Spain

Roadmap for lignocellulosic biomass and relevant policies for a bio-based economy in 2030

Calliope Panoutsou, Asha Singh, Daniel Garcia Galindo; David Sanchez

c.panoutsou@imperial.ac.uk; daniel.garcia@fcirce.es; dsanchez@cener.com
What types of lignocellulosic biomass are included in the analysis?

Lignocellulosic biomass in this analysis includes:

- Forest biomass from primary forestry productions (fellings), primary field residues and secondary forest industry residues;
- Agricultural biomass from primary field activities;
- Biowastes and post consumer wood;
- Dedicated perennial crops.
Context

The roadmap provides scientific evidence for policy, industry and regional stakeholders for the following issues:

- domestic, sustainable lignocellulosic biomass feedstock potentials at national/regional/local levels;
- resource and energy efficient value chains which are expected to be implemented at scale by 2030;
- Sustainability Risks;
- Key indicators per value chain;
- Policies that can facilitate uptake of indigenous lignocellulosic biomass;
- Recommended roadmap actions based on current good practices.
Key questions, addressed by S2Biom

- Where is biomass found?
- What is estimated sustainable potential by 2030?
- What are the sustainable potentials by biomass type and where can they be found?
- How do feedstocks perform in terms of sustainability risks?
- Which value chains have high resource and energy efficiency?
- What is the national policy landscape?
- What future policy interventions can be considered based on good practice?
Where is biomass found?

- The following slide presents a map with total sustainable* occurrence of lignocellulosic biomass by region, measured in ‘000 dry tonnes per year.

* The estimated potentials include sustainability criteria as required by the Renewable Energy Directive.
Total lignocellulosic biomass by region

Supply in kton DM per region (2030, BASE)

total_all
- 0-1
- 1-2
- 2-3
- 3-4
- 4-5
- 5-10
- 10-25
- 25-50
- 50-100
- 100-500
- 500-1000
- 1000-2500
- 2500-5000
- >5000 kton/region
What is the availability per biomass type?

- Sustainable potential from residues, dedicated crops, biowastes and post consumer wood totals 53.5 m dry tonnes / year.
- Primary forestry production accounts for an additional 9.93 m dry tonnes / year.
- The following slide presents a graph of potential available lignocellulosic biomass by source, excluding primary forestry production.
Lignocellulosic biomass availability by source by 2030 ('000 dry tonnes)
What are the sustainable potentials by biomass type and where can they be found?

- The following slides present maps of estimated sustainable potential lignocellulosic biomass by region and by main source, namely:
  - Forest (primary forestry production, field residues and secondary forest residues)
  - Agriculture (primary field residues and tree prunings)
  - Biowastes and post consumer wood
  - Dedicated perennial crops
- Annual sustainable potential up to 15.95m dry tonnes
Agriculture

- Annual sustainable potential up to 14.67m tonnes
Biowastes and post consumer wood

- Annual sustainable potential up to 10.4 m tonnes
Dedicated perennial crops

- Annual sustainable potential up to 22.4m tonnes
# How do feedstocks perform in terms of sustainability risks?

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Sustainability risks (high - red; moderate - yellow; low - green)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary forestry production</td>
<td>Land use (ILUC risk)</td>
</tr>
<tr>
<td>Stemwood from thinnings &amp; final fellings</td>
<td>Biodiversity</td>
</tr>
<tr>
<td>Primary forestry production</td>
<td>Soil &amp; Carbon stock</td>
</tr>
<tr>
<td>Stem and crown biomass from early thinnings</td>
<td>Water</td>
</tr>
<tr>
<td>Primary forestry residues</td>
<td></td>
</tr>
<tr>
<td>Logging residues from final fellings</td>
<td></td>
</tr>
<tr>
<td>Primary forestry residues</td>
<td></td>
</tr>
<tr>
<td>Stumps from final fellings</td>
<td></td>
</tr>
<tr>
<td>Secondary residues from wood industries</td>
<td></td>
</tr>
<tr>
<td>Saw mill residues</td>
<td></td>
</tr>
<tr>
<td>Secondary residues from wood industries</td>
<td></td>
</tr>
<tr>
<td>Other wood processing industry residues</td>
<td></td>
</tr>
<tr>
<td>Primary forestry production</td>
<td></td>
</tr>
<tr>
<td>Stems and crown biomass from early thinnings</td>
<td></td>
</tr>
<tr>
<td>Agricultural residues</td>
<td></td>
</tr>
<tr>
<td>Straw/stubbles</td>
<td></td>
</tr>
<tr>
<td>Agricultural residues</td>
<td>Positive in preventing forest fires, especially in arid climatic conditions</td>
</tr>
<tr>
<td>Woody prunning &amp; orchards residues</td>
<td>Loss of dead wood and stumps may negatively influence species diversity and soil fauna. Contrary to this, leaving them all on the ground may result in increased fertilisation (N and wood ash) and negative impacts on vegetation</td>
</tr>
<tr>
<td>Secondary residues of industry utilising agricultural products</td>
<td>Increased risk of soil erosion; risk to loose soil organic carbon; risk to loose nutrients and risk of reduced soil fertility and soil structure when overharvesting forest residues</td>
</tr>
<tr>
<td>By-products and residues from food and fruit processing industry</td>
<td>None</td>
</tr>
<tr>
<td>Biodegradable municipal waste</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Biodegradable waste</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Post consumer wood</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Hazardous post consumer wood</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Non hazardous post consumer wood</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Perennial lignocellulosic crops</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
<tr>
<td>Miscanthus, switchgrass, giant reed, willow, poplar</td>
<td>Positive in regions where it avoids landfill</td>
</tr>
</tbody>
</table>

- Land use (ILUC risk)
- Biodiversity
- Soil & Carbon stock
- Water
How do feedstocks perform in terms of sustainability risks?

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Sustainability risks (high- red; moderate- yellow; low- green)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Land use (iLUC risk)</td>
</tr>
<tr>
<td>Primary forestry production</td>
<td>Stemwood from thinnings &amp; final fellings</td>
</tr>
<tr>
<td>Primary forestry production</td>
<td>Stem and crown biomass from early thinnings</td>
</tr>
<tr>
<td>Primary forestry residues</td>
<td>Logging residues from final fellings</td>
</tr>
<tr>
<td>Primary forestry residues</td>
<td>Stumps from final fellings</td>
</tr>
<tr>
<td>Secondary residues from wood industries</td>
<td>Saw mill residues</td>
</tr>
<tr>
<td>Secondary residues from wood industries</td>
<td>Other wood processing industry residues</td>
</tr>
<tr>
<td>Agricultural residues</td>
<td>Straw/stubbles</td>
</tr>
<tr>
<td>Agricultural residues</td>
<td>Woody pruning &amp; orchards residues</td>
</tr>
<tr>
<td>Secondary residues of industry utilising agricultural products</td>
<td>By-products and residues from food and fruit processing industry</td>
</tr>
<tr>
<td>Biodegradable municipal waste</td>
<td>Biodegradable waste</td>
</tr>
<tr>
<td>Post consumer wood</td>
<td>Hazardous post consumer wood</td>
</tr>
<tr>
<td>Post consumer wood</td>
<td>Non hazardous post consumer wood</td>
</tr>
<tr>
<td>Perennial lignocellulosic crops</td>
<td>Miscanthus, switchgrass, giant reed, willow, poplar</td>
</tr>
</tbody>
</table>
Which value chains have high resource and energy efficiency?

- The following show value chains with relatively high efficiency in the following aspects:
  - Energy efficiency
  - Greenhouse gas emissions
  - Air quality
  - Technological maturity
### Value chains: forest and agriculture

<table>
<thead>
<tr>
<th>Energy efficiency</th>
<th>Greenhouse gases</th>
<th>Air quality</th>
<th>Technological maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combustion at small scale including households</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>High conversion efficiency with modern technology</td>
<td>Low fossil input in the value chain</td>
<td>-</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>Older stoves have low conversion efficiency. Heat not always efficiently used.</td>
<td>-</td>
<td>High emissions from older wood stoves.</td>
</tr>
<tr>
<td><strong>Combustion at small-medium scale including buildings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>High conversion efficiency</td>
<td>Low fossil input in the chain</td>
<td>-</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>-</td>
<td>-</td>
<td>Emissions better than smaller scale but higher than natural gas.</td>
</tr>
<tr>
<td><strong>Combustion at medium scale, heat led</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>High conversion efficiency</td>
<td>Low input of fossil fuels; high GHG savings especially for Combined Heat and Power</td>
<td>Better control options for emissions</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>-</td>
<td>-</td>
<td>Higher emissions than natural gas combustion.</td>
</tr>
<tr>
<td><strong>Biochemical - lignocell. hydrolysis and fermentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>-</td>
<td>High GHG savings in case of process integration and limited fossil input.</td>
<td>Ethanol has low emissions as transport fuel.</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>Around 50% conversion efficiency</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
## Value chains: wastes

<table>
<thead>
<tr>
<th>Energy efficiency</th>
<th>Greenhouse gases</th>
<th>Air quality</th>
<th>Technological maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waste incineration and energy recovery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>Adding energy recovery to waste management improves its pathway; high efficiency if CHP</td>
<td>High GHG benefit, particularly compared to landfill (avoided methane emissions); energy recovery substitutes fossil fuels</td>
<td>If landfill is avoided, lower air emissions.</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>Relatively low net energy output; auxiliary fuel may be required due to low calorific value of fuel</td>
<td>-</td>
<td>Issues in terms of emissions of waste incineration. Emission control is circa one third of project cost.</td>
</tr>
<tr>
<td><strong>Combustion at medium scale, heat driven</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>&gt;85% conversion efficiency in case of heat only; 65-85% efficiency for CHP installations</td>
<td>Low input of fossil fuels; especially in case of CHP GHG savings can be high</td>
<td>Better control options for PM emissions compared to small scale installations.</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>-</td>
<td>-</td>
<td>Still higher PM emissions than natural gas combustion.</td>
</tr>
<tr>
<td><strong>Gasification &amp; CHP at medium scale - heat driven</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td>Up to 80% conversion efficiency, depending on heat only or CHP installations.</td>
<td>Low/no input of fossil fuels; especially in case of CHP GHG savings can be high</td>
<td>Low emissions of gas engine or turbine</td>
</tr>
</tbody>
</table>
## Key indicators per value chain

<table>
<thead>
<tr>
<th>Forest biomass</th>
<th>Non-renewable energy requirement (GJ non-renewable inputs/GJ outputs)</th>
<th>Cumulative energy demand (GJ inputs/GJ outputs)</th>
<th>Output service quality (€ outputs - € inputs (excl.biomass) per dry tonne of biomass input at plant gate)</th>
<th>GHG reduction, compared to reference (%)</th>
<th>Levelised life cycle cost, based on CAPEX and OPEX (incl. feedstock cost), expressed in relation to the output of energy carriers (€/GJ energy carriers)</th>
<th>Jobs in FTE along the full value chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>Residential wood chips boilers - small scale (10-25 kW)</td>
<td>1.39 GJ/GJ</td>
<td>0.044 GJ/GJ</td>
<td>188 €/ton d.m.</td>
<td>92%</td>
<td>17 €/GJ</td>
</tr>
<tr>
<td>Services</td>
<td>Wood chip boilers-large size (50 kW)</td>
<td>1.24 GJ/GJ</td>
<td>0.039 GJ/GJ</td>
<td>211 €/ton d.m.</td>
<td>93%</td>
<td>13 €/GJ</td>
</tr>
<tr>
<td>Industry</td>
<td>CHP using solid biomass &gt; 15MW</td>
<td>2.79 GJ/GJ</td>
<td>0.088 GJ/GJ</td>
<td>198 €/ton d.m.</td>
<td>93%</td>
<td>30 €/GJ</td>
</tr>
<tr>
<td></td>
<td>CHP using solid biomass 0.5 - 15 MW</td>
<td>1.31 GJ/GJ</td>
<td>0.042 GJ/GJ</td>
<td>280 €/ton d.m.</td>
<td>95%</td>
<td>19 €/GJ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agricultural biomass</th>
<th>Non-renewable energy requirement (GJ non-renewable inputs/GJ outputs)</th>
<th>Cumulative energy demand (GJ inputs/GJ outputs)</th>
<th>Output service quality (€ outputs - € inputs (excl.biomass) per dry tonne of biomass input at plant gate)</th>
<th>GHG reduction, compared to reference (%)</th>
<th>Levelised life cycle cost, based on CAPEX and OPEX (incl. feedstock cost), expressed in relation to the output of energy carriers (€/GJ energy carriers)</th>
<th>Jobs in FTE along the full value chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>Straw and agricultural residues for small scale local heating plants</td>
<td>1.39 GJ/GJ</td>
<td>0.089 GJ/GJ</td>
<td>170 €/ton d.m.</td>
<td>88%</td>
<td>18 €/MJ</td>
</tr>
<tr>
<td>Services</td>
<td>Straw and agricultural residues for CHP &gt; 10 MW</td>
<td>1.31 GJ/GJ</td>
<td>0.084 GJ/GJ</td>
<td>253 €/ton d.m.</td>
<td>92%</td>
<td>20 €/GJ</td>
</tr>
<tr>
<td>Industry</td>
<td>Straw and agricultural residues for CHP &gt; 10 MW</td>
<td>1.31 GJ/GJ</td>
<td>0.084 GJ/GJ</td>
<td>253 €/ton d.m.</td>
<td>92%</td>
<td>20 €/GJ</td>
</tr>
<tr>
<td>Utility</td>
<td>Direct co-firing coal process</td>
<td>1.21 GJ/GJ</td>
<td>0.030 GJ/GJ</td>
<td>253 €/ton d.m.</td>
<td>96%</td>
<td>20 €/GJ</td>
</tr>
<tr>
<td>Bioethanol 2nd</td>
<td>Cellulose-EtOH</td>
<td>2.44 GJ/GJ</td>
<td>0.054 GJ/GJ</td>
<td>144 €/ton d.m.</td>
<td>85%</td>
<td>24 €/GJ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biowastes</th>
<th>Non-renewable energy requirement (GJ non-renewable inputs/GJ outputs)</th>
<th>Cumulative energy demand (GJ inputs/GJ outputs)</th>
<th>Output service quality (€ outputs - € inputs (excl.biomass) per dry tonne of biomass input at plant gate)</th>
<th>GHG reduction, compared to reference (%)</th>
<th>Levelised life cycle cost, based on CAPEX and OPEX (incl. feedstock cost), expressed in relation to the output of energy carriers (€/GJ energy carriers)</th>
<th>Jobs in FTE along the full value chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry/ Utility</td>
<td>anaerobic digestion &amp; medium scale CHP</td>
<td>2.00 GJ/GJ</td>
<td>0.007 GJ/GJ</td>
<td>197 €/ton d.m.</td>
<td>88%</td>
<td>28 €/GJ</td>
</tr>
<tr>
<td>Transport</td>
<td>anaerobic digestion + upgrading to methane</td>
<td>1.56 GJ/GJ</td>
<td>0.071 GJ/GJ</td>
<td>122 €/ton d.m.</td>
<td>81%</td>
<td>14 €/GJ</td>
</tr>
</tbody>
</table>
What is the national policy landscape*?

- The following slides provide diagrams to illustrate how existing policies / measures support one or more of the following:
  - Biomass supply
  - Logistics
  - Conversion
  - Distribution
  - End use

- Policies / measures are categorised as: 1) Regulation, 2) Financing and 3) Information

* Policy mapping and respective recommendations are the result of intensive review but as the field is dynamic the authors appreciate there may be missing elements.
Current policy: forest

Biomass Supply

Logistics

Conversion

Distribution

End Use

Guarantee of Origin for RE and CHP

Forest Law

Decrees on RES Electricity (Feed-in Tariffs) RE Auctions

Investment Subsidies

Biomass for heating in buildings (subsidies)

Royal Decree on Electricity Distribution (Grid Access etc)

Regulations

Financing

Information
Current policy: agriculture & dedicated crops

Biomass Supply

Logistics

Conversion

Distribution

End Use

Guarantee of Origin for RE and CHP

Common Agricultural Policy

Decrees on RES Electricity (Feed-in Tariffs)
Re Auctions

Investment Subsidies

Biomass for heating in buildings (subsidies)

Animal By-Products

Royal Decree on Electricity Distribution (Grid Access etc)

Regulations

Financing

Information
Current policy: wastes

Biomass Supply
Logistics
Conversion
Distribution
End Use

Guarantee of Origin for RE and CHP

Decrees on RES Electricity (Feed-in Tariffs)
RE Auctions

Biofuels Specifications

Investment Subsidies

Biofuel Sustainability Criteria

Law on Air Quality and Protection

Regulations
Financing
Information

Support Scheme for Biofuels
What improvements can be made based on good practice*?

- The following slides illustrate selected policies from Member States that have had significant positive impact in promoting the use of lignocellulosic biomass.
- Based on this Good Practice, recommended new policies are shown (shaded boxes) to complement existing policies.

* Policy mapping and respective recommendations are the result of intensive review but as the field is dynamic the authors appreciate there may be missing elements.
Good Practice - Feedstocks

Biomass sourcing

Wastes
- AT: Waste management & Regulation on recycling of waste wood
- DE: Kreislaufwirtschaftsgesetz-KrWG- Waste disposal
- NL: strategic initiative for anaerobic digestion of MSW - organics

Forest biomass
- FI: private forest owners
- FI: forest certification
- BE: Subsidies for afforestation and forest management

Agricultural biomass
- AT: ÖPUL – Austrian Agri-environmental Programme: Tailored investment support with market sector focus
- DE: EEG- Feedstock bonus for plants using straw

Dedicated crops
- DE: ÖPUL – "Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz” provides farmers with financial support for the cultivation of short rotation coppices.

Logistics

BE: VLAREM- collecting & treatment

FI: forest certification

High impact
Moderate impact
Good Practice - End use sectors

Conversion

Heat
- UK: Renewable Heat Initiatives (RHI)
- AT: Green Electricity Act & CHP Act: refines scales of applications and target specific sectors and biomass resource types and end uses.
- DE: Renewable Energy Sources Act 2014 - Act (EEG 2014); Market premium (in EEG § 35); Flexibility premium for existing installations (EEG, § 54)
- UK: Renewables Obligation (RO) scheme, based on green certificates favouring certain technologies
- DE: Federal Immission Control Act (BImSchG)

CHP
- AT: Green Electricity Act & CHP Act: refines scales of applications and target specific sectors and biomass resource types and end uses.
- DE: Renewable Energy Sources Act 2014 - Act (EEG 2014); Market premium (in EEG § 35); Flexibility premium for existing installations (EEG, § 54)
- UK: Renewable Transport Fuel Obligation (RTFO) and certification system
- DE: Energy Tax Act (EnergieStG) : It accounts for transport biofuels
- FI: Act of Excise Duty on Liquid Fuels, a taxation system, in which each component of a liquid fuel is taxed separately, based on its energy content and carbon dioxide emission, meaning reduced taxation for biofuels

Biobased products
- DE: National Bioeconomy Strategy
- SE : Swedish Research and Innovation Strategy for a Bio-based Economy

Distribution

AT: Climate and Energy Fund-Subsidy scheme wood heating.
- NL: Energy Investment Allowance (EIA), tax reductions for boilers
- ES: BIOMCASA I & II, funding for efficient use of biomass

End Use

UK: Renewables Obligation (RO) scheme, based on green certificates favouring certain technologies
- DE: repayment bonus from market program (MAP) and soft loans with low interest rates public sector bank KfW
- DE: Energy Tax Act (EnergieStG) : It accounts for transport biofuels
Recommended new policy*: forest

- Biomass Supply
- Logistics
- Conversion
- Distribution
- End Use

Guarantee of Origin for RE and CHP

Forest Law

Decrees on RES Electricity (Feed-in Tariffs)

Investment Subsidies

Maintenance subsidies/loans for biomass heating & ‘band’ payments for specific residual streams only

Fixed premiums
Follow-up tariffs for existing RES-E plants

Biomass for heating in buildings (subsidies)

Green electricity feed-in tariff regulation: introduce premiums for specific diameters cuttings; thinnings, etc.

Royal Decree on Electricity Distribution (Grid Access etc)

- Regulations
- Financing
- Information

*Shaded boxes show recommended new measures
Recommended new policy: agriculture & dedicated crops

- Biomass Supply
- Logistics
- Conversion
- Distribution
- End Use

**Guarantee of Origin for RE and CHP**

- Common Agricultural Policy
- Animal By-Products

- Decrees on RES Electricity (Feed-in Tariffs)

- Green electricity feed-in tariff regulation: introduce feedstock premium for agricultural residues

- Investment Subsidies

- Standards for agricultural biomass

**End Use**

- Biomass for heating in buildings (subsidies)

- Maintain subsidies/loans for biomass heating & ‘band’ payments for specific residual streams only

- Royal Decree on Electricity Distribution (Grid Access etc)

**Regulations**

- Financing

- Information
Recommended new policy: wastes

- Biomass Supply
- Logistics
- Conversion
- Distribution
- End Use

Standards for biowastes

- Guarantee of Origin for RE and CHP
- Decrees on RES Electricity (Feed-in Tariffs)
- Feed-in tariff regulation: introduce feedstock premium for biowastes
- Biofuels Specifications
- Investment Subsidies
- Biofuel Sustainability Criteria
- Support Scheme for Biofuels
- Climate & Energy Fund: Band payments for specific biowaste streams only
- Law on Air Quality and Protection

Regulations
Financing
Information
Conclusions

- Spanish regions have relatively high biomass availability. The national lignocellulosic biomass potential is around 53.5m dry tonnes / year (excluding primary forest harvest), with forest, agriculture and waste sources all significant.
- The existing policy framework forms a foundation for future support measures to be introduced.
- The study has recommended a number of new policies (and refinements to existing policies) that are based on Good Practice and can further facilitate mobilisation of lignocellulosic biomass for a bio based economy by 2030.
Further reading

- [www.s2biom.eu](http://www.s2biom.eu)
- [www.biomass-tools.eu](http://www.biomass-tools.eu) *click* in main menu on ‘Biomass chain data’ ---> ‘Biomass characteristics’
- [www.biomass-tools.eu](http://www.biomass-tools.eu) *click* in main menu on ‘Data downloads’
This project is co-funded by the European Union within the 7th Frame Programme. Grant Agreement n°608622.

The sole responsibility of this publication lies with the author. The European Union is not responsible for any use that may be made of the information contained therein.