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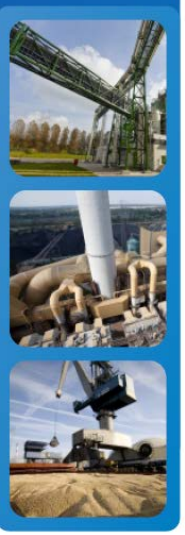
SECTOR STUDY ON BIOMASS-BASED HEATING IN THE WESTERN BALKANS



Renewable Energy Coordination Group Meeting
Energy Community Secretariat - 2 March 2016

Consultant Organization

Consortium leader

Tractebel Engineering - Part of ENGIE Group

*GDF SUEZ Group is now ENGIE Group

Present in more than 20 countries and project in over 80

3,300 Employees

Certified experience in biomass

Partner

Centre for Renewable Energy Sources and Saving (CRES) - Greece

Long-term experience in biomass and Western Balkans

Local support

South East European Consultants - Serbia

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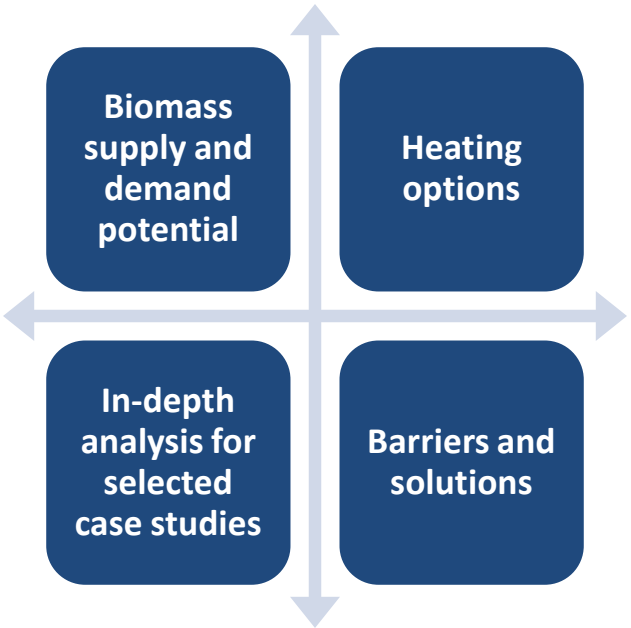
Objective and scope of the study

Objective: identify viable **investment options** and **policy measures** to increase the use of biomass for heating in the region in a **sustainable** manner

Impacts:
1. meet 2020 RE target
2. enhance energy security
3. improve reliability and sustainability of heat supply
4. support local forestry/biomass industry in a sustainable manner
5. reduce greenhouse gas emissions and local air pollution

Scope:



- Covers ALB, BIH, CRO, FYROM, KOS, MNE, SER
- Balances regional scope and recommendations with country-specific issues and options
- More detailed assessment in about 4-6 case studies

Funding: **Western Balkans Investment Facility (and ESMAP); sponsored by the Energy Community Secretariat, World Bank as implementing agency**

Overview of project tasks

Analysis of the biomass supply potential

Assessment of the available and sustainable biomass resource potential for heating

Assessment of potential for production of fast growing biomass crops on abandoned and/or degraded agricultural lands

Indication of the availability and viability of biomass supply at country and regional level

Assessment of heating Systems

Overview of the existing heating systems

Identify the demand potential and implementation options for biomass-based heating

Provide specific key recommendations/ conclusions at the country level

Assessment of economically viable biomass options for heating

Evaluation of the technical and economic potential to increase the use of biomass energy for heating in each country through

- conversion of existing CHPs and Heat-Only-Boilers
- construction of new biomass-based heating systems
- fuel switching
- efficiency improvement options for building//apartment level heating solutions in use

Analysis of key barriers and measures to increase biomass-based heating

Analysis of the relevant institutional, regulatory, financial, legal and policy framework and international experience in order to identify regional key barriers and to recommend measures to address them

Overview of project tasks

Detailed assessment of using biomass for heating in selected cities/sub-regions – Case Studies

Six cities or sub-regions ('case studies') in the Western Balkans will be selected for in-depth assessments

In-depth/ investment-ready assessment of biomass-based heating and supply options in the selected case studies will be performed

Case Studies

Case Study 1:
Household level program for replacement of old/traditional wood boilers/stoves in FYR of Macedonia

Case Study 2:
Developing small biomass-based District Heating systems in Bosnia Herzegovina

Case Study 3:
Implementing biomass small HOBs in Public Building in Prishtina and assessing biomass supply chains for DH in Gjakova

Case Study 4:
Developing agriculture biomass supply chains in the cross border region of Serbia, Bosnia, and Croatia

Case Study 5:
Biomass co-firing in coal thermal power plants in Serbia

Stakeholders Roundtables

Presentation of key results and findings at stakeholder roundtables at regional and country level

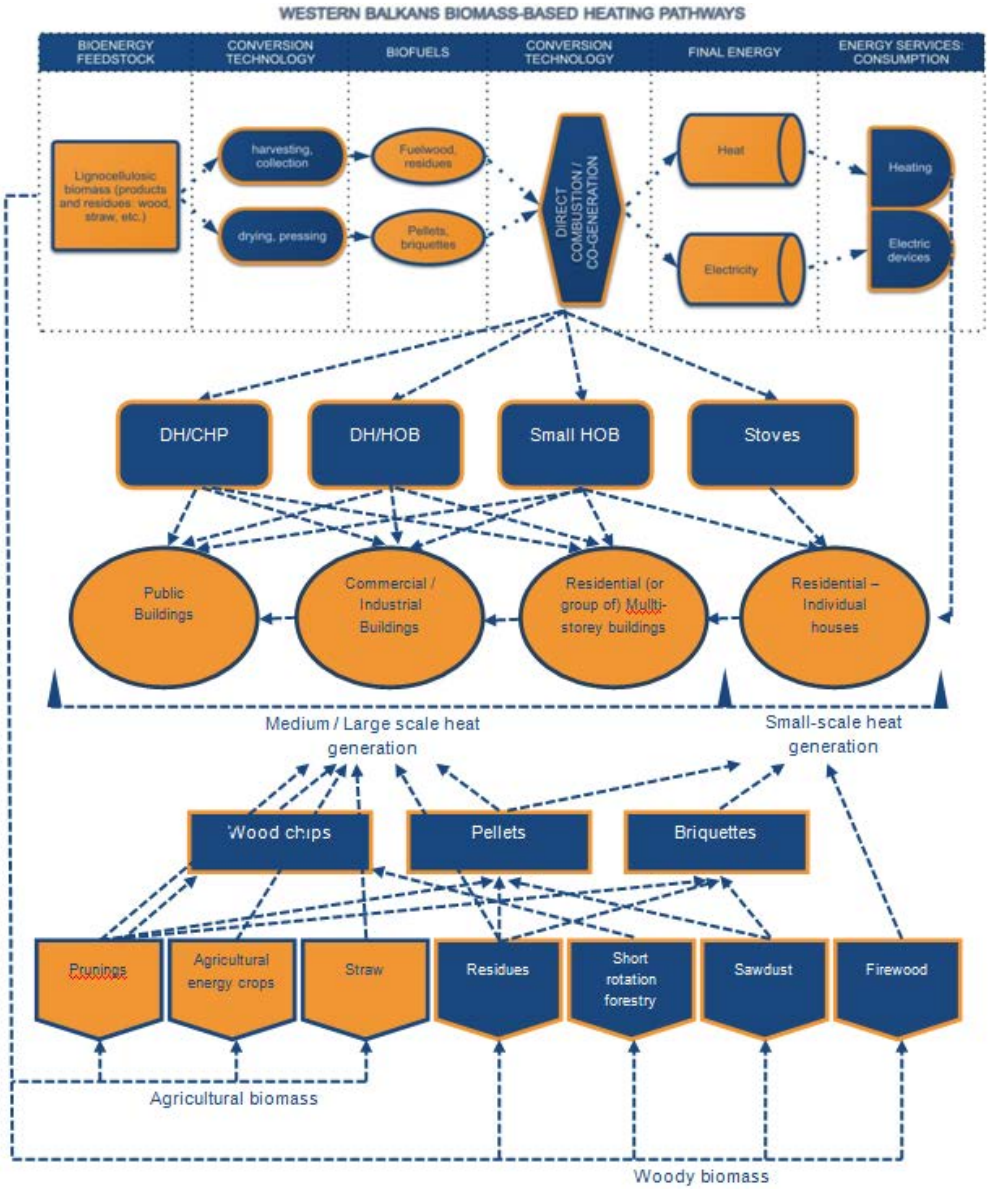
Biomass-based Heating Pathways in the W-B

Biomass potential

Biomass heating technologies

End-use sectors

Biomass fuels



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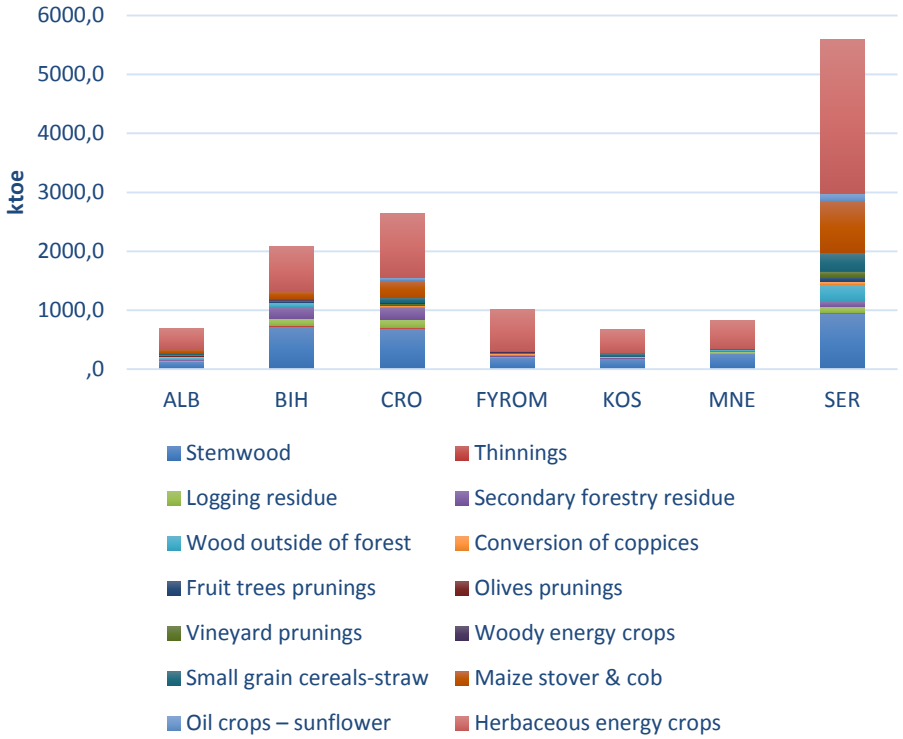
Sustainable Biomass Potential for Heating in the W-B

Focus on biomass resources that:

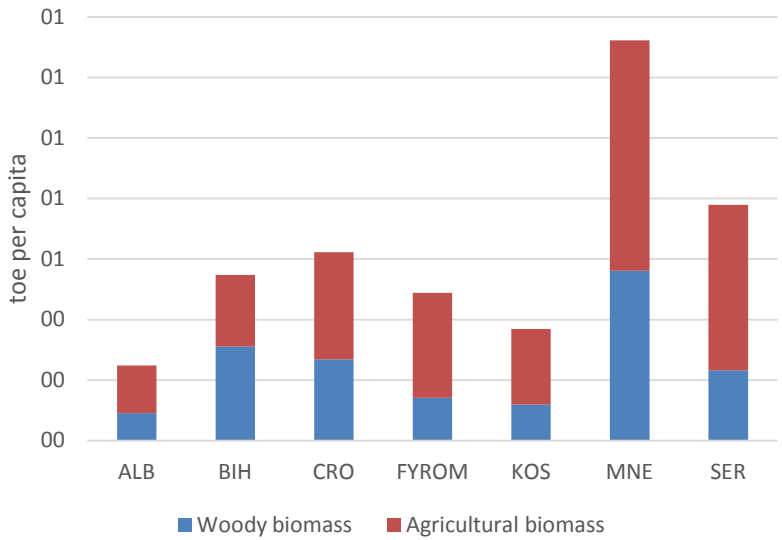
- can be used for heat production
- suitable for technologies and supply chains that could be implemented in the near future in W. Balkans



Scenario includes conversion of 1% of other forest land and 1% of unused agricultural land into energy plantations; RED sustainability criteria applied;

- Forest biomass and woody biomass outside forests
- Agricultural residues: primary agricultural residues from small grain cereals and corn and fruit tree prunings
- Energy crops

Total sustainable biomass potential for heating in the W-B
13.5 M toe



Largest sustainable biomass potential per capita – in MNE, followed by SER, CRO, BIH, FYROM, KOS and ALB

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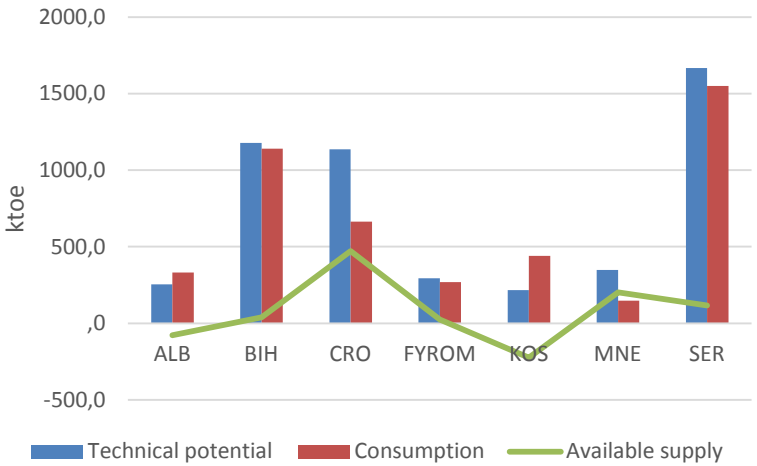
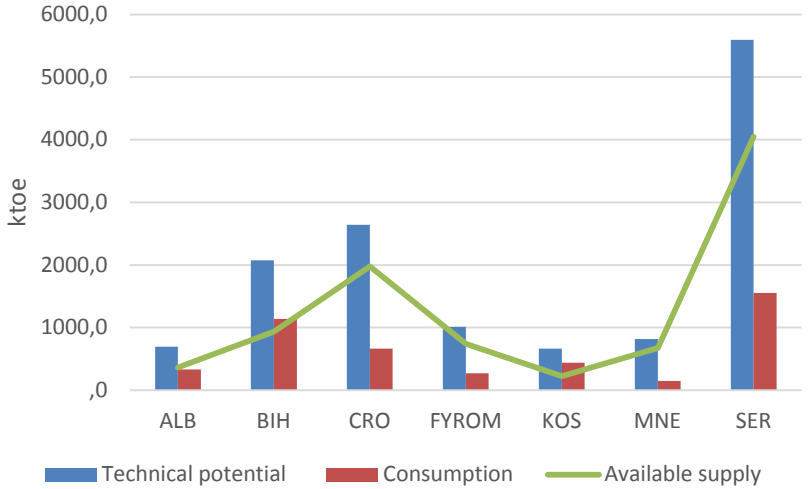
Available sustainable Biomass Supply for Heating in the W-B

Woody biomass – sustainable potential, consumption and available supply in the W-B countries



Total biomass – sustainable potential, consumption and available supply in the W-B countries



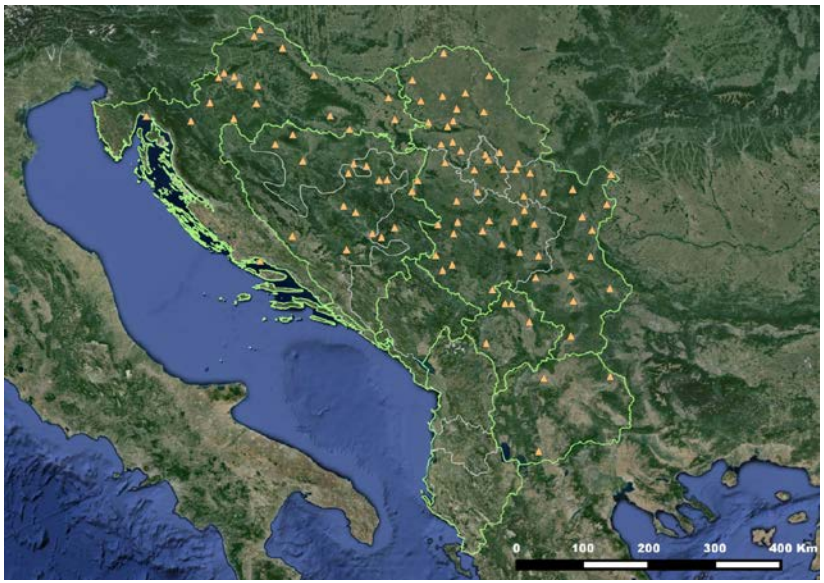
Woody biomass is available for supply in CRO and MNE, and to some smaller extent in SER, BIH, and FYROM, while KOS and ALB currently use woody biomass above sustainable levels

Agricultural biomass potential is untapped and present largest opportunity to increase biomass-based heating in the W-B countries

Heating options in the W-B region

Only 12% of Heat Demand in the W-B is covered by District Heating

DH schemes still characterized by obsolete technology and considerable heat losses (in the range of 12–20%) resulting in high operational costs



District Heating coverage in W-B countries

ALB	-
BIH	14%
CRO	9%
FYROM	6%
KOS	5%
MNE	-
SRB	22%

- Almost 90% of heat market - unregulated, without developed policies and support and with large social impact

Natural Gas supply for heating available only in:

- Croatia
- Serbia – for supply of DH companies (north and central part of Serbia, and 8% of total number of households)
- Bosnia and Herzegovina – for supply of DH companies in Sarajevo Canton only
- FYR of Macedonia – for supply of DH company in Skopje only

- Buildings without access to a DH and natural gas often use small, manually stoked, wood/coal-fired residential boilers, without emission controls
- Extremely dirty, producing air pollutants (particulates, CO, and SOX)
- Efficiencies of burners are at the level of 30% to 50% - well below EU standards where modern biomass appliances have efficiency >85%

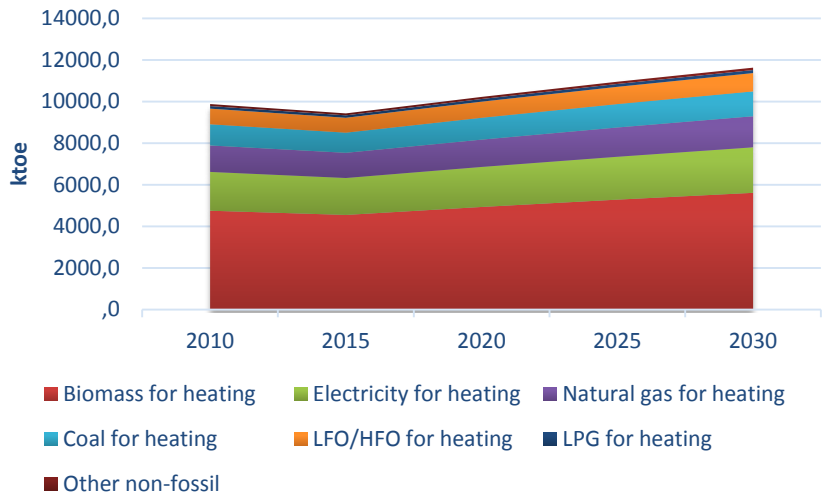
- Introduction of the incentives must be linked to efficiency standards

- **EN 303-5 – Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW**

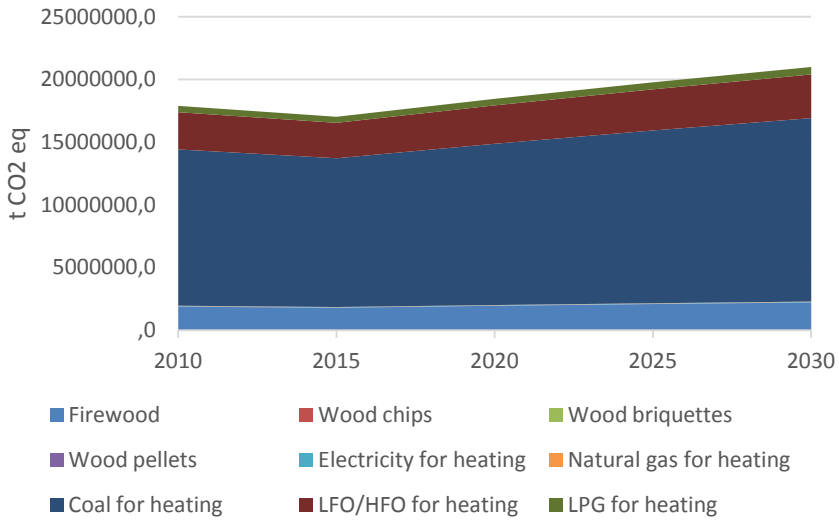
Baseline scenario for heating until 2030 in the W-B

Primary energy supply (TPES) in the W-B projected to grow 18% (7,419 ktoe) until 2030

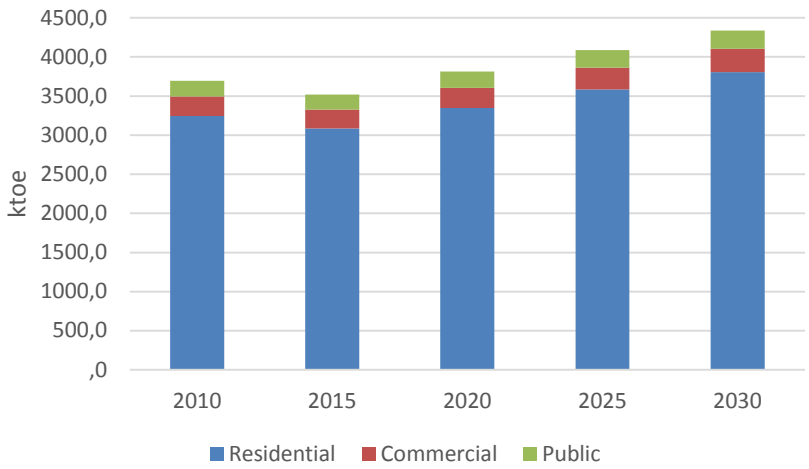
Primary energy supply for heating until 2030



GHG emissions from the heating sector in the W-B



Biomass used for heating until 2030, per sector of consumption



- *Use of biomass for heating projected to grow 23% until 2030, with average annual growth rate of 1.4%*
- *GHG emissions from heating projected to grow from 17 to 21 mill t CO2 eq until 2030*

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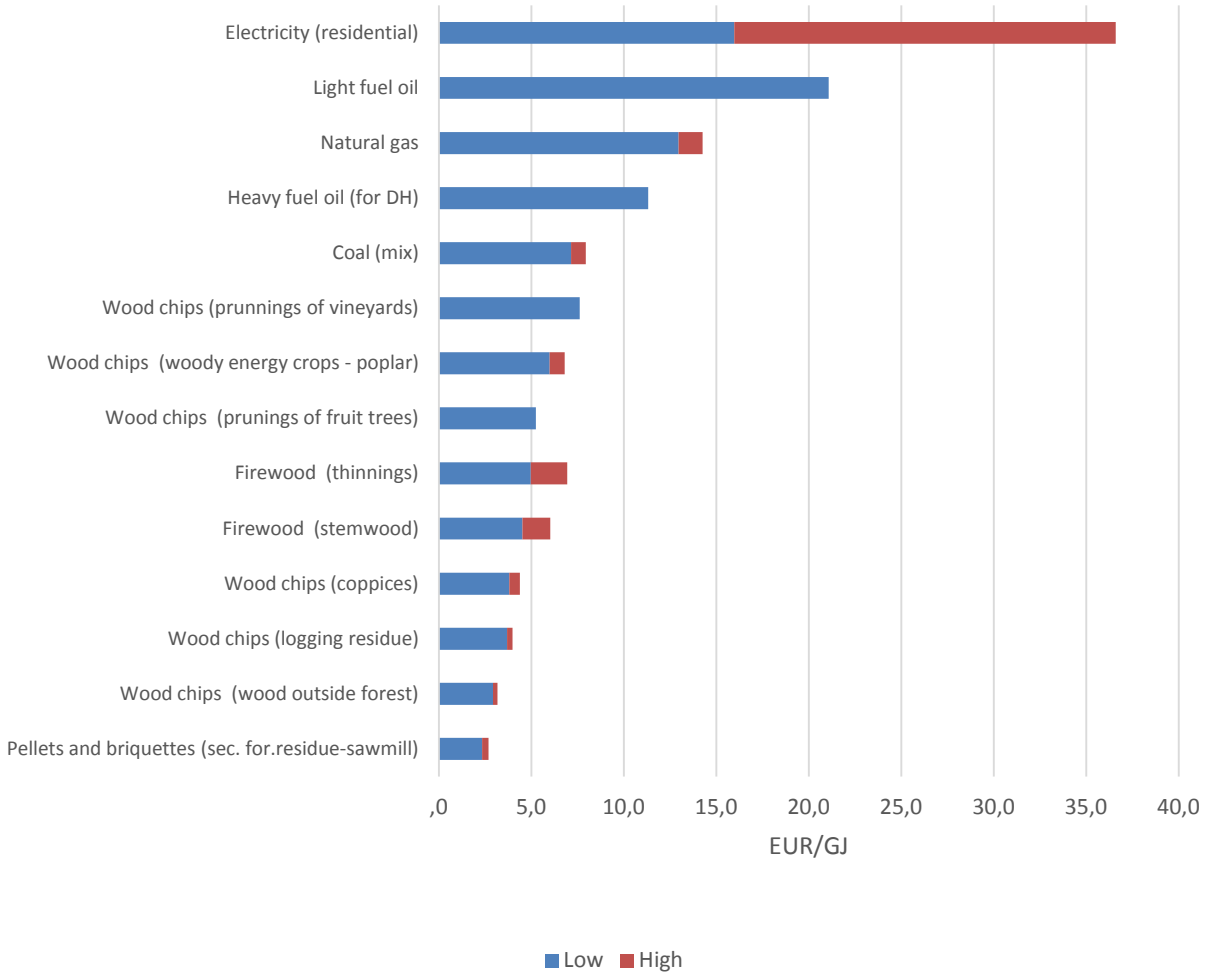
Costs of fuels for heating in the W-B

Costs of coal, natural gas, electricity and oil are higher compared to biomass, thus all the sustainable technical biomass potential for heating is considered as economic



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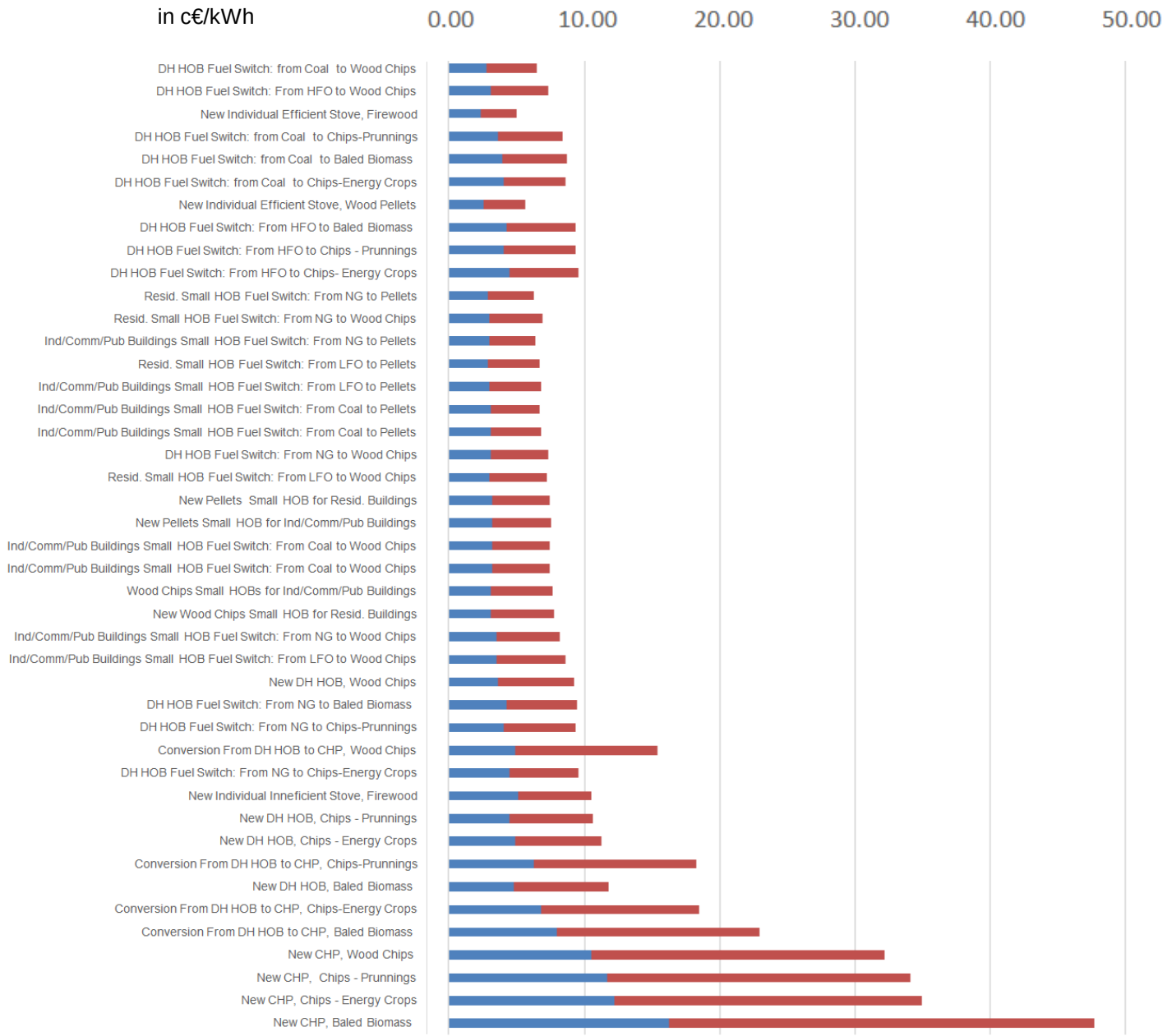
Ranking of biomass-based heating option in the W-B based on the lowest social cost



Comparison is performed using levelized cost of heat

Cost levels - the full social costs based on current market prices of heating technologies, costs of biomass fuels plus the costs of externalities

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Biomass vs. fossil fuels heating options in the W-B

Comparison of cost effectiveness is performed using levelized cost of heat

Cost levels represent the full social costs based on current market prices in the W-B plus the costs of externalities

Heating option	Coal	HFO / LFO	NG	Electricity	Heat Pumps
DH HOBs					
Wood chips	🟢		🔴		
Straw	🟢		🟡		
CHPs					
Wood chips			🔴		
Straw			🔴		
Retrofitting Options					
Wood Chips	🟢	🟢	🟢	🟢	
Straw	🟢	🟢	🟢	🟢	
Small HOBs Residential, Commercial, Public					
Wood chips	🟢	🟢	🟢	🟢	
Pellets	🔴	🟢	🟡	🟢	
Retrofitting Options					
Wood chips	🟢	🟢	🟢	🟢	
Pellets	🔴	🔴	🔴	🔴	
Individual Heating					
Firewood (Inefficient Stove)	🟢		🔴	🟢	🔴
Firewood (Efficient Stove)	🟢		🟢	🟢	🟢
Pellets	🟢		🟢	🟢	🟡

🟢 Biomass heating more cost-effective vs. conventional

🔴 Biomass heating less cost-effective vs. conventional

🟡 Biomass heating is at the level of conventional heating

NOTE:
Current market prices of wood pellets in the W-B countries are largely affected and driven by very high import demand and prices on main exporting markets for wood pellets – Italy and Austria

Current levels of wood pellets market prices allow for the use of fire wood (stemwood) for pellets production, that is not considered as sustainable

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Meeting the planned 2020 targets for renewable heating

COUNTRY	2009 Biomass consumption for H&C (ktoe)	2013 Progress reports on NREAPS - ALB, FYROM, KOS, SER; BIH, MNE - IEA Energy Balances (ktoe)	2020 Biomass - H&C target (ktoe)	Residual biomass heating required to meet 2020 RES-H targets (ktoe)	Estimated biomass heating installations to meet 2020 targets – with min. 85% efficiency (MW)
ALB	219	202	247	45	341
BIH (1)	1,029	791 (179 IEA)	1,396	606 (1,217)	3,788
FYROM	191	146	204	58	340
KOS	235	248	284	36	170
MNE (2)	60	168	273	105	597
SER	1,054	1,028	1,142	114	648
W-B	**2,787**	**2,582**	**3,546**	**964**	**5,883**

(1) Residual biomass heating calculated based on the assumption that BIH shall include full biomass consumption in the Energy Balance

(2) 2020 target for biomass heating in MNE is corrected (proportionally increased) based on the changed statistical record on past solid biomass consumption

Required fresh biomass to meet 2020 demand for biomass heating

≈ 3.4 million tons

Estimated capital costs for investing in different biomass heating technologies to meet 2020 targets

≈1.5 billion EUR

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Program for efficient biomass stoves and boilers

Country	Annual replacement of inefficient stoves (MW)	Cost of annual replacement (M EUR)	Heat energy savings from the replacement in the period 2017-2027 (ktoe)	Savings of woody biomass from the replacement in the period 2017-2027 (in kt, as received)
ALB	99	5	65	250
BIH	218	10	178	691
CRO	42	2	37	142
FYROM	112	5	97	375
KOS	147	7	162	630
MNE	36	2	33	126
SER	117	5	127	493
W-B	771	36	699	2707

Program for efficient stoves in the residential sector – to facilitate the substitution of inefficient stoves at an annual rate of 10% of heat demand

Implementation of the Program would result in:

- **Reduction of 53% of heat demand in households using inefficient stoves and boilers, after 2027**
- **700 ktoe of heating energy savings**
- **2.7 million tons of woody biomass savings**

Common barriers that are hampering the increased use of biomass for heating

Technical barriers

SUPPLY SIDE

- Fuel supply logistics
- Unregistered logging
- Biomass supply infrastructure
- Fuel quality
- Forest fires

DEMAND SIDE

- Proven and reliable technology
- Old district heating plants
- System response time
- Heat load at medium to large CHP
- Space requirement
- Low connectivity of district heating in the residential sector
- Quality and age of building stock
- Poor metering and control of heating systems

Financial barriers

VALUE CHAIN COSTS & PRICES

- Capital costs
- Operation and Maintenance costs
- Feedstock costs (versus fossil cost & under resource competition form non energy markets)
- Fuel price stability
- Other administrative costs (grid connection, licensing)

REVENUES

- Heat sales revenues
- Electricity sales revenues
- Energy tariffs

GRANTS & ACCESS TO CAPITAL

- Expensive high efficiency and low polluting technology/ equipment
- Small scales
- Low competences in municipalities
- Grants
- Strict rules for public budgets
- Access to / Cost of capital
- Biomass perceived as high risk investment
- Eligibility for favorable loans

Common barriers that are hampering the increased use of biomass for heating

Policy and regulatory barriers

POLICY	REGULATION
• Fragmented and short term measures • Lack of overall strategy for heat in the region • Low or no inclusion of biomass heating equipment in public procurement • Legal provisions for heat pricing • Incentives • Low implementation of Air Protection Law	• Standardization • Building code • Certification • Infrastructure • Registry

Social barriers

KNOWLEDGE ON BIOMASS HEAT BENEFITS & RISKS	SOCIAL CONCERNS OVER BIOMASS PRODUCTION AND ENERGY USE
• Low clarity on biomass supply information • Low clarity in biomass consumption patterns/ data across the various markets (domestic, commercial, etc.) • Monitoring/ census • Statistical data • Low awareness across stakeholders' groups from policy, supply and demand for cost efficient biomass technologies and the related benefits • Educational capacity building instruments • Lack of training courses for professionals • Lack of knowledge/ information tailored for investors • Cross ministerial committees' / discussion forums	• Environmental issues related to the use of residual biomass for energy • Environmental issues related to the use of forest biomass for energy • Environmental issues related to the cultivation of energy crops • Environmental risks for biomass energy use • Ecosystems & natural habitat

Common barriers that are hampering the increased use of biomass for heating

Market barriers	
MARKET ORGANISATIONAL ISSUES	
• Local; national, regional (Western Balkans) market development • Equipment for agricultural biomass • Organizational capability (skilled personnel availability, know-how) and management of complexity	• Administrative issues (planning, grid connection, power export option etc.) • Amenity issues including convenience and lifestyle • Smart meters for monitoring and billing

THE ROADMAP FOR BIOMASS-BASED HEATING IN THE WESTERN BALKANS - Biomass supply

Pillar I	Component	Sub- components	Until 2020	Until 2030
Biomass Supply	Planning and monitoring	Forest Road infrastructure	Preparation of forest road master plans in W-B countries Identification of the most urgent forest road rehabilitation projects Best practice forest roads rehabilitation guidelines	Implementation of forest roads master plans
	Sustainable forest management practices	Afforestation	Action plan for afforestation of abandoned/damaged land	Focus on improving forest management in both public and private sector/ private forest owners
		Multi- purpose forestry demonstration techniques	Action plan for sustainable forest management in W-B region Improving silviculture and the sustainability of forest management through demonstration activities	Continue awareness raising on the benefits of efficient use of biomass resources
		Forest fire management	Best practices and new technologies (software) about monitoring and prevention of forest-fires Develop synergy with the European Forest Fire Information System (EFFIS), managed by JRC - http://forest.jrc.ec.europa.eu/effis/	Improvement of monitoring, surveillance and detection of the fires through provision of equipment and vehicles for forest-fires fighting
		Biomass supply infrastructure	Develop biomass trade centers	Provision of equipment/mechanization to improve logistics Training of local actors
	Enabling environment for agricultural biomass	Knowledge for energy crop/ tree species	Action plan for the potential of energy crops	Establish Western Balkans technology platform for biomass
		Use of marginal land	Definition and identification of abandoned/damaged (marginal) land	Demonstration activities on energy cropping
		Commercial conversion technologies for agricultural biomass	Improve market for commercial technologies for agricultural biomass	Support R&D activities for the combustion of agricultural biomass in order to develop local industry

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THE ROADMAP FOR BIOMASS-BASED HEATING IN THE WESTERN BALKANS – Efficient biomass heat technologies

Pillar II	Component	Sub- components	Until 2020	Until 2030
Efficient biomass heat technologies	Standardisation	Adopt & transpose standards	Harmonisation in the respective standards and regulations according to the European requirements National certification scheme for biomass stoves, including Energy labelling	Continue harmonization and implementation of Energy labelling
		Improve testing infrastructures	Improve quality of infrastructure (technical rule book, laboratories, testing, etc.) for laboratories for testing of biomass stoves, HoBs according to CEN technical standards	Ensure consistent update according to EU and CEN Continue support to the work of the national standardisation technical committees
	Programme for efficient stoves/ boilers	Financing facility for biomass heat	Establish financing facility for residential sector Identification and selection of local banks Training for bankers	Program monitoring and continued support
		Develop customer oriented services for local banks participating in financing Programs	Information on certified equipment suppliers Guidebooks, Best practices, Case studies Online calculators for biomass heat	Program monitoring and continued support
	Programme for District Heating	Improve infrastructure for DH	Improve/ renovate both plants and distribution systems. Collaboration/risk-sharing - with KfW that has experience and program for upgrade of DH plants in several W-B countries	Upgrade of existing DH systems and construction of new
		Improve grid connection costs	Regulatory Energy Agencies to develop Heating Network Code, and regulate cost sharing Simplify procedures and shorten the period – for electricity and grid connection Introduce appealing procedure on the decision for grid connection point (which currently doesn't exist)	Follow legislative developments in the EU Transposition of new EU legislation
	Financing	Improve financing for transition to modern biomass-based heating in Western Balkans	Establish financing facility for Provision of efficient equipment for biomass based heating in the residential sector Construction of new DH systems that use biomass Fuel switching to biomass in the DH plants Introduction of biomass-based CHP in district heating plants Increase use of biomass-based heating in the residential buildings	Continued support – development of co-financing programs with EE/RE Funds in the W-B and/or other International donors

THE ROADMAP FOR BIOMASS-BASED HEATING IN THE WESTERN BALKANS – Regulatory framework

Pillar III	Component	Sub- components	Until 2020	Until 2030
Framework conditions (I)	Regulatory framework	Forestry	Certification of forest products Improve legislation to prevent unregistered production/consumption based on best practices Define levels of allowed annual cut in W-B countries Regulate mandatory performance of National Forest Inventory Prepare legislation to allow conversion of marginal agricultural land into forest land Prepare regional guidelines for monitoring of biomass production and consumption, and collection of data	Law enforcement
		Biomass heat	Regional strategy on heating from renewables – with clear targets Legal provisions for "green" public procurement that would include biomass heating Legislation related to price regulation of heating	Follow developments in the EU legislation Monitoring of Strategy implementation
		CHP/ DH	Develop heating policies in W-B countries, with clear provisions and guidelines for third party access to DH networks, construction of new DH networks Include DH in the jurisdiction of Energy Regulatory Agencies in the W-B Preparation of National development plan for CHP plants	Policy improvements
		Buildings	Ensure appropriate transposition of Eco-design Directive (2009/125/EC) and any actions/ regulations relevant to biomass heat. Ensure compliance with European Energy Performance of Buildings Directive- EPBD (2010/31/EU)	Follow up and transpose all relevant directives and EC regulations.
		Air quality	Application of provisions of Law on Air Protection to residential sector, to improve consequences of indoor pollution Align legislation on Air quality with the EU	Follow EU legislative development on Air quality

THE ROADMAP FOR BIOMASS-BASED HEATING IN THE WESTERN BALKANS – Data, Public Awareness, Capacity Building

Pillar III	Component	Sub- components	Until 2020	Until 2030
Framework conditions (II)	Data collection and monitoring	Biomass supply	Registry for biomass supply	Monitoring and updating
		Statistics	Integrate biomass in national statistics/ census	Monitoring and updating
		Buildings	Develop database/registry of building stock, heating systems in public/institutional sector Establish database/registry of small HOBs in residential buildings	Monitoring and updating
	Awareness	Improve market	Organise B2B and other market related events for high efficiency biomass, DH, CHP technologies	Ensure B2B and market related event are consistent with technology developments and integrate recent improvements across biomass based heat chains.
		Campaign on biomass heat	Organise campaigns to increase awareness for the benefits of biomass heating	Follow up campaigns based on market requirements
	Capacity Building	Local stakeholders in the forestry sector	Training, workshops for cost-effective residual biomass harvesting and/or upgrading technologies.	Further focus, tailor and adjust campaigns considering technology, market and policy developments.
		Municipalities	Training, workshops for efficient biomass technologies that offer higher efficiency, cost-savings and flexibility compared to conventional fossil fuel-based electricity systems.	
		Professionals	Training for stoves and boilers producers on the benefits from technical standardization	
		Investors	Training, workshops on the efficiency gains through installation of CHP among potential investors	
		Stakeholders from government	Develop cross ministerial and institutional collaboration to build the capacity for legislation development, transposition of the relevant European Directives, compliance with certification, standardization and sustainability rules.	

Thank you for your attention

Dejan STOJADINOVIC
Team Leader
dejan.stojadinovic@tractebel.engie.com

Branko GLAVONJIC
Key Biomass Expert

Christoforos PERAKIS
Key Biomass Expert

Calliope PANOUTSOU
Key Policy Expert

Elena DE BORTOLI
Project Manager

Ole JOHANSEN
Key Heating Expert

Panagiotis GRAMMELIS
Key Heating Expert

Biljana CEPUJNOSKA
Key Energy Economist

ANNEX

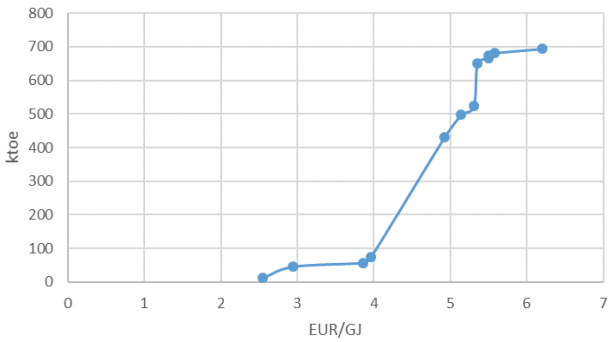
Economic potential of Biomass for Heating in the W-B

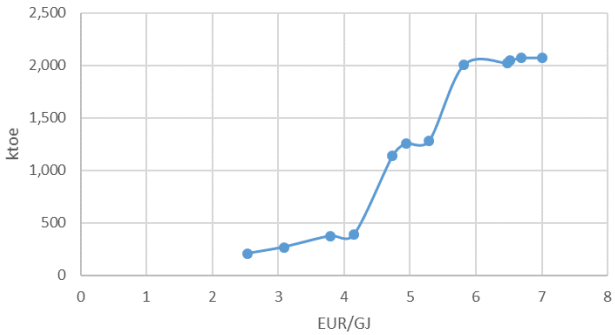
(based on the costs of production per typical value chain, with transport <50km)

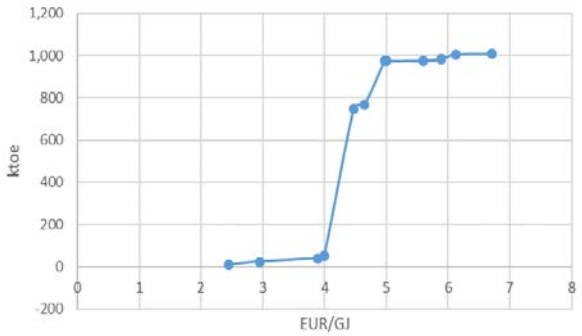
ALBANIA	Sustainable technical potential (ktoe)
Secondary forestry residue	12
Wood outside of forest	34
Logging residue	12
Conversion of coppices	16
Energy crops - Miscanthus	357
Maize	67
Prunings of fruit trees	26
Stemwood	128
Straw (small grain cereals and oil crops)	16
Prunnings of vineyards	8
Thinnings	7
Woody energy crops - poplar	12.5

BOSNIA AND HERZEGOVINA	Sustainable technical potential (ktoe)
Secondary forestry residue	207
Wood outside of forest	62
Logging residue	105
Conversion of coppices	12
Energy crops - Miscanthus	750
Maize	121
Straw (small grain cereals and oil crops)	25
Stemwood	725
Woody energy crops - poplar	19
Thinnings	21
Prunings of fruit trees	26
Prunnings of vineyards	2

FYR OF MACEDONIA	Sustainable technical potential (ktoe)
Secondary forestry residue	11
Wood outside of forest	14
Logging residue	17
Conversion of coppices	13
Energy crops - Miscanthus	695
Maize	21
Stemwood	203
Straw (small grain cereals and oil crops)	0
Thinnings	2
Prunings of fruit trees	6
Prunnings of vineyards	24
Woody energy crops - poplar	4







Costs of coal, natural gas, electricity and oil are higher compared to biomass, thus all the sustainable technical biomass potential for heating is considered as economic

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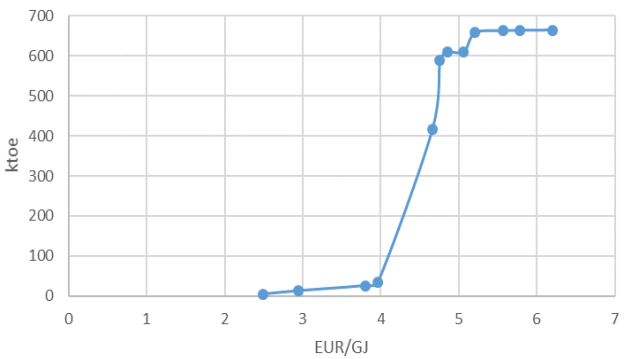
Economic potential of Biomass for Heating in the W-B

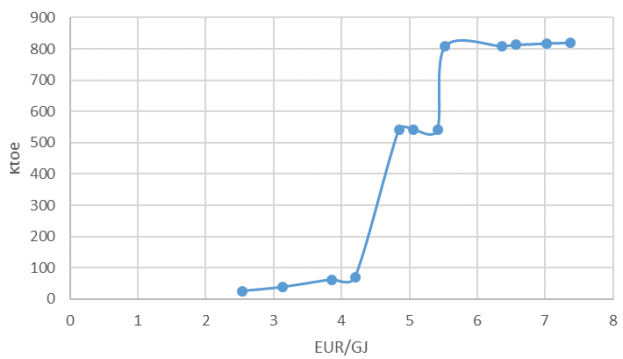
(based on the costs of production per typical value chain, with transport <50km)

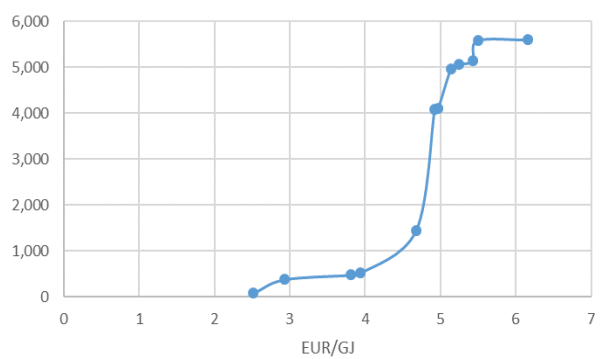
KOSOVO	Sustainable technical potential (ktoe)
Secondary forestry residue	4
Wood outside of forest	8
Logging residue	13
Conversion of coppices	10
Energy crops - Miscanthus	381
Stemwood	173
Maize	20
Thinnings	1
Straw (small grain cereals and oil crops)	48
Prunings of fruit trees	5
Prunnings of vineyards	1
Woody energy crops - poplar	1

MONTENEGRO	Sustainable technical potential (ktoe)
Secondary forestry residue	25
Wood outside of forest	13
Logging residue	24
Conversion of coppices	8
Energy crops - Miscanthus	472
Maize	0
Straw (small grain cereals and oil crops)	0
Stemwood	266
Thinnings	1
Woody energy crops - poplar	4
Prunings of fruit trees	4
Prunnings of vineyards	3

SERBIA	Sustainable technical potential (ktoe)
Secondary forestry residue	89
Wood outside of forest	296
Logging residue	97
Conversion of coppices	39
Stemwood	936
Energy crops - Miscanthus	2,625
Thinnings	23
Maize	865
Prunings of fruit trees	95
Prunnings of vineyards	76
Straw (small grain cereals and oil crops)	438
Woody energy crops - poplar	18







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