Biomass for growth:
potentials and challenges of bioenergy
in the Danube Region

OVERVIEW of CASE STUDIES

Bratislava. December 1, 2016




This project is co-funded by the European Union within the 7th Frame Programme. Grant Agreement n°608622.

Rationale:

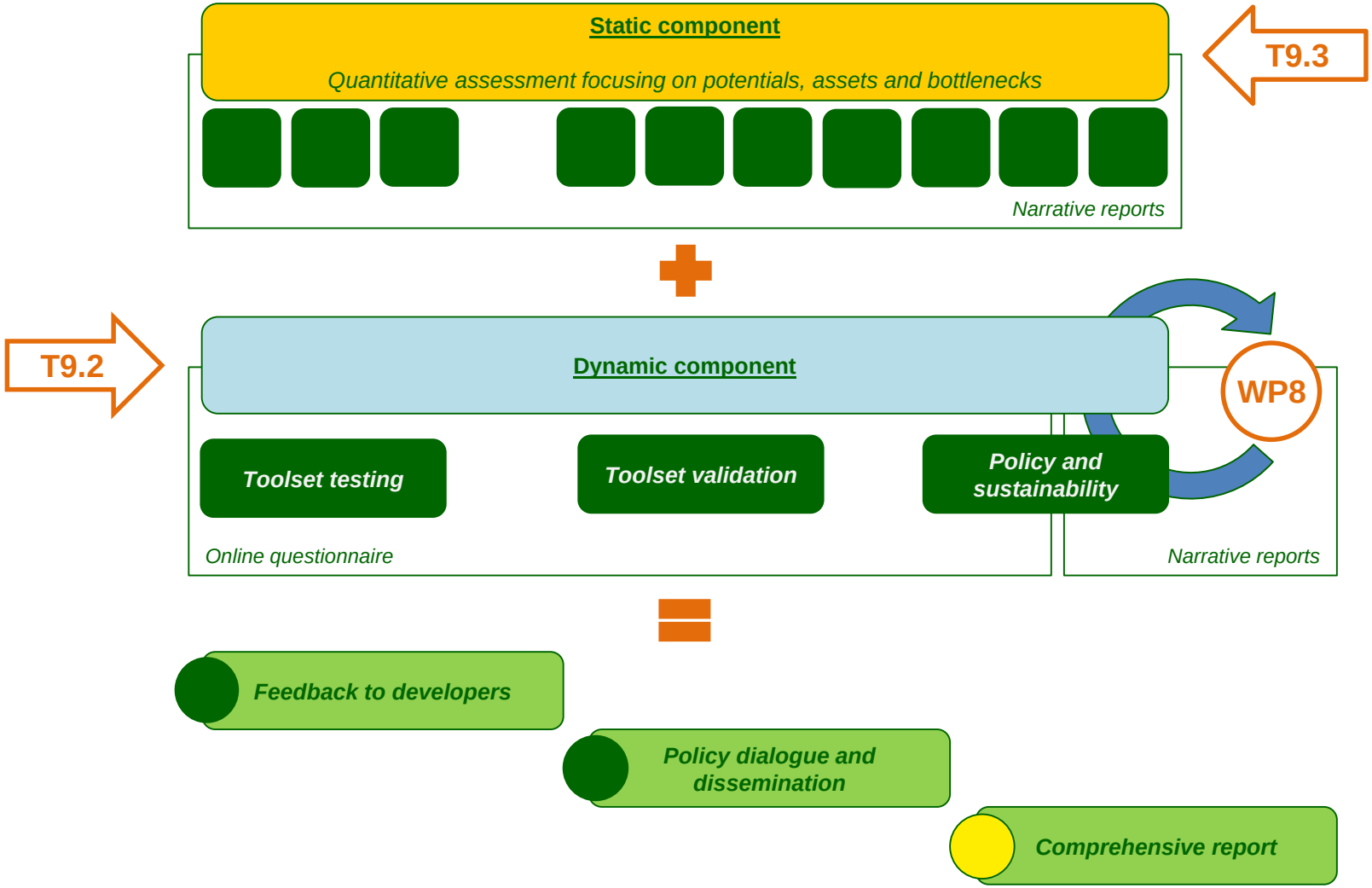
→ *To involve stakeholders with a participatory approach into the development of SRTs for ensuring that their needs are incorporated into the design*

→ *To involve stakeholders for field testing of the tool through case studies*

→ *To approach stakeholders along the value chain at various levels to "market" the SRTs during and after testing and to support dissemination, exploration and improvements through constant interaction and feedback*

Key outputs: **10 case studies have been successfully implemented. They fed other activites and allowed modelling the S2BIOM Vision and Strategy, while corroborating the databases and verifying the interoperability of the Toolset with locally developed methodologies**

Methodology:



Task 9.3.2: Strategic Case Studies

Strategic Case Studies

SCS have been performed in areas with lower biomass supply and logistics development, and relatively poor availability of data.

SCS address wider, more strategic aspects, focusing also on the involvement of stakeholder groups. Toolset validation has been implemented in this context and the potentials to integrate S2BIOM Toolset with locally developed tools and models has been explored. SCS contributed to create valuable dissemination opportunities as well.

SCS have been performed in the following areas:

- Slovenia
- Croatia
- Germany-Poland
- Autonomous Province of Vojvodina, Serbia;
- Western Romania
- South-East Europe (Greece, Serbia, Turkey, Romania and Bulgaria);
- Ukraine.

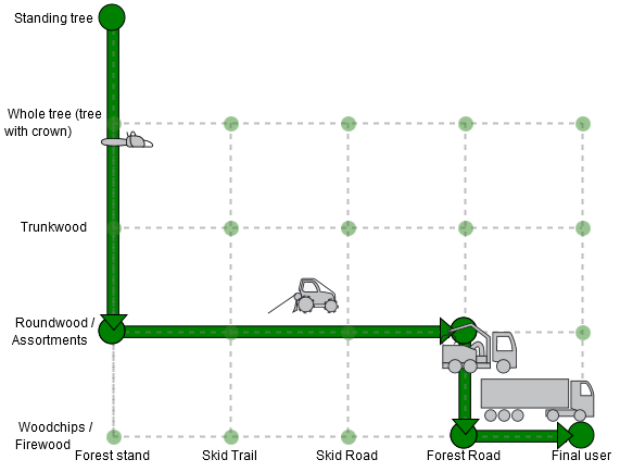
Slovenia
Woody biomass availability for a district heating plant

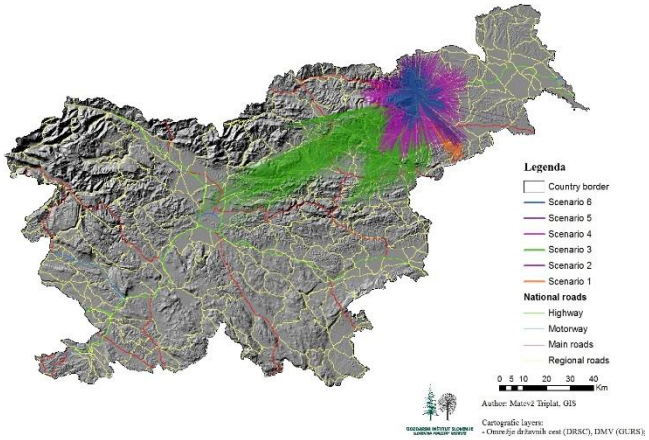
The case study allowed investigating the feasibility of the conversion of the district heating plant of Maribor, the second largest city in Slovenia, to locally sourced woody biomass.

Unlike other SCS implemented in S2BIOM, the potential investors have already been identified and the 5MW district heating system scenario has been agreed jointly.

The SCS encompasses the folowing steps: (a) Identification of needs, (b) Analysis of wood biomass potentials, (c) Tailoring of a logistic model, (d) Cost analysis.

Besides the definition of the capture area and cost-supply, the SCS included the development of recommendations and interaction with the policymaking level.





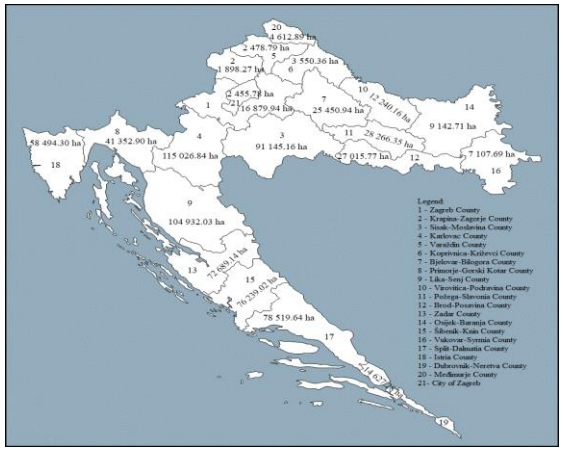
Time for timber loading	30	min
Time needed for timber unloading	15	min
Material truck costs	84.96	€/ h
Work costs (driver)	7.83	€/ h

Croatia
SRC on unused agricultural land

Large areas of agricultural land remains uncultivated in Croatia, both private and state owned. At the same time there are high unemployment rates, particularly in rural areas.

Better governance of resources with the aim of sustainable development represents a unique chance to tackle emission reduction, energy security, job creation and rural development through harmonized and organic solutions.

Regional authorities are committed to sustain the development of RES, with particular regards to the optimization of the use of agricultural residues. To this end, a regional biomass action plan was commissioned, and policy measures are developed.



- *Calculation with assumption of 12 t_{DM}/ha/year biomass yield*
- *State owned, private owned and aggregate land is considered separately*
- *Four scenarios:*
  - ***S1 – 30 %** of land cultivated by SRC*
  - ***S2 – 20 %** of land cultivated by SRC*
  - ***S3 – 10 %** of land cultivated by SRC*
  - ***S4 – 20 %** of land cultivated by combination of SRC and most wide spread fruit sorts in Croatia (apple, pear, peach, cherry, plum, walnut and hazelnut)*

Croatia	Technical potential [m^3/y]	Energy potential [TJ/y]
$S1_a$	1,404,094.31	4,902.29
$S1_b$	1,426,108.32	4,979.16
$S1_c$	2,830,202.63	9,881.45
$S2_a$	936,062.87	3,268.20
$S2_b$	950,738.88	3,319.44
$S2_c$	1,886,801.75	6,587.63
$S3_a$	468,031.44	1,634.10
$S3_b$	475,369.44	1,659.72
$S3_c$	943,400.88	3,293.82
$S4_a$	1,169,257.63	4,176.11
$S4_b$	1,212,193.70	4,328.94
$S4_c$	1,233,661.73	4,355.57

AP Vojvodina, Serbia
Agricultural residues

The economy of Vojvodina is largely based on agriculture and food industry, with fertile agricultural land making up 84% of its territory.

The region is well connected with neighbouring countries and benefits from Danube river logistics; it also has a strong industrial background, also in the energy and conventional fuels sector.

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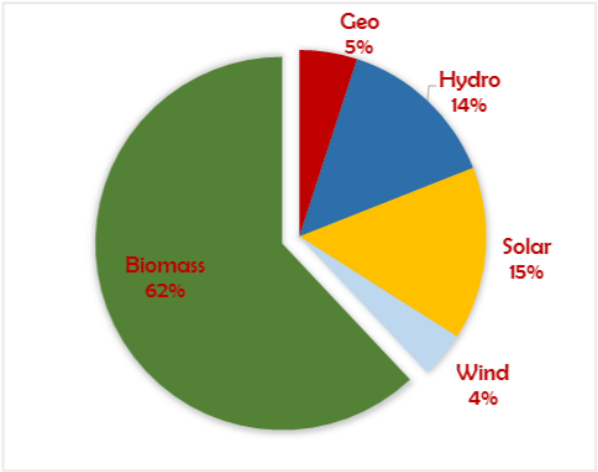
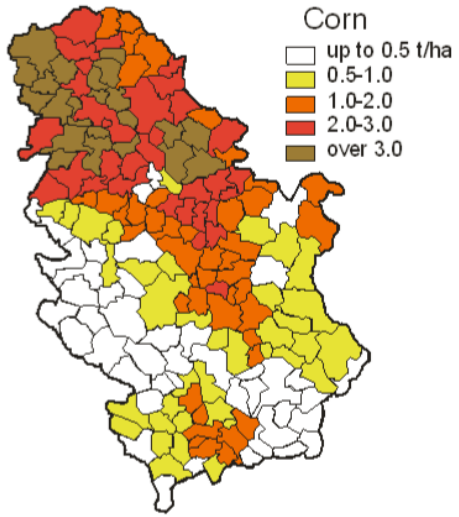




Residues potential

Crop	Acreage (1.000 ha)	Total mass (1.000 t)	Sustainable potential (1.000 t)		Energy potential (1000 t)	
			Big farms	M/S farms	Big farms	M/S farms
Wheat	298	1.120	264	320	**250**	**280**
Rye	1.5	4.5	1	1	1	1
Barley	48	155	52	50	48	45
Corn	637	3,288	s 114	s 310	**$ 110**	**$ 280**
			c 10	c 360	**€ 10**	**€ 330**
Sunflower	172	680	0	0	0	0
Soybean	128	620	150	130	150	130
Rapeseed	4.2	17.6	6	5	6	5
Total		5.885,10	597	ca. 1.176	ca. 575	ca. 1.071
			1.773		**1.646**	

Prof. Dr. M. Martinov et al. — University of Novi Sad, Faculty of Technical Sciences, Dep. Environmental Engineering (Serbia)

Western Region, Romania
Agricultural residues

The case study provided in-depth insight in both the methodology developed by ROSENC for measuring the economic development of biomass value chains in Western Romania, and in providing valuable quantitative input.

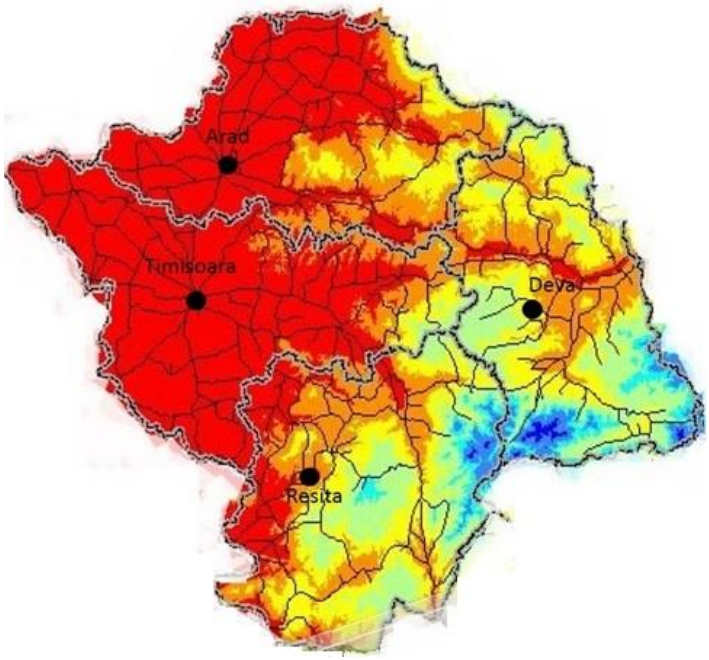
In particular, the current biomass potentials have been assessed together with the relevant logistical implications. Economic value has been assigned to each type of biomass.

The case study proved particularly valuable to explore the possibilities for interoperability of S2BIOM methodology and the models that have been developed locally.

Equation for logistic analysis:

$$P\ (€/t) = v\ [\tfrac{€}{t}] + t1\ [\tfrac{€}{t*km}] + p[\tfrac{€}{t}] + t2\ [\tfrac{€}{t*km}]\ ,$$

P= pellets/ briquettes final costs
v= raw material costs
t1,2= transport costs
p= processing costs

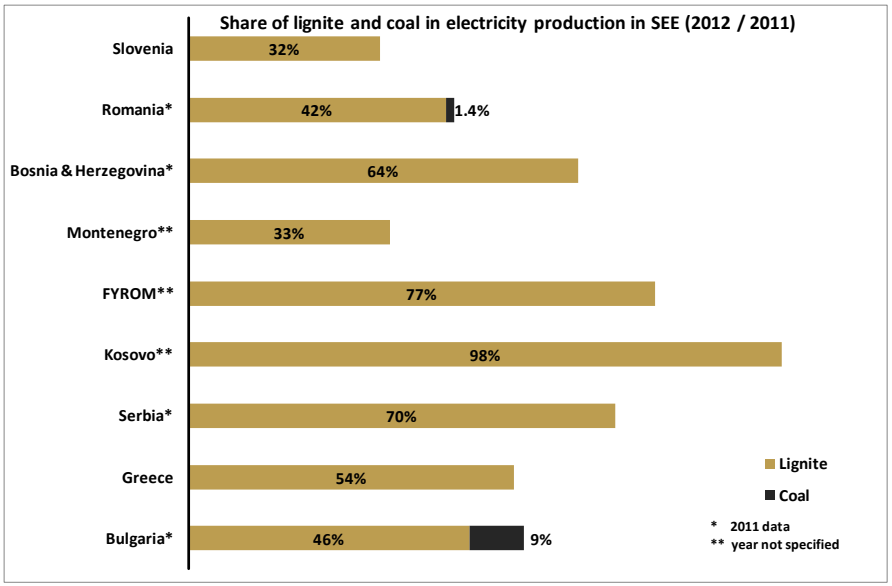


Type of biomass	Tons of residues produced yearly (t)	Theoretical Energetic Potential (MWh/t)	Technical Energetic Potential (MWh/t)	Achievable Energetic Potential_2020 (MWh/t)
Wheat straws	1,262,817	5,139,669	2,569,835	2,569,835
Maize residues	1,616,496	8,858,398	4,429,199	4,429,199
Barley straws	113,126	452,504	226,252	226,252
Sun flower	242,146	1,063,024	531,512	531,512
Sugar beet	23,396	21,005		
Wood residues	1,400,000	6,020,000	3,010,000	3,010,000
Energetic willow	10,000	57	57	57
Miscanthus	2,000	8.8	8.8	8.8
Total Energy Potential (MWh)		**21,661,874**	**10,830,937**	**10,830,937**

SEE regional study
Biomass co-firing in lignite-powered TPPs

The SCS focused on the potential of biomass co-firing in lignite-fired TPPs as an easy to implement technological improvement capable of reducing GHG emissions.

This is deemed particularly relevant in SEE, where biomass is currently underutilized and there is limited investment capacity vis-à-vis non particularly challenging RES targets.

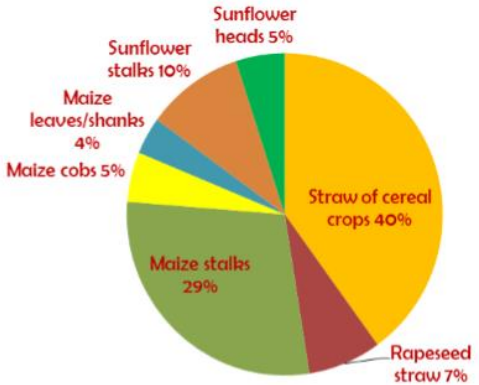


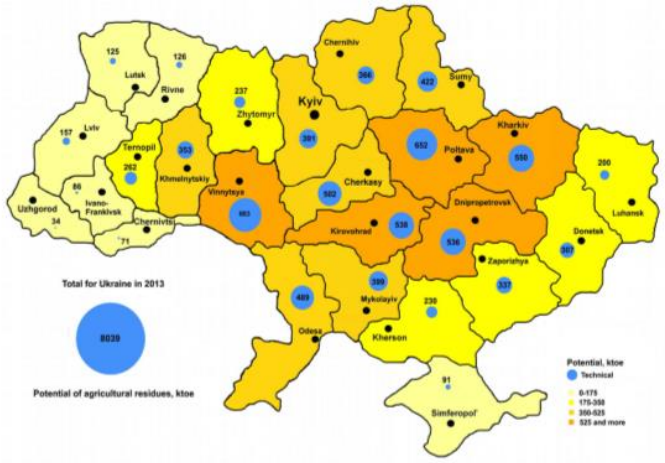
More importantly, the deployment of biomass co-firing might contribute to structuring local/regional markets for sustainable lignocellulosic biomass, thus allowing the switch from individual to collective use, which is currently predominant in the region.

Ukraine
Agricultural residues

Being one of the world's largest grain exporters, Ukraine has a highly developed agro-food sector. It has extensive fertile farmlands, yet large portions of agricultural land are currently under- or non-utilized. Notwithstanding the importance of agriculture, the share of biomass in the total energy production is currently slightly more than 1,2% with relevant untapped potential.

The instability in the region jeopardizing the country's energy security, fostering RES and gradual replacement of fossil fuels is paramount. Assessment of potentials and realistic cost/supply estimations are necessary to strengthen the sustainable biomass market.





Residues potential

	Yields, Mt	Theoretical potential, Mt	Technical pot., Mt	Technical pot., Mtoe
Cereal straw	32.1	30.6	9.2	3.2
Rapeseed straw	2.4	4.2	1.7	0.6
Corn	30.9	40.2	16.0	3.0
- stalks		*30.3*	*12.1*	*2.3*
- cobs		*5.6*	*2.2*	*0.4*
- husk		*4.2*	*1.7*	*0.3*
Sunflower	11.0	20.9	8.3	1.2
- stalks		*14.3*	*5.7*	*0.8*
- baskets		*6.6*	*2.6*	*0.4*
TOTAL	76.4	95.9	**35.2**	**8.0**

Dr. Tetiana Zhelizna et al. Renewable Energy Agency (Ukraine)

Germany-Poland
Supplying large scale biofuels plants with local biomass between Germany and Poland

The SCS investigated value chains of thermochemical production of drop-in synthetic biofuels from wood chips and straw via catalytic and fast pyrolysis pretreatment.

The study focused on decentred production of intermediate energy carriers to be further refined in centralized facilities.

The study considered the following conversion paths:

- *Catalytic pyrolysis (CP) of forestry residues produces a pyrolysis oil with low oxygen content which is transported to a refinery for integrated production of transportation fuels.*
- *Fast pyrolysis (FP) of straw yields a biosyncrude transported for gasification followed by chemical synthesis to transportation fuel.*

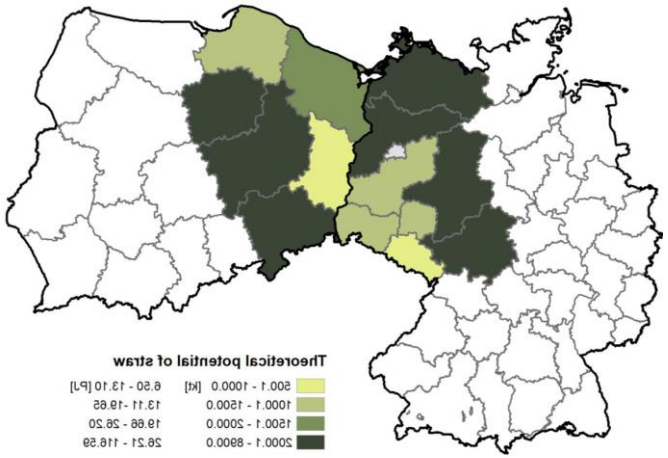


Table 2 Technical potential of straw and forestry residues in case study area

Region	Straw		Forest residues	
	kt	PJ	kt	PJ
DE3 - Berlin	0.75	0.01	25.73	0.26
DE4 - Brandenburg	1,772.94	23.05	1,625.75	16.26
DE8 - Mecklenburg-Vorpommern	2,480.04	32.24	706.42	7.06
DED - Sachsen	1,737.24	22.58	752.61	7.53
DEE - Sachsen-Anhalt	2,234.40	29.05	735.22	7.35
DEG - Thüringen	1,521.64	19.78	942.03	9.42
PL21 - Malopolskie	204.68	2.66	134.38	1.34
PL41 - Wielkopolskie	1,426.56	18.55	791.76	7.92
PL42 - Zachodniopomorskie	1,140.54	14.83	876.31	8.76
PL43 - Lubuskie	453.87	5.90	792.02	7.92
PL51 - Dolnoslaskie	1,587.68	20.64	691.34	6.91
PL61 - Kujawsko-Pomorskie	976.22	12.69	390.93	3.91
PL63 - Pomorskie	799.31	10.39	592.64	5.93
total DE	9,747.01	126.71	4,787.76	47.88
total PL	6,588.87	85.66	4,269.37	42.69
Total	**16,335.89**	**212.37**	**9,057.13**	**90.57**

Lessons learnt & way forward:

- **Capitalizing on the SCS would allow further detailing the assessment of potentials in the Danube Region**
- **The quality of case studies and the results of the validation exercise show that it would be beneficial to further investigate the possibility to "decentralize" the Toolset, as well as its modularity**
- **The Toolset and other S2BIOM deliverables deserve more and better marketing at national and macro-regional level.**

Online validation questionnaire: The questionnaire is still accessible at the following URL

https://it.surveymonkey.com/r/S2BIOM_Toolset_Validation

It includes 86 questions with skip logic applied so to allow for both validation and testing. Validation can be performed for all sectors and categories, or in a selective way.

Thank you for your attention!

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