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Sustainable Networks for the Energetic Use of Lignocellulosic Biomass in South East Europe

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Ptolemais, June 2014

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1 Methodology

The Aol (Area of Intervention) **specific checklists** were derived from the **Transnational Innovation Road Map and Research Agenda** delivered by BOKU for the improvement of the defined (regional) biomass SCORPs.

The checklist, as the roadmap where divided into **categories** such as:

1. Introduce new and expand existing innovation networks in SEE
2. Improve process and customer orientation
3. Reduce the energy input in the supply chain
4. Store biofuels
5. Improve material characteristics
6. Improve forest fuel logistic concepts
7. Expand the resource basis for bioenergy generation
8. Deal with technical/ecological challenges
9. Cooperation

Each region received a template of the checklist and was instructed to follow the below stated steps:

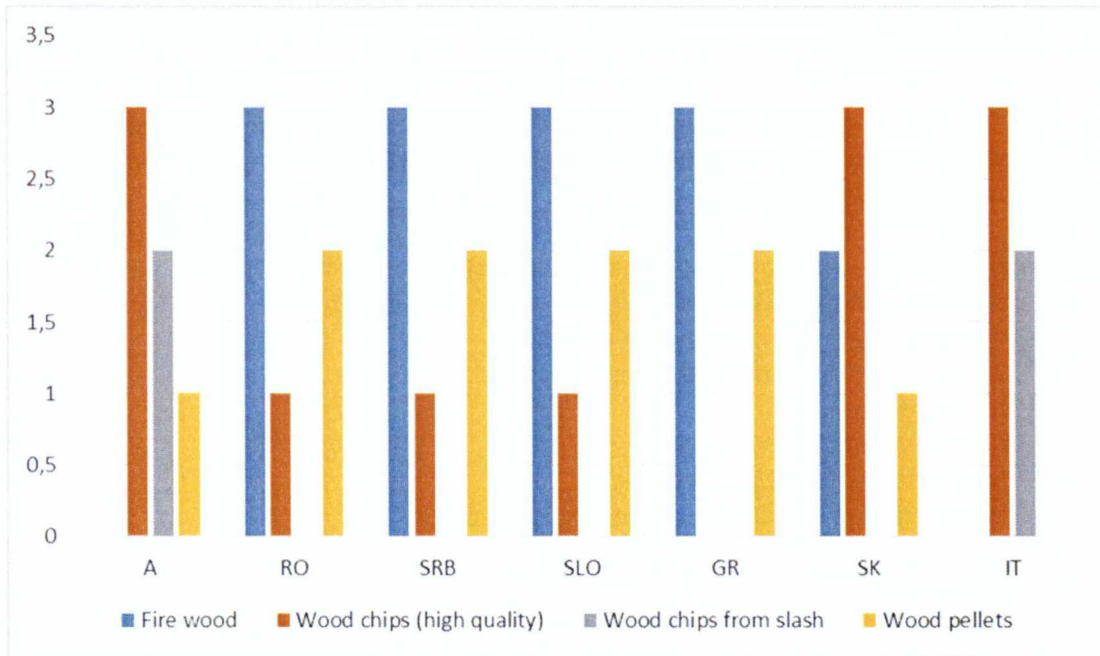
- Indication of the region's SCORPs defined in previous steps (production of fire wood, wood pellets and wood chips, either premium/high quality or from slash originating) depending on the priority to be given (1st, 2nd or 3rd).

E.g. Styria, Slovakia and South Tyrol indicated wood chips as their 1st priority SCORP in contrast to Romania, Serbia, Slovenia and Western Macedonia which indicated fire wood as their 1st priority.

- Evaluation of each category (1-9) of each SCORP (fire wood, pellets and wood chips) by giving "low", "moderate", "high" or "not at all" characterization to each action (Annex I).

2 Analysis of checklists

One of the results shows the priority of SCORPS in the participating regions. As depicted in the next graph the production of wood logs/fire wood and SCORPS connected to this kind of end product have the **first priority** in four regions (Romania, Serbia, Slovenia and Western Macedonia). SCORPS dedicated to pellet production were identified as **second priority** area in four regions (Romania, Serbia, Slovenia and Western Macedonia). Wood pellets and fire wood were not considered as relevant only in South Tyrol. High quality wood chips were identified as first priority in three countries (Styria, South Tyrol and Slovakia). Wood chips originating from slash were a second priority only in Styria and in South Tyrol. Wood chips in general were not identified as relevant only in Greece. SCORPS connected to production of high quality wood chips were identified as **third priority** in three countries (Romania, Serbia and Slovenia). These selected priorities show also the status of market development in the participating regions.



Graph 1: Relevance of different SCORPS identified by participating regions

Note: Mark 3 was given to the SCORPS with “first priority”, 2 for “second priority” and 1 for “third priority”

The importance of the selected categories (1-9) is interpreted by region but also by type of SCORP. The complete results per category, selected SCORP and region can be found below.

Analysis per category

Introduce new and expand existing innovation networks in SEE	Priority of action
All partners expressed significant interest to <i>enhance adaption and implementation of best practices in the forest fuel supply chain</i> (Exception - low interest for Styria regarding wood pellets).	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="background-color: #ffffcc; padding: 5px;">moderate</div> <div style="background-color: #38761d; color: white; padding: 5px;">high</div> </div>
Improve process and customer orientation	Priority of action
The <i>Automatic round wood takeover at biomass trade centres</i> it is not an interesting activity for the most partners (Exception – high interest for Styria regarding premium wood	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="background-color: #ffffcc; padding: 5px;">moderate</div> <div style="background-color: #800000; color: white; padding: 5px;">not at all</div> </div>

chips).	
As well as <i>Enabling the possibility for customers to pick up biomass outside the opening hours of biomass trade centres or similar retailers was not seen as a priority for the most partners</i>	

Store biofuels	Priority of action
All partners expressed some interest for <i>Improving storage properties of biomass fuels at consumer</i> as well as for	
<i>Increase the knowledge of long-term storage of biomass</i>	

Improve material characteristics	Priority of action
<i>Torrefaction</i> , was not seen as a priority at all or at least as a moderate-low priority.	

Improve forest fuel logistic concepts	Priority of action
<i>Increase the use of the railway for forest fuel transport</i> and	
<i>Use inland water way for forest fuel transport if possible</i> was not at all a priority or at least a moderate priority	

Expand the resource basis for bioenergy generation	Priority of action
<i>Market barriers should be eliminated by uniform quality standards and the increasing need for resources should be served by an extension of the usable feedstock</i> was seen as of high interest for almost all partners	

Analysis per selected SCORP

Fire wood

Results per SCORP

- All partners agreed that **stimulating the use of national competencies and enhancing the adaption and implementation of best practices in the forest fuel supply chain** should be of considerable priority.
- **Improving the storage properties of biomass fuels at the consumer** was identified as of low priority as well as the **development of new methods for easily measuring quality characteristics**.
- All partners agreed that **market barriers should be eliminated** in order to expand the resource basis for bioenergy generation.
- Low interest was shown for **improving harvesting technologies to provide additional assortments for energetic use**.

Axi specific checklists derived from the Innovation roadmap for the improvement of the defined biomass						
SCORPs						
Select the region (from drop-down list)	Romania	Serbia	Slovenia	Western Macedonia	Slovakia	
Indicate the priority	First priority	First priority	First priority	First priority	Second priority	
Select the chosen SCORPs of your region	High level	High level	High level	High level	High level	
Indicate the priority of the actions from the drop down list below as "high", "moderate", "low" or "not at all".						
Introduce new and expand existing innovation networks in SEE						
Promote international R&D collaboration	high	low	low	moderate	moderate	
Stimulate use of national competences	high	high	moderate	high	moderate	
Enhance adoption and implementation of best practices in the forest fuel supply chain	high	high	high	high	moderate	
Improve process and customer orientation						
Use of online tools for selling forest fuel assortments (online information/ordering platform for biomass, biomass trading etc. portal)	high	not at all	high	moderate	low	
Increase the use of ICT within all processes	high	not at all	moderate	moderate	moderate	
Automatic round wood takeover at biomass trade centres	not at all	not at all	moderate	not at all	moderate	
Enabling the possibility for customers to pick up biomass outside the opening hours of biomass trade centres or similar retailers	not at all	not at all	moderate	low	low	
Introduce trademarks	low	moderate	moderate	moderate	low	
Interest in biomass trade centres	moderate	moderate	high	low	high	
Reduce the energy input in the supply chain						
Reduction of energy input in processing biomass (e.g. chipping)	high	low	low	low	high	
Increase tool life and extend periodicity of maintenance to reduce overall energy input over the life time	moderate	moderate	not at all	moderate	low	
Apply economic methods to determine optimal processing with reduced energy input	high	moderate	low	low	high	
Reduction of energy consumption in forest fuel logistics	high	low	low	low	high	
Store biofuels						
Improving storage properties of biomass fuels at producer/trader	low	low	moderate	low	high	
Improving storage properties of biomass fuels at consumer	low	low	low	low	moderate	
Increase the knowledge of long-term storage of biomass	low	low	moderate	low	high	
Study self-ignition of stored materials	low	not at all	not at all	not at all	low	
Improve material characteristics						
Develop new methods for easily measuring quality characteristics	moderate	low	low	low	moderate	
Drying of forest fuels						
1. Technologies	moderate	high	not at all	low	moderate	
2. Economic calculations	high	high	moderate	low	high	
3. Incorporation in efficient supply chain	high	high	low	low	moderate	
Torrefaction	moderate	not at all	not at all	not at all	low	
Separation of undesired contaminants	high	not at all	low	low	moderate	
Improve forest fuel logistic concepts						
Increase the use of the railway for forest fuel transport	not at all	low	not at all	not at all	moderate	
Use inland water way for forest fuel transport if possible	not at all	moderate	not at all	not at all	not at all	
Seek for multimodal solution for forest fuel transport	high	low	low	low	moderate	
Increase the number and capability of biomass terminals	high	moderate	moderate	low	moderate	
Balance intermediate storage against the connected extra costs	high	low	low	not at all	moderate	
Optimize location and capacity of comminution	low	not at all	low	low	moderate	
Develop methods to reduce empty drives	moderate	not at all	moderate	moderate	moderate	
Develop new types of containers or adapt existing container types according to customer needs and feedstock properties	low	not at all	low	low	high	
Increase the use of a system enabling delivery of wood chips (blow into storage) similar to pellets	not at all	not at all	not at all	not at all	low	
Studying the interaction of different supply chains to each other	high	not at all	moderate	low	moderate	
Expand the resource base for bioenergy generation						
Market barriers should be eliminated by uniform quality standards and the increasing need for resources should be served by an extension of the usable feedstock	high	high	high	high	moderate	
Energetic use of wood from slopes, meadows and less economically valuable forests	moderate	low	moderate	low	high	
Harvesting and energetic utilization of non-woody biomass (e.g. reed, miscanthus, etc.)	moderate	not at all	not at all	low	not at all	
Broadleaved wood utilization efficiency increase	high	high	moderate	low	high	
Fundamental research in breeding and agriculture for energy plants	low	low	low	low	high	
Establishment of short rotation plantation of fast growing trees on agricultural land	not at all	low	not at all	low	moderate	
Afforestation of abandoned land and other lands that is not in use for other purposes	high	high	not at all	moderate	high	
Fundamental research in breeding and agricultural technology (plantation, harvesting, etc. etc.)	not at all	low	not at all	low	moderate	
Research in conflicts between natural conservation and biomass production on both, woodland and agricultural land	high	low	low	low	high	
Research in CO ₂ storage and emissions for different types of biomass	high	low	low	low	high	
Use of non-forest wood fuels, e.g. wood from tree pruning along roads or paths, from parks as well as from agricultural sites (fruit trees)	moderate	low	low	low	high	
Use of wood from removing trees from pasture land	moderate	not at all	not at all	not at all	high	
Improve harvesting technology to provide additional assortments for energetic use (e.g. comcobs)	moderate	low	low	low	moderate	
Basic studies on material blends: e.g. logistics and storage; combustion characteristic; disposal of ash, emissions	moderate	low	low	low	high	
Deal with technical/ecological challenges						
Utilization of biomass ashes	high	low	not at all	low	high	
Slash utilization map for specific regions	high	low	not at all	moderate	high	
Decision support system (DSS) for ecologically efficient supply chains utilizing logging residues	high	low	moderate	low	high	
Study of nutrient cycles for (i) forest biomass, (ii) energy plants, and (iii) secondary feedstocks	high	low	low	moderate	moderate	
Cooperation						
Cooperation between forest owners for market development	high	moderate	high	moderate	moderate	
Cooperation between different actors within the forest fuel supply chain	high	moderate	moderate	moderate	moderate	
Cooperation between material and energetic use via joint procurement reducing procurement costs and increasing supply security for both uses	high	low	moderate	low	high	
Development of usage concepts, operators and business models for diverse supply chains	high	low	low	low	moderate	
Development of supply concepts for industrial applications, especially with regard to security of supply and risk management	high	low	low	low	moderate	
Development of recognized and practicable methods for the preparation of LCAs for the entire biomass supply chain	high	moderate	moderate	moderate	high	
Creation of material flow analysis for biomass in the different regions	high	low	low	moderate	high	
Improve standardisation in the field of bioenergy	high	moderate	moderate	high	moderate	

Graph 2: Fire wood as priority SCORP

Pellets

Results per SCORP

- All partners showed considerable interest in **stimulating the use of national competencies** to introduce and expand networks and to **increase the use of ICT within all processes** in order to improve process and customer orientation.
- Similarly, all partners showed considerable interest in the **reduction of the energy input in processing biomass** in order to reduce the energy input in the supply chain.
- Little interest was expressed regarding the **improvement of storage properties of biomass fuels at the consumer** as well as for **new drying technologies of forest fuels** along with **torrefaction** to improve material's characteristics.
- Regarding the improvement of fuel logistic concepts, the **increase of the use of railways and the use of inland water ways for forest fuel transport** are of low or no interest as well as the **optimization of the location and the capacity of comminution**.
- Similarly, **harvesting and energetic utilization of non-woody biomass, fundamental research in breeding and agriculture for energy plants/agricultural technology** as well as **establishment of short rotation plantations of fast growing trees on agriculture land** was also identified as of low interest.
- Use of **wood from removing trees and improvement of harvesting technologies to provide additional assortments for energetic use** are also of low interest.

Aoi specific checklists derived from the Innovation roadmap for the improvement of the defined biomass						
Select the region (from drop-down list)	SCORPs					
	Style	Romania	Serbia	Slovenia	Western Macedonia	Slovakia
Indicate the priority	Third priority	Second priority	Second priority	Second priority	Second priority	Third priority
Select the chosen SCORPs of your region	Pellets	Pellets	Pellets	Pellets	Pellets	Pellets
Indicate the priority of the actions from the drop down list below as "high", "moderate", "low" or "not at all".						
Introduce new and expand existing innovation networks in SEE						
Promote international R&D collaboration	moderate	high	low	high	high	moderate
Stimulate use of national competences	moderate	high	high	high	high	high
Enhance adaption and implementation of best practices in the forest fuel supply chain	low	high	high	moderate	high	moderate
Improve process and customer orientation						
Use of online tools for selling forest fuel assortments (online information/ordering platform for biomass, Biomass Trading Geo Portal)	moderate	high	moderate	low	moderate	low
Increase the use of ICT within all processes	moderate	high	moderate	moderate	high	high
Automatic round wood takeover at biomass trade centres	not at all	not at all	moderate	not at all	not at all	moderate
Enabling the possibility for customers to pick up biomass outside the opening hours of biomass trade centres or similar retailers	low	not at all	not at all	low	low	low
Introduce trademarks	low	low	high	high	high	low
Interest in biomass trade centres*	low	moderate	high	high	low	high
Reduce the energy input in the supply chain						
Reduction of energy input in processing biomass (e.g. chipping)	high	high	moderate	high	moderate	high
Increase tool life and extend periodicity of maintenance to reduce overall energy input over the life time	high	moderate	low	moderate	moderate	low
Apply economic methods to determine optimal processing with reduced energy input	moderate	high	low	high	high	high
Reduction of energy consumption in forest fuel logistics	moderate	high	low	low	moderate	high
Store biofuels						
Improving storage properties of biomass fuels at producer/trader	low	low	low	high	moderate	low
Improving storage properties of biomass fuels at consumer	moderate	low	low	low	low	low
Increase the knowledge of long-term storage of biomass	high	low	low	low	moderate	low
Study self-ignition of stored materials	moderate	low	moderate	not at all	moderate	low
Improve material characteristics						
Develop new methods for easily measuring quality characteristics	low	moderate	moderate	high	moderate	low
Drying of forest fuels						low
1. Technologies	low	moderate	low	moderate	moderate	low
2. Economic calculations	low	high	low	high	high	high
3. Incorporation in efficient supply chain	low	high	low	moderate	moderate	moderate
Torrefaction	low	moderate	not at all	not at all	low	low
Separation of undesired contaminants	low	high	low	low	low	low
Improve forest fuel logistic concepts						
Increase the use of the railway for forest fuel transport	moderate	not at all	low	low	not at all	low
Use inland water way for forest fuel transport if possible	not at all	not at all	moderate	not at all	not at all	not at all
Seek for multi-modal solution for forest fuel transport	high	high	low	moderate	moderate	low
Increase the number and capability of biomass terminals	high	high	moderate	low	low	moderate
Balance intermediate storage against the connected extra costs	high	moderate	low	moderate	low	moderate
Optimize location and capacity of comminution	low	low	moderate	moderate	low	moderate
Develop methods to reduce empty drives	high	moderate	moderate	high	moderate	low
Develop new types of containers or adapt existing container types according to customer needs and feedstock properties	low	moderate	low	moderate	moderate	high
Increase the use of a system enabling delivery of wood chips (blow into storage) similar to pellets	not at all	not at all	not at all	not at all	not at all	low
Studying the interaction of different supply chains to each other	moderate	high	low	moderate	moderate	moderate
Expand the resource basis for bioenergy generation						
Market barriers should be eliminated by uniform quality standards and the increasing need for resources should be served by an extension of the usable feedstock	low	high	high	high	high	moderate
Energetic use of wood from slopes, meadows and less economically valuable forests	not at all	moderate	high	low	moderate	low
Harvesting and energetic utilization of non-woody biomass (e.g. reed, miscanthus, etc.)	not at all	moderate	not at all	low	moderate	not at all
Broadleaved wood utilization efficiency increase	not at all	moderate	high	low	low	low
Fundamental research in breeding and agriculture for energy plants	not at all	low	moderate	low	moderate	low
Establishment of short rotation plantation of fast growing trees on agricultural land	not at all	not at all	moderate	not at all	low	low
Afforestation of abandoned land and other lands that is not in use for other purposes	low	high	high	not at all	high	low
Fundamental research in breeding and agricultural technology (plantation, harvesting, etc.)	not at all	not at all	moderate	not at all	moderate	low
Research in conflicts between natural conservation and biomass production on both, woodland and agricultural land	low	high	low	low	moderate	high
Research in CO ₂ -storage and -emissions for different types of biomass	moderate	high	moderate	moderate	low	high
Use of non-forest wood fuels, e.g. wood from tree pruning along roads or paths, from parks as well as from agricultural sites (fruit trees)	not at all	moderate	moderate	high	high	low
Use of wood from removing trees from pasture land	not at all	moderate	not at all	not at all	not at all	low
Improve harvesting technology to provide additional assortments for energetic use (e.g. comcobs)	not at all	moderate	low	low	low	low
Basic studies on material blends: e.g. logistics and storage; combustion characteristics; disposal of ash, emissions	low	high	low	moderate	moderate	high
Deal with technical/ecological challenges						
Utilization of biomass ashes	moderate	high	low	low	low	high
Slash utilization map for specific regions	not at all	high	low	moderate	moderate	high
Decision support system (DSS) for ecologically efficient supply chains utilizing logging residues	not at all	high	low	moderate	low	low
Study of nutrient cycles for (I) forest biomass, (II) energy plants, and (III) secondary feedstock	low	high	moderate	low	moderate	low
Cooperation						
Cooperation between forest owners for market development	not at all	high	moderate	high	moderate	low
Cooperation between different actors within the forest fuel supply chain	high	high	moderate	low	moderate	low
Cooperation between material and energetic use via joint procurement reducing procurement costs and increasing supply security for both users	low	high	low	low	low	low
Development of usage concepts, operators and business models for diverse supply chains	low	high	moderate	moderate	moderate	moderate
Development of supply concepts for industrial applications, especially with regard to security of supply and risk management	moderate	high	moderate	moderate	moderate	moderate
Development of recognized and practicable methods for the preparation of LCAs for the entire biomass supply chain	moderate	high	moderate	moderate	high	high
Creation of material flow analysis for biomass in the different regions	low	high	low	low	high	high
Improve standardisation in the field of bioenergy	low	high	high	high	high	moderate



Graph 3: Wood Pellets as priority SCORP

Wood chips (premium and slash)

Results per SCORP

- All partners expressed interest in **enhancing the adaption and implementation of best practices in the forest fuel supply chain** as well as the **increase of the use of ICT within all processes**.
- **Enabling the possibility for customers to pick up biomass outside the regular opening hours** was of low interest.
- Some interest was shown regarding the **development of new methods for easily measuring quality characteristics** as well as for **drying of forest fuels (technologies, economic calculations and incorporation in efficient supply chains)**.
- **Torrefaction** was not considered as a priority in this SCORP.
- **Railways and water ways** were also not considered as options to improve forest fuel logistic concepts.
- On the contrary, all regions consider as of high importance **to eliminate the market barriers** in order to expand the resource basis for bioenergy generation.
- Likewise, **utilization of biomass ashes** was also of high importance to the regions regarding the technical/ecological challenges.
- **Cooperation between forest owners for market development, cooperation between different actors within the forest fuel supply chain, development of supply concepts for industrial applications and improving standardization** were also identified as of considerable interest.

Aoi sA1-W2 specific checklists derived from the Innovation roadmap for the improvement of the defined biomass SCORPs								
Select the region (from drop-down list)	Btyrie	Romania	Sarbia	Slovenia	Slovakia	South Tyrol		
Indicate the priority	First priority	Second priority	Third priority	Third priority	First priority	First priority	Second priority	
Select the chosen SCORPs of your region	Premature wood chips	Wood chips from slash	Woodchips	Wood chips	Wood chips	Premature wood chips	Wood chips from slash	
Indicate the priority of the actions from the drop-down list below as "high", "moderate", "low" or "not at all".								
Introduce new and expand existing innovation networks in SEE								
Promote international R&D collaboration	moderate	high	high	high	moderate	high	not at all	not at all
Stimulate use of national competences	moderate	moderate	high	high	high	high	low	low
Enhance adaption and implementation of best practices in the forest fuel supply chain	moderate	high	high	high	high	high	high	high
Improve process and customer orientation								
Use of online tools for selling forest fuel assortments (online information/ordering platform for biomass, Biomass Trading Geo Portal)	high	not at all	high	moderate	high	high	not at all	not at all
Increase the use of ICT within all processes	high	high	high	moderate	high	high	moderate	moderate
Automatic round wood takeover at biomass trade centres	high	not at all	not at all	moderate	moderate	moderate	not at all	not at all
Enabling the possibility for customers to pick up biomass outside the opening hours of biomass trade centres or similar retailers	low	not at all	not at all	not at all	low	low	not at all	not at all
Introduce trademarks	high	low	low	moderate	high	low	not at all	not at all
Interest in biomass trade centres*	low	low	moderate	high	high	high	not at all	not at all
Reduce the energy input in the supply chain								
Reduction of energy input in processing biomass (e.g. chipping)	high	high	high	moderate	moderate	high	not at all	not at all
Increase tool life and extend periodicity of maintenance to reduce overall energy input over the life time	high	high	moderate	low	moderate	high	not at all	not at all
Apply economic methods to determine optimal processing with reduced energy input	moderate	high	high	low	high	high	not at all	not at all
Reduction of energy consumption in forest fuel logistics	high	high	high	low	moderate	high	not at all	not at all
Biomass materials								
Improving storage properties of biomass fuels at producer/trader	moderate	high	low	moderate	moderate	high	moderate	moderate
Improving storage properties of biomass fuels at consumer	moderate	high	low	low	low	high	high	high
Increase the knowledge of long-term storage of biomass	high	high	low	low	high	high	low	low
Study self-ignition of stored materials	high	high	low	not at all	moderate	high	low	low
Improve material characteristics								
Develop new methods for easily measuring quality characteristics	moderate	high	moderate	moderate	high	high	high	high
Drying of forest fuels	moderate	high	moderate	moderate	high	high	high	high
1. Technologies	moderate	high	moderate	moderate	high	high	high	high
2. Economic calculations	moderate	high	high	moderate	high	high	high	high
3. Incorporation in efficient supply chain	high	high	high	moderate	moderate	high	high	high
Tormetation	not at all	not at all	moderate	not at all	low	moderate	not at all	not at all
Separation of undesired contaminations	moderate	high	high	moderate	low	high	high	high
Improve forest fuel logistic concepts								
Increase the use of the railway for forest fuel transport	low	not at all	not at all	low	moderate	moderate	not at all	not at all
Use inland water way for forest fuel transport if possible	not at all	not at all	not at all	moderate	not at all	not at all	not at all	not at all
Seek for multimodal solution for forest fuel transport	high	moderate	high	low	moderate	moderate	not at all	not at all
Increase the number and capability of biomass terminals	high	moderate	high	moderate	high	high	not at all	not at all
Balance intermediate storage against the connected extra costs	high	high	moderate	low	high	moderate	not at all	not at all
Optimize location and capacity of commination	moderate	high	low	moderate	moderate	high	not at all	not at all
Develop methods to reduce empty drives	high	high	moderate	moderate	moderate	high	not at all	not at all
Develop new types of containers or adapt existing container types according to customer needs and feedstock properties	high	high	moderate	low	moderate	high	moderate	moderate
Increase the use of a system enabling delivery of wood chip (flow into storage) similar to pellets	high	low	not at all	not at all	high	low	low	low
Studying the interaction of different supply chains to each other	high	high	high	low	moderate	moderate	low	low
Expand the resource base for bioenergy generation								
Market barriers should be eliminated by uniform quality standards and the increasing need for resources should be served by an extension of the usable feedstock	high	high	high	high	high	high	high	high
Energetic use of wood from slopes, meadows and less economically valuable forests	moderate	high	moderate	high	moderate	high	low	low
Harvesting and energetic utilization of non-woody biomass (e.g. reed, miscanthus, etc.)	not at all	low	moderate	not at all	low	not at all	high	high
Broadleaved wood utilization efficiency increase	low	low	moderate	high	low	high	low	low
Fundamental research in breeding and agriculture for energy plants	low	low	moderate	moderate	low	high	not at all	not at all
Establishment of short rotation plantation of fast growing trees on agricultural land	low	low	high	moderate	low	high	not at all	not at all
Afforestation of abandoned land and other lands that is not in use for other purposes	low	low	high	high	not at all	high	not at all	not at all
Fundamental research in breeding and agricultural technology (plantation, harvesting, etc.)	low	moderate	high	moderate	low	moderate	not at all	not at all
Research in conflicts between natural conservation and biomass production on both woodland and agricultural land	low	high	high	low	low	high	not at all	not at all
Research in CO ₂ storage and -emissions for different types of biomass	moderate	moderate	high	moderate	moderate	high	not at all	not at all
Use of non-forest wood fuels, e.g. wood from tree pruning along roads or paths, from parks as well as from agricultural sites (fruit trees)	moderate	high	moderate	moderate	high	high	low	low
Use of wood from removing trees from pasture land	moderate	high	moderate	not at all	moderate	high	low	low
Improve harvesting technology to provide additional assortments for energetic use (e.g. comoba)	not at all	low	moderate	low	high	high	low	low
Basic studies on material blends: e.g. logistics and storage; combustion characteristic; disposal of ash, emissions	moderate	high	high	low	moderate	high	high	high
Deal with technical/ecological challenges								
Utilization of biomass ashes	high	high	high	moderate	high	high	high	high
Slash utilization map for specific regions	not at all	high	high	moderate	high	high	high	high
Decision support system (DSS) for ecologically efficient supply chains utilizing logging residues	not at all	high	high	low	moderate	high	high	high
Study of nutrient cycles for (i) forest biomass, (ii) energy plants, and (iii) secondary feedstock	moderate	high	high	moderate	moderate	high	not at all	not at all
Cooperation								
Cooperation between forest owners for market development	high	high	high	moderate	high	high	high	high
Cooperation between different actors within the forest fuel supply chain	high	high	high	moderate	moderate	high	high	high
Cooperation between material and energetic use via joint procurement reducing procurement costs and increasing supply security for both uses	high	high	high	low	moderate	high	high	high
Development of usage concepts, operation and business models for diverse supply chains	moderate	high	high	moderate	moderate	high	low	low
Development of supply concepts for industrial applications, especially with regard to security of supply and risk management	high	high	high	moderate	high	high	high	high
Development of recognized and practicable methods for the preparation of LCAs for the entire biomass supply chain	moderate	moderate	high	moderate	moderate	high	low	low
Creation of material flow analysis for biomass in the different regions	high	high	high	low	moderate	high	high	high
Improve standardisation in the field of bioenergy	high	high	high	moderate	high	high	high	high

Graph 4: Wood chips as priority SCORP

