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

S2Biom Project Grant Agreement n°608622

D4.10

A full technical description of the integrated toolset, central database and general user interface developed in WP4

Version: 0.2

6.04.2017

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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CEI CENTRAL EUROPEAN INITIATIVE
btg biomass technology group
biomass research

About this document

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Executive summary

The client side of the tool is a web based system. Users can access the toolset by their web browsers. The final version runs on all major browsers at www.biomass-tools.eu.

The database containing all data generated by the project to be integrated into the tool is designed with PostgreSQL 9.4 and PostGIS 2.0 geospatial extension. The application server runs on Apache Tomcat software. The CMS (Content Management System) runs on Liferay software. The mapping software in the tool to be used is GeoServer.

All server side components are open source products which run under Linux and under Windows.

Apache Tomcat, version 7.0.68, is the application engine for tailor made Java-components and for the Liferay Content Management System and for geoserver mapping engine. For Liferay version 6.2 is used. For Geoserver version 2.7.2 was installed.

The S2BIOM toolset will be available in at least the next 5 years in the current version at www.biomass-tools.eu. It will be maintained to the current standard and it will be ensured that server up-dates are checked in order to keep the S2BIOM toolset available. Alterra-DLO (now called Wageningen Environmental Research (WenR)) will be the main responsible for keeping the toolset accessible and maintained to the current standard.

In addition there will be new follow-up activities which will enable a further up-date and extension of data in the S2BIOM database and further applications of the S2BIOM tools. Two Horizon 2020 have already been approved which build on the data and provide new case study application of the S2BIOm tools.

Table of contents

1 Introduction

In this report a full overview is given of the technical characteristics of all components the S2BIOM toolset consists off. In Chapter 2 an overview is given of all components in the toolset. In Chapter 3 an overall description is given of the technical characteristics of the whole toolset and where needed specified per component. In Chapter 4 it is explained how the toolset can be further developed and maintained.

2 Overall structure of the S2BIOM Toolset

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

The database containing all data generated by the project to be integrated into the tool is designed with PostgreSQL and PostGIS. The application server runs on Apache Tomcat software. The CMS (Content Management System) runs on Liferay software. Finally the mapping software in the tool to be used is GeoServer.

For the full chain assessment tools and the biomass matching tools a large database was developed and populated with all possible combinations of (pre-coocked) assessments, data and reports. All data is made presentable in the different tools the toolset contains in which users can interact with the data in the database according to their demand specifications.

The complete toolset of S2BIOM is consists of the following directories and files:

1) S2BIOM data

content of directory (on data partition of SERVER):

.data: directory containing all data generated in the project that can be downloaded from the toolset at different places such as country datafiles all in excel fomat

.doc content of downloadable documents, also subdirectory with bewhere pdfs

.sld content of SLD (Geoserver Style files), this directory must exist on the system, but files may be deleted, since the application generates new versions upon request

.xls. Content of xls directory, contains locagistics simple sheets which are part of the LocaGIStics tool for design and evaluation of biomass delivery chains

2) S2BIOM database

This directory contains of a full dump of the database, the scripts for creating the database and the data templates that were used

They are located in the following directories:

Backup_Jan2017 Dump of postgis database

data_template Templates used for collection of data

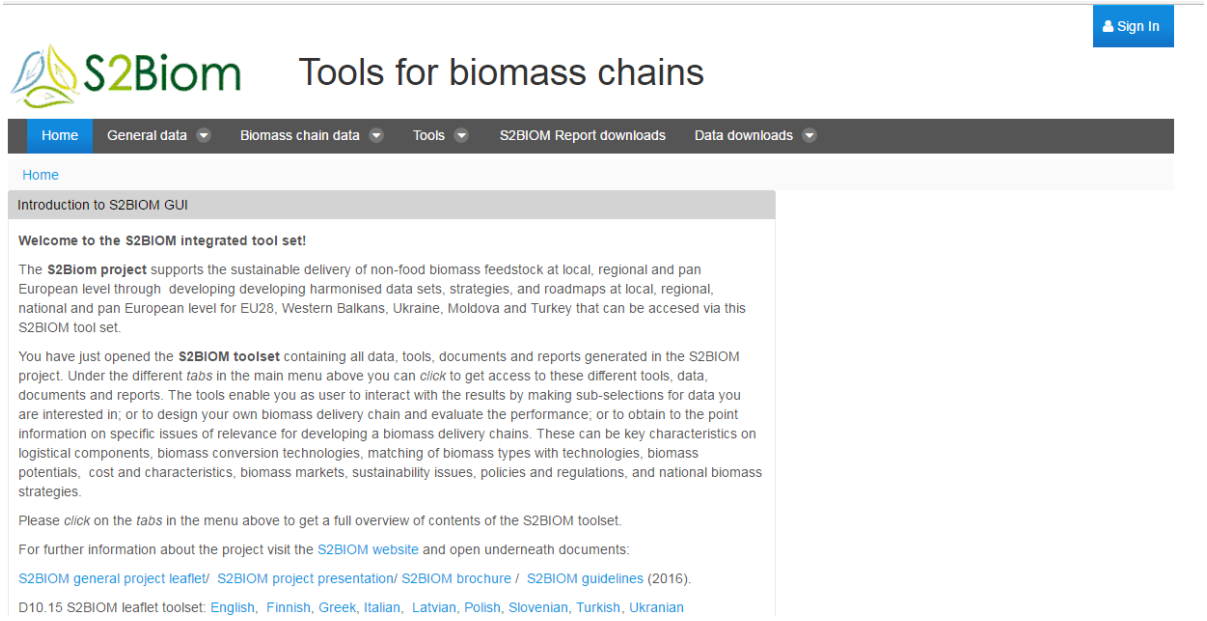
database_scripts SQL scripts for creating a new database

3) S2BIOM server

It contains the configured tomcat directory with all s2biom portlets. The last version is /opt/liferay/s2biom directory, made on 13th Jan 2017.

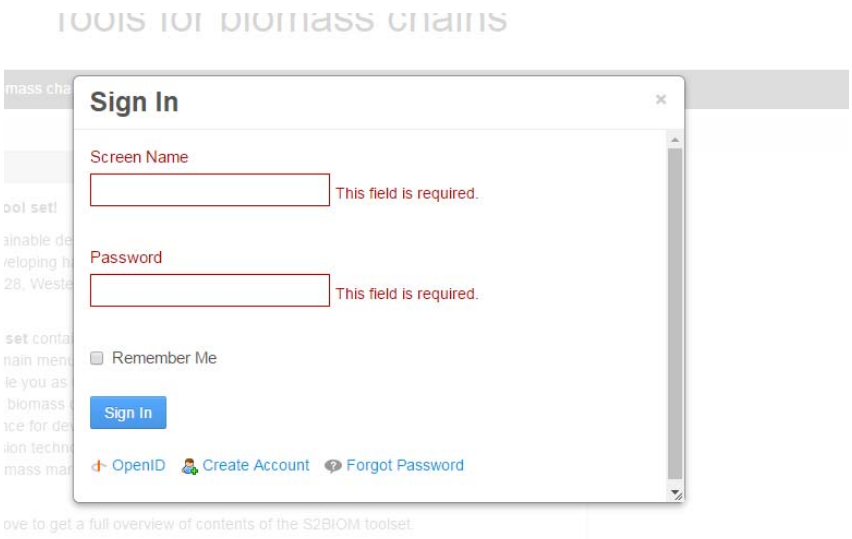
2.1 General user Interface structure and overview of tools in toolset

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. The links open the documents included in the S2BIOM data directory / data/.



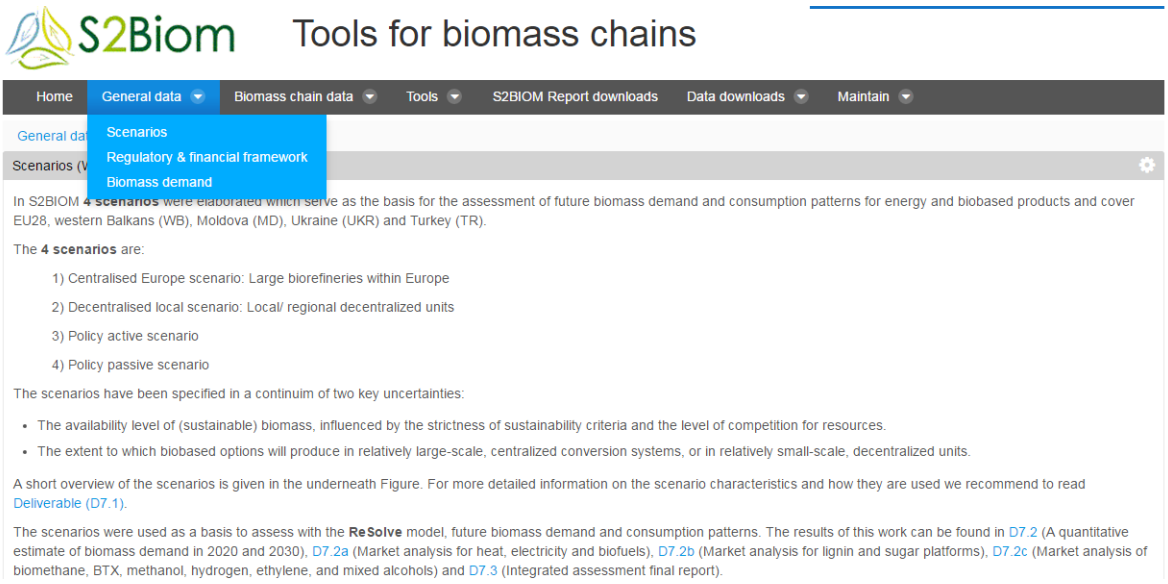
When starting to use the S2BIOM toolset users must sign in. The first time they start using the toolset they have to create their own user account by *clicking* on the top right tab **'Sign in'** and in the next menu on the tab 'Create Account'. The account name and password is automatically created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



In the following the different entry items are further described to get a full overview how the GUI is organised over all data and knowledge generated in the project.

2.1.1 General data

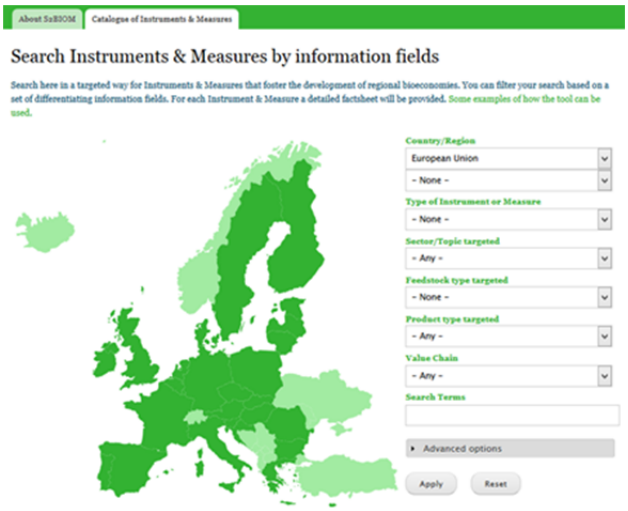


General data: Under this item the following output is included:

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. The documents are opened from the S2BIOM data directory.
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.

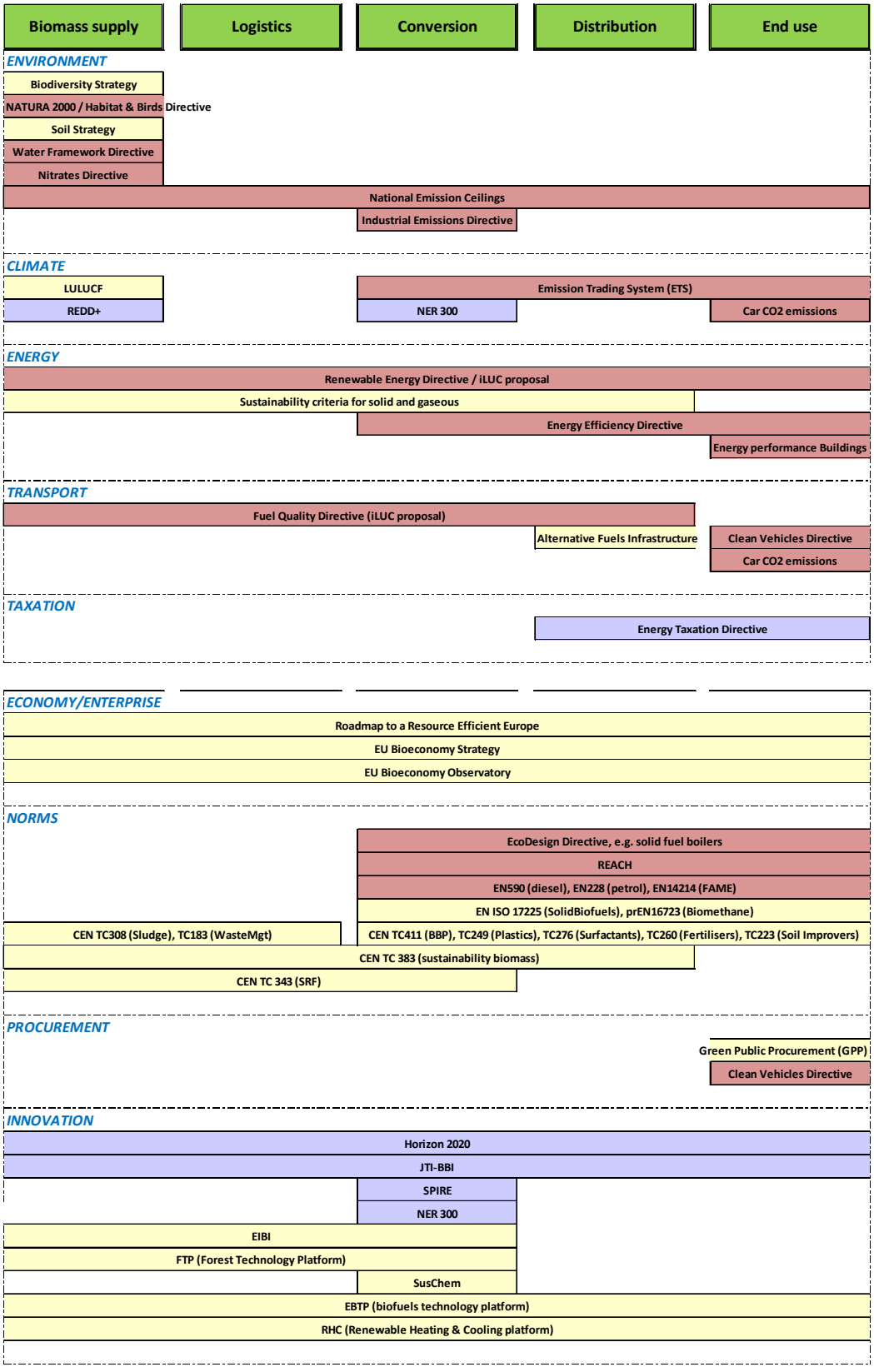
The Biomass Policy Tool:



All data on regulations were collected through an excel database. These excel data have been loaded in a central access database. The data in the access database were transferred to a new PostgreSQL 9.3 database, with the PostGIS2.0 geospatial extension, to make it available to be interactively displayed in the Biomass Policy tool to enable viewing and download.

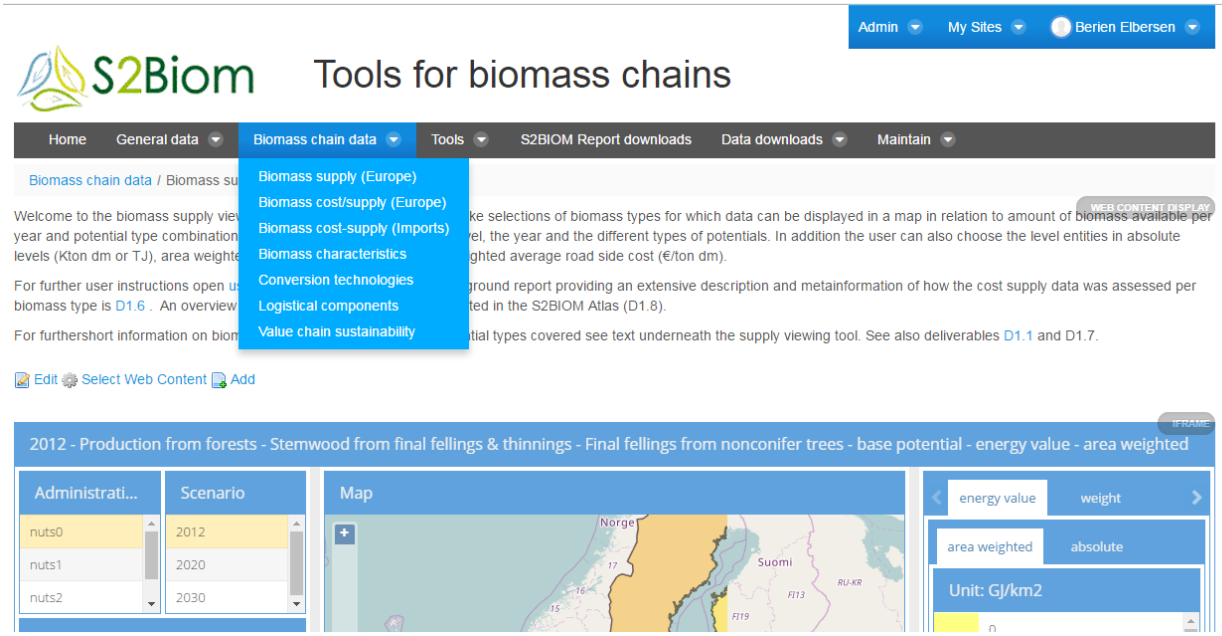
The access database contains fields per regulation and policy organised geographically and most interestingly according to place in the biomass delivery chain that it impacts on (see Figure underneath). In the viewing tool the data request can be taken from these different perspectives of biomass delivery chain positions. The PostgreSQL database that is to be populated with the access data enables access to the data in a viewing tool taking at least 16 different perspectives ranging from geographic, the 5 positions in the chain (from supply to end-use) and according to the 9 issues (from environment to innovation).

Figure 1 Organisation of the regulation and policy database



2.1.2 Biomass chain data and S2BIOM database structure and interaction

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.

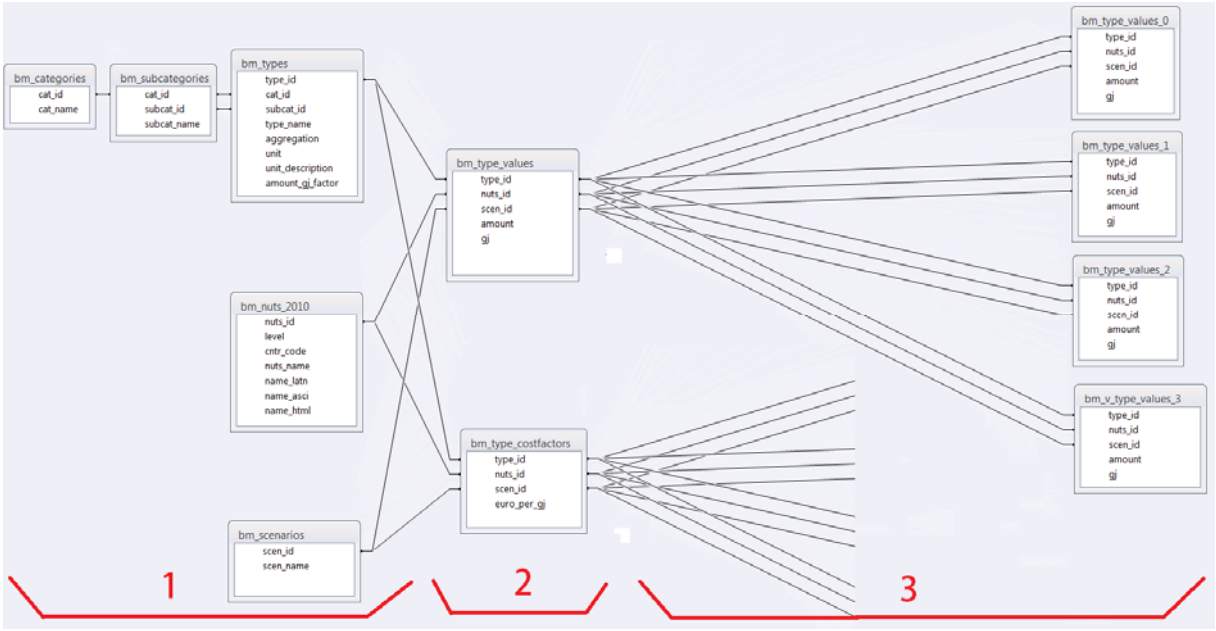


The database has been developed using the open source database software PostgreSQL 9.3, with the PostGIS2.0 geospatial extension. The database runs under Linux.

In the following an overview is given of the S2BIOM database structure and interactions with the different viewing tools.

2.1.3 Database for biomass cost supply

The Entity-Relationship Diagram for the cost supply database looks like this:



On the left side we see the base tables (part 1). These define on which items cost and supply information have been collected. The information has been collected 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. The overview of the biomass types is presented in Table 2.

Table 1 Overview of biomass cost-supply database

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
1221	12	122	Primary residues from forests	Stumps from final fellings & and thinnings	Stumps from final fellings originating from nonconifer	Stumps from final fellings from nonconifer trees

type_id	cat_id	subcat_is	Category	subcategory	short_name	name
					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

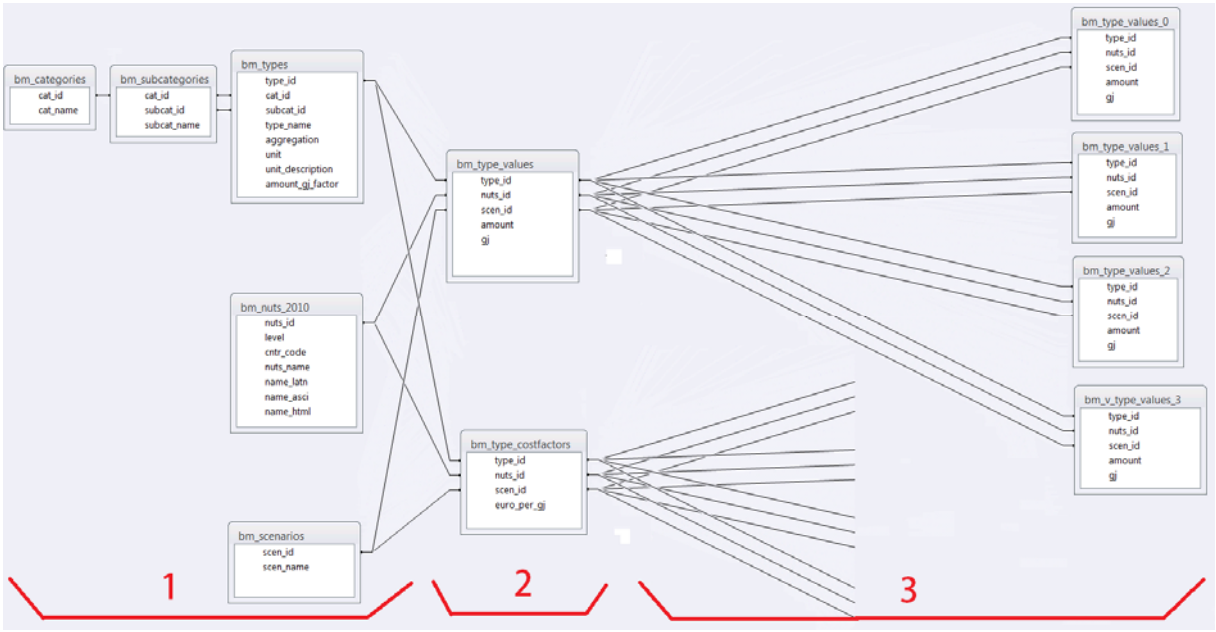
type_id	cat_id	subcat_is	Category	subcategory	short_name	name
5111	51	511	Municipal waste	Biodegradable municipal waste	Biowaste as part of integrally collected municipal waste: Biodegradable waste of not separately collected municipal waste (excluding textile and paper)	Biowaste unseparately collected
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

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.



In the middle we see the bm_type_values and bm_type_costfactors tables (part 2). Inside these the tables the actual values for supply and cost are stored, by NUTS region and by scenario (= type of biomass potential). The NUTS region can be at any level, as long as the region is defined inside the table bm_nuts_2013.

On the right we see some derived tables, to make the informaton available on all NUTS levels (part 3). If supply values on a lower NUTS level are provided, the values at a higher level can be calculated by taking the sum of the amounts at the lower level. We only do so if the value on the higher NUTS level has not been provided separately. So if no value has been provided for a NUTS region, we look if values are

available at lower lowels and sum them up. These values are stored in the derived tables: we have a derived table at any availabe NUTS level.

A similar approach is taken for the costfactors, with the difference that this works in the opposite direction. If a cost factor is provided for a country, this cost factor gets assigned to lower NUTS levels within the country in case there is no cost factor provided for these NUTS regions. Again there is are derived tables for any available NUTS level (these are not in the picture for convenience).

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 the potential for this type of biomass is assessed and what main input data were used to calculate the potential X for that specific type of biomass. The compositional data on the biomass are crucial for the biomass matching tool explained in next Section under integrated assessment tools.

2.2 Database for biomass conversion technologies

An overview of available conversion technologies and their properties is stored in the conversions table and related tables. The related tables are one-to-many sub-tables for output capacity and for additional input that might be needed for the conversion process. Finally there are domain tables to store possible values for selected attributes.

There are 51 conversion technologies stored inside the database.

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!

Data sources used to define conversion efficiencies in 2020:

Data sources used to define conversion efficiencies in 2030:

General data sources for technical properties:

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

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

2.2.1 Database for logistical concepts

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:		References:	
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).		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)		

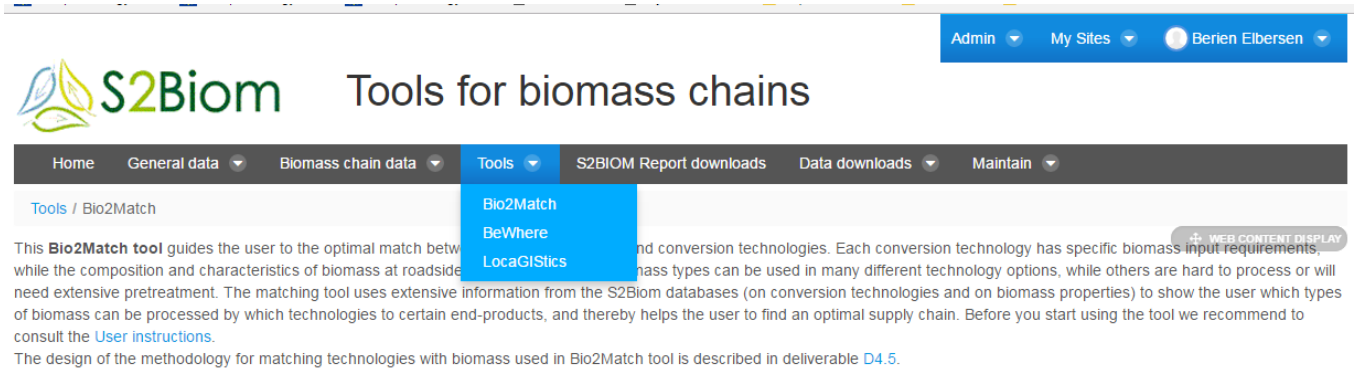
2.2.2 Database for biomass matching tool

The database for the Biomass Matching tool will consist of the 3 databases described in the former, additional compositional 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.

The further design of this database particularly in relation to the biomass composition and the knowledge database on the matching of biomass to conversion and pre-treatment technologies is explained in the next Section.

2.3 Full chain assessment tools

In this part of the GUI the more integrative assessment tools developed in the project are to be placed.

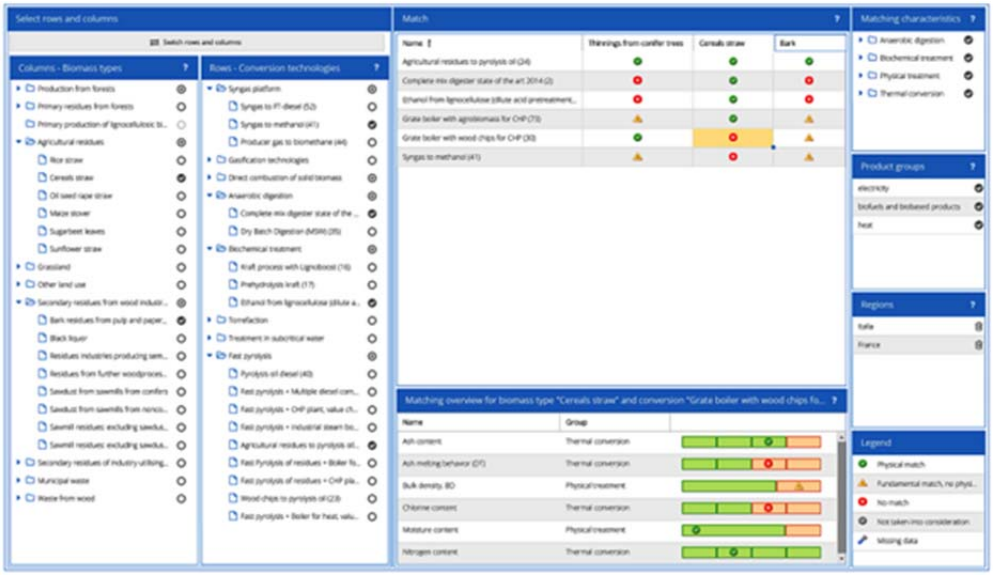


2.3.1 Biomass conversion pathways matching

This tool provides support to users in finding the best match between a certain amount of biomass with specific characteristics as specified in the cost-supply

database (WP 1) and the conversion (WP2) and/or logistical components and pre-treatment technologies.

The Biomass and Technology Matching Tool 'Bio2Match'



The tool can be used to find out:

- Which conversion pathways are appropriate for biomass in your region?
- Is there a need for biomass pre-treatment?

The methodology for the Bio2Match tool was defined on the basis of the classification system, with fundamental characteristics (which cannot easily be modified) and physical characteristics (which can easily be modified) for the biomass. The procedure that the tool utilizes for matching each biomass and each technology is schematically shown in the Figure below.

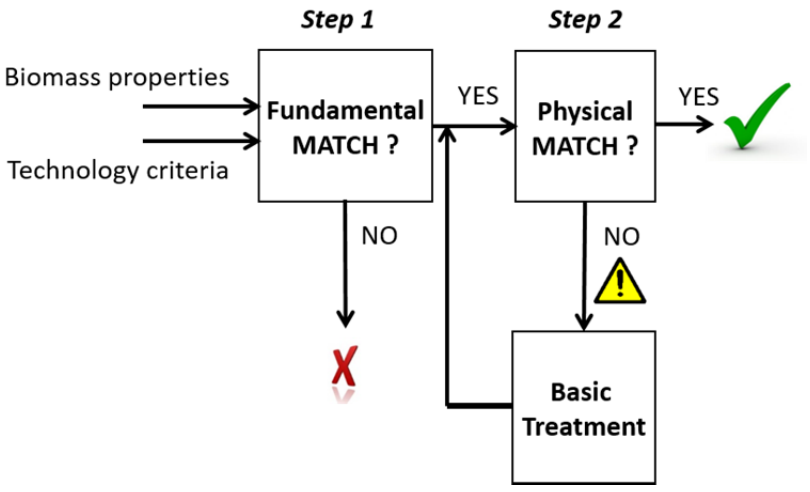


Figure 1 The Bio2Match tool methodology.

Depending on which type of technology is chosen (thermal, (bio-)chemical, anaerobic fermentation), the relevant fundamental properties of the biomass are first compared with the technology criteria (step 1). When each biomass property class has a lower or equal number than the technology criteria for those properties, there is a fundamental match, and the tool subsequently investigates the physical properties (step 2). When the values for the main physical properties also match, the tool generates the answer “there is a match”, indicated by a green traffic light symbol. When there is a fundamental match but no physical match, the tool generates the answer “there is a match, if the biomass receives basic treatment”, indicated by a yellow exclamation mark. When there is no fundamental match, the tool does not proceed to step 2, but generates the answer “there is no match”, indicated by a red traffic light symbol.

2.3.2 Full chain assessments

In this part access is provided to 2 tools:

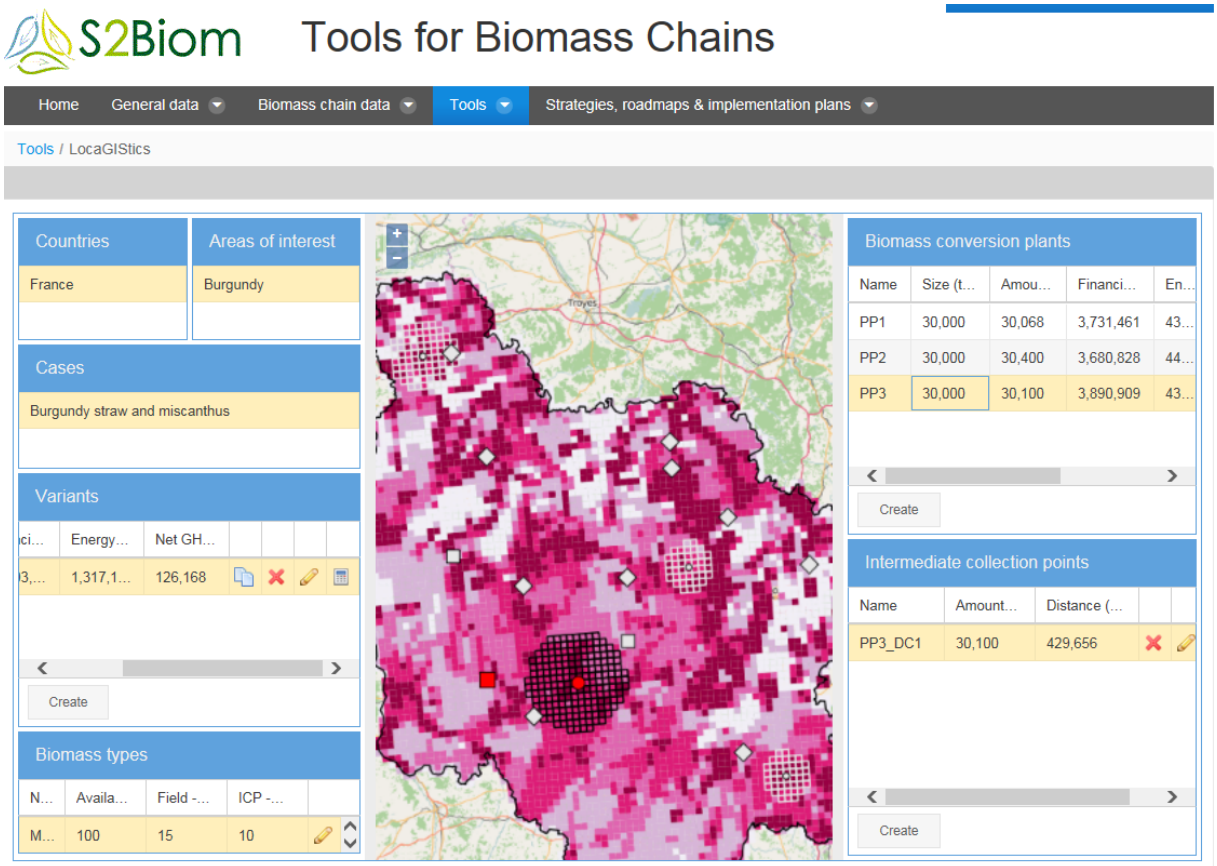
1) A **viewing tool for BeWhere model assessment results**

   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.

2) An interactive tool **LocaGIStics** which is running in the S2BIOM toolset. It enables the user to design and evaluate different biomass delivery chains in regions for which information and data is included in the database. In the

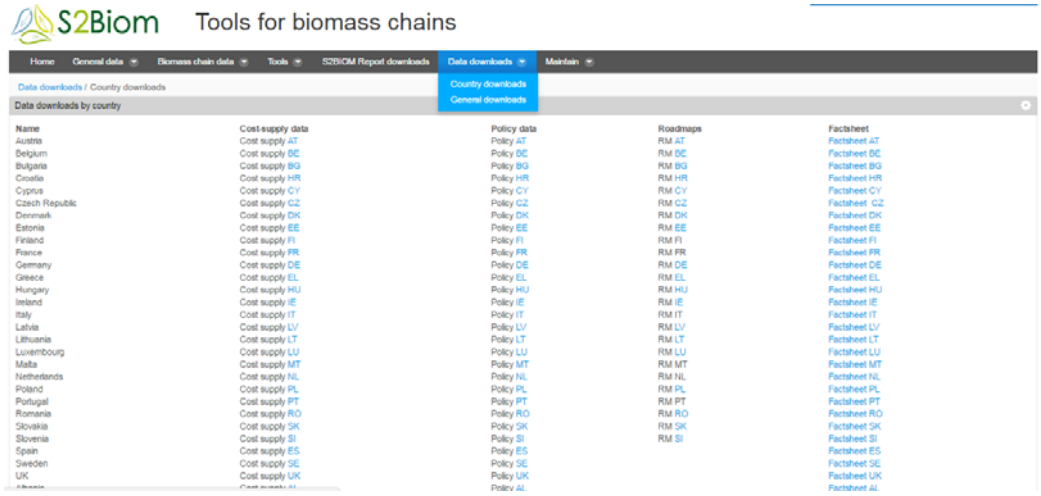
current and final version the regions of Burgundy and the whole of Spain are available.



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

2.3.3 Strategies, roadmaps & implementation plans

This part of the GUI gives access to all documents and data downloads. Users select documents and data files which can be downloaded from the S2BIOM data directory.

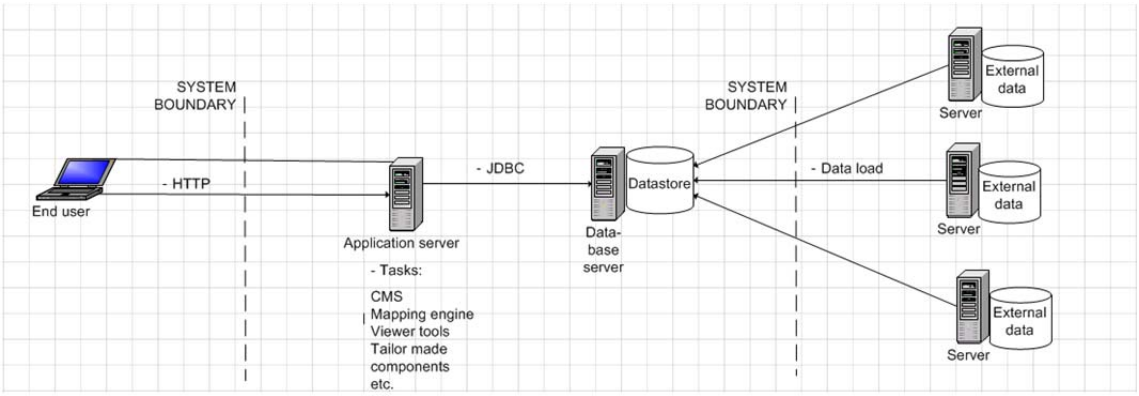


All data, reports, strategies outcomes of interactive workshops are included in the central database and made accessible and/or downloadable through the GUI.

3 Technical characteristics of the S2BIOM toolset

The technical implementation of the tool is organised according to the scheme presented underneath.

Overview of tool, server and database links



The client side of the tool is a web based system. Users can access the toolset by their browsers, the current versions of all major browsers are supported.

The database containing all data generated by the project to be integrated into the tool is designed with PostgreSQL and PostGIS. The application server runs on Apache Tomcat software. The CMS (Content Management System) runs on Liferay software. Finally the mapping software in the tool to be used is GeoServer.

For the full chain assessment tools and the biomass matching tools a large database will be developed with all possible combinations of (pre-coocked) assessments which will be presentable to the users according to their demand specifications. This solution is necessary to limit the running time of the tools. More complicated analysis requirements can be ‘ordered’ by the users of the tools and will be provided after some calculation time and/or model initiation input of the tool managers in the project.

Technical implementation of the components

All server side components are open source products which run under Linux and under Windows.

The database has been developed using the database software PostgreSQL 9.4, with the PostGIS2.0 geospatial extension.

Apache Tomcat, version 7.0.68, is the application engine for tailor made Java-components and for the Liferay Content Management System and for geoserver mapping engine. For Liferay version 6.2 is used. For Geoserver version 2.7.2 was installed.

4 S2BIOM toolset maintenance

The S2BIOM toolset will be available in at least the next 5 years in the current version at www.biomass-tools.eu. It will be maintained to the current standard and it will be ensured that server up-dates are checked in order to keep the S2BIOM toolset available. Alterra-DLO (now called Wageningen Environmental Research (WenR)) will be the main responsible for keeping the toolset accessible and maintained to the current standard.

In addition there will be new follow-up activities which will enable a further up-date and extension of data in the S2BIOM database to be accessible through the different tools.

Concretely there are 2 Horizon 2020 projects starting in March 2017 that will take the S2BIOM database and the S2BIOM tools further:

1) **MAGIC**: *Marginal lands for Growing Industrial Crops: Turning a burden into an opportunity* . There will be several ways to extend the S2BIOM database and toolset in MAGIC:
    a. Marginal lands will be mapped and characterized further
    b. Industrial cropping opportunities for these marginal lands will be further evaluated
    c. With the new results from MAGIC the S2BIOM database and the cost-supply viewing tools can be extended and improved in relation to better estimates of cropping potential and cost of non-food cropped biomass potentials on marginal lands in Europe
    d. The Bio2Match tool can also be further extended with new conversion technologies and new biomass types covering the matching of biomass conversion technologies with industrial biomass produced on marginal lands
    e. The LocaGIStics tool will be extended with new regional case studies for regions with large dedicated cropping opportunities on marginal lands identified as part of the MAGIC project.
2) BECOOL: Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels. The work in BECOOL will provide opportunities to extend the S2BIOM database and Toolset further as follows:
    a. The conversion technology specifications in the database can be further improved in the field of advanced biofuels
    b. The biomass cost-supply data can be further extended with new cropped and residual biomass types in relation to potentials, cost and biomass characteristics.
    c. The Bio2Match tool can also be further extended with new conversion technologies for advanced biofuels and new biomass types

d. The LocaGIStics tool will be extended with new regional case studies for both European and Brazilian regions with large feedstock potentials for advanced biofuels.