Delivery of sustainable supply of non-food biomass to support a "resource-efficient" Bioeconomy in Europe

S2Biom Project Grant Agreement n°608622

D4.11

User guide for the S2BIOM integrated toolset

Version: 0.1

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SEVENTH FRAMEWORK PROGRAMME

About S2Biom project

The S2Biom project - Delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe - supports the sustainable delivery of non-food biomass feedstock at local, regional and pan European level through developing strategies, and roadmaps that will be informed by a “computerized and easy to use” toolset (and respective databases) with updated harmonized datasets at local, regional, national and pan European level for EU28, Western Balkans, Moldova, Turkey and Ukraine. Further information about the project and the partners involved are available under www.s2biom.eu.

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SEVENTH FRAMEWORK PROGRAMME

About this document

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Executive summary

This is the user guide for all components in the S2BIOM toolset. This report provides detailed guidelines to users of the S2BIOM toolset. First it provides a full overview of all components in the toolset and their functionalities. This is followed by specific user instructions for the more complicated tools integrated in the S2BIOM toolset. First the user instructions for the Policy data viewer are presented, followed by those for the biomass supply data viewer and for the biomass cost supply data viewer. In separate chapters the detailed user instructions are given for the more complicated tools developed the Bio2Match tool and the LocaGIStics tool.

The client side of the S2BIOM toolset is a web based system. Users can access the toolset by their web browsers. The final version runs on all major browsers.

www.biomass-tools.eu

The S2BIOM toolset contains all data, tools, documents and reports generated in the S2BIOM project. Under the different tabs in the main menu the user can click to get access to these different tools, data, documents and reports. The tools enable the user to interact with the results by making sub-selections for data of interest; or to design own biomass delivery chains and evaluate the performance; or to obtain to-the-point information on specific issues of relevance for developing biomass delivery chains. These can be key characteristics on logistical components, biomass conversion technologies, matching of biomass types with technologies, biomass potentials, cost and characteristics, biomass markets, sustainability issues, policies and regulations, and national biomass strategies.

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1 Introduction to using the S2BIOM toolset

1.1 Introduction and structure of the report

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www.biomass-tools.eu

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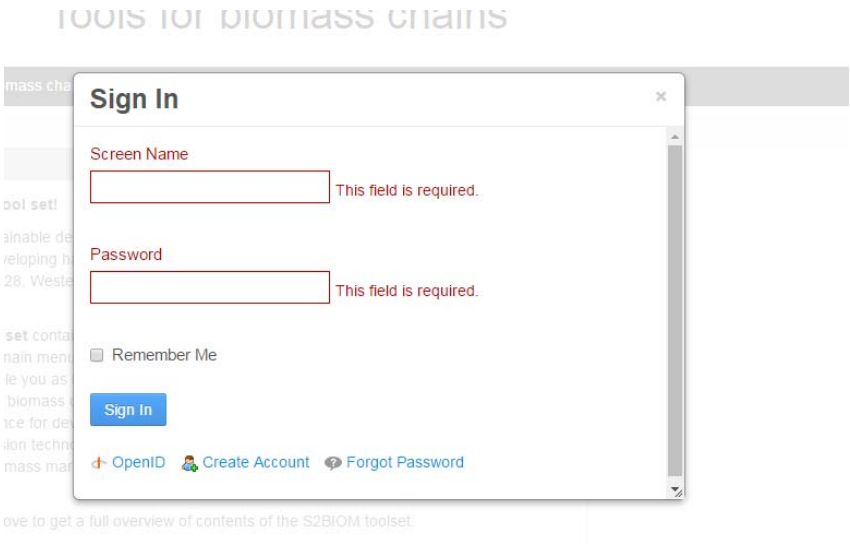
This is the user guide for all components in the S2BIOM toolset. This report has the following structure. In Chapter 2 a full overview is given of all components in the toolset. In the next chapters specific user instructions are given for the more complicated tools integrated in the S2BIOM toolset. In Chapter 3 the user instructions are given for the Policy data viewer and download tool. In Chapter 4 the user instructions are given for the biomass supply data viewer and for the biomass cost supply data viewer. In Chapter 5 it is explained how to use the Bio2Match tool. In Chapter 6 the LocaGIStics tool use is explained. In Chapter 7 an overview is given of all data and documents that can be downloaded from the toolset.

1.2 Getting started

When starting to use the S2BIOM toolset users must sign in. The first time they start using the toolset they have to create their own user account by *clicking* on the top right tab **'Sign in'** and in the next menu on the tab 'Create Account'. The account name and password is automatically created and all users creating an account are automatically registered in a registry database in the tool.

Because people enter through a personal account, activities in the toolset are tracked and documents can be saved elaborated by the user in the LocaGIStics tool. When

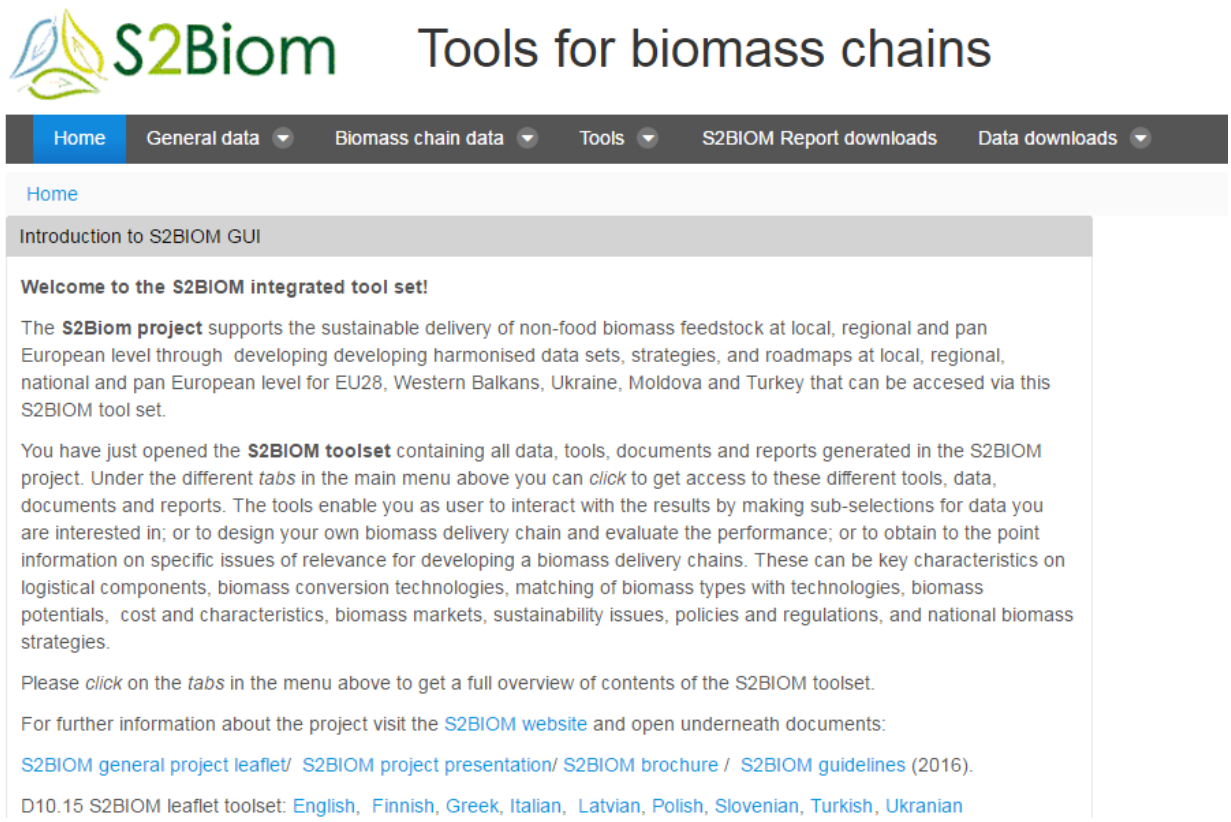
the user logs-in again the files remain available and can be further elaborated by the user.



2 Overview of the S2BIOM Toolset and its functionalities

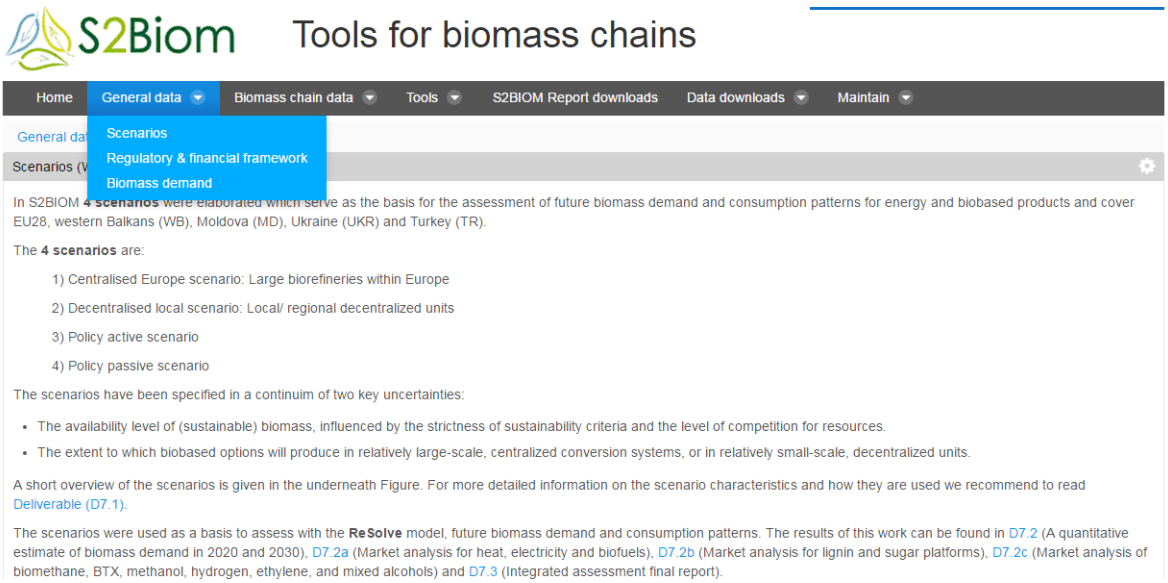
2.1 General user Interface (GUI) and overview of tools in S2BIOM toolset

The overall structure of the GUI is presented below. The main items according to which the entrance to the S2BIOM tool set is organised are presented in this overview. When users enter the GUI it opens in the 'Home' view. It provides an explanation on the background and objectives of the project, to whom the toolbox of S2BIOM is targeted, how to use it and links to relevant documents generated in the project.



In the following the different entry items are further described to get a full overview how the S2BIOM toolset is organised and what information can be found where.

2.2 General data



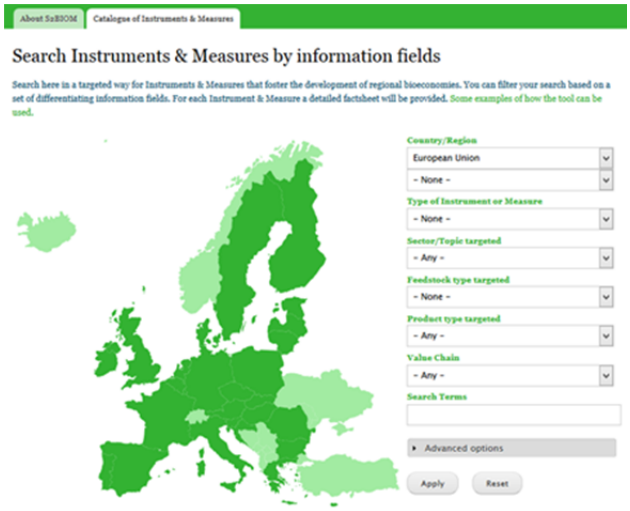
General data: Under this item the following output is included:

1) **Scenarios** developed in the project and information on these with links to relevant reports which are opened from the S2BIOM data directory

2) **Biomass demand** provides access to information in the form of text and through links which can be opened according to user selections.

3) In the **Regulatory & financial frameworks** information is provided in text, through links to open documents from the S2BIOM data directory and by providing access to a separate tool '**S2Biom policy database**' which is available at an external server hosted by VITO: https://s2biom.vito.be/. It is a catalogue of policy instruments and measures, information on the regulatory and financial frameworks impacting bioeconomy development throughout Europe. For each policy measure / instrument, information is provided on a set of descriptive criteria. These are displayed in the form of factsheets.

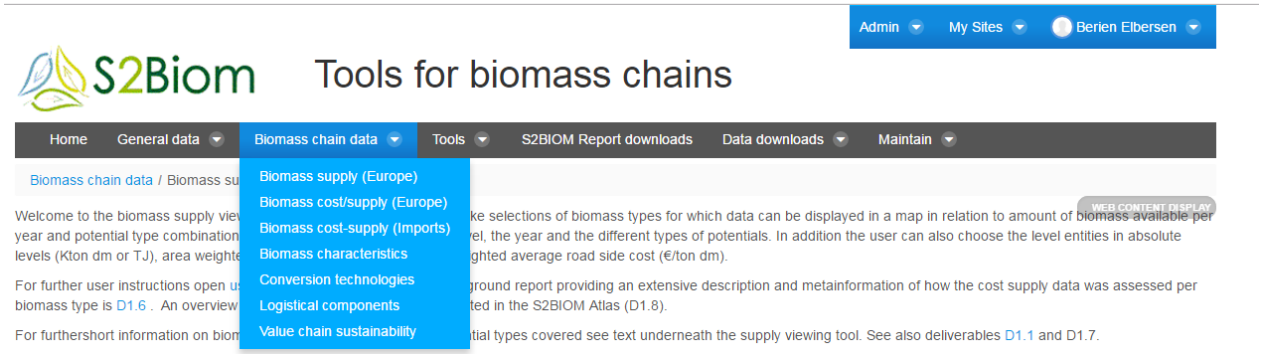
The Biomass Policy Tool:



For further user instructions on how to use the Policy database go to Chapter 3 in this report.

2.3 Biomass chain data and S2BIOM tools

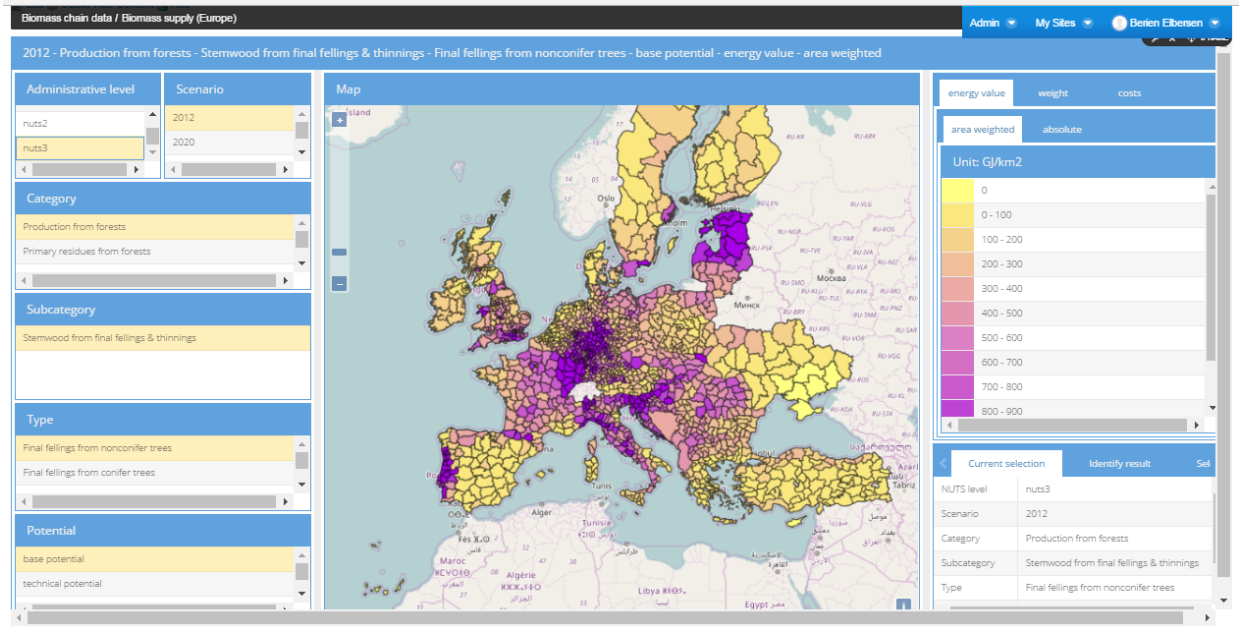
Under the item '**Biomass chain data**' access is provided to all data included in the central S2BIOM database and this is accessed interactively through several viewing tools.



In the following an overview is given of the different tools enabling the interaction with the data contained in the S2BIOM database.

2.3.1 Biomass supply (Europe) data viewer

Underneath a view of the Biomass supply viewer for Europe.



This tool enables the user to make selections of biomass types for which data can be displayed in a map in relation to amount of biomass available per year and potential type combination. The user can select the regional level, the year and the different types of potentials. In addition the user can also choose the level entities in absolute

levels (Kton dm or TJ), area weighted (Kton dm/km2 or GJ/km2) and weighted average road side cost (€/ton dm)..

The viewer contains information on 56 types of biomass, at various NUTS levels and for 2 to 9 types of potentials. The biomass types are divided into 9 categories with 15 subcategories. An overview of all biomass types included in this viewer and thus in the S2BIOM database is given in Annex 1 of this report

The geographical information is organised by the 2013 NUTS regions. The NUTS levels 0 to 3 are loaded into the database. This can be expanded if needed. Most information has been delivered at NUTS level 3 and can be presented at Nuts 0, 1, 2 and 3 levels depending on the users choice.

The cost-supply are divided into 3 or more types of potentials (or scenarios as named in the scheme underneath) and for 3 time periods:

scenario	year	year	year
Technical potential	2012	2020	2030
Base Potential	2012	2020	2030
User defined potential 1	2012	2020	2030
User defined potential 2	2012	2020	2030
User defined potential 3	2012	2020	2030
User defined potential ….	2012	2020	2030

For the user defined potentials; these are to be defined specifically per biomass type and sometimes there are only 2 for biomass A, while there could be 4 for biomass type B.

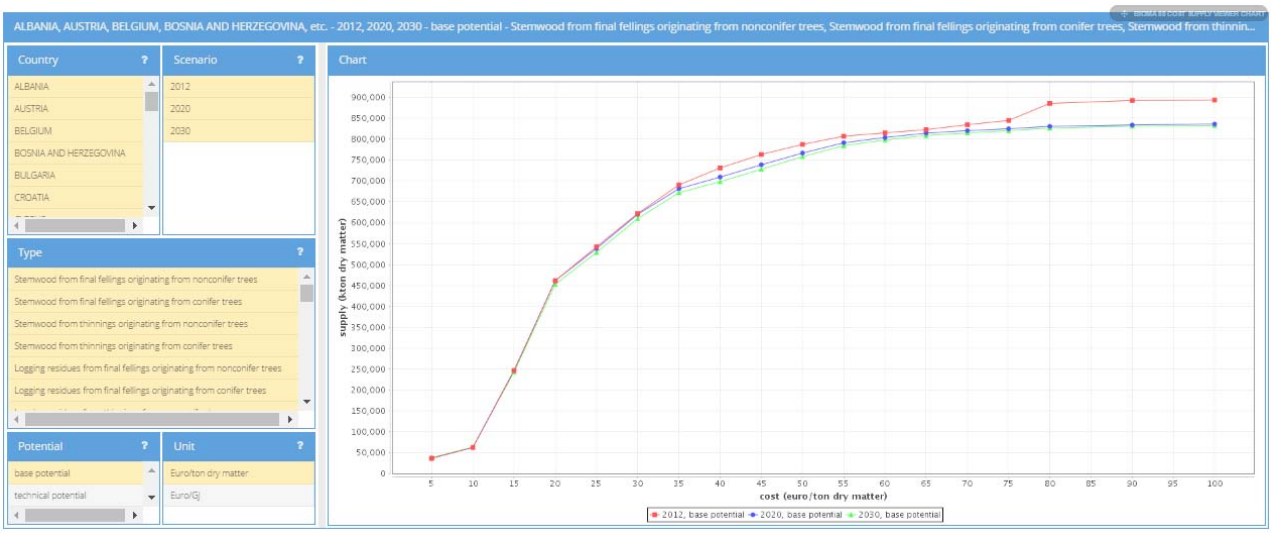
Further user instructions on this tool are presented in Chapter 4 of this report.

2.3.2 Biomass cost supply (Europe) data viewer

This biomass cost-supply viewer enables the user to make selections of biomass types for which cost levels can be displayed in a cost-supply graph. The graph displays the total accumulated biomass (ordered from cheap to expensive) against the average **road side cost level** for the country/countries and scenario years selected. The amount of biomass is displayed on the y-axis and the road side cost level on the x-axis.

For further user instructions see Chapter 4 in this report. The background report providing an extensive description of how the cost supply data was assessed per biomass type is Deliverable D1.6 (Dees et al, 2016) .

Road side cost refer to all biomass production collection and pre-treatment cost up to the road where the biomass is harvested/collected. The road side cost are a fraction of the total 'at-gate-cost.' Cost levels assessed here do NOT refer to market prices!



The cost for the collection from the road-side to the gate as well as the pre-treatment costs are estimated in other WPs in S2BIOM for specific biomass delivery chains further assessed in models (ReSolve) and the S2BIOM tools (**BeWhere** & **LocaGIStics**) accessible via the main menu in this toolset under **'Tools**'.

The cost up to the road side includes the cost for production prior to harvesting, in case of dedicated perennial crops, crop establishment, fertilizing, crop protection, harvesting/cutting, uprooting, baling, shredding, chipping, crushing collecting and/or densifying in the point of harvest and bringing it to the main road side. Activities related to establishing the contract (transaction costs) and other overheads are not (yet) accounted for. These cost can be quite substantial. One way of dealing with this is to assume a fixed percentage on top of the calculated road side cost (typically in the range of 20% - 50%).

The overall methodology followed to calculate the road side cost is the *Activity Based Costing* (ABC). It involves the whole production process of alternative production routes that can be divided in logical organisational units, i.e. activities. Since the production of most biomass is spread over several years, often long term cycles in which cost are incurred continuously while harvest only takes place once in so many years, the Net Present Values (NPV) of the future costs are calculated.

The cost data elaboration also requires a feedstock specific approach. If cost are estimated for biomass that is specifically produced for energy or biobased products, i.e. in the case of dedicated crops the cost structure is clear and all cost can be allocated to the final product. All cost should include the fixed and variable cost of producing the biomass including land, machinery, seeds, input costs and on field harvesting costs. If the biomass is a waste, i.e. cuttings of landscape elements or

grass from road side verges, the cost could be zero, as cutting and removing these cutting is part of normal management. However, bringing the biomass to the conversion installation requires some pre-treatment costs, e.g. for drying or densifying and then transport costs have to be made to bring it to the conversion installation. These cost will not be assessed here however as we concentrate on the road side cost.

Crop residues also require a separate approach as harvesting cost can usually be allocated to the main products, i.e. grain in the case of cereal straw, and not to the residue. However, the baling of the straw and the collection up to the roadside can be included in the costs.

The cost are determined for 2012, the reference year and are kept constant in the future years 2020 and 2030.

2.3.3 Biomass cost-supply imports

For the S2BIOM project, the potential of import of lignocellulosic biomass was assessed and specified in the form of cost supply curves from countries outside EU28 such as the Russian Federation, Ukraine, Canada, Brazil and USA.

The interlinked GLOBIOM (Global Biosphere Management Model) and G4M (Global Forest Model) model have been used to create the cost supply curves of biomass trade (import). In its core, GLOBIOM is a partial equilibrium model designed to assess the resource efficiency of biomass use, including energy production, livestock management, and food and timber production. In essence, it is an economic model that jointly covers the forest, agricultural, livestock, and bioenergy sectors, inherently allowing it to consider a range of direct and indirect implications of biomass use

One set of cost supply curves, that can be accessed through this part of the toolset was created to define how much biomass can be imported to EU28 from the rest of the world for bioenergy purposes (mainly heat and electricity), and one curve defining the potential import of biofuels. Though the two cost supply curves differ in terms of the end use of biomass that is imported, they are both defined in terms of the amount of biomass that could in the future be imported for a specific cost. In the case of bioenergy, the cost supply curve was defined in terms of cubic meters of wood chips and wood pellets that can be imported for heat and electricity production. In the case of biofuels, the cost supply curve was defined in terms of PJ of ethanol (1st and 2nd generation) and biodiesel that can be imported for the transport sector.

The cost-supply data on imports can be viewed in this part of the toolset, but the data can also be downloaded in excel table format.

2.3.4 Biomass characteristics

The cost supply database also includes additional values per type of biomass in relation to the physical and chemical composition of the biomass and meta information on the way and sources from where the composition information is derived. The compositional data on the biomass are crucial for the biomass matching tool explained in next Section under integrated assessment tools.

2.3.5 Database for biomass conversion technologies

Through the **Conversion technologies viewing tool** users can access the database on lignocellulosic biomass conversion technologies characteristics. The data included in this database are feeding the **Bio2Matc**h, the **BeWhere** and the **LocaGIStics** tools all accessible via the main menu in this toolset under '**Tools**'.

The 51 conversion technologies included in the database are presented in an overview table in the first view of the tool (see underneath). To access the detailed technology characterisation sheets in de database the user can *click* on the technology number in the last column of the table (to the right). To return to the overview table again click on the return arrow.

75 Items per Page | Page 1 of 1 | Showing 51 results. | ← First | Previous | Next | Last →

Category	Subcategory	Name	Output capacity	Common biomass input	Technology readiness level	Number
Direct combustion of solid biomass	Fixed bed combustion for heat	Grate boiler with straw for heat	Heat (2 MWth)	Cereals straw, Giant reed (Perennial grass)	Level 9, System ready for full scale deployment	75
Treatment in subcritical water	Hydrothermal processing	HTC Hydrothermal carbonisation of biowaste to coal for CHP	Biocoal (2.1 tonnes/hour)	Separately collected biowaste: Biodegradable waste of separately collected municipal waste (excluding textile and paper), Biowaste as part of integrally collected municipal waste: Biodegradable waste of not separately collected municipal waste (excluding textile and paper), Other by-products and residues from food and fruit processing industry	Level 7, Integrated pilot system demonstrated	74
Direct combustion of solid biomass	Fixed bed combustion for CHP (steam cycle)	Grate boiler with agrobiomass for CHP	Power (10 MWe), Heat (20 MWth)	Cereals straw, Giant reed (Perennial grass)	Level 9, System ready for full scale deployment	73
Fast pyrolysis	Pyrolysis plus boiler for heat and steam	Residues pyrolysis + CHP plant, value chain example	Power (3.7 MWe), Heat (12.4 MWth)	Cereals straw, Sunflower straw, Logging residues from final fellings originating from nonconifer trees, Logging residues from final fellings originating from conifer trees	Level 6, Prototype system verified	72
Fast pyrolysis	Pyrolysis plus boiler for heat and steam	Residues pyrolysis + Boiler for heat, value chain example	Power (0.1 MWe), Heat (16.4 MWth)	Cereals straw, Sunflower straw, Logging residues from final fellings originating from nonconifer trees, Logging residues from final fellings originating from conifer trees	Level 7, Integrated pilot system demonstrated	71
Fast pyrolysis	Pyrolysis plus boiler for heat and steam	Fast pyrolysis + CHP plant, value chain example	Power (4.13 MWe), Heat (15.24 MWth)	Residues from further woodprocessing, Stemwood from thinnings originating from nonconifer trees, Stemwood from thinnings originating from conifer trees	Level 6, Prototype system verified	70
Fast pyrolysis	Pyrolysis oil and diesel engine for electricity	Fast pyrolysis + Multiple diesel combustion engines, value chain example	Power (5.83 MWe), Heat (8.7 MWth)	Residues from further woodprocessing, Stemwood from thinnings originating from nonconifer trees, Stemwood from thinnings originating from conifer trees	Level 6, Prototype system verified	69
Fast pyrolysis	Pyrolysis plus boiler for heat and steam	Fast pyrolysis + Industrial steam boiler, value chain example	Power (0.66 MWe), Heat (31.4 MWth)	Residues from further woodprocessing, Stemwood from thinnings originating from nonconifer trees, Stemwood from thinnings originating from conifer trees	Level 9, System ready for full scale deployment	68
Fast pyrolysis	Pyrolysis plus boiler for heat and steam	Fast pyrolysis + Boiler for heat, value chain example	Power (0.53 MWe), Heat (19.6 MWth)	Residues from further woodprocessing, Stemwood from thinnings originating from nonconifer trees, Stemwood from thinnings originating from conifer trees	Level 8, System integrated in commercial design	67

The technologies covered can be classified in 6 main categories: treatment in subcritical water, syngas platform, gasification technologies, fast pyrolysis, direct combustion of solid biomass, chemical pretreatment, biochemical hydrolisis and fermentation and anaerobic digestion. For a further description of the biomass conversion technologies database please consult deliverable D2.3. The properties collected for conversion technologies belong to several categories:

1. *General properties.*

View details of Dry Batch Digestion (MSW)

GENERAL PROPERTIES

Name	Dry Batch Digestion (MSW)	Level of commercial application	Commercial large scale
Main category	Anaerobic digestion	Important pilots and EU projects	Only to develop innovations
Subcategory	Plug flow digester	Expected Developments	Mainly in biogas upgarding and in efficiency improvement
Image url		Current Technology Readiness Level in 2014	Level 9, System ready for full scale deployment
Year of first implementation	1900	Expected Technology Readiness Level in 2030	Level 9, System ready for full scale deployment
Estimated number of systems in operation	100	Justify expected Level in 2030	System is commercial - Innovations implemented

Main operating principle:

Mainly used for Municipal Solid Waste (MSW). MSW or comparable substaret is digested over a 2 to 4 week period in a closed area. It is a batch process. Temperature can be between 30 and 60C.

2. *Technical properties.*

View details of Dry Batch Digestion (MSW)

TECHNICAL PROPERTIES

Capacity of outputs (typical values)

Power (MWe) 1					
Conversion efficiencies: net returns electricity(GJ/GJ biomass input)	typical: 0.2	min: 0.1	max: 0.4	typical in 2020:	typical in 2030:
Biogas (m3/hour) 700 LHV (GJ / m^3) 19.7					
Conversion efficiencies: net returns fuel(GJ/GJ biomass input)	typical: 0.5	min: 0.2	max: 0.90	typical in 2020:	typical in 2030:
Methane (m3/hour) 420 LHV (GJ / m^3) 32.8					
Conversion efficiencies: net returns fuel(GJ/GJ biomass input)	typical: 0.5	min: 0.2	max: 0.9	typical in 2020:	typical in 2030:

Data sources used to define conversion efficiencies in 2014:

Depends on biomass input type!

External inputs (not generated by the biomass in the conversion process)

Power (kW): 1000

Heat (useful, not process steam) (kW): 1000

Indication: experience based data	Yes
Number of possible full load hours per year (hours)	5000
Number of typical full load hours per year (hours)	3500
Typical Lifetime of Equipment (years)	15

Data sources used to define conversion efficiencies in 2020:

Data sources used to define conversion efficiencies in 2030:

General data sources for technical properties:

3. *Biomass input specifications*

View details of Dry Batch Digestion (MSW)

BIOMASS INPUT SPECIFICATIONS

Biomass input, common for the technology used:	HH MSW, Household waste; NACE MSW, Waste not from households; NACE Vegetal, Waste not from households; Grass, Abandoned grassland; Grass, Biomass (roadside Verges);
Biomass input, technically possible but not common:	Cardoon, Energy Grasses, Annual Crops, Perennial Crops; Sorghum, Energy Grasses, Annual Crops, Perennial Crops; Reed Canary Grass, Energy Grasses, Annual Crops, Perennial Crops; Maize, Straw/stubbles;

Traded form	Other (Black liquor, BMW, PO etc.)	
Dimensions	Not applicable	
Moisture content	(% wet basis) typical 50	max 70
Minimal bulk density	(kg/m^3, wet basis) 500	
Maximum ash content	(% dry basis) 40	
Minimal ash melting point (= initial deformation temperature)	(°C)	
Volatile matter (only for thermally trated material, torrefied or steam explosed)	(VM%)	

Maximum allowable contents

Nitrogen, N (wt%, dry)	Sulphur, S (wt%, dry)	Chlorine, Cl (wt%, dry)

Optional attributes

Net caloric value	(MJ/kg) min	max
Gross caloric value	(MJ/kg) min	max
Biogas yield	(m^3 gas/ton dry biomass) 50	% methane 50
Cellulose content	(g/kg dry matter) min 0	max 100
Hemicellulose content	(g/kg dry matter) min	max 100
Lignin content	(g/kg dry matter) min 0	max 100
Crude fibre content	(g/kg dry matter) min 0	max 100
Starch content	(g/kg dry matter) min 0	max 100
Sugar content	(g/kg dry matter) min 0	max 100
Fat content	(g/kg dry matter) min 0	max 100
Protein content	(g/kg dry matter) min 0	max 100
Acetyl group content	(g/kg dry matter) min 0	max 100

4. *Financial and economic properties.*

View details of Dry Batch Digestion (MSW)

FINANCIAL AND ECONOMIC PROPERTIES

Investments costs	in 2014 (€): 5000000	expected in 2020 (€):	expected in 2030 (€):	Labour needed	Operators (FTE): 1	Staff and engineering (FTE): 1

2.3.6 Database for logistical concepts

The logistical components viewing tool provides information on logistical components as storage, pre-treatment and transportation technologies that are available to handle biomass are accumulated in the logistics table and related tables. The related tables are domain tables to store possible values for selected attributes. There are 220 logistic components stored inside the database, but their number is still growing. The properties collected for logistic components belong to several categories:

1. *General properties.*

View details of Doppstadt DZ 750 Kombi

GENERAL PROPERTIES

Commercial name	Doppstadt DZ 750 Kombi	Level of commercial application	Sold in Germany.
Main category	Communition (size reduction)	Year of first implementation in practice	
Subcategory	Shredding	Estimated number of systems in operation since introduction	
Image url	http://bfw.ac.at/fmdb/maschinen.web?kat=1929	Current Technology Readiness Level in 2014	Level 9, System ready for full scale deployment
Most common/suitable applications	Pre-treatment of wood.	Expected Technology Readiness Level in 2030	Level 9, System ready for full scale deployment

Main operating principle:

Trailer platform with own diesel engine. The power requirement is 450 kW. The available data for the input processing capacity are in unit nm3/h therefore we took the converter: 1nm3 = 0.4 m3 (Source: Kakovostna lesna goriva za vsakogar, Slovenian Forestry Institute - in Slovenian).

References:

http://www.woodybiomass.org/PagesRS/www.woodybiomass.org/userfiles/files/Microsoft%20Word%20-%20TOR-Annex%203_WE%20Technology_report_Krajnc.pdf and http://bfw.ac.at/fmdb/maschinen.web?kat=1929.

2. *Technical properties.*

View details of Doppstadt DZ 750 Kombi

TECHNICAL PROPERTIES

Energy demand	(MJ/t)		Number of full load hours per year	(h)	1800
Type of energy needed		Diesel	Maximum load volume of transport system	(m^3)	165
Other input demand			Maximum load weight of transport system	(t)	
Pre-treatment efficiency	(output/input)		Typical lifetime of equipment	(years)	5
Input processing capacity	(m^3/h)	80	Labour requirements pre-treatment	(h/t)	
Storage capacity for input	(t)		Labour requirements storage	(h/t)	
Storage capacity for output	(t)		Labour requirements transport	(h/t)	
			Transportability		Mobile

3. *Biomass input specifications*

View details of Doppstadt DZ 750 Kombi

BIOMASS INPUT SPECIFICATIONS

Acceptable biomass input groups	Wood;			Moisture content input (%, wet base)	Minimum	Maximum
Received (intermediate) biomass	Log wood, firewood			Bulk density input (kg/m^3, wet base)	Minimum	Maximum
Minimum particle size input	length (mm)	width / diameter (mm)	height (mm)	Maximum input level of contamination with exogenous material (%, dry base)		
Maximum particle size input	length (mm)	width / diameter (mm) 400	height (mm)	Maximum ash content input (%, dry base)		

4. *Biomass output specifications*

View details of Doppstadt DZ 750 Kombi

BIOMASS OUTPUT SPECIFICATIONS

Indication of follow up process(es)	Transport;	Moisture content output (%, wet base)	Minimum	Maximum
Delivered (intermediate) biomass	Wood chips	Bulk density output (kg/m^3, wet base)	Minimum	Maximum
Dimensions	P300: 3,15 mm < P < 300 mm Fine fraction F05: < 5 %	Maximum output level of contamination with exogenous material (%, dry base)		
		Maximum ash content output (%, dry base)		

5. *Financial and economic properties*

View details of Doppstadt DZ 750 Kombi

FINANCIAL AND ECONOMIC PROPERTIES

Specific investment costs of equipment, included auxiliaries	(€)	Transport costs per kilometer	(€/km)	
Operation and maintenance costs	(€/t)	Transport costs per tonne	(€/t)	
- Calculation method	Effective operation time	Transport costs per load	(€)	
Storage costs	(€/t)	Transport costs fixed	(€)	
Loading costs	(€/t)	Infrastructure needed		None
Unloading costs	(€/t)			

2.3.7 Value chain sustainability

In this part of the toolset information is provided on the sustainability framework for criteria and indicators for biomass delivery chains elaborate in WP5 of the project. The work in WP5 on sustainability of biomass delivery chains for the bioeconomy was started with a benchmark analysis of existing sustainability schemes (D5.2) .This was then followed up by an inventory of how sustainability issues are currently addressed in bioeconomy value chains in a selected number of countries (D5.3). The outcome of both evaluations was used to design the eventual sustainability framework for Criteria and indicators for biomass delivery chains which is described in D5.4

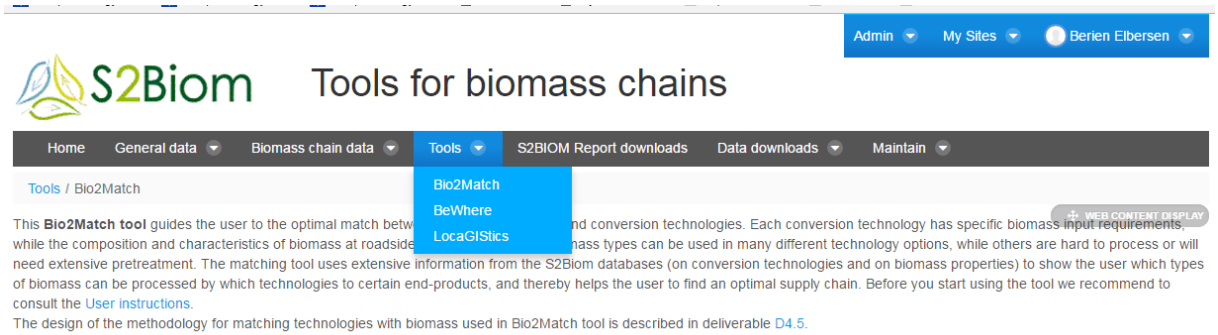
Theme	Criterion	#	Indicator	Description	Ambition: Basic set – Minimum requirement	Basic set – Comparative (non-renewable reference)	Basic set – Comparative (biomass reference)	Basic set – Descriptive	Advanced set – Minimum requirement	Advanced set – Comparative (non-renewable reference	Advanced set – Comparative (biomass reference)	Advanced set – Descriptive
		1.2	Secondary Resource Efficiency	Heating value of biomass output divided by heating value of secondary resource; applies to conversion of residues and wastes			✓		✓			
		1.3	Energy Efficiency	Cumulative energy requirements (all inputs based on LHV primary energy) compared to outputs		✓			✓			
		1.4	Functionality (Output service quality)	Economic value of outputs (€/GJ and + €/ton), compared to economic value of heat which could be produced from burning (dried) primary inputs (reference = heat from NG ~ 10€/GJ); economic values excluding taxes, for industrial customers						✓	✓	
	2. Climate Change	2.1	Life Cycle-based CO_2eq	GHG emissions during the whole value chain (i.e. feedstock collection , logistics, pretreatment and conversion, distribution and end-use phase) in relation to the final output (combination of electricity, useful heat, biofuels & biomaterials)	✓				✓			
		2.2	Other GHG emissions	GHG from carbon stock changes incl. soils (if applicable)		✓	✓		✓			

A subset of the S2BIOM sustainability indicators were also calculated for conversion technologies (included in the S2BIOM technology database) & biomass type combinations and these can be viewed and downloaded in an excel database .

The environmental indicators calculated include energy efficiency (MJprim/MJout), direct life-cycles GHG emissions **(**g CO2/MJout), air emissions **(**SO2eq g/MJout and PM10 g/MJout)**,** land use efficeincy **(**m2/GJout) and employment (pers/TJout) for the average EU situations in 2020 and 2030 (based on PRIMES REF). These indicators were calculated with the GEMIS system updated with the conversion technologies data from the S2BIOM database (GEMIS 4.95).

2.4 Full chain assessment tools

In this part of the S2BIOM toolset the more integrative and advanced assessment tools developed in the project are placed.



There are 3 tools included:

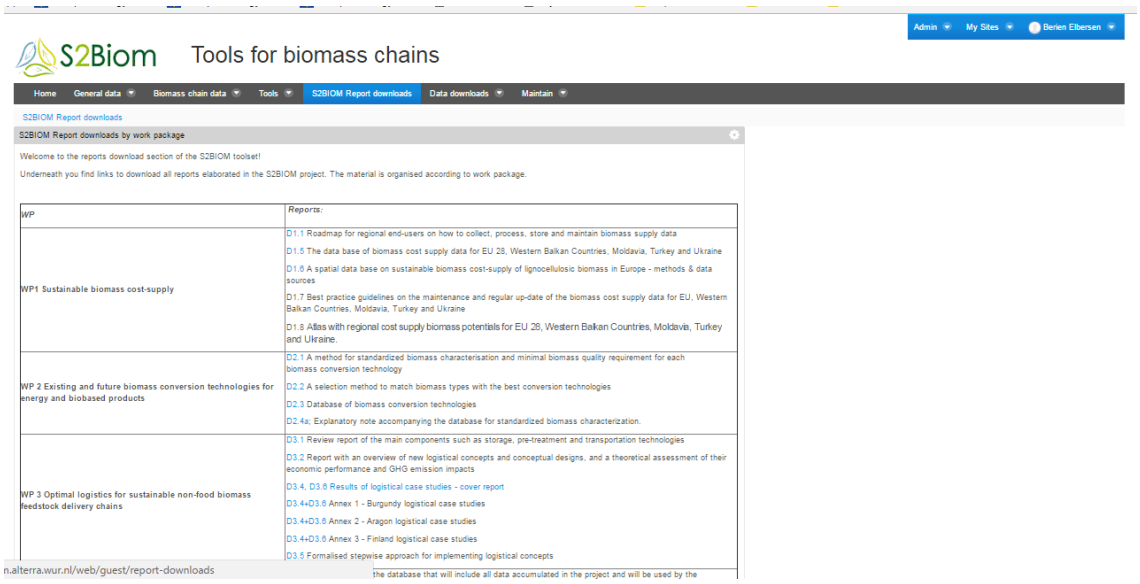
1) **Bio2Match tool**: It provides support to users in finding the best match between a certain type of biomass with specific characteristics as specified in the cost-supply database (WP 1) and the conversion technologies (WP2). Detailed user instruction for the Bio2Match viewing tool are provided in Chapter 5 of this report. The database for the Bio2Match tool consist of the 3

databases described in the former, additional information on the physical and chemical composition of the biomass and an additional knowledge database providing the rules according to which a biomass type matches with a biomass conversion technology and/or with a pre-treatment technology to adapt the physical composition of the biomass to the requirements of a specific conversion technology.

2) ***BeWhere model output viewing tool:*** This tool supports the presentation of the assessment results performed in S2BIOM with the BeWhere model. BeWhere model supports the development of EU-wide and national strategies to design and evaluate an optimal network of biomass delivery chains. The basis of this tool is a techno-economic spatial model that enables the optimal design and allocation of biomass delivery chains (at national level) based on the minimization of the cost and emissions of the full supply chain taking account economies of scale, in order to meet certain demand (as assessed in WP 7 (see also menu '**General data**' -→ '**Biomass demand**'.).
3) **LocaGIStics** tool: This tool enables the user to design and evaluate biomass delivery chains. The locaGIStics tool was developed as a results of the work done in WP3 to develop a formalised stepwise approach for the implementation of optimal logistical concepts adapted to specific regional circumstances. The LocaGIStics tool has been made operational for 2 regions in Europe: Burgundy and Spain. Before using the tool we recommend to consult the detailed user guidelines in Chapter 6.

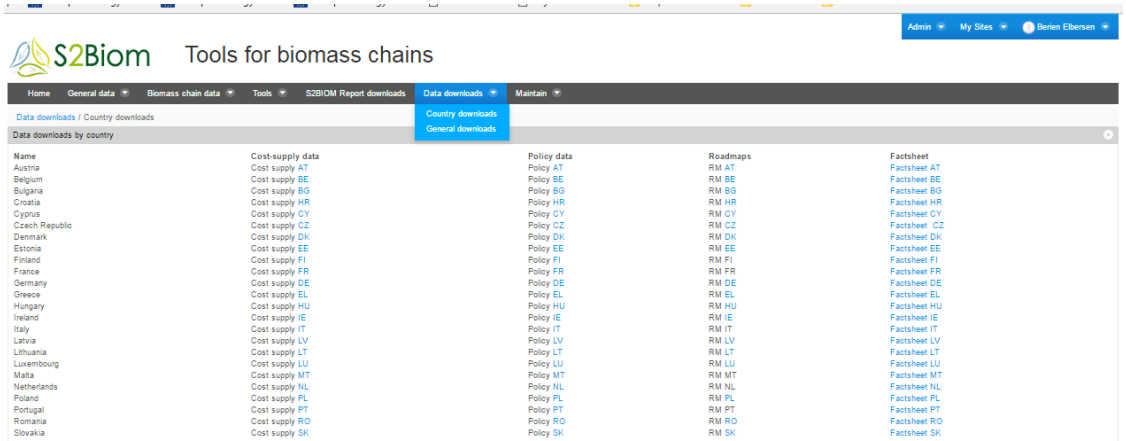
2.5 S2BIOM report downloads

In this part of the S2BIOM toolset people can find all S2BIOM reports which can be downloaded here.



2.6 Data downloads

In this part of the toolset the user can download all data files and country reports for all 37 countries covered in the S2BIOm project. The downloads include excel files with the biomass cost-supply data at country level (Nuts 3 data) for the different potentials and years, the country specific data on policies contained in the policy database, road maps for lignocellulosic biomass and relevant policies for a biobased economy in 2030 and factsheets per country benchmarking the country policy options for long term mobilization of biomass for the biobased economy.



3 Regulatory and financial framework: Policy viewer: detailed user instructions

The Regulatory viewing tool is accessible through the S2BIOM toolset via de tab '**General data**' -→ '**Regulatory and financial framework'.**

The database was populated and the tool was developed simultaneously as part of WP 6. In the following instructions are provided on how to use the tool and how to also incorporate new data in it.

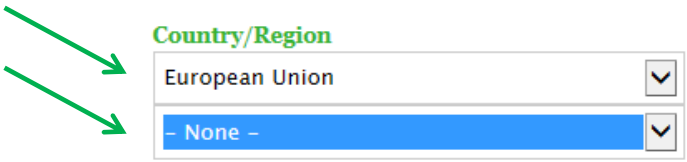
3.1 Instructions on how to use the database

For access to the database the Step Guide below should be followed:

Go to the tab Catalogue of Instruments & Measures

Country/Region:

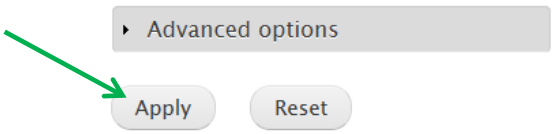
Choose ‘European Union’ in the first box, and specify the country in the second box. For EU regulations, select ‘EU28’ instead of a specific country. It is also possible to further drill into a region within a country.



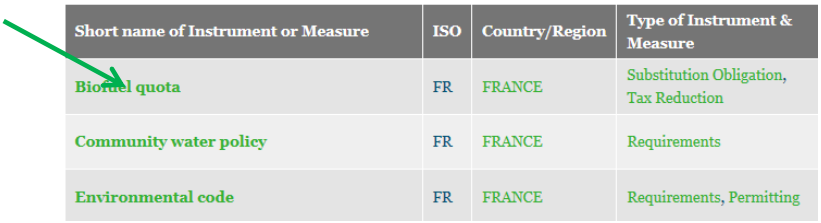
You can also make other selections for the query, e.g.

- type of Instrument or Measure (Economic, Regulatory, Voluntary),
- topic targeted (e.g. energy, agriculture, …)
- Feedstock type targeted
- Product type targeted
- Part of the value chain

Click on apply



In the table Click on the short name of the I&M that you want to see



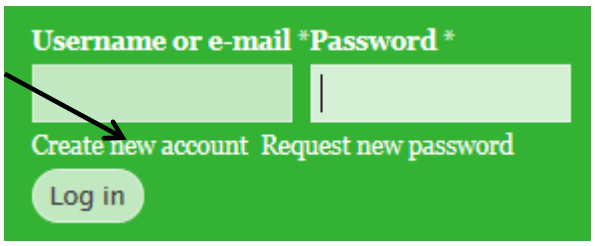
Short name of Instrument or Measure	ISO	Country/Region	Type of Instrument & Measure
Biofuel quota	FR	FRANCE	Substitution Obligation, Tax Reduction
Community water policy	FR	FRANCE	Requirements
Environmental code	FR	FRANCE	Requirements, Permitting

You will then see a factsheet with key information, contact references and advanced information

If you wish to update certain information, or create new Instruments/Measures, you need to log in through your account (Be aware; THIS is not the same account as for the S2BIOM toolset log-in!!).

1. Create account

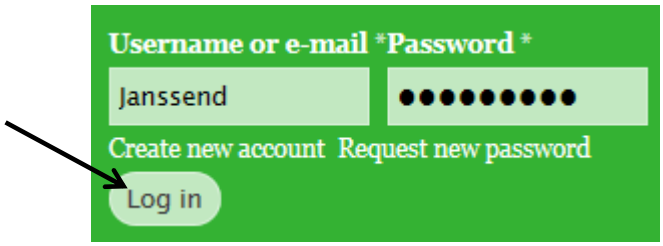
See right on the top: click on “create new account”



follow instructions to create an account

2. Log in

'Log in' with your username or e-mail and your password and click on Log in



3.2 How to update Instruments & Measures in the Database?

a. Access to be database: see introduction

b. In the table Click on the short name on the I&M that you want to update

Short name of Instrument or Measure	ISO	Country/Region	Type of Instrument & Measure
Biofuel quota	FR	FRANCE	Substitution Obligation, Tax Reduction
Community water policy	FR	FRANCE	Requirements
Environmental code	FR	FRANCE	Requirements, Permitting

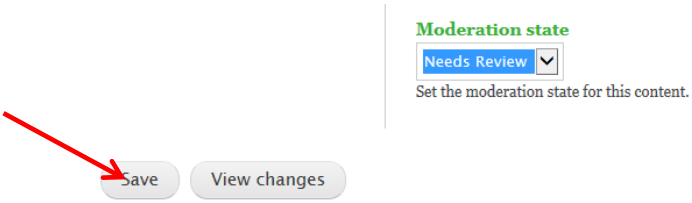
Go to tab New draft

Change the text in the fields you want to update

Click on 'Save' at the bottom of the page to save the entered data.

Your adapted I&M will be saved for review.

Once reviewed by the administrator (VITO), the updated factsheet will be published on-line.



3.3 How to add new Instruments & Measures in the Database?

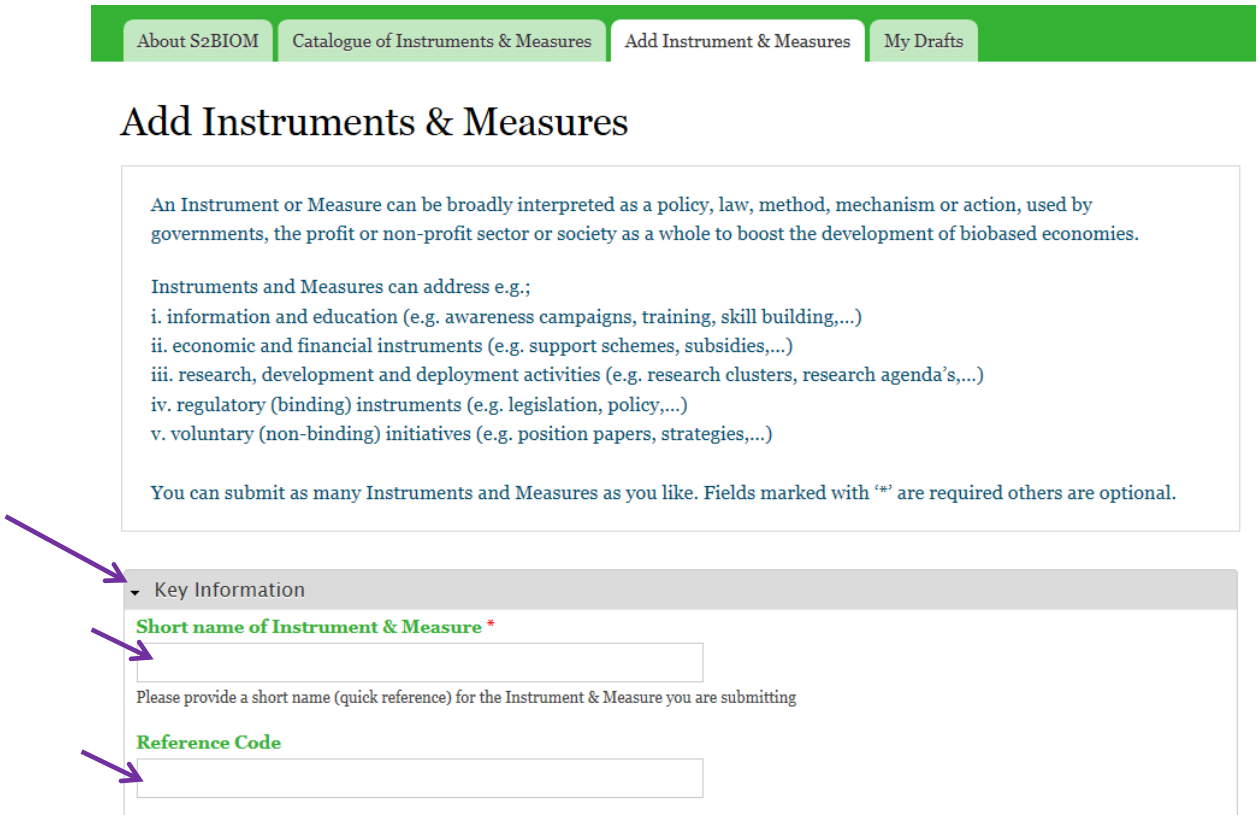
Go to tab '[Add Instruments & Measures](#)'

Fill in at least all mandatory fields marked with a red asterisk *

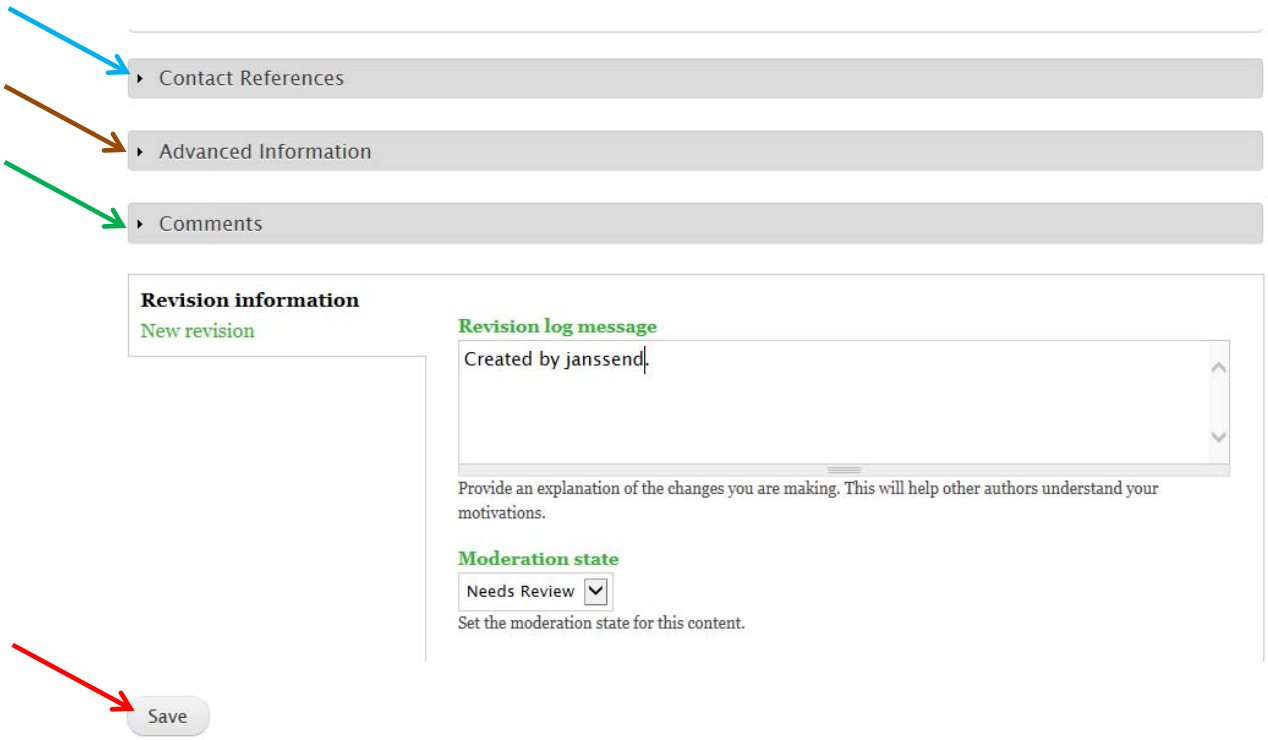
In subtab Key Information:

- Short name of Instrument / Measure*
- Reference Code
- Country/Region* (you can drill down to NUTS 3 level if needed)
- Description*
- Goal/Aim*
- Type of instrument* (you can add several)

- Sector/topic targeted*
- Status*
- Connection with EU policy
- (Trade Relevance) (mainly important for the BioTrade2020+ project)



And add relevant information in the following subtabs: to do so click on the successive tabs and fill in the respective fields (as far as relevant).



Subtab Contact References

- Full name of Instrument & Measure (English – native language)
- Links (you can add several)
- Responsible authority + contact (website)
- Completed by … (company name) & on … (month & year)
- Acknowledgement (if you build on info from other projects, e.g. RES-LEGAL)

Subtab Advanced information

- (Secondary goal)
- Feedstock type targeted (you can add general feedstock categories, and specifically select specific feedstock types if relevant)
- Product type targeted (click for which product type the measure is relevant)
- Value chain (click for which part of the value chain the measure is relevant)
- (Enterprise scale)
- (Connection with national policy)
- Year I/M started, last amended, ended

Subtab Comments

- Overall comments
- Environmental sustainability requirements (e.g. GHG, land use, emissions, …)
- Efficiency requirements (e.g. CHP requirement)
- Material hierarchy (e.g. exclusion of certain materials because of other uses)

Click on ‘Save’ at the bottom of the page to save the entered data.

Your I&M will be saved for review.

Once reviewed by the administrator (VITO), the factsheet will be published on-line.

4 Biomass supply and cost-supply viewers: detailed user instructions

4.1 Biomass supply viewer

General:

The biomass supply data viewer enables the user to make selections of biomass types for which data can be displayed in a map in relation to amount of biomass available per year and potential type combination. The user can select the regional level (Nuts 0(=national) to Nuts 3) at which the data need to be displayed, the year and the different types of potentials. In addition the user can also choose whether the data needs to be displayed in absolute levels (Kton dm or TJ), area weighted (Kton dm/km2 or GJ/km2) and weighted average road side cost (€/ton dm).

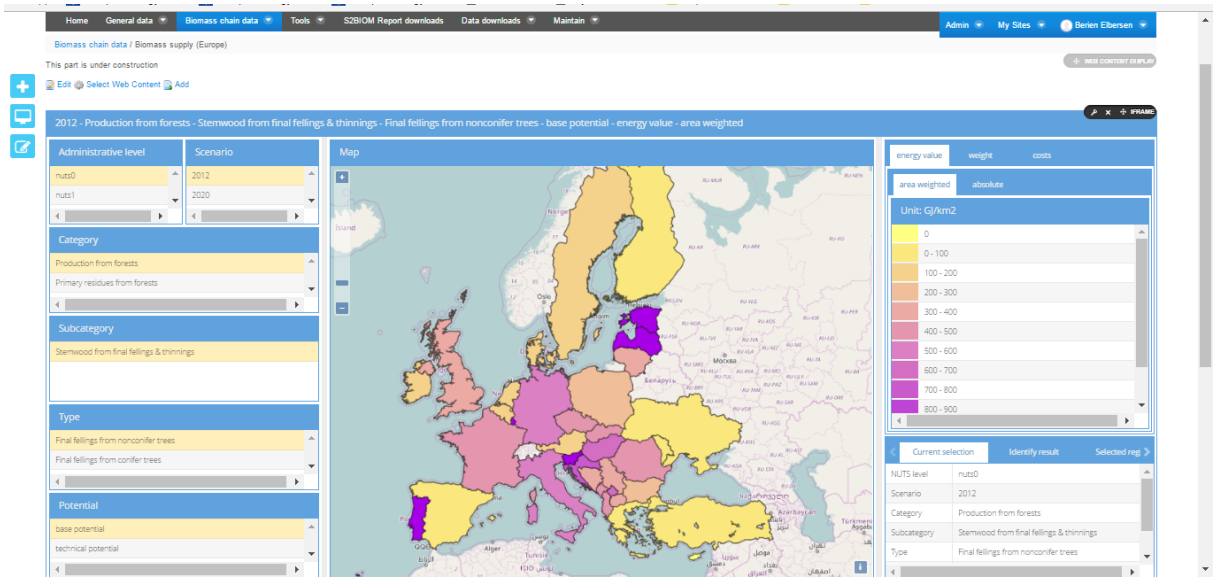
The user can select the scenario year and the potential type to be displayed on the map.

NOTE 1: Details on the relationship between cost levels and supply can be obtained from the 'Cost supply viewer' also accessible via the main 'Biomass chain data' entry in the main menu of the S2BIOM tool set.

NOTE 2: All data viewable in this tool can be downloaded per country in excel format via the main menu item 'Data downloads'-→ 'Country downloads'.

NOTE 3: The cost levels displayed here refer to the ***road side cost*** *of the biomass. Road side cost refer to all biomass production collection and pre-treatment cost up to the road where the biomass is located. The road side cost are usually a fraction of the total 'at-gate-cost.' Cost levels assessed here do not refer to market prices!*

Getting started:
The starting screen below shows the supply viewer when opened. It shows biomass availability at national level (Nuts 0) for stemwood from final fellings in all European countries covered by S2BIOM.



User interaction:

To operate the tool one starts specifying the choices in the top left hand pane ('**Administrative level**'), shifting to the right to '**Scenario**' , then choosing '**Category**', '**Subcategory**', '**Type**' and '**Potential**'. In all these panes one can select one item by clicking on it.

The most detailed spatial level is the **Nuts 3**.

On the top right one can select the entities and type of information to be displayed per biomass type in the map. Standard amounts are displayed in Kton dm per region. By clicking on the tab '**energy value'** one can map results in TJ. The biomass levels can also be displayed in Kton or TJ per km2 by clicking on the tab '**area weighted**'.

Cost levels per type of biomass can also be displayed. These cost refer to the ***road side cost*** of the biomass. To display these click on the top right tab '**cost**'. Road side cost refer to all biomass production collection and pre-treatment cost up to the road where the biomass is located. The road side cost are usually a fraction of the total 'at-gate-cost.' Cost levels assessed here do not refer to market prices!

In the bottom right corner users can get further information on what selections are displayed in the map. This is displayed by clicking the tab 'Curent selection'.

User can also click in the map on one region. For this region the levels displayed in the map are presented in the bottom right pane under the tab '**Identify results'**.

Under the bottom right tab 'Selected regions' one can make selections and remove selection for regions. These region selections can then be used as preselected regions for which the biomass types present can serve as the pre-selection used in the **Bio2Match tool**. To use these pre-selected regions in Bio2Match first select the region of interest. Then click on the bottom right tab '**Lookup biomass types in**

Biomass and technology matching tool'. After click the Bio2Match tool is opened for the pre-selected biomass-region combinations.

4.2 Biomass cost-supply viewer

Introduction:
The cost-supply data viewer enables the user to make selections of biomass types for which cost levels can be displayed in a cost-supply graph. The graph displays the total accumulated biomass (ordered from cheap to expensive) against the average road side cost level for the country/countries and scenario years selected.

The amount of biomass is displayed on the y-axis and the road side cost level on the x-axis.

Users can select one or more countries (using 'ctrl' and 'Alt' tab on their keyboard), scenarios and biomass types for which they want to display the cost-supply relation. To select more than one country, scenario year or type use the 'ctrl' or 'shift' and select.

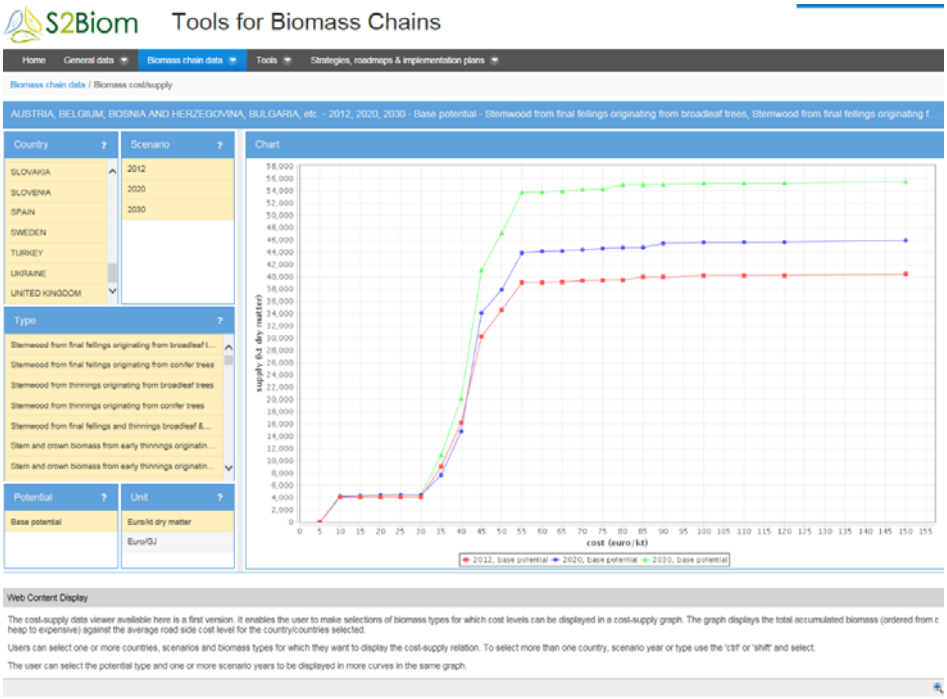
The user can select the potential type and one or more scenario years to be displayed in more curves in the same graph.

NOTE 1: Details on the average cost levels for individual biomass types per region/country can be obtained from the 'Supply viewer' also accessible via the main 'Biomass chain data' entry (choose 'costs' on the top right).

*NOTE 2: The cost levels displayed here refer to the **road side cost** of the biomass. Road side cost refer to all biomass production collection and pre-treatment cost up to the road where the biomass is located. The road side cost are usually a fraction of the total 'at-gate-cost.' Cost levels assessed here do not refer to market prices!*

Getting started:
The starting screen below shows a cost supply relationship covering all accumulated biomass (for all types) in all European countries covered by S2BIOM (y-axis) against the road side cost levels (x-axis).

Different curves are only displayed for different scenario years.



User interaction:

To <u>operate the tool</u> one starts specifying the choices in the top left hand pane (‘**Countries**’), going down to ‘**Scenario**’ pane on the left side, and then moving to ‘**Type**’, ‘**Potential**’ and finally ‘**Unit’**. In all these panes one can select one item by clicking on it or one can select more items by clicking in combination with the ‘*ctrl’* (non-continues list) and ‘*shift’* (continues list) tab.

Further support on the user interaction functions can be derived under the **‘?’** symbol in every pane.

Country: Select 1 or more countries. More countries can be selected by using the ‘*ctrl’* (non-continues list) and ‘*shift’* (continues list) tab.

Scenario: Select 1 or more scenario years to be displayed as separate curves in one graph. More scenario years can be selected by using the *ctrl* (non-continues list) and *shift* (continues list) tab.

Type: Select 1 or more biomass types to be displayed as accumulated biomass supply. More biomass types can be selected by using the *ctrl* (non-continues list) and *shift* (continues list) tab.

Potential. Select one or more potential types for which cost-supply curves can be displayed in one graph. More potentials can be selected by using the *ctrl* (non-continues list) and *shift* (continues list) tab.

Unit: Select the unit in which the cost-supply relation needs to be presented. A choice can be made between Euro/kton dry matter (€ per kton biomass in dry matter) or Euro/GJ (€ per Giga Joule) referring to the energy value of the biomass using heating value conversion factors for dry biomass. The latter choice for energy value

is chosen to make the internal comparison of biomass road side cost levels more comparable between the different types of biomass.

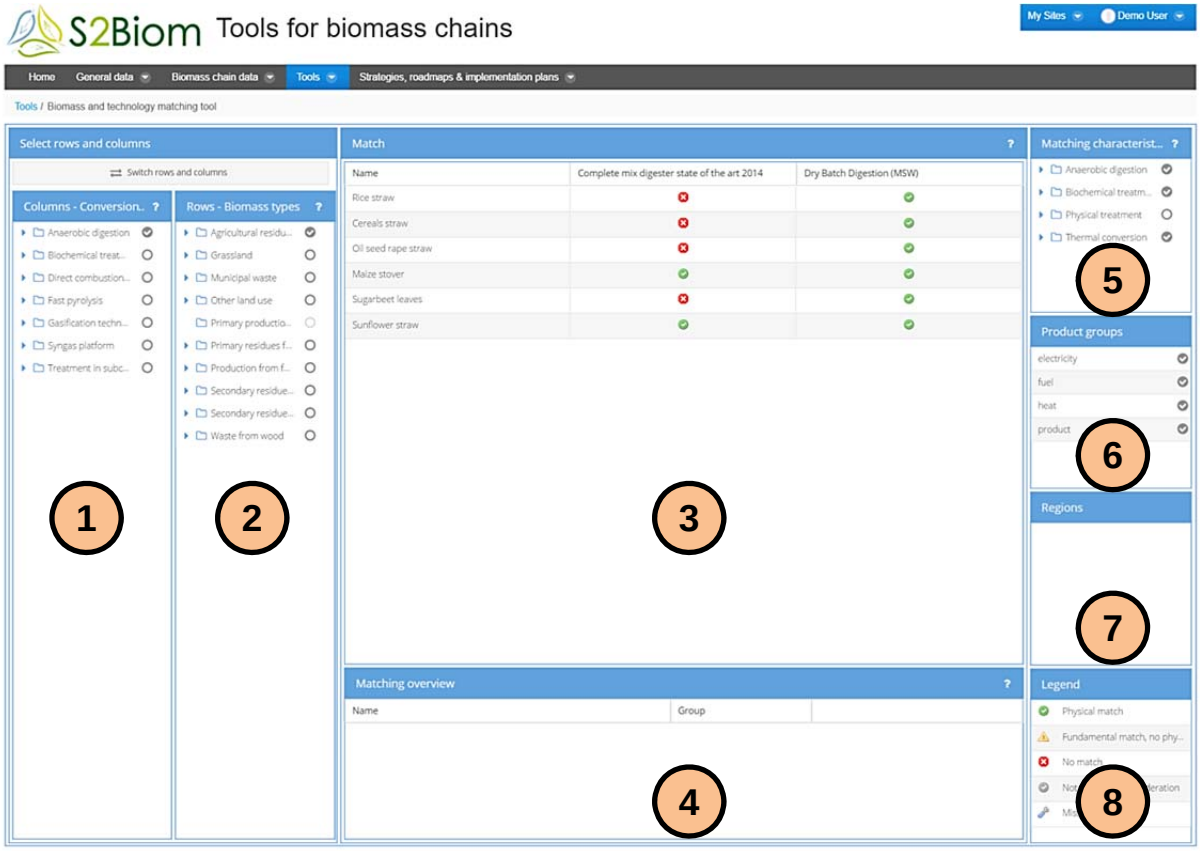
5 Bio2Match tool: detailed user instructions

5.1 General information:

This tool guides the user to the optimal match between biomass resources and conversion technologies. Each conversion technology has specific biomass input requirements, while the composition and characteristics of biomass at roadside varies widely. Some biomass types can be used in many different technology options, while others are hard to process or will need extensive pre-treatment. The matching tool uses extensive information from the S2Biom databases to show the user which types of biomass can be processed by which technologies to certain end-products, and thereby helps the user to find an optimal supply chain.

5.2 Getting started:

The figure below shows the starting screen of the user-interface of Bio2Match, which contains eight different panes. In the figure below the panes are numbered 1-8 for clarification purposes.



The left two panes (#1 and #2) are for the selection of biomass types and technologies to match. You can select any number of biomass types and conversion technologies that you are interested in. The central screen (#3) then shows which

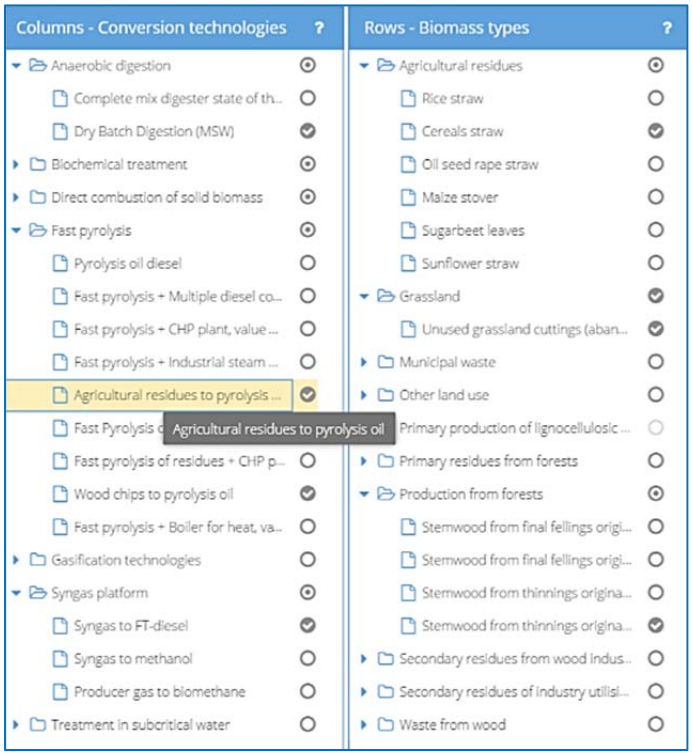
technologies match to which types of biomass, based on the information in the S2Biom databases.[1] Pressing the button 'switch rows and columns' switches the position of panes #1 and #2 and switches the columns and row in pane #3, so you can select your preferred viewing option. You can click on a single biomass-technology combination in pane #3 to find out why a feedstock does or does not match to a certain technology. This is displayed in the matching overview, pane #4.

In pane #5 the characteristics or feedstock properties that need to be taken into account for the match can be selected. Pane #6 is a product filter, with which you can limit the amount of technologies displayed on the basis of the products that you are interested in. Pane #7 is a region filter. It is normally inactive, but is automatically activated when the tool is accessed through one of the other S2Biom tools, the 'Biomass supply database'. It limits the amount of biomass types displayed on the basis of their availability in the region that you selected in the Biomass supply database. Pane #8 is a legend to panes #3 and #4.

Most of the panes contain a "?" button, which gives a short description of that pane when you hold the pointer above it. The section below describes the functionalities of each pane in more detail.

1& 2 The conversion technologies and biomass types selection panes (1 & 2)

In the conversion technologies pane you can select which technologies to include in the match. The figure on the right side shows the partly expanded list of conversion technologies. The list is divided into seven groups, which are further broken down into individual types of technologies. You can select groups or individual technologies, as shown in the figure. If a technology name is too long for the box, you can click on it and a pop-up box appears with the full name. The conversion technology list is linked to the conversion technologies database, so you can find more details about the technologies



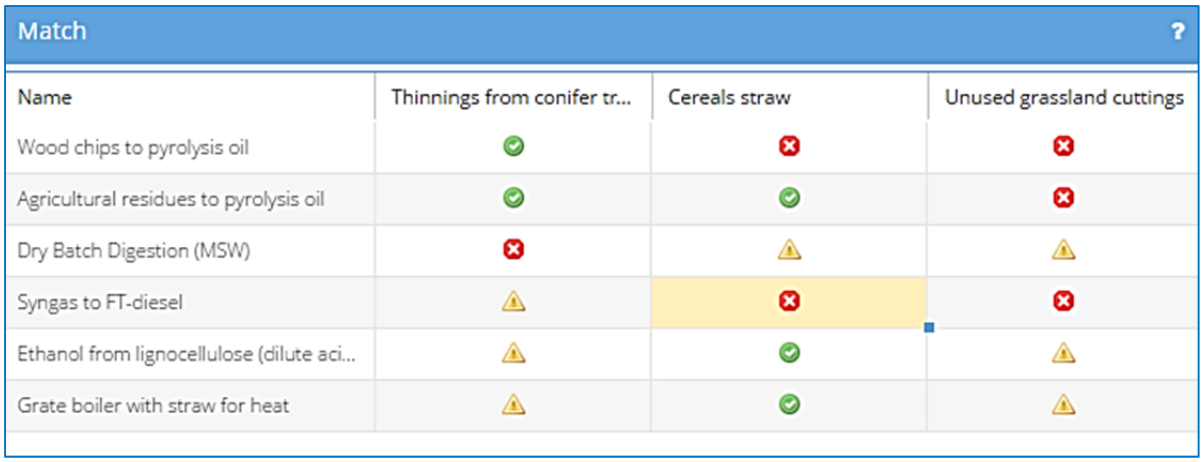
[1] For the methodology behind the matching, the reader is referred to the separate document 'Bio2Match general description and methodology', which is available in the user documentation.

there.[2]

In the biomass selection pane you can select which biomass types to include in the match, in the same way as in the conversion technologies pane.

3 The match pane

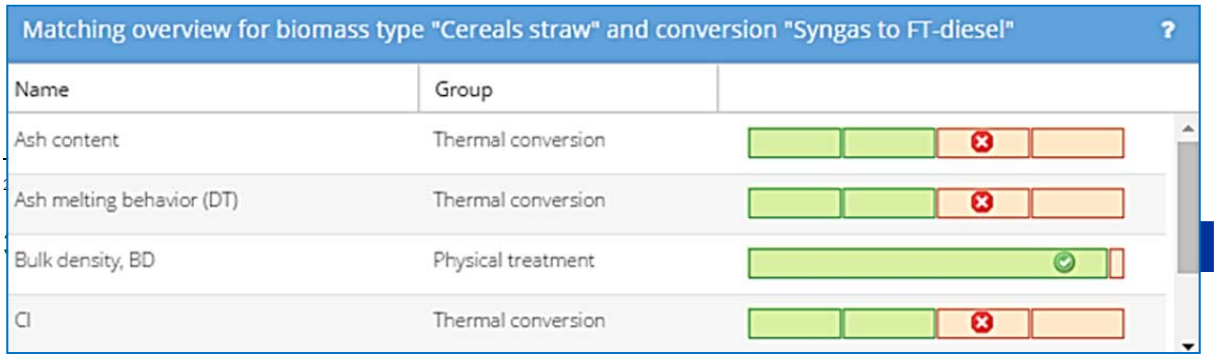
The match pane shows you which of the selected biomass types match to which of the selected conversion technologies. A green check ("V") symbol indicates that there is a match between the biomass type and the conversion technology. In other words: the technology can process that type of biomass. A red error ("X") symbol indicates that a biomass type and technology do not match, so that biomass type cannot be processed by that conversion technology. A yellow alarm ("!") symbol indicates that in principle that type of biomass can be processed by the conversion technology, but beforehand some form of simple pretreatment is necessary, specifically drying or densification.



You can obtain more detailed information about a specific match by clicking on one of the symbols, after which the matching overview pane (#4) shows the details of that match.

4 The matching overview pane:

The matching classification system is visualized in pane #4 with four blocks per property, in which green blocks represent the biomass quality that the technology can handle. When only the left block is green, that means the technology can handle only



feedstock of class 1 quality, when all four are green the technology can also handle lower quality classes. The matching symbol represents the actual quality of the selected biomass. If the symbol is positioned in a green block there is a match and the label turns green, if it is situated in a red block that means the technology cannot handle that feedstock quality and the label turns red in the case of a fundamental property or yellow in the case of a physical property.

In this way you can quickly identify which biomass property is responsible when a biomass and technology do not match. In the example of a syngas to Fischer-Tropsch diesel process (gasification followed by conversion) with cereal straw as feedstock, as depicted in the figure above, it can be seen that the ash and chlorine contents and the ash melting temperature are all responsible for the fact that there is no match.

Another outcome could be in the case of a match, in which you may find that a certain biomass type is of such high quality that it would be less than optimal to use it for a certain technology, because another biomass type of lower quality could also be converted by that same technology. This would make it useful to also investigate the details of a match when it is a positive one. An example of that is shown in the figure below, of the match of a residue conversion process ("agricultural residues to pyrolysis oil") with stemwood from conifer trees. The technology can handle much lower quality biomass than the conifer stemwood, as can be seen from the ash content and ash melting behaviour.

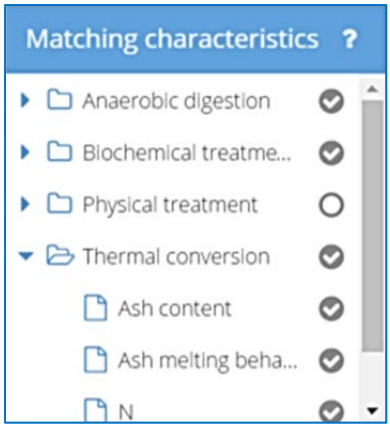
The figure below also shows how the matching tool indicates that a specific property was not taken into account. Then the check sign in the bar becomes grey, as is the case for the bulk density in this case.

The default setting of the matching overview pane is to only show the basics of the match. However, as a user you can choose to display more information, such as the ranges of each class.

Important to note is also that the matching information is based on typical values for biomass types, while in practice the properties of biomass depend heavily on the

growing and harvesting conditions (soil, fertilizer, season of harvest, etc.). Therefore you can also choose to display the best and worst-case values of the biomass properties. This can be done by clicking on the overhead bar of the matching overview pane and then selecting additional columns, as shown in the figure below.

5. The matching characteristics pane



A feature that the tool contains is that you can select which properties need to be taken into account for the matching. If you find that for your specific case (be it technology or feedstock) a certain property is not important, you can unselect that specific characteristic in the dropdown menu in pane #5, after which the tool recalculates which technologies match to which types of biomass without that property being taken into account. The characteristics are divided into four groups. One group for the properties related to anaerobic digestion technologies, one related to biochemical treatment, one to thermal conversion (including the other five conversion technologies groups: direct combustion, fast pyrolysis, gasification, syngas platform and treatment in subcritical water), and one to physical pretreatment, in order to reduce moisture content or increase the bulk density of the biomass. By default the tool selects all the fundamental properties, and no physical properties.

6. The product groups pane

With the product groups filter (pane #6) you can select which types of products you are interested in. For

example only heat or electricity, or fuels or biobased products. The filter then automatically selects only the technologies that are able to produce those specific products. Irrelevant technologies in the conversion technologies pane become light grey, and can no longer be selected for a match.

Important to keep in mind when selecting one or two product groups only is that there is often a thin line between different products. For example ethanol can be seen as both a fuel and a biobased product, while some technologies produce multiple products in parallel.

7. Regions pane

The last feature is a regions filter. This is a part of the tool that is linked to another tool on the S2Biom website, the biomass supply database.[3] This database contains availability data of all the biomass categories that are in the Bio2Match tool as well. You can select a certain region (or multiple regions) in the biomass supply database and then link to Bio2Match, which then automatically filters the biomass types that are relevant for those specific regions. The regions that were selected are then mentioned in pane #7, and can be unselected from this pane as well.

[3] Under the 'Biomass chain data' tab in the websites top menu, click 'Biomass supply'.

6 Full chain assessment tools; BeWhere viewing tool and LocaGIStics: detailed user instructions

6.1 BeWhere output viewing tool

The model BeWhere itself cannot be used by the end-users. Instead the end-users can view & download the pre-run scenario results of BeWhere through the S2BIOM toolset. The users can choose in the viewing tool the scenario specifications for which to view results in the underneath menu. In the left pane you can specify and download BeWhere sollutions for heat and power installations and in the right pane for biofuel installations.

The downloadable BeWhere results are available in the S2BIOM data directory and are selected by the user by clicking the menu and specifying the selection criteria.

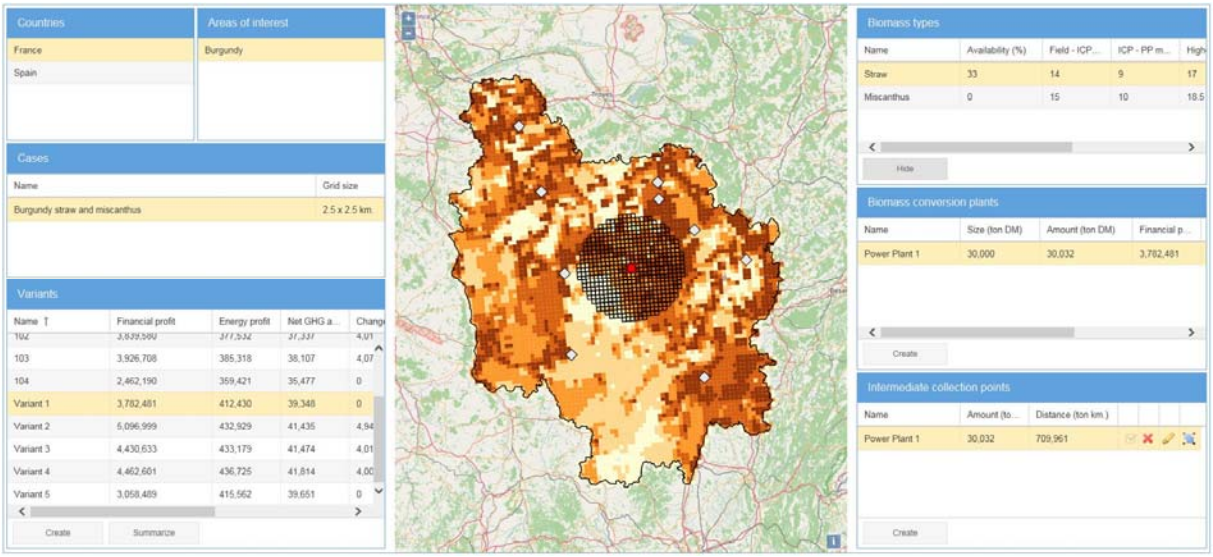
6.2 LocaGIStics

General information:

This tool supports the user to design biomass delivery chains at regional level (implemented for Burgundy and Spain) and to analyse in a comparative way (for different biomass delivery chains) the economic and GHG emission and mitigation potential and the spatially explicit land use and environmental implications. It uses data about biomass supply, different biomass conversion and pre-treatment technologies and novel logistical concepts of biomass hubs and yards.

Getting started:

The starting screen below shows a map of the selected country and region.



In the map displayed the grey diamonds refer to suggested power plant locations as analysed by the BeWhere tool analysis (see in the main user interface the 'Tools' --->'BeWhere'). Each of these suggested locations refers to one power plant to which the biomass is directly sourced from the field without making use of intermediate collection points.

In the LocaGIStics tool the user is now invited to design one or more biomass delivery chains choosing the size and location of the power plant while designing the chain with or without intermediate collection points.

Use of LocaGIStics tool:

To operate the tool one starts specifying the choices in the top left hand pane ('**Countries**'), going down to the **'Variants'** pane on the left side, and then moving to the top right panes specifying '**Biomass types**' '**Biomass conversion plants**' and finally the '**Intermediate collection points'**.

<u>Countries, Areas of interest, Cases pane:</u>

You can choose these panes to specify the case study:

Variants pane: Click on the '**Create'** button and give a name for the variant of the chain you are going to design (e.g. 'only straw' or 'mixed straw and Miscanthus'). Then click on the '*Submit*' button. You can see that the variant that you have just created is now highlighted with a yellow bar. If needed you can edit the name of the variant using the icon.

Variants

Name	Financial profit	Energy profit	Net GHG a...	Change in...	Direct N2O...	Indirect N2...
102	3,839,580	377,532	37,337	4,019,948	77,310	148,446
103	3,926,708	385,318	38,107	4,073,814	88,637	141,965
104	2,462,190	359,421	35,477	0	0	0
Variant 1	3,782,481	412,430	39,348	0	0	0
Variant 2	5,096,999	432,929	41,435	4,945,974	157,380	126,353
Variant 3	4,430,633	433,179	41,474	4,019,948	77,310	148,446
Variant 4	4,462,601	436,725	41,814	4,009,354	87,322	139,631
Variant 5	3,058,489	415,562	39,651	0	0	0

Create Summarize

Note: Always check later on if the correct variant is still chosen (highlighted) because this might sometimes be accidentally changed in this prototype e.g. after a calculation.

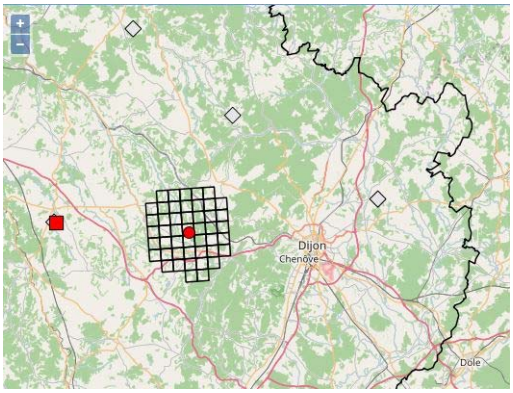
Note: Unfortunately there is a limit to the width of the columns depending on the size of your screen. You can change the size of the columns in each pane by putting your pointer on the border of the column and dragging it to one side. This way you can better read the heading and/or the data.

Biomass types: This section shows the available biomass types (in the Burgundy case these are straw and Miscanthus). You can choose the actual percentage of a biomass type that you want to include in your analysis (this could be lower than the maximum). The choice could be e.g. to use only straw, then you need to set the percentage of the other biomass types (now only Miscanthus is included) to '0'. Use the icon to edit the biomass availability and related properties (field moisture % and moisture content after intermediate collection/pre-treatment). After editing click on '*submit*' button.

Biomass types

Name	Availability (%)	Field - ICP moistu...	ICP - PP moistur...	Higher heating value...	Biomass costs...	Energy use biomass at roadside...
Straw	33	14	9	17	45	0.5
Miscanthus	0	15	10	18.5	8.82	0.84

Hide



Note: *All biomass properties have a default settings (in this case 33% straw and 0% Miscanthus), but can be changed by the user.*

Note: The map shows the biomass availability in a grid pattern. Deep coloured grids have higher biomass availability then light coloured grids. The 'active' biomass type (highlighted with the yellow bar), for which a biomass conversion plant is selected is shown on the map. In the Burgundy case straw is yellow and Miscanthus is purple.

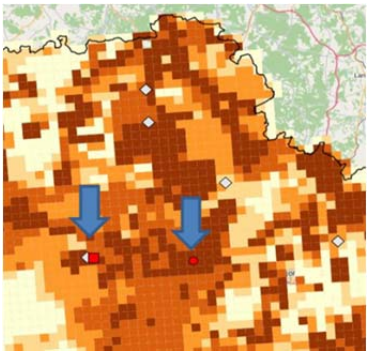
Note: One can also hide the biomass map in order to see the topographical map of the area containing roads, cities, etc.

Biomass conversion plants: In this pane you define the power plant location and demand size (in this example the demand size is chosen to be 30,000 ton of biomass, and only small size deviations of about 10% can be made). By clicking the '*Create*' button one can add a new power plant and specify its name and size in terms of amount of biomass (in ton dry matter) processed on a yearly basis. After clicking '*Submit*' a power plant is located on the map (red square) in the centre of the region.

Biomass conversion plants

Name	Size (ton DM)	Amount (ton DM)	Financial profit	Energy profit	Net GHG avoided			
Power Plant 1	30,000	30,032	3,782,481	412,430	39,348			

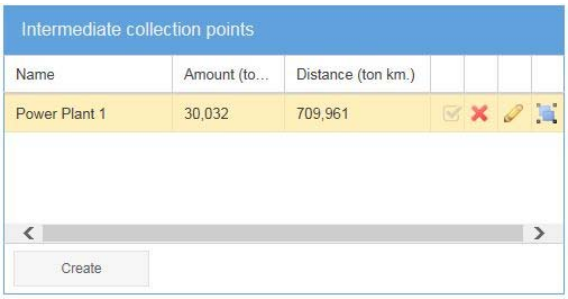
Create



You can now move the red square to the location on the map where you want to locate the plant.

Note: The suggested locations by BeWhere (grey diamonds in the map) can be used as a reference point, and the biomass density shown on the map (brown grids) are also meant to be a guidance.

Intermediate collection points: In this pane the intermediate collection points supplying to the Biomass conversion plant that was just designed in the former pane can be defined. The first step is to click on '*Create*' and then assign a name. Then click on '*Submit*'.



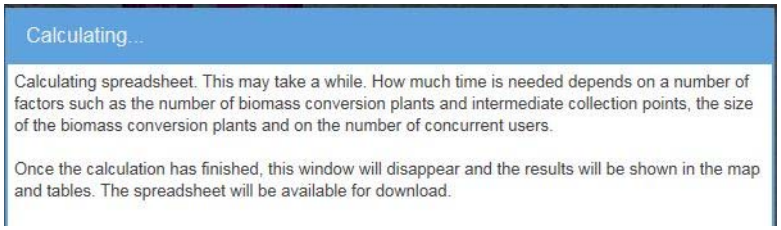
You will see a red circle on the map indicating the location of the intermediate collection point. You can now click on this red circle and drag it to the position where you want the intermediate collection to take place (most likely the place selected should be where the biomass is most concentrated spatially so that you obtain short transport distances to the intermediate collection point). If you want the intermediate collection to coincide with the power plant itself you can click on the icon in the 'Intermediate collection point' pane. This definition of intermediate collection points can be repeated for a second intermediate collection point.

Note: a minimum of one and a maximum of two intermediate collection points per power plant needs to be selected.

After this step more power plants can be added together with their collection points by repeating the definition steps in the 'Biomass conversion plants' and 'Intermediate collection points' panes.

Calculation of results: If the user thinks all biomass types, power plants and intermediate collection points have been defined properly the calculation of the results can be generated. To do this the user needs to go back to the **'Variants'** pane and press the calculator icon.

Note: Only press the icon once. The system then starts to calculate. This can take a few minutes. You will get the following screen:



Do not press again on the calculator but wait until the tool generates the calculation results: These results will appear in several places:

1) A grid pattern will appear on the map indicating the grid cells sourcing the defined power plants.

2) In the '**Variants**' pane the *financial profit, energy profit* and the *GHG avoided* is specified as assessed for the defined biomass conversion plants.

3) In the '**Biomass conversion plant**' pane the *financial profit, energy profit* and the *GHG avoided* are quantified but specifically for the biomass conversion plant

Calculation of new variants and comparison of performance of biomass delivery chains: To make a new design there are two options:

- In the '**Variants**' pane click on '*Create*' and give your new design a name
- In the '**Variants**' pane click on the former variant created and click on the copy icon. The former design can then be adapted with new specifications by going through the definitions steps in the 'Biomass Types', 'Biomass conversion plants' and 'Intermediate collection points' panes as described above.

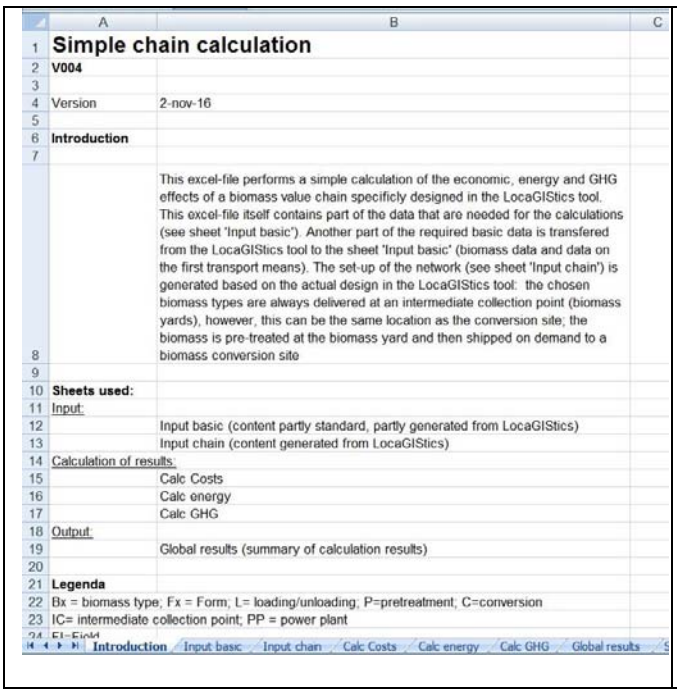
If a Variant or a plant specification or an intermediate collection point needs to be removed just click on the icon.

Per design more biomass conversion plants and per plant more intermediate collection points can be specified and results displayed on the map.

Simple sheet

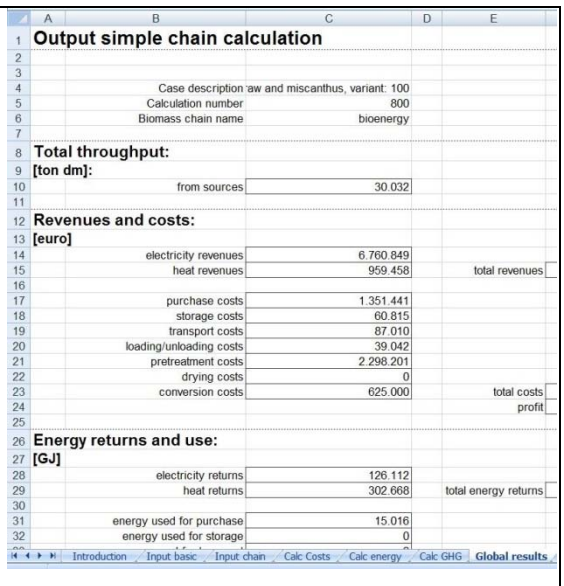
The calculations and the calculation results can also be displayed in an excel file. This can be accessed by clicking on the excel icon in the Biomass conversion plant pane. The system will then start up excel on your computer and display the calculation sheets and results.

Note: there are more working sheets showing the different input variables and calculation of the main indicators quantified in the tool on costs and revenues, energy use and returns, calculation of GHG emissions and avoided.



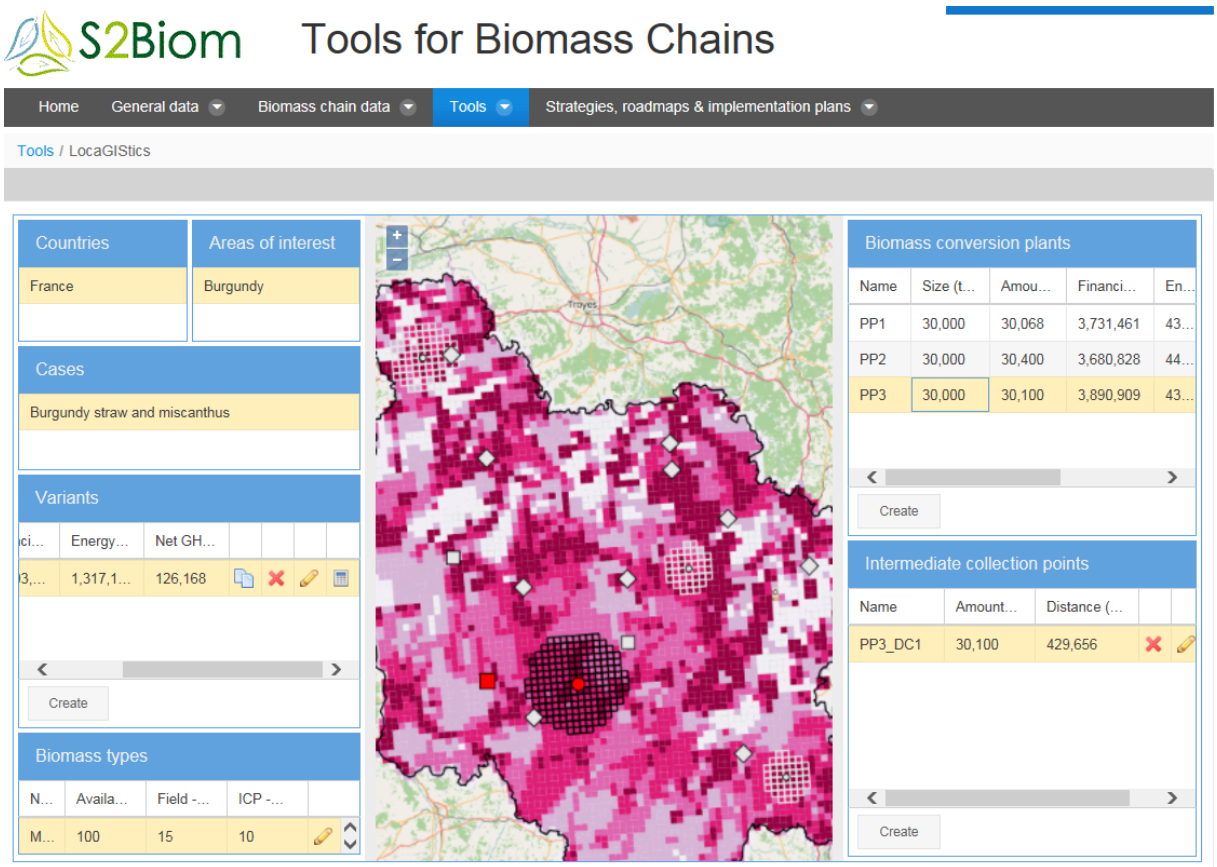
	A	B	C
1	**Simple chain calculation**		
2	**V004**		
3			
4	Version	2-nov-16	
5			
6	**Introduction**		
7			
8		This excel-file performs a simple calculation of the economic, energy and GHG effects of a biomass value chain specificly designed in the LocaGIStics tool. This excel-file itself contains part of the data that are needed for the calculations (see sheet 'Input basic'). Another part of the required basic data is transfered from the LocaGIStics tool to the sheet 'Input basic' (biomass data and data on the first transport means). The set-up of the network (see sheet 'Input chain') is generated based on the actual design in the LocaGIStics tool: the chosen biomass types are always delivered at an intermediate collection point (biomass yards), however, this can be the same location as the conversion site; the biomass is pre-treated at the biomass yard and then shipped on demand to a biomass conversion site	
9			
10	**Sheets used:**		
11	Input:		
12		Input basic (content partly standard, partly generated from LocaGIStics)	
13		Input chain (content generated from LocaGIStics)	
14	Calculation of results:		
15		Calc Costs	
16		Calc energy	
17		Calc GHG	
18	Output:		
19		Global results (summary of calculation results)	
20			
21	**Legenda**		
22	Bx = biomass type; Fx = Form; L= loading/unloading; P=pretreatment; C=conversion		
23	IC= intermediate collection point; PP = power plant		
24	F1=Field		

Introduction | Input basic | Input chain | Calc Costs | Calc energy | Calc GHG | Global results



	A	B	C	D	E
1	**Output simple chain calculation**				
2					
3					
4		Case description	aw and miscanthus, variant: 100		
5		Calculation number	800		
6		Biomass chain name	bioenergy		
7					
8	**Total throughput:**				
9	**[ton dm]:**				
10		from sources	30.032		
11					
12	**Revenues and costs:**				
13	**[euro]**				
14		electricity revenues	6.760.849		
15		heat revenues	959.458		total revenues
16					
17		purchase costs	1.351.441		
18		storage costs	60.815		
19		transport costs	87.010		
20		loading/unloading costs	39.042		
21		pretreatment costs	2.298.201		
22		drying costs	0		
23		conversion costs	625.000		total costs
24					profit
25					
26	**Energy returns and use:**				
27	**[GJ]**				
28		electricity returns	126.112		
29		heat returns	302.668		total energy returns
30					
31		energy used for purchase	15.016		
32		energy used for storage	0		

Introduction | Input basic | Input chain | Calc Costs | Calc energy | Calc GHG | Global results



This tool is the most complicated tool developed in the S2BIOM toolset in terms of functionalities, data integration, calculation upon user specifications.

7 Annexes

Annex 1 Overview of biomass categories included in the S2BIOM database for Europe

type_id	cat_id	subcat_is	category	subcategory	short_name	name
1111	11	111	Production from forests	Stemwood from final fellings & thinnings	Stemwood from final fellings originating from nonconifer trees	Final fellings from nonconifer trees
1112	11	111	Production from forests	Stemwood from final fellings & thinnings	Stemwood from final fellings originating from conifer trees	Final fellings from conifer trees
1113	11	111	Production from forests	Stemwood from final fellings & thinnings	Stemwood from thinnings originating from nonconifer trees	Thinnings from nonconifer trees
1114	11	111	Production from forests	Stemwood from final fellings & thinnings	Stemwood from thinnings originating from conifer trees	Thinnings from conifer trees
1115	11	111	Production from forests	Stemwood from final fellings & thinnings	Stemwood from final fellings and thinnings broadleaf & coniferous trees	Stemwood from broadleaf & coniferous trees
1121	11	112	Production from forests	Stem and crown biomass from early thinnings	Stem and crown biomass from early thinnings originating from broadleaf trees	Early thinnings from nonconifer trees
1122	11	112	Production from forests	Stem and crown biomass from early thinnings	Stem and crown biomass from early thinnings originating from conifer trees	Early thinnings from conifer trees
1211	12	121	Primary residues from forests	Logging residues from final fellings & thinnings	Logging residues from final fellings originating from nonconifer trees	Logging residues from final fellings from nonconifer trees
1212	12	121	Primary residues from forests	Logging residues from final fellings & thinnings	Logging residues from final fellings originating from conifer trees	Logging residues from final fellings from conifer trees
1213	12	121	Primary residues from forests	Logging residues from final fellings & thinnings	Logging residues from thinnings from nonconifer trees	Logging residues from thinnings from nonconifer trees
1214	12	121	Primary residues from forests	Logging residues from final fellings & thinnings	Logging residues from thinnings from conifer trees	Logging residues from thinnings from conifer trees

type_id	cat_id	subcat_is	category	subcategory	short_name	name
1221	12	122	Primary residues from forests	Stumps from final fellings & and thinnings	Stumps from final fellings originating from nonconifer trees	Stumps from final fellings from nonconifer trees
1222	12	122	Primary residues from forests	Stumps from final fellings & and thinnings	Stumps from final fellings originating from conifer trees	Stumps from final fellings from conifer trees
2111	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Biomass sorghum (Annual grasses)	Biomass sorghum
2112	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Miscanthus (Perennial grass)	Miscanthus
2113	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Switchgrass (Perennial grass)	Switchgrass
2114	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Giant reed (Perennial grass)	Giant reed
2115	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Cardoon (Perennial crop)	Cardoon
2116	21	211	Primary production of lignocellulosic biomass crops	Energy grasses, annual & perennial crops	Reed Canary Grass (Perennial grass)	Reed Canary Grass
2121	21	212	Primary production of lignocellulosic biomass crops	Short rotation coppice	SRC Willow	SRC Willow
2122	21	212	Primary production of lignocellulosic biomass crops	Short rotation coppice	SRC Poplar	SRC Poplar
2123	21	212	Primary production of lignocellulosic biomass crops	Short rotation coppice	Other SRC	Other SRC
2211	22	221	Agricultural residues	Straw/stubbles	Rice straw	Rice straw
2212	22	221	Agricultural residues	Straw/stubbles	Cereals straw	Cereals straw
2213	22	221	Agricultural residues	Straw/stubbles	Oil seed rape straw	Oil seed rape straw
2214	22	221	Agricultural residues	Straw/stubbles	Maize stover	Maize stover
2215	22	221	Agricultural residues	Straw/stubbles	Sugarbeet leaves	Sugarbeet leaves
2216	22	221	Agricultural residues	Straw/stubbles	Sunflower straw	Sunflower straw

type_id	cat_id	subcat_is	category	subcategory	short_name	name
2221	22	222	Agricultural residues	Woody prunning & orchards residues	Residues from vineyards	Residues from vineyards
2222	22	222	Agricultural residues	Woody prunning & orchards residues	Residues from fruit tree plantations (apples, pears and soft fruit)	Residues from fruit tree plantations
2223	22	222	Agricultural residues	Woody prunning & orchards residues	Residues from olives tree plantations	Residues from olives tree plantations
2224	22	222	Agricultural residues	Woody prunning & orchards residues	Residues from citrus tree plantations	Residues from citrus tree plantations
2225	22	222	Agricultural residues	Woody prunning & orchards residues	Residues from nuts plantations	Residues from nuts plantations
2311	23	231	Grassland	Grassland	Unused grassland cuttings (abandoned grassland, managed grasslands not used for feed)	Unused grassland cuttings
3111	3	311	Other land use	Biomass from other areas under landscape maintenance	Grassy biomass from landscape maintenance (recreational and nature protection areas, dykes)	Landscape care (grassy)
3112	3	311	Other land use	Biomass from other areas under landscape maintenance	Woody biomass from landscape maintenance (landscape elements)	Landscape care (woody)
3121	3	312	Other land use	Biomass from road side verges	Grassy biomass from road side verges	Road side verges (grassy)
3122	3	312	Other land use	Biomass from road side verges	Woody biomass from road side verges	Road side verges (woody)
4111	41	411	Secondary residues from wood industries	Saw mill residues	Sawdust from sawmills from conifers	Sawdust (conifers)
4112	41	411	Secondary residues from wood industries	Saw mill residues	Sawdust from sawmills from nonconifers	Sawdust (nonconifers)

type_id	cat_id	subcat_is	category	subcategory	short_name	name
4113	41	411	Secondary residues from wood industries	Saw mill residues	Sawmill residues: excluding sawdust, conifers	Other residues (conifers)
4114	41	411	Secondary residues from wood industries	Saw mill residues	Sawmill residues: excluding sawdust, nonconifers	Other residues (nonconifers)
4121	41	412	Secondary residues from wood industries	Other wood processing industry residues	Residues industries producing semi finished wood based panels	Residues from industries producing semi finished wood based panels
4122	41	412	Secondary residues from wood industries	Other wood processing industry residues	Residues from further woodprocessing	Residues from further woodprocessing
4131	41	413	Secondary residues from wood industries	Secondary residues from pulp and paper industry	Bark residues from pulp and paper industry	Bark
4132	41	413	Secondary residues from wood industries	Secondary residues from pulp and paper industry	Black liquor	Black liquor
4211	42	421	Secondary residues of industry utilising agricultural products	By-products and residues from food and fruit processing industry	Olive-stones	Olive-stones
4212	42	421	Secondary residues of industry utilising agricultural products	By-products and residues from food and fruit processing industry	Other by-products and residues from food and fruit processing industry	Other food processing residues
4213	42	421	Secondary residues of industry utilising agricultural products	By-products and residues from food and fruit processing industry	Rice husk	Rice husk
4214	42	421	Secondary residues of industry utilising agricultural products	By-products and residues from food and fruit processing industry	Pressed grapes dregs	Pressed grapes dregs
4215	42	421	Secondary residues of industry utilising agricultural products	By-products and residues from food and fruit processing industry	Cereal bran	Cereal bran

type_id	cat_id	subcat_is	category	subcategory	short_name	name
5111	51	511	Municipal waste	Biodegradable municipal waste	Biowaste as part of integrally collected municipal waste: Biodegradable waste of not separately collected municipal waste (excluding textile and paper)	Biowaste unseparately collected
5112	51	511	Municipal waste	Biodegradable municipal waste	Separately collected biowaste: Biodegradable waste of separately collected municipal waste (excluding textile and paper)	Biowaste separately collected
5211	52	521	Waste from wood	Post consumer wood	Hazardous post consumer wood	Hazardous post consumer wood
5212	52	521	Waste from wood	Post consumer wood	Non hazardous post consumer wood	Non hazardous post consumer wood