and agricultural residues for biogas
	Wood pellets for household heating	Waste water sludge for biogas

\*Overview excl. liquid biofuel pathways

	LCA reports	CA reports
<b>Netherlands</b>	<a href="#">→</a>	<a href="#">→</a>
<b>Germany</b>	<a href="#">→</a>	<a href="#">→</a>
<b>Lithuania</b>	<a href="#">→</a>	<a href="#">→</a>
<b>Poland</b>	<a href="#">→</a>	<a href="#">→</a>
<b>Finland</b>	<a href="#">→</a>	<a href="#">→</a>
<b>Italy</b>	<a href="#">→</a>	<a href="#">→</a>

## On Market Mapping

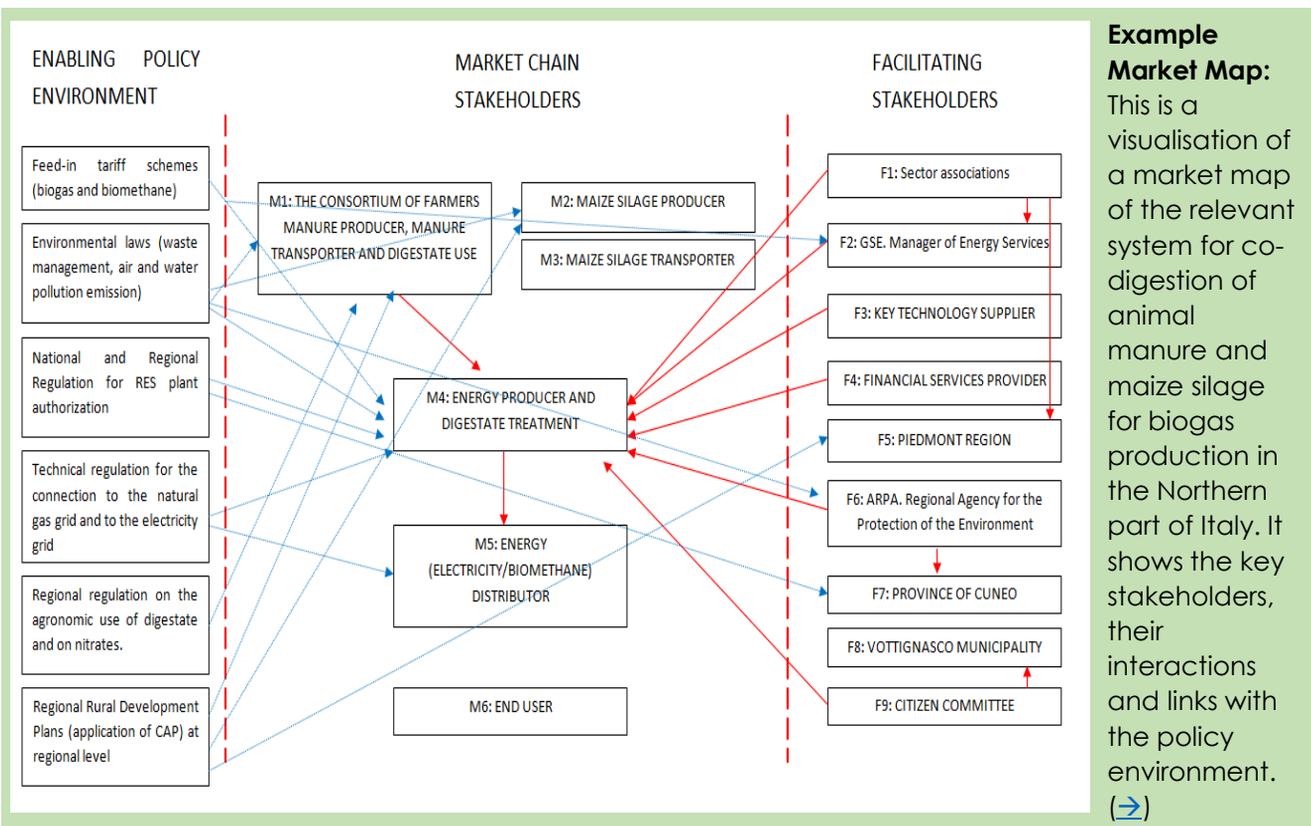
**Method:** System mapping (also known as market mapping) is an analysis tool that was initially developed by (Albu & Griffith, 2005) to closely examine the characteristics of the markets into which small farmers in developing countries might enter. The analysis consists of a description of three core elements: the business enabling environment; the market chain; and the supporting services.

In the EU FP7 projects (ENTTRANS, 2008) and (APRAISE, 2014) system mapping was used to identify with case study country stakeholders the system inefficiencies or blockages which would impede an acceleration of the development, deployment and diffusion of low emission energy technologies identified for such sectors as energy production, energy consumption in buildings and residential dwellings, transport and waste. System mapping is furthermore included in the toolbox for the Global Technology Needs Assessment (TNA) project (UNEP DTU Partnership, 2016). In the TNA project, the tool is used by developing countries for an analysis of the system for deployment or diffusion of a prioritised climate technology, identification of system barriers and elaboration on actions to clear these barriers. These actions are then included in a Technology Action Plan.

Based on the system map, an overview of barriers can be identified by stakeholders ('what are blockages in the system to successful implementation of a prioritised climate technology option?').

**Reports:** In all six BIOTEAM countries a total of 12 market system mapping assessment reports have been developed for a selection of biogas-based and solid biomass-based bioenergy pathways. The reporting comprises out of an extended data/information report (*long*) and a shorter non-technical synthesis report (*short*) with findings on the key effects of external shocks (such as policy or market changes) on the behaviour of stakeholders in the market system.

	Market Map Biogas		Market Map Solids	
NL	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>
DE	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>
LT	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>
PL	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>
FI	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>
IT	<a href="#">Long</a>	<a href="#">Short</a>	<a href="#">Long</a>	<a href="#">Short</a>



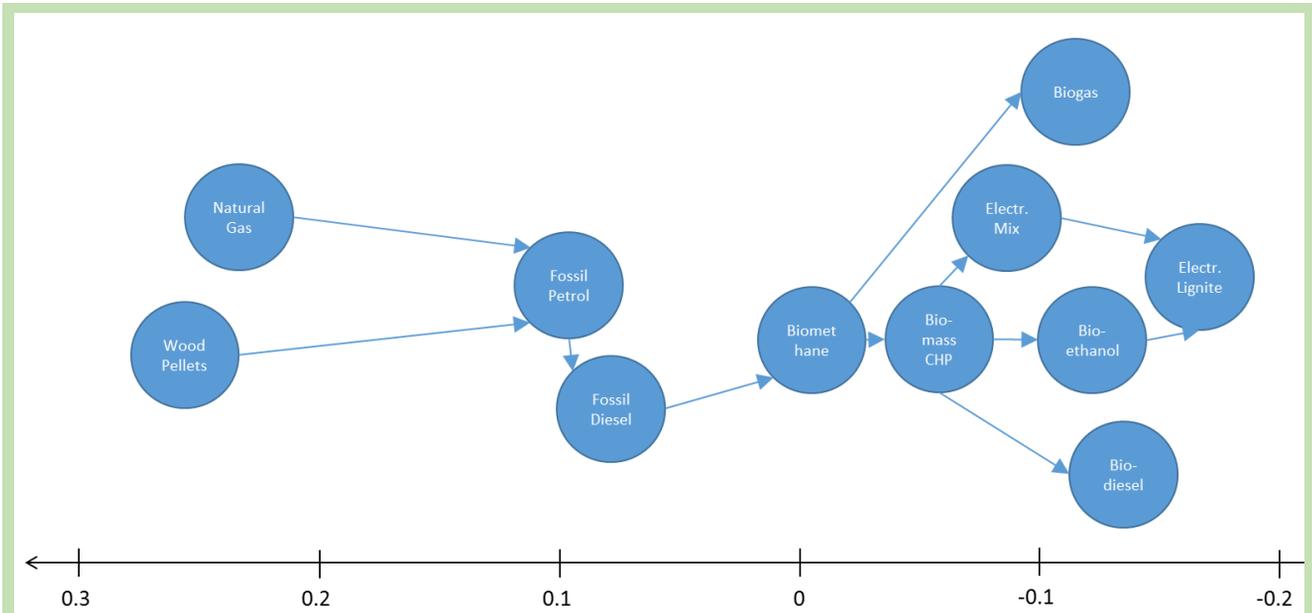
## On Multi Criteria Decision Analysis

**Method:** In MCDA methods, several alternatives are compared based on at least two criteria while referring to personal preferences of one or more decision makers. Thus, they allow the consideration of several goals, where qualitative and quantitative criteria can both be included. These features are very useful when assessing the sustainability of bioenergy pathways. On the one hand, MCDA methods can provide the basis for a recommendation or order different alternatives. On the other hand, the structured decision process itself can lead to new insights and support the understanding of the decision problem.

PROMETHEE was chosen because it is an outranking method which does not allow complete compensation of bad criterion values by good criterion values. This feature is especially important when assessing the sustainability of alternatives. Furthermore, the method is very transparent and comparatively easy to understand, assuring that stakeholders, who may not be experts in the field of MCDA, comprehend the decision process. A good understanding of the decision process also increases the acceptance of the MCDA results.

**Reports:** For each of the six BIOTEAM countries an MCDA assessment has been performed so as to discuss the implications of different weightings on the preferential order of (bio-)energy pathways. The MCDA reporting was performed as a way in which different co-benefits and trade-offs of bioenergy and fossil energy can be compared in order to derive a ranking (or pre-order) of alternatives. It was found that such weighting and ranking is highly context-specific and should always be tailored to a specific situation. MCDA has proven to be a robust and flexible method to create more transparency in decision making on bioenergy support (access MCDA country reports via download box).

MCDA reports	
NL	<a href="#">➔</a>
DE	<a href="#">➔</a>
LT	<a href="#">➔</a>
PL	<a href="#">➔</a>
FI	<a href="#">➔</a>
IT	<a href="#">➔</a>



### Example weighting and ranking alternatives:

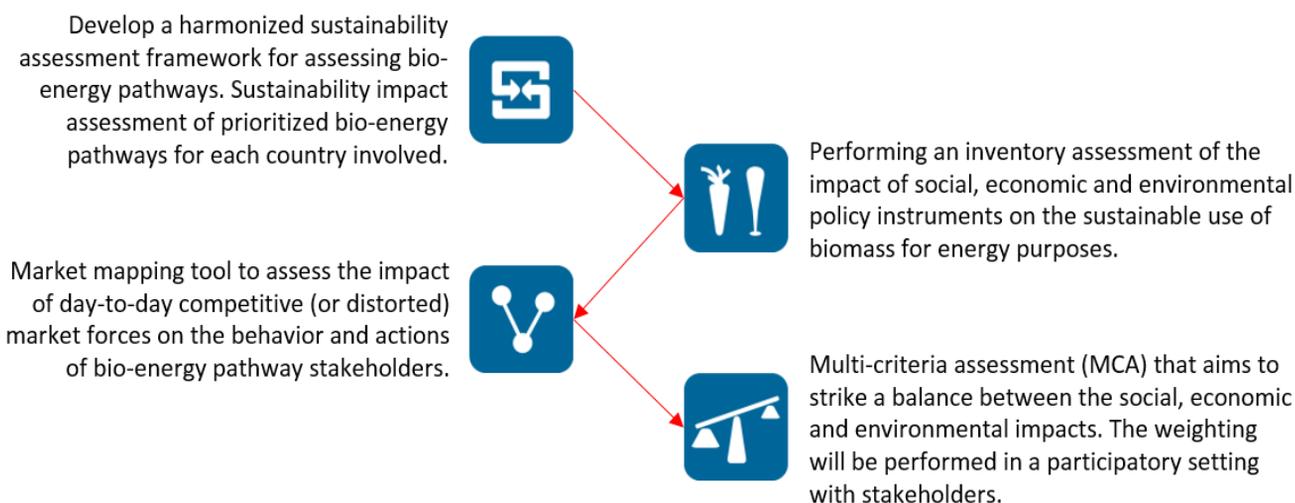
Partial pre-order of bioenergy and fossil energy pathways in Germany according to a specific weighting of social, economic and environmental indicators. The report also shows pre-orders based upon different weighting/preference profiles ([➔](#))

Sustainability categories	Ecology	Economy	Society
	weight	weight	weight
Environmental	57.1%	27.8%	33.3%
Economic	28.6%	55.5%	22.2%
Social	14.3%	16.7%	44.5%

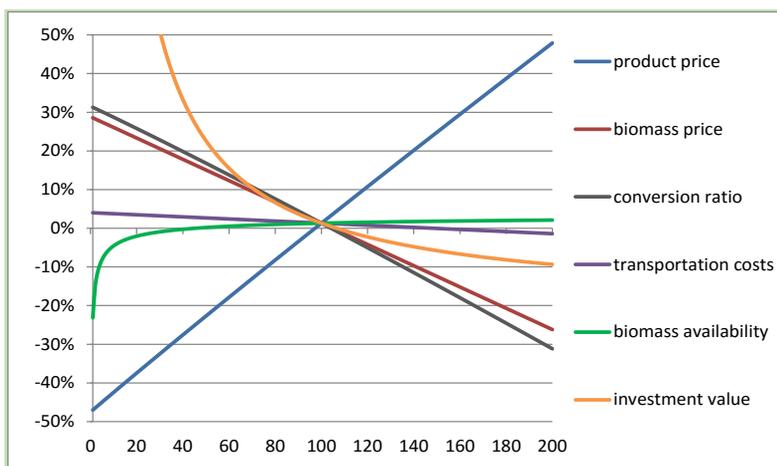
## VI. About BIOTEAM: 4 Key Activities

The BIOTEAM project comprises out of 4 key activities, 1) Pathways, 2) Policies, 3) Systems and 4) Optimization. These four key activities build upon each other (see Figure). The Pathway Sustainability Assessment has been performed with the help of Life Cycle Assessments (LCA) performed in each country, while the Systems analysis was executed with the help of market mapping (see Section IV).

Part of the optimization analysis was executed with the help of Multi-Criteria Decision Analysis (see also Section 5). The other work on optimization made use of a 'micro-economic optimization model' that uses different financial – economic parameters to determine the optimal plant capacity and maximize profitability. These assessments were performed at a country level based upon a selection of bioenergy pathways, in order to be able to discuss and anticipate investor reactions to changes to current legislation and subsidy regimes related to bioenergy developments. The results and discussions presented in these reports are intended to help public and private stakeholders to better understand the fundamental policy and economic drivers of specific bioenergy pathways.



The BIOTEAM work on 'Policies' primarily focussed on assessing which set of policy instruments have a certain impact on the various actors that are active in bioenergy pathways. Together with relevant public and private stakeholders a short-list of key policy instruments was derived per bioenergy pathway. These key policy instruments were considered most influential on the success (or failure) of specific bioenergy pathways. The policy inventory assessment was an essential input for the market system analysis, where the effect of these policies on stakeholder behaviour was evaluated.

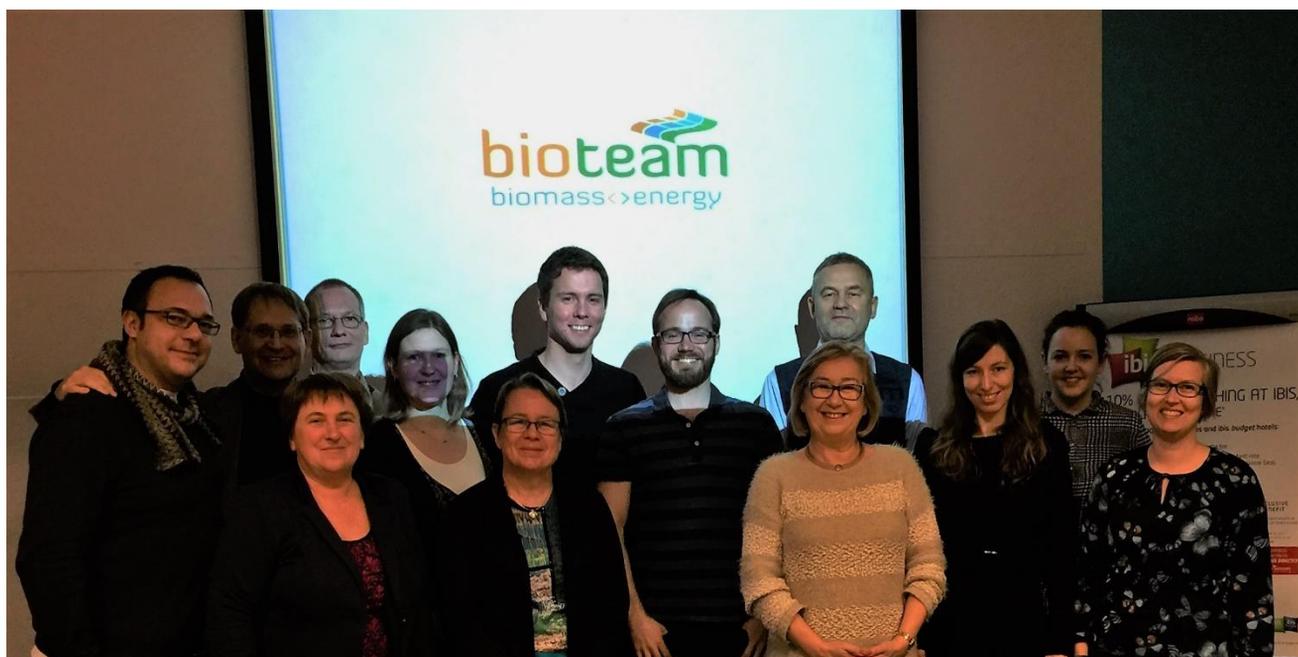


**Example micro-economic optimization:** ROI sensitivity analysis for a biogas plant with capacity of 2,000 kW<sub>el</sub> in Poland. It was found that with a growing share of manure in total mass of input, the ROI would have a tendency of gradual growth, until reaching about 70% in the biomass supply (calculated in mass value). For a higher share of manure transport costs would increase quickly and effectiveness of the plant would lower rapidly (→)

	Policy Inventory (long)	Policy Inventory (short)	Micro-Economic Optimization
Netherlands	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>
Germany	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>
Lithuania	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>
Poland	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>
Finland	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>
Italy	<a href="#">→</a>	<a href="#">→</a>	<a href="#">→</a>

## VII. Insights the BIOTEAM partners want to share with you!

Within this section, all BIOTEAM partners will take the floor and share with you their own key messages and lessons learned. If you want to get a better understanding of the diverse nature of the work performed within BIOTEAM you are highly advised to check the messages from the countries and persons of your interest.



On this picture the majority of the consortium partners gathered in Brussels, Belgium. The photo was taken one day after the successful final event held on the 16<sup>th</sup> of February 2016. This was the last (BIO)TEAM meeting within the frame of the EU co-funded project. (picture: from left to right)

- **Daniele Russolillo** from Fondazione per l'Ambiente T. Fenoglio di Torino, Italy ([→](#))
- **Aki Villa** from the University of Eastern Finland ([→](#))
- **Zydrė Kadziulienė** from the Lithuanian Research Centre for Agriculture and Forestry, Lithuania ([→](#))
- **Eero Fors** from the University of Eastern Finland ([→](#))
- **Vita Tilvikiene** from the Lithuanian Research Centre for Agriculture and Forestry, Lithuania ([→](#))
- **Kaija Hakala** from the Natural Resources Institute, Finland ([→](#))
- **Eise Spijker** from Joint Implementation Network, the Netherlands ([→](#))
- **Lars Lauven** from the University of Göttingen, Germany ([→](#))
- **Katarzyna Grecka** from the Baltic Energy Conservation Agency, Poland ([→](#))
- **Andrzej Szajner** from the Baltic Energy Conservation Agency, Poland ([→](#))
- **Krisztina Szendrei** from Joint Implementation Network, the Netherlands ([→](#))
- **Beatriz Bayer** from the University of Göttingen, Germany ([→](#))
- **Taija Sinkko** from the Natural Resources Institute, Finland ([→](#))

## Joint Implementation Network (JIN) - Climate & Sustainability

JIN Climate and Sustainability is a knowledge centre focusing on climate change policy issues in general and the concept of emissions trading in particular. JIN was established in 1995 and is based in Groningen (the Netherlands). Since 2001, JIN has regularly worked on EU-funded projects in the areas of climate change, sustainable development, bioenergy, energy efficiency, and development and transfer of technologies for climate and development.



### Ms. Krisztina Szendrei – Researcher at Joint Implementation Network



[krisztina@jin.ngo](mailto:krisztina@jin.ngo)

#### Wants to share with you:

*"The development of an efficient policy framework to facilitate a new market model for district heating systems in the Netherlands is rather challenging. District heating is a locally generated and traded product contrary to natural gas that is available through the extensive public grid. Policy makers need to consider these differences and opt for a mix of policy instruments to support district heating systems rather than using a 'copy-paste policy approach' based on the customs from the natural gas sector."*

#### Suggested BIOTEAM content

BIOTEAM policy brief on **'District heating systems: Breaking the monopoly?'** ([→](#)).

BIOTEAM policy brief on **'Options for a new market model to promote low carbon district heating systems in the Netherlands'** ([→](#))

### Mr. Eise Spijker – Researcher at Joint Implementation Network (BIOTEAM project coordinator)



[eise@jin.ngo](mailto:eise@jin.ngo)

#### Wants to share with you:

*"In addition to direct support for bioenergy (and renewables), also targeted and cost-efficient fossil fuel phase-out strategies are needed. In order to facilitate the energy transition, more insights are needed in the co-benefits and trade-offs of bio-energy pathways as well as from fossil energies. Transparency in environmental and social impact accounting at the level of value chains is needed to provide policy makers and the general public with more balanced information that fuel decision making and public perceptions."*

#### Suggested BIOTEAM content

07-12-2015; Side-event at the Netherlands Climate Pavilion on **'Green Growth and Bioenergy. The risks of NOT integrating climate strategies with other development objectives'** during the COP-21 in Paris, France 2015 ([→](#)).

15-03-2016; Oral presentation on the **'Cost-Effectiveness of Bio-Energy Support Schemes'** during the Conference 'Biomass what are the best ways to use it?', Novi Sad, Serbia ([→](#))

March 2016; Special Project Report on **Integrated Sustainable Manure management in the Circular Economy** in the Netherlands ('Integraal Duuzaam Mestbeheer in de Circulaire Economie in Nederland') – special report (in Dutch [→](#)) / presentation (in English [→](#))

## Natural Resources Institute, Finland (LUKE)

### former MTT Agro-food Research

Researchers and specialists working in Luke provide new solutions towards the sustainable development of the Finnish bioeconomy and the promotion of new biobased businesses. Together with our partners we will build a society based on bioeconomy. Sustainable use of natural resources calls for advances in know-how and new business models – as well as close collaboration.



#### Taija Sinkko – Researcher at Natural Resources Institute Finland



[taija.sinkko@luke.fi](mailto:taija.sinkko@luke.fi)

#### Wants to share with you:

“Sustainability of bioenergy is commonly assessed by greenhouse gas emissions and other environmental indicators, but there is a need for wider considerations, i.e. also social and economic aspects should be considered. However, it is not easy to compare sustainability assessment results of bioenergy to fossil energy as some indicators say bioenergy is better and some say it is worse. For this, there is a need to use Multi Criteria Decision Analysis (MCDA) to find out which pathways are more favourable than others. ”

#### Suggested BIOTEAM content

Article on Journal of the farmers` organization/Science supplement (Maaseudun tulevaisuus/Maaseudun tiede 3/2014) **“Metsäenergian kestävydessä painavat myös alueelliset vaikutukset” (Regional impacts are crucial in the sustainability of forest energy).**

Project report, Deliverable 5.2 **“Strategic bioenergy decisions using Multi Criteria Decision Analysis in Finland”** (→).

#### Kaija Hakala – Principal Researcher at Natural Resources Institute Finland



[kaija.hakala@luke.fi](mailto:kaija.hakala@luke.fi)

#### Wants to share with you:

“Sustainability of bioenergy generation varies between countries and bioenergy pathways. In most cases usage of bioenergy helps to reduce greenhouse gas emissions. Depending on priorities per country, different aspects of sustainability: environmental, social or economic may be crucial in choosing the pathway and means of bioenergy production. ”

#### Suggested BIOTEAM content

Policy brief about the **future threats of district heating** (→)

Talk about the **sustainability performance of bioenergy**, findings from the BIOTEAM project, at the EUBCE conference 2 June 2015 (→)

## Lithuanian Research Centre for Agriculture and Forestry (LRCAF)

The mission of LRCAF is the conduct of basic and applied research relevant for science, national economic development and ecological needs, rational and sustainable use of land, forest and environmental resources and high quality production. It aims to develop experimental and other activities in the fields of agronomy, horticulture, forestry science, ecology and other related branches to promote the sustainable use of land, the forest economy and rural development.



**LITHUANIAN  
RESEARCH CENTRE  
FOR AGRICULTURE  
AND FORESTRY**

### Ms. Vita Tilvikiene – Researcher at Lithuanian Research Centre for Agriculture and Forestry



[vita.tilvikiene@lammc.lt](mailto:vita.tilvikiene@lammc.lt)

#### Wants to share with you:

“Biogas production from agricultural biomass, organic residues is getting more and more popular in most of European countries; therefore high attention should be paid for the process. The profitability of anaerobic digestion is very much influenced by the effectiveness of digestate utilization. The use of digestate is very important in all the countries, but in different aspects – for GHG reduction, field fertilization and etc. All the environmental, economic and social indicators should be taken into account for the preparation of European and national legislation schemes.”

#### Suggested BIOTEAM content

Policy brief “**Digestate – residues or organic fertilizer?**” (in Lithuanian) ([➔](#))

Market system mapping report on **biogas CHP in Lithuania** ([➔](#))

### Ms. Diana Lukmine – Researcher at Lithuanian Research Centre for Agriculture and Forestry



[ekonsk@mi.lt](mailto:ekonsk@mi.lt)

#### Wants to share with you:

“As oil prices increased dramatically during last years and with climate change mitigation high on the agenda, targets and strategies for bioenergy are gaining momentum. Bioenergy will likely and inevitably play an important role in the future energy mix as we transition from a fossil fuel economy to an energy-efficient, renewables-based energy system. Rapid expansion of biofuels without adequate concern to risks and side-effects can indeed create many serious problems, therefore authorities should be particularly competent to prepare the bioenergy development programs.”

#### Suggested BIOTEAM content

Policy brief “**Changes in heating sector in Lithuania**” ([➔](#))

Market system mapping report on **Wood Biomass – source for heat production in Lithuania** ([➔](#))

## Georg August University, Göttingen (UGOE), Germany

### Chair of Production and logistics

Focus of our research activities is the cost-effective and ecology-oriented design of production and logistics systems.



GEORG-AUGUST-UNIVERSITÄT  
GÖTTINGEN

#### Dr. Lars-Peter Lauen – Post-Doc at University of Göttingen



[lars.lauen@wiwi.uni-goettingen.de](mailto:lars.lauen@wiwi.uni-goettingen.de)

#### Wants to share with you:

“The success of bioenergy pathways depends in large parts on their economic competitiveness compared to the prevalent alternatives. While environmental and social aspects make an important contribution to a pathway's sustainability, its economic attractiveness determines whether investments will be made and, through the subsidy scheme, whether taxes or other charges need to be raised. For bioenergy pathways, the choice of capacity (balancing economies of scale and transportation costs) and product portfolio (balancing investment requirements and plant income) are among the key variables to ensure lasting success. ”

#### Suggested BIOTEAM content

Reports from the BIOTEAM partner countries on micro-economic optimization of bioenergy (→)

#### Mr. Tim Schröder – Researcher at the University of Göttingen



[tim.schroeder@wiwi.uni-goettingen.de](mailto:tim.schroeder@wiwi.uni-goettingen.de)

#### Wants to share with you:

“There is not one single 'best' bioenergy pathway. The assessment of pathways is heavily depending on the preferences of the decision makers. Decision makers with a focus on environmental criteria may favour a different pathway than decision makers with a focus on economic criteria. Thus, the decision which pathways shall be promoted is not trivial and there may be more than one answer to this question. An MCDA analysis as it was performed in the BIOTEAM project helps decision makers to understand the complexity of the problem and to make informed choices.”

#### Suggested BIOTEAM content

2016; Application of a multi-criteria decision analysis (MCDA) method in order to assess the sustainability of bioenergy pathways in the six BIOTEAM countries. (→)

#### Mrs. Beatriz Beyer – Researcher at the University of Göttingen



[beatriz.beyer@wiwi.uni-goettingen.de](mailto:beatriz.beyer@wiwi.uni-goettingen.de)

#### Wants to share with you:

“Bioenergy pathways contribute to a more sustainable Europe. The MCDA analysis and bilateral comparison of biomass pathways and their fossil substitutes demonstrate the great potentials of bioenergy. Whereby a combination of strategies are needed for each country individually, due to different social and natural conditions, the differing strengths of each European country should be used to balance out their respective weaknesses. A stronger European cooperation, especially in terms of resources, could lead to a more favourable economic, social and ecological European energy market.”

#### Suggested BIOTEAM content

Deliverable 2.5 from the BIOTEAM partner countries - Life cycle inventory of the sustainability performance of bioenergy pathways – a comparative assessment. (→)

## Fondazione per l'Ambiente T. Fenoglio di Torino, Italy

Fondazione per l'Ambiente is a non-profit body that promotes research, communication and experts' training in the sector of environmental policies at local level.



Fondazione per l'Ambiente  
Teobaldo Fenoglio  
ONLUS

### Mr. Daniele Russolillo - Program Manager at Fondazione per l'Ambiente



[daniele.russolillo@fondazioneambiente.org](mailto:daniele.russolillo@fondazioneambiente.org)

#### Wants to share with you:

"The added value of applying a methodology like market mapping to complex pathways like the bioenergy ones, coupled with thorough sustainability assessment, has shown up clearly during BIOTEAM Project. Bioenergy systems are characterized by a strong relevance of the stakeholder network at local level.

BIOTEAM, developed a close relationship with market actors. These interactions made the Consortium realize that for effective policy making and a better regulatory framework, valuable insights from the stakeholders, a clear identification of actors and enabling institutions, and a deep understanding of the relationship among the stakeholders is key. On a more personal note, the different contexts and issues in Partners' Countries have enriched my ability to develop a larger systemic view of biomass sustainability".

#### Suggested BIOTEAM content

16-02-2016; "**Challenges regarding the development of the Italian district heating regulatory framework**" during the BIOTEAM Final Workshop in Brussels, Belgium ([→](#))

29-03-2013; "**Sustainability performance and market mapping of biomass pathways for energy and non energy uses**" during the international workshop "Biorefinery for the production of energy and bio-based products", Turin, Italy ([→](#))

### Mrs. Alice Montalto – Former researcher at Fondazione per l'Ambiente



#### Wants to share with you:

"The BIOTEAM project made clear that in Italy a more efficient, transparent and simplified policy framework is needed in order to foster the bioenergy transition. Research projects with a multisector approach and focus on sustainability / green growth (environmental, economic and social) are crucial in order to support policy makers in building robust policy frameworks.

At the European level, we should head towards a better policy integration among EU countries taking into account the numerous benefits deriving from the exploitation of cross-national synergies of bioenergy pathways."

#### Suggested BIOTEAM content

28-01-2015; "**Optimizing pathways and market systems for enhanced competitiveness of sustainable bio-energy**" during the national workshop "Solid biomass/forestry: what is the key for sustainable development?". Turin, Italy ([→](#))

## The Baltic Energy Conservation Agency (BAPE), Gdansk, Poland

Baltic Energy Conservation Agency (BAPE) was established in 1996. The mission of the company is to promote and support the activities aimed at increasing the energy efficiency, rational energy utilization and wider usage of renewable energy sources in building and industrial sectors.



Baltycka  
Agencja  
Poszanowania  
Energii Sp. z o.o.

### Dr Andrzej Szajner – Vice-President of Baltic Energy Conservation Agency, Gdansk, Poland



[aszajner@bape.com.pl](mailto:aszajner@bape.com.pl)

#### Wants to share with you:

"Future of Polish renewable energy sector, including bioenergy pathways, is not clear. The old certificate system has proved to be inefficient and in everyday practice the system has been abused and expected goals have not been met. Heat and energy based on coal dominate the energy market. However obligations for 2020 are declared to be met. Comprehensive sustainability analysis, using tools developed within BIOTEAM project and MCDA method, taking into account opinions of representative stakeholders from bioenergy sector shall determine the best utilisation of domestic renewable resources and stimulate efficient incentives systems. This would improve largely quality of environment and support local communities."

#### Suggested BIOTEAM content

Article on '**Sustainability of pellet and biogas pathways**'; National monthly magazine 'Czysta Energia' - 'Clean energy', No 6/2014 (154) (in Polish)

Policy brief '**Cogeneration in biomass DH systems in Poland**'; website of the Association "Energy and environment conservation" SAPE-Poland ([→](#))

### Katarzyna Grecka – Vice-President of Baltic Energy Conservation Agency, Gdansk, Poland



[kgrecka@bape.com.pl](mailto:kgrecka@bape.com.pl)

#### Wants to share with you:

"Selection of the bioenergy path should be a result of bioenergy utilization analysis and objective evaluation of competing paths. Such analyses show that, in many cases, the use of pellets for energy purposes is the right solution leading to greenhouse gas emissions reduction as well as lower level of local pollution deriving from heat supply systems. However, the current support schemes for project implementation are insufficient. They should take into account the development of local labour markets as well as social aspects."

#### Suggested BIOTEAM content

Oral presentation and discussion on '**Sustainability parameters in pellet production in Poland and EU countries**'; 12th International Fair of Devices and Technologies for Pellet and Briquette Industry "PELLETS-EXPO & BRIQUETTES-EXPO", Bydgoszcz, Poland; 16.06.2015

Policy brief "**Development of pellet industry in Poland**"; website of the Association "Energy and environment conservation" SAPE-Poland ([→](#))

## University of Eastern Finland (UEF)

UEF is a multidisciplinary university, which offers teaching in more than 100 major subjects. We have four faculties: the Philosophical Faculty, the Faculty of Science and Forestry, the Faculty of Health Sciences, and the Faculty of Social Sciences and Business Studies.

Our activities underscore multidisciplinary. Our key interdisciplinary research areas are built around four global challenges. These challenges are Ageing, lifestyles and health; Learning in a digitised society; Cultural encounters, mobilities and borders; and Environmental change and sufficiency of natural resources.



UNIVERSITY OF EASTERN FINLAND

### Dr. Aki Villa – Researcher in the University of Eastern Finland, the School of Forest Sciences



[aki.villa@uef.fi](mailto:aki.villa@uef.fi)

#### Wants to share with you:

“Bioenergy is a holistic way to use energy. In many cases, it is environmentally, economically and socially sustainable. The biggest advantage of bioenergy is its locality. It cycles local, sun based resources into different energy and material products. At the same time, it creates regional benefits for individual people and societies. Europe consists of regions and the main aim of the EU policies should encourage this diversity and local people’s possibilities to live on their land. We need predictable, supporting and long-lasting policies which offer positive signals to investors and entrepreneurs to invest into efficient and sustainable forms of bioenergy and bio-based products. In addition to that, we need versatile research which strengthens the foundation of three dimensions of sustainability – environment, economy and society.”

#### Suggested BIOTEAM content

Market system mapping report on **wood chips district heating in Finland** (→)

### Eero Forss – Researcher in the University of Eastern Finland, the School of Forest Sciences



[eero.forss@uef.fi](mailto:eero.forss@uef.fi)

#### Wants to share with you:

“There is no question that the future of mankind lies heavily in the use of renewable energy. In BIOTEAM, experts from various European countries were brought together to contribute to the green economy. It was not just the academic work but also getting to know each other and circumstances in the different countries that inspired. The inclusion of stake-holders (practical actors, decision makers etc.) brought clear added value through insight, experience and ideas. This kind of trans-boundary interaction and co-operation is one key to achieving sustainable results in combatting our common enemy, climatic change.”

#### Suggested BIOTEAM content

Comparative Sustainability Assessments of Finnish Bioenergy pathways (→)