BioTrade2020plus

Supporting a Sustainable European Bioenergy Trade Strategy

Intelligent Energy Europe
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Deliverable 4.1

A survey of online tools for information on biomass supply chains

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The BioTrade2020plus Project

Objectives

The main aim of BioTrade2020plus is to provide guidelines for the development of a **European Bioenergy Trade Strategy for 2020 and beyond** ensuring that imported biomass feedstock is sustainably sourced and used in an efficient way, while avoiding distortion of other (non-energy) markets. This will be accomplished by analyzing the potentials (technical, economical and sustainable) and assessing key sustainability risks of current and future lignocellulosic biomass and bioenergy carriers. Focus will be placed on wood chips, pellets, torrefied biomass and pyrolysis oil from current and potential future major sourcing regions of the world (Canada, US, Russia, Ukraine, Latin America, Asia and Sub-Saharan Africa).

BioTrade2020plus will thus provide support to the use of stable, sustainable, competitively priced and resource-efficient flows of imported biomass feedstock to the EU – a necessary pre-requisite for the development of the bio-based economy in Europe.

In order to achieve this objective close cooperation will be ensured with current international initiatives such as IEA Bioenergy Task 40 on "Sustainable International Bioenergy Trade - Securing Supply and Demand" and European projects such as Biomass Policies, S2BIOM, Biomass Trade Centers, DIA-CORE, and PELLCERT.

Activities

The following main activities are implemented in the framework of the BioTrade2020plus project:

- Assessment of **sustainable potentials of lignocellulosic biomass** in the main sourcing regions outside the EU
- Definition and application of sustainability criteria and indicators
- Analysis of the **main economic and market issues of biomass/bioenergy imports** to the EU from the target regions
- Development of a dedicated and **user friendly web-based GIS-tool** on lignocellulosic biomass resources from target regions
- **Information to European industries** to identify, quantify and mobilize sustainable lignocellulosic biomass resources from export regions
- **Policy advice on long-term strategies** to include sustainable biomass imports in European bioenergy markets
- **Involvement of stakeholders** through consultations and dedicated workshops

More information is available at the BioTrade2020plus website: **www.biotrade2020plus.eu**

About this document

This report corresponds to D4.1 – A survey of online tools for information on biomass supply chains. It has been prepared by: Stiching DLO.

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1. Introduction

One of the important outputs of the BioTrade2020plus project is a “dedicated and user friendly interactive tool based on GIS and an integrated user interface, accessible through a website, compiling all the relevant information and knowledge (e.g. biomass supply, demand and quality requirements, and policies within the EU and elsewhere) regarding different lignocellulosic biomass and bioenergy carriers from target regions, intended for use by industrial players, policymakers and other stakeholders.” (See Annex 1 of Description of Work, 2013)

For the design of this tool two parallel activities have taken place in work package 4 in 2014: first, a user requirements analysis based on interviews held with 50 stakeholders at the 2014 Biomass conference in Hamburg. Deliverable 4.2 reports on these interviews (Requirements of end users for the interactive BioTrade2020plus tool, 2014).

The second activity undertaken to provide input for the design of the BioTrade2020plus tool, is an evaluation of existing tools for exploring or assessing issues in bioenergy and biomass. This evaluation identifies useful elements in functionality and data presentation. Moreover, it helps to determine added value and unique qualities of the BioTrade2020plus tool in comparison to the other tools.

This document provides an overview of existing tools that supply information on biomass production and trade, in so far as they offer data or functionality that is relevant for the development of the BioTrade2020plus tool.

2. Design of the BioTrade2020plus tool: requirements analysis

The overall objective of WP4 is to elaborate a web-based easy to use interactive tool that is based on existing biomass supply tools and fully adapted to the main end-user requirements. The interactive tool's main goal is to provide detailed spatially explicit cost-supply information on biomass sources, to assist in the identification of sustainable origins of imported solid biomass from the targeted sourcing regions.
The requirements for the tool, which are necessary for the design, development and user evaluation, are derived from three sources:

1. the project the project outputs: objectives and the work that is currently being developed. All project results should be accessible through the tool
2. interviews with prospective users of the tool;
3. evaluation of existing tools.

Already in the description of work (Annex 1 of the DOW) a list of requirements for the tool was specified which will be covered for sure in the development of the tool. These requirements include the following:

1. Web-based access via the main user interface;
2. Display of data and information in map and tabular format for a pre-selected territorial area, reference year, current and future scenario situations;
3. Provision of selection and conversion functionality to choose and switch units/currencies, select desired biomass feedstocks, zoom desired areas and perform simple user-weighted analyses of the sustainability of the quantities shown (e.g., tonnes dry mass, tonnes/ha, kJ, in €/tonne d.m., €/GJ);
4. Allow for regional searches, i.e. in the case of determine the area needed to supply a certain amount of feedstock or determine the amount of feedstock within a defined region or with a seasonal availability. Restricting the search to selected feedstock should be possible. If the data permits competition for feedstock with current use should be accounted for;
5. A download option for selected data in a selectable format for further analysis;
6. The tool will be readily adaptable to future developments, by allowing additional and new data to be added to the system;
7. For expert users functionality to allow for manipulation of basic calculations, enabling these users to address the assumptions underlying the presented data for example in relation to scenario specifications.

2.1 Requirements based on the project outputs

According to the project description the tool should provide information focussing on the following sourcing regions which include the different Case Studies defined whithin BioTrade2020plus project scope:

- North America: USA;
- South America: Brazil, and Colombia
- South East Asia: Malaysia, Indonesia;
- Eastern Europe: Russia, Ukraine;
- Southern and Eastern Africa.

The information provided for each region will include:

1. Sustainability risks per biomass type following a key set of sustainability indicators and a SWOT methodology;
2. Details of the sustainability schemes in place, the criteria covered in the schemes and the biomass trade flows covered by a scheme;
3. Overview of the regulatory framework implemented in and outside the EU affecting biomass imports into the EU;
4. Current and future international trade patterns and market segments of biomass resources and competing uses for non-energy applications and for local uses;
5. Key characteristics of the traded biomass particularly in relation to suitability for different conversion/pre-treatment pathways;
6. Support for matching cost-supply of biomass to price-demand patterns.

2.2 Requirements analysis using the results from the interviews with prospective users of the tool

At the 2014 Biomass Conference in Hamburg, 50 prospective users were interviewed on their information needs and expectations of an online interactive tool. The results of these interviews and conclusions on the requirements for the tool are described in Deliverable 4.2.

A summary of the main outcomes is shown below:

- The main information needs of the interviewees concern biomass resources availability and related topics such as markets, policies, and sustainability; and different types of conversion technologies. Choosing from a number of options, most interviewees expect a tool to offer “detailed spatially explicit cost-supply on biomass sources”. Information on cost-supply was most often wanted by interviewees involved in biomass conversion, collection and other related industry. The focus of the interviewees was on agricultural residues; on Europe (but half of the respondents also need information about other parts of the world) and on information on current and the next 10 to 20 years.

- In general the interviewees said that data must be accurate, up-to-date and maintained after the project time span; data must be well documented and traceable (including assumptions behind them, references, and the methodological approach); and the interface must be user-friendly. Examples of expectations of a tool, expressed by the interviewees are: “Up-to-date information on biomass cost-supply at local level”; “Biomass availability, characteristics, prices, exact location. Accurate enough to build a business case with”; “Detailed company information related to the technologies the companies work with and the markets they operate in”; and “Sustainability criteria, biomass policy on EU level”.

Only few interviewees at the moment use online interactive tools for their information needs on biomass.

2.3 Requirements analysis using the evaluation of online tools on biomass

An evaluation of existing tools that make information on biomass accessible, is expected to provide:

1. An overview of data categories provided most often by online tools, as well as data types and global regions that are not covered by existing tools;
2. An overview of functionality provided by online tools;
3. Best practices for the development of the BioTrade2020plus tool;
4. Weaknesses to be avoided.

For the evaluation of existing tools it was conducted a literature search and an online (Internet) search in spring and summer 2014. For each of the tools, we made a short description and assessed the following features:

- main goal;
- target users;
- aspects of chain covered by tool;
- type of user interaction;
- elements that are considered useful for the BioTrade2020plus tool;
- weaknesses (in relation to the project goals).

In the next paragraphs we provide an overview of the most important available instruments, using a framework based on a recent report of the NREL, the National Renewable Energy Laboratory (Milbrandt, A. & Uriarte, C. (2012): Bioenergy Assessment Toolkit). This report contains a comprehensive overview of existing tools; this includes online, interactive, map based tools as well as instruments such as databases, reports, and written guidelines.

The NREL report lists the available instruments according to their usefulness in a stepwise process in identifying bioenergy opportunities in a given area :

1. Assessment of biomass resources (examine feedstock availability – their quantity, location, and costs);
2. Assessment of the potential markets; including assessment of socio-economic and environmental impacts, policies and import/export opportunities;
3. A feasibility study to determine the economic viability of the bioenergy opportunity identified.

The results of the search are included in Appendix 1. The description is not exhaustive, but is limited to observations directly relevant for the design of the BioTrade2020plus tool.

3. Overview of online assessment tools for biomass delivery chains

3.1 Biomass resource assessment tools

There are several tools already accessible via internet that focus on providing information on biomass availability and also support for integrating biomass into a biomass delivery chain. These tools provide support in the first step in development and scale-up of a bioenergy project. Tools that support this step and for which information has been collected include the Biomass Geo-Wiki, BIORAISE, the Biomass Inventory Mapping and Analysis Tool (BIMAT), the Bioenergy Atlas and BioSAT. In Annex 1 more detailed back-ground information is provided on all tools reviewed in this inventory. In the following a short description is given of the biomass resource assessment tools identified.

Biomass Geo-Wiki (http://biomass.geo-wiki.org/login.php?menu=home) is a platform built on Google maps to visualize, analyze and further improve environmental data sets in terms of biomass availability.

The BIORAISE tool (http://bioraise.ciemat.es/bioraise/intro.aspx) provides a calculation of biomass resource availability (agricultural and forestry primary, secondary and tertiary resources) for Spain, Portugal, France, Italy and Greece.

The Biomass Inventory Mapping and Analysis Tool (BIMAT) (Agriculture and Agri-food Canada; http://atlas.agr.gc.ca/agmaf/index_eng.html#context=bimat-ocib_en.xml) is an interactive mapping application that provides Internet-based GIS functionality to query and visualize biomass inventory data. Users are able to make informed decisions based on spatially-explicit information that presents a comprehensive view of biomass quantity and opportunity in Canada. Biomass supply and location information is made available through a collection of thematic maps and interactive queries of the herbaceous and woody databases.

The BioEnergy Atlas (NREL; http://maps.nrel.gov/bioenergyatlas/) includes two interactive maps for the U.S.A., BioPower and BioFuels. These interactive geospatial applications allow users to view biomass resources, infrastructure, and other relevant information, as well as query the data and conduct initial screening analyses on for instance biofuels potential for a given area, and biopower production for a selected feedstock in a specific area.

The BioSAT tool (http://biosat.utk.tennessee.edu/BioSAT/index.html) is a web-based economic decision-making framework for agricultural and forestry biomass. It provides supply chain cost and logistics for cellulosic biomass markets and products. It covers part of the USA.

Most of these tools go beyond showing availability and locations and include economic information on the costs of the biomass. BIORAISE is designed for the calculation of biomass resources and transportation costs around selected locations on an interactive map. BioPower offers common conversion factors to determine the potential biopower production for a selected feedstock in a specific area. BioSAT does not provide a map-based interface but guides the users through a set of questions leading to a geographic-based economic cost assessment.

3.2 Market Analysis Tools

A second group of tools supports users in understanding existing and potential markets for biomass resources and possible barriers. They provide information on the state of technology and the country's experience with each technology; production cost; socio-economic and environmental impacts of biomass production and use; the policy framework in support of the biomass industry, and trade opportunities. We present here examples of tools for some of these information categories: BioPAD BISCUIT, RASLRES Bioenergy Tool, Bioenergy calculator, Biobased Economy Route Map, Waste to Biogas Tool, BeWhere, Biomassawerven, The Sustainability Quick Check for Biofuel (SQCB), Biograce, and the UN-Energy Bioenergy DST (Decision Support Tool). Several other tools exist (but are not further discussed here) that help users to assess specific aspects of technical installations, such as the Biomass Decision Support Tool, http://www.carbontrust.com/resources/tools/biomass-decision-support-tool (Carbon Trust, UK).
Some tools offer general help in understanding the full supply chain, such as **BioPAD BISCUIT** (http://www.biopad.eu/biscuit/). This online tool offers access to expert information about Bioenergy Supply Chains, outlining the steps required to take natural raw materials and turn them into valuable energy sources. BioPAD (Bioenergy Proliferation and Deployment) targets the Northern Periphery of Europe.

The RASLRES Bioenergy tool (http://www.raslres.eu/bioenergy-tool/) has been developed to stimulate key bioenergy markets, initially in Ireland, Northern Ireland, Scotland and Sweden. The tool provides local, regional and national information for users and suppliers on wood fuel, as well as energy alternatives such as reed canary grass and marine biomass.

The Bioenergy Calculator (http://www.raslres.eu/bioenergy-tool/bioenergy-calculator/) is an intelligent component of the RASLRES Bioenergy Tool that allows users to calculate the approximate financial and emissions saving they can make by switching for fossil fuels to biofuel for their energy needs.

3.2.1 Technology Evaluation Tools

The tools identified in this category focus completely on the technology available to convert biomass into energy. These type of tools are not available (yet) at large scale. Underneath only one example of such a tool is presented.

The Biobased Economy Route Map (http://www.biobasedeconomy.nl/routekaart/) is an interactive infograpic that aims to provide a better understanding of biomass delivery chains that make up the biobased economy. The tool visualises a nodal network including pre-treatment, conversion routes, intermediate and final products produced and provides explanations for technologies that are involved.

3.2.2 Techno-Economic Analysis Tools

Several tools have been developed to support users, especially economic operators, in finding advantageous locations for their installations. The tools generally include some of the factors that determine the suitability of locations.

The Waste to Biogas Tool (http://epamap21.epa.gov/biogas/index.html) is designed for decision-makers with significant technical expertise in the fields of waste management, wastewater treatment, and renewable energy. It connects organic waste

producers and potential users (e.g. wastewater treatment facilities) for the purpose of biogas production through co-digestion.

BeWhere(http://www.iiasa.ac.at/web/home/research/modelsData/Bewhere/BEWHERE1.en.html)developed by IIASA, is a techno-economic model that optimizes the location of bio-energy production plants based on the minimization of costs and emissions of supply chains. The model is not available for online use.

Biomassawerven (http://www.biomassawerven.nl/) is an online map of so-called biomass wharves in the Netherlands. These are installations where different biomass streams, including organic residue streams, are collected and processed, producing biobased materials, fuels and compost products.

3.2 Environmental Impact Analysis Tools

The tools in this category focus on the environmental impact of biomass delivery chains. They provide support in assessing certain environmental impacts which are quantifiable. Most of the tools in this category cover GHG emissions and some broader life cycle assessment support. The most well-known tools are presented underneath.

The Sustainability Quick Check for Biofuel (SQCB) (http://www.sqcb.org) is designed for a rapid assessment of key factors of individual production chains with life cycle environmental impacts of individual biofuels by combining data from reference data sets. It enables producers to check the compatibility of their biofuels productions with sustainability certification criteria. The tool allows the user to enter own data of the product life cycle for the parameters that (i) are most relevant and (ii) induce the highest variability for the environmental performance of a biofuel.

Biograce (http://www.biograce.net/home) is a biofuel greenhouse gas emission calculation tool offering a very specific support to economic operators that are involved in the development of a biofuel production chain in the EU. Biofuels delivered to the EU biofuel targets have to comply with the minimal mitigation requirements as specified in the EU Renewable Energy Directive (RED 2009/28/EC) and the Fuel Quality Directive (2009/30/EC). The Biograce tool enables the user both to further design and specify a chain and to make a calculation of the full life cycle emission of green house gas (GHG) in their biofuel chain.

3.4 Policy Analysis Tools

In the last category of tools information is made available to policy makers on biomass delivery chain development opportunities in order to develop road maps and strategies at local level. These type of tools are specifically targeted to policy makers, but also contain valuable information for inveters and researchers and consultants.

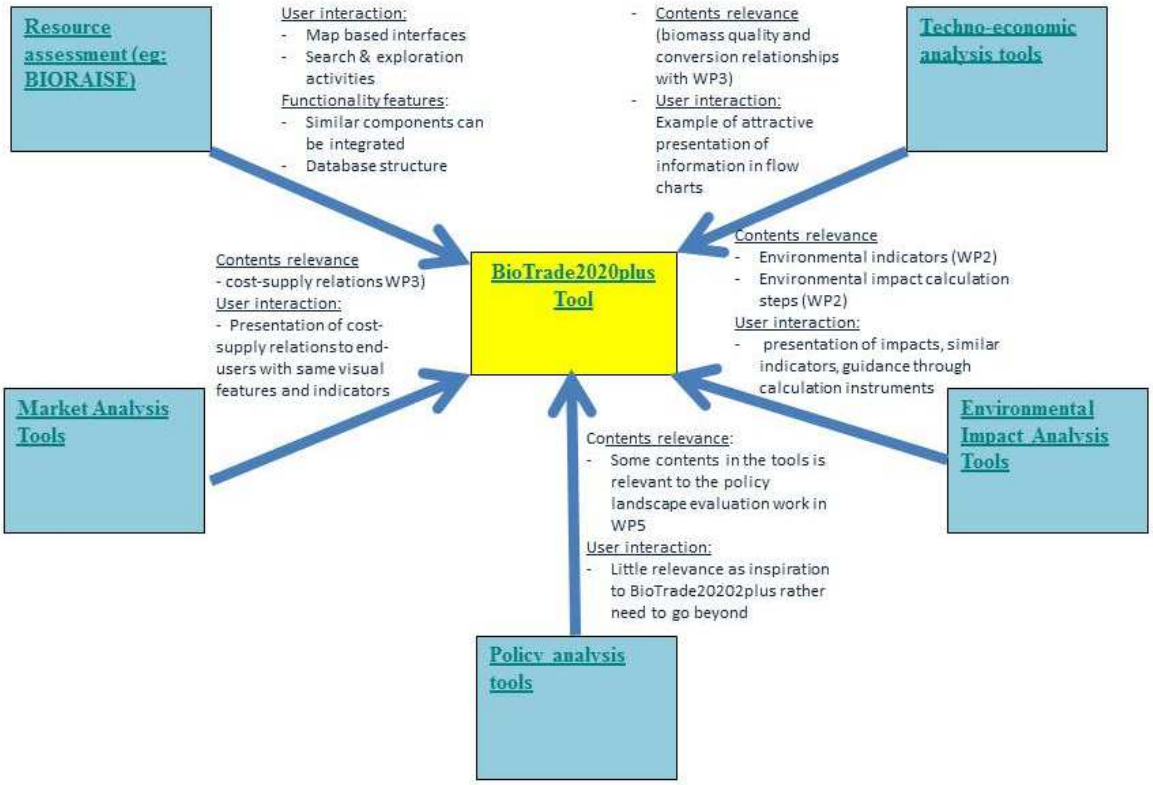
The UN-Energy Bioenergy DST (Decision Support Tool) (http://www.bioenergydecisiontool.org/bio_tool.htm) (FAO, UNEP) provides stepwise guidance to decision makers in governments to develop sustainable bioenergy policies and strategies, and to assess investment proposals. The tool consists of a website linking short descriptions of topics to chapters in an e-book.

The NREL report Bioenergy Assessment Toolkit also offers examples of (non-interactive) Trade Analysis Tools and Socio-Economic Impact Analysis Tools within the category Market Tools. It also provides examples of tools to conduct feasibility studies and roadmap activities, and for benchmarking. We have not identified usable, online, interactive tools that cover these issues.

4. Discussion and recommendations

The tools presented here are very diverse in regards to the data they include, regions they cover, their functionalities and information presentation. We nevertheless attempt to draw some general conclusions that are relevant for the design of the BioTrade2020plus tool and summarize these into recommendations.

The BioTrade2020plus tool will offer a combination of content and functionality found in 4 categories of tools discussed above: 1. resource assessment tools; 2. market analysis tools, especially 3. environmental impact analysis tools and 4. policy analysis tools. This is schematically specified in the next figure and explained underneath.



The resource assessment tools such as BIORAISE, are mostly map based, appropriate for the type of information the tools offer, and for the search and exploration activities of users. Map based interfaces generally allow users to zoom in to and select regions, and sometimes to conduct analyses on the data for selected regions. The interface of these tools will be evaluated more closely during the design process of the BioTrade2020plus tool, and features that support the usability of the tool and match the data and technical requirements will be included in the design.

The market analysis tools are generally not geographically oriented but guide the users through a number of steps and provide information on each step on market relations and responses. They cover market aspects on cost-supply relations which are to be integrated into the tool, but which need to be developed in workpackage 3 of this project. The main relevance of these tools for the development of the BioTrade2020plus tool it on the contents and the presentation of cost-supply relations.

The techno-economic analysis tools evaluated are limited as few of these are already available on-line. Their focus is on the technological conversion processes for biomass. It is exactly this part of the chain that is not addressed very deeply in BioTrade2020 plus. These tools can therefore only provide limited input on centents, except for information that focusses on the suitability of biomass for specific conversion processes which is relevant information to be shared with end-users to support them in finding best matches between imported biomass and conversion requirements. Links between BioTrade2020plus tool and these techno-economic analysis tools could provide end-users complementary information needed to set-up full biomass delivery chains. Another aspect the inventory of these tools provides is examples of how complicated technological information can be presented to end-users in an attractive and easy to understand way.

The environmental impact analysis tools evaluated typically include calculation instruments so users can make an assessment of their plans in an exploratory phase; however they differ considerably in complexity and presentation. The link between the BioTrade2020plus tool and these environmental impact analysis tools is especially on the level of the contents in relation to the environmental impact analysis and indicators. The latter are specifically addressed in WP2 of this project. WP2 of this project may use the indicators and calculation instruments of these existing tools as inspiration for the selection of indicators and calculation knowledge rules to be implemented in the BioTrade2020plus tool. Also the way the interaction with the end-user of these environmental assessment tools in relation to presentation of environmental risk analysis and impact analysis assessments and results can be an example for the design of the BioTrade2020plus tool.

Policy analysis tools that are currently accessible online, guide users through policy issues presenting descriptive documents. Other, more interactive techniques will be considered for enhancing the accessibility of the information on policies now collected and analyzed in work package 5. The design for this component will be developed in cooperation with WP5, but so far the tools available in this field seem to only providing access to documents and provide limited interactive exchange with the users. In that respect they are not very inspirational to the design of the BioTrade2020plus tool, but are actually useful as a benchmark for this project showing that support to policy makers can go beyond what is done so far in existing tools. BioTrade2020plus should be able to provide more ready to use information to end-users enabling to identify directly which policy stimulation measures and regulations are most relevant when importing biomass from outside the EU to the EU both in terms of opportunities and threats. The policy information gathered in WP5 will need to be linked to biomass types and full conversion pathways. The tools identified in this category so far do not provide this targeted interaction.

Finally the following general observations may be made on the use, content and functionality of the analyzed tools:

In the first place, the available documentation for the tools provides very little information on the target users and their specific information needs. The objectives of most of the tools are described in a general manner, suggesting that the tools are designed in the first place to make data sets available online; but not to meet specific information requirements of selected users or stakeholder groups. We have found no data on the use of the tools, nor feedback of users such as evaluations of the perceived usability and satisfaction of users. It is therefore difficult to assess the usefulness of these tools and their data presentations for different user categories and their information needs.

- **A recommendation for the BioTrade2020plus tool is to communicate clearly on the home page/landing page the target users for whom the tool is developed, and the type of information needs the data may meet. The tool should include a mechanism to collect data on the use of the tool, and evaluation of its effectiveness by users.**

In the examples discussed above, the research or policy organisation that developed the tool is also the main contributor of the data. In recent years however, we see a trend that websites and online data collections invite users or other stakeholders to provide feedback on the data (for instance to improve the quality) or contribute data. The Biomass Geo-Wiki platform is the only example we found of such an application. It includes different types of contributors and contributions, such as citizens' observations (Schepaschenko et al., 2012).

Crowd sourced data may enhance data accuracy, timeliness and comprehensiveness, but including, and managing these contributions require a different software system as well as organisation. The biomass and biotrade community would benefit from a participatory model in which they are both data users and providers.

- **The aim of the BioTrade2020plus project is to communicate research data to interested stakeholders and is not set up to deliver a participatory tool. However, a recommendation for the BioTrade2020plus tool is to consider this trend during the design and development phase and where possible allow users at least to comment on the data.**

A second general concern for these tools is whether the data are kept up to date. The tools that are developed in research projects, such as the BioSAT tool, are generally not updated after the project is concluded. Users may be confused and eventually disappointed because the tools are still available online and no notification is provided that the project is obsolete and information is outdated. The online tools that are updated regularly, often do not provide information on the frequency of these updates and users have to put in effort to retrieve the dates for the data sets.

- **A recommendation for the BioTrade2020plus tool is to indicate clearly for every data set the collection date, and the frequency of updates.**

Because most of the data provided by the tools have a geographic relation or component, the interface often includes a clickable map. Maps are easy to understand and use, and allow users to quickly find data relevant for their purpose. The maps in the tools often allow users to query the data and explore the outcomes in tables as well as on the map.

- A map based interface will be a useful presentation technique for most of the expected users of the BioTrade2020plus tool**.**

Some tools offer not only data but also calculation tools. These may help users for preliminary assessments when they consider setting up business. However, it is not always obvious how accurate and reliable the outcomes are.

- **If calculation tools are offered, users must be informed of the accuracy and reliability of the outcomes.**

Most tools offer information on specific regions but not on a global scale. The Biomass Geo-Wiki platform is an exception because it is aimed at global coverage.
Also, most tools provide understanding and support in setting up biomass delivery chains by addressing and facilitating only one or a few of the many aspects that need to be taken into account (Elbersen et al., 2014).

There is a need for tools that support of both 1. the design of a biomass delivery chain and 2. the assessment of the biomass delivery chain impacts in terms of environmental and economic implications on a global scale. **The BioTrade2020plus tool will address this need by providing information in one single tool on biomass availability, sustainability issues and economic aspects of the supply chain.**

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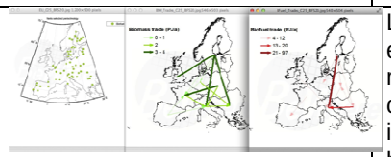
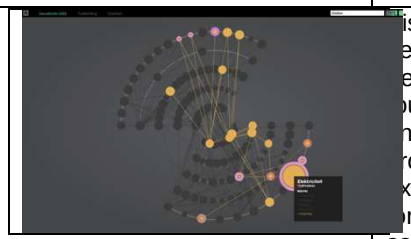
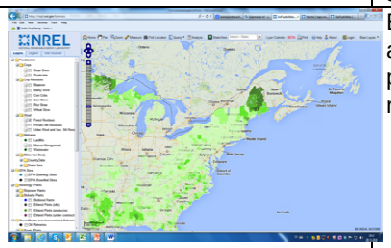
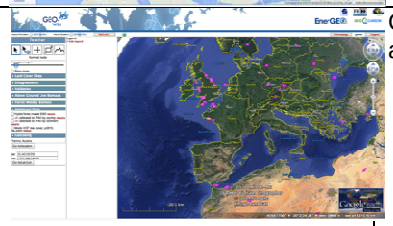
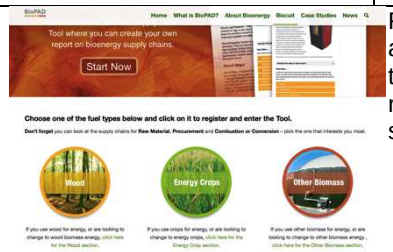
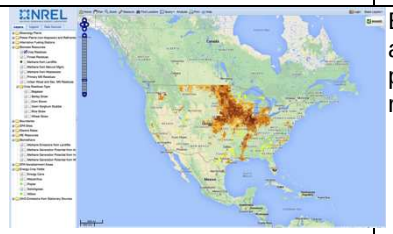
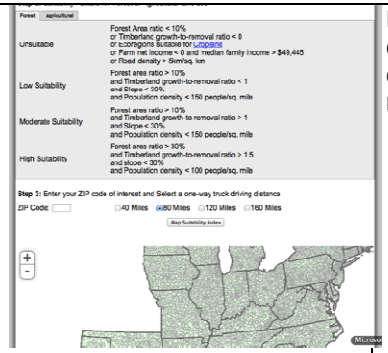
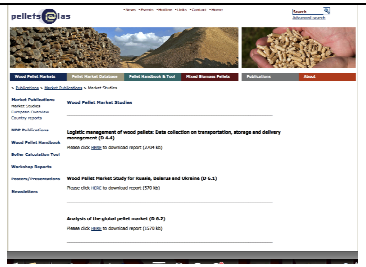
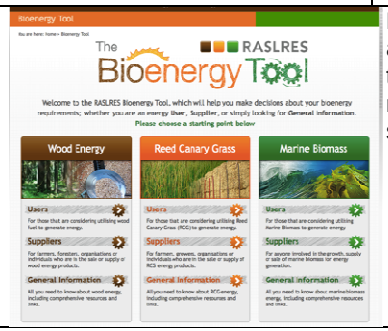
Appendix 1

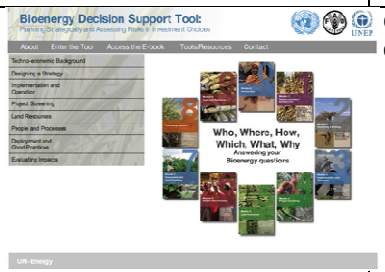
Online tools for information on biomass supply chains, in alphabetical order.

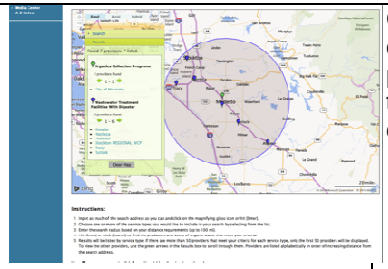
Name; url; developed by/for	Category of tool	Description	Screenshot	Aspects of chain covered by tool	Type of user interaction	Target users; other features
BeWhere; http://www.iiasa.ac.at/web/home/research/modelsData/Bewhere/BEWHERE1.en.html IIASA, Luleå University of Technology, Sweden,	Combination of Techno-economic and environmental impact analysis tool	Techno-economic model that optimises the location of bio-energy production plants based on the minimization of costs and emissions of supply chains. Includes wood waste, crop residues, lignocellulosic industrial waste and three different biofuel technologies (second-generation ethanol, methanol, and Fischer-Tropsch diesel).		Location and type of existing and new renewable energy conversion installations, total bioenergy mix, related costs and GHG emissions and mitigations.	Delivers the number and location of new production plants, the optimal technology selected, costs of each segment of the supply chain, bio-energy potentials, avoided emissions at the regional, national or EU level.	
Biobased Economy Route Kaart; http://www.biobasedeconomy.nl/routekaart/ Dröge & Drimmelen, Schwandt Infographics and Food & Biobased Research-Wageningen UR.	Techno-economic analysis tool	Interactive infographic providing an overview of chains that make up a biobased economy. Informative visual overview of all the chain nodes and technological processes involved.		isualises a nodal etwork including pre-eatment, conversion outes, intermediate nd final products roduced. Includes an xplanatory description r all technological aspects.	Web-based public tool; allows viewing of pre-selected information..	Users: general public. Goal is information visualisation and transfer; emphasis on engaging visualisation.
The BioFuels Atlas; http://maps.nrel.gov/biomass NREL (National Renewable Energy Laboratory, USA)	Resource assessment tool	The BioFuels Atlas enables geographically based analysis of U.S. biomass resources and potential biofuels production from these resources. It also overlays resource maps with features such as bioenergy and brownfield sites, distribution infrastructure, and power plants. Content is dynamic and updated as new data become available.		Biomass resources and potential biofuels production from these resources.	Map based, with selection of related topics through menus, and analysis function.	Not specified; easy to use and access.

Biograce; www.biograce.net Agentschap NL, ADEME, BIOENERGY 2020+ GmbH, BIO Intelligence Service, EXERGIA, IFEU, CIEMAT, STEM, LBST. The project was financed by Intelligent Energy Europe.	Environmental impact analysis tool with special focus on GHG calculation	Biofuel greenhouse gas emission calculation tool; calculation based on the methodology in Annex V of the Renewable Energy Directive (RED) (2009/28/EC).		The tools allows individual input numbers, calculates direct emissions including N□O field emissions, emission savings, improved agricultural management mitigation gains. 22 default biofuel pathways included in the tool.	Users can calculate their own GHG emission; define own standard values, add process steps and set up new biofuel production chains.	Users: expert users in policy and industry.
Biomassawerven; http://www.biomassawerven.nl/ BVOR (Netherlands)	Resource assessment tool with special focus on logistics	Online map of so-called biomass wharves in the Netherlands. At biomass wharves a diversity of biomass streams are collected and processes. Products include biobased fuels, compost products and raw materials.		Collection and distribution.	Map based. Selections are made on a.o. biomass types, products, certification.	Producers of compost, biogas, biomass from organic residual flows.
Biomass Geo-Wiki; biomass.geo-wiki.org GEO-WIKI Team IIASA, University of Applied Sciences Wiener Neustadt, University of Freiburg.	Resource assessment tool with special focus on crowd sourcing data for biomass potential assessment	Platform built on Google maps to visualise, analyse and further improve environmental data sets in terms of biomass availability.		Covers global biomass availability.	Offers global overview of available datasets, overlaid on the Google Earth platform to obtain a quantified overview of terrestrial biomass availability in uniform units. Users can also upload own data.	Users: mostly research community.
Biomass Inventory Mapping and Analysis Tool (BIMAT); http://www.agr.gc.ca/eng/?id=1363789978653#calc_biomass_inventory Agri-Geomatics Service; Agriculture and Agri-food Canada	Resource assessment tool for biomass potential assessment	BIMAT is an interactive mapping application that provides Internet-based GIS functionality to query and visualize biomass inventory data. Users can make well-informed decisions based on spatially-explicit information that presents a comprehensive view of biomass quantity and opportunity in Canada.		Biomass supply and location information. Estimate the cost of harvesting and transporting the agricultural residues to the specified location.	Internet-based GIS functionality to query and visualize biomass inventory data. Biomass supply and location information is made available through a collection of thematic maps and interactive queries of	

					the herbaceous and woody databases.	
BioPAD Biscuit; http://www.biopad.eu/biscuit/ Western Development Commission www.wdc.ie (Ireland), funded under the ERDF Interreg IVB Northern Periphery Programme (NPP).	Resource-assessment with wider focus on biomass availability and full chain development, e.g. biomass matching to conversion technology.	The BioPAD BISCUIT is an online tool that offers easy access to expert information about Bioenergy Supply Chains, outlining the steps required to take natural raw materials and turn them into valuable energy sourcesBioPAD (Bioenergy Proliferation and Deployment) targets the Northern Periphery of Europe.		Full-supply-chain approach to supporting the development of the renewable energy sector.	Decision support tool, offers stepwise guidance.	The tool allows anyone the opportunity to find out about bioenergy supply chains and the opportunities this renewable fuel source provides.
The BioPower Atlas; http://maps.nrel.gov/biopower NREL (National Renewable Energy Laboratory, USA)	Resource-assessment with focus on biopower	BioPower is an interactive map for comparing biomass feedstocks and biopower by location. This tool helps users select from and apply biomass data layers to a map as well as query and download biopower and feedstock data. The analysis function offers common conversion factors that allow users to determine the potential biopower production for a selected feedstock in a specific area.		Biomass resources and potential bioenergy production from these resources.	Map based, with selection of related topics through menus, and analysis function.	Not specified; easy to use and access.
BIORAISE; http://bioraise.ciemat.es/bioraise/intro.aspx Tercera Fase Software, S.L.U. for: CIEMAT, CEDER, BIOMA, SUDOE, Spanish Ministry of Economy.	Resource-assessment with focus on local biomass chain development.	Computer GIS-based tool designed for the calculation of biomass resources and costs existing around selected locations (in Spain, Portugal, France, Italy and Greece). .		The up-stream part of the chain is covered in terms of estimates of available biomass and costs.	Web viewer which displays the geographic environment of the included countries and relevant basic elements, e.g. location of producers and other market players. Calculated results presented in tables.	Users: involved in biomass, some knowledge required.

BioSAT tool; http://biosat.utk.tennessee.edu/BioSAT/index.html USDA Forest Service; The Southeastern Sun Grant Center; The University of Tennessee; North Carolina State University; Oak Ridge National Laboratory; U.S. Department of Energy; U.S. Department of Transportation; and U.S. Endowment for Forestry and Communities.	Resource-assessment with wider focus cost-supply ralations	BioSAT fuses layers of spatial and economic data together to create a relational database for geographic-based economic cost assessment for woody and agricultural residue biomass collection or processing demand centers.Web-based economic decision-making framework. It covers part of the USA.		Provides supply chain cost and logistics for cellulosic biomass markets and products.	Offers an easy to use guided assessment, as well as models and tools for advanced users.	Users: a broad client base interested in cellulosic biomass markets and products.
PELLETS@TLAS; http://www.pelletsatlas.info/ Funded by Intelligent Energy Europe.	Resource-assessment with focus on pellet market	The PELLETS@LAS is a public database providing up-to-date pellet market information based on comprehensive data collection for Europe. It aims to develop and promote transparency on the European fuel pellet market, to facilitate pellet trade and to remove market barriers, mainly information gaps but also local supply bottlenecks, production surpluses and uncertainties in quality assurance management.		Pellet market actors, prices, production, capacity and consumption.	Website including a collection of several outputs of the research project: database, handbooks, Wood Pellet Boiler Calculation Tool.	Stakeholders in European pellet market.
RASLRES The BioEnergy Tool; http://www.raslres.eu/bioenergy-tool/; Bioenergy calculator Northern Periphery Programme	Combination of resource-assessment and techno-economic analysis tool for full chain development	The RALRES pilot models use different technologies and biomass fuels to support locally managed – and owned – supply systems and business models for producing and using renewable energy. Ended in 2012.		Full-supply-chain approach to supporting the development of the renewable energy sector.	Decision support tool, offers stepwise guidance.	Fuel suppliers and fuel users. RASLRES's main aim is to increase the use and uptake of locally produced renewable bio-energy solutions in rural areas in the NPP region.

Sustainability Quick Check for Biofuel; http://www.sqcb.org/ SECO, Empa, Agroscope Reckenholz-Tänikon ART and HTW Berlin.	Environmental impact analysis tool focussing on full chain LCA of biofuel chains	This tool is designed for a rapid assessment of key factors of individual production chains with life cycle environmental impacts of individual biofuels by combining data from reference data sets. It enables producers to check the compatibility of their biofuels productions with sustainability certification criteria. It facilitates access to the international market for producers of biofuels in emerging countries, and therefore contributes to a more sustainable implementation and biofuels production.		Biofuel production.	The user can enter the most sensitive parameters of the life cycle of biofuels. Subsequently, the life cycle inventories of all process steps are computed and normalized to the functional unit of "driving one person km (pkm) with an average car". On this basis, life cycle impact assessment methods are applied with focus on greenhouse gas emissions and on total environmental impact points . The results are graphically compared to a biofuel reference path and to a fossil reference.	Users: biofuel producers.
UN- Energy Bioenergy Decision Support Tool (DST); http://bioenergydecisiontool.org FAO and the United Nations Environment Programme (UNEP) under the framework of UN-Energy.	Policy analysis tool	The DST provides stepwise guidance to decision makers in governments to develop sustainable bioenergy policies and strategies, and to assess investment proposals.		Considers the complete chain.	Includes a framework, E-book, and references to interactive tools	DST: users are decision makers in governments. Analytical tools: users are policy makers and project developers.

Waste to Biogas Mapping Tool; http://epamap21.epa.gov/biogas/index.html EPA (United States Environmental Protection Agency)	Resource and techno-economic analysis tool for biogas	The tool is an interactive map created to connect organic waste producers and potential users for the purpose of biogas production through co-digestion.		Covers the producers of biogas and the potential end-users in terms of address, type of activity.	Map-based; allows user to enter an address or city (in the USA, Pacific Southwest region) and select search criteria, to find the producers and users of organic waste.	This tool is designed for decision-makers with significant technical expertise in the fields of waste management, wastewater treatment, and renewable energy. This includes businesses, state and local governments, and non-profits.