



Macroeconomic study on net effects of import substitution of fossil fuels with biomass



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Introduction

- Substitution of fossil fuels with biomass in district heating systems would have the effects on:
 - district heating system (cost of heating energy production and price of heating energy),
 - local and regional economy (new jobs and income),
 - national economy (trade deficit and import dependency reduction).
- Total effect of such fuel switch could be observed from:
 - financial,
 - social,
 - macroeconomic and
 - environmental perspective.



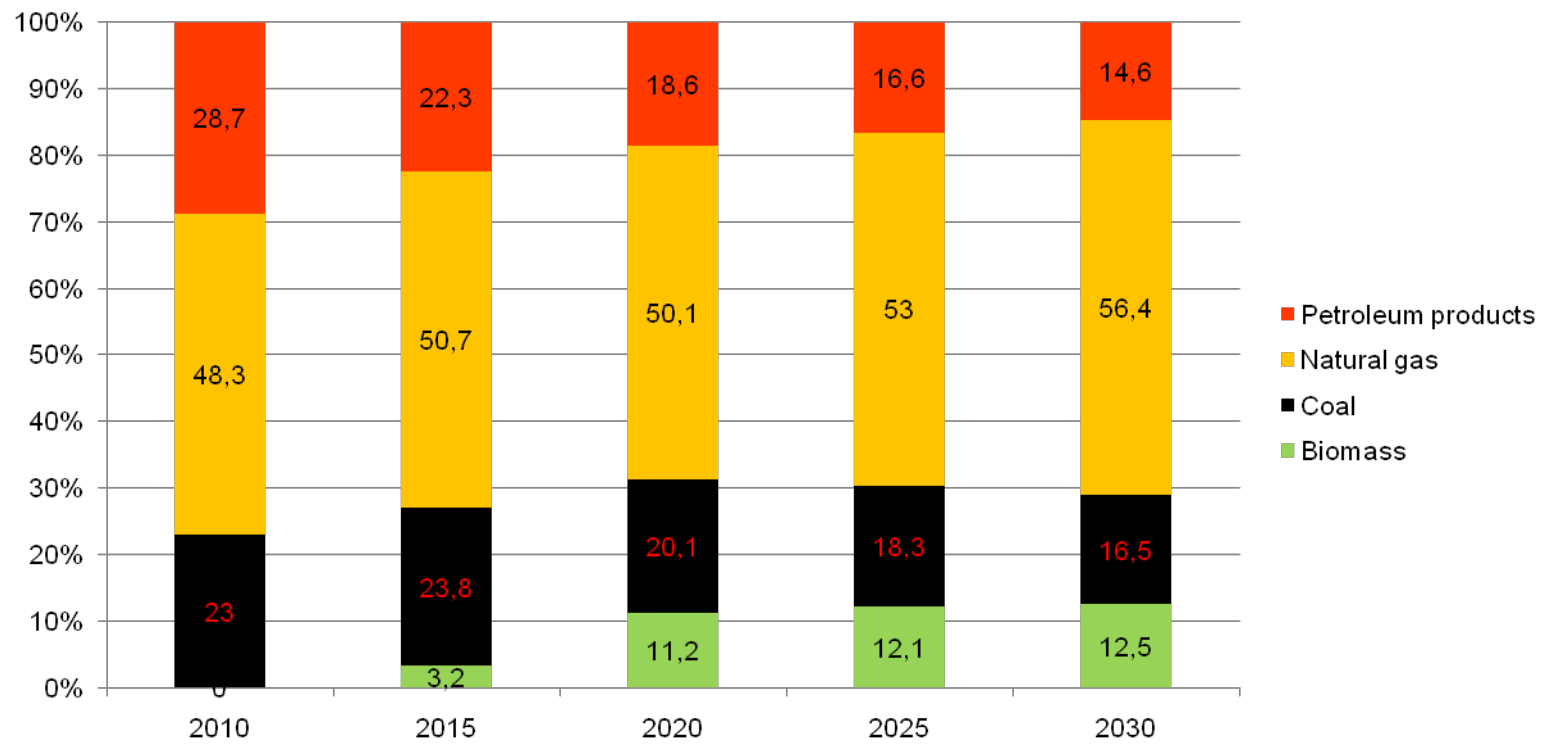
The objective of the study

- To estimate the impact of substitution of fossil fuels with biomass in district heating systems (DHS) on regional economy (income and employment) in municipalities of:
 - Priboj,
 - Prijepolje,
 - Nova Varoš,
 - Mali Zvornik,
 - Bajina Bašta and
 - Novi Pazar.





Projection of changes in the structure of energy sources for heat generation in Serbia





Advantages of district heating systems based on biomass

- Lower and predictable energy costs
- Money remains in the local economy
- More local jobs
- Use of a plentiful and renewable resource
- Environmental benefits



BENEFITS



Methodology

- ***Total economic effect***
 - ***Direct impact***
 - ***Indirect impact***
 - ***Induced Effect***



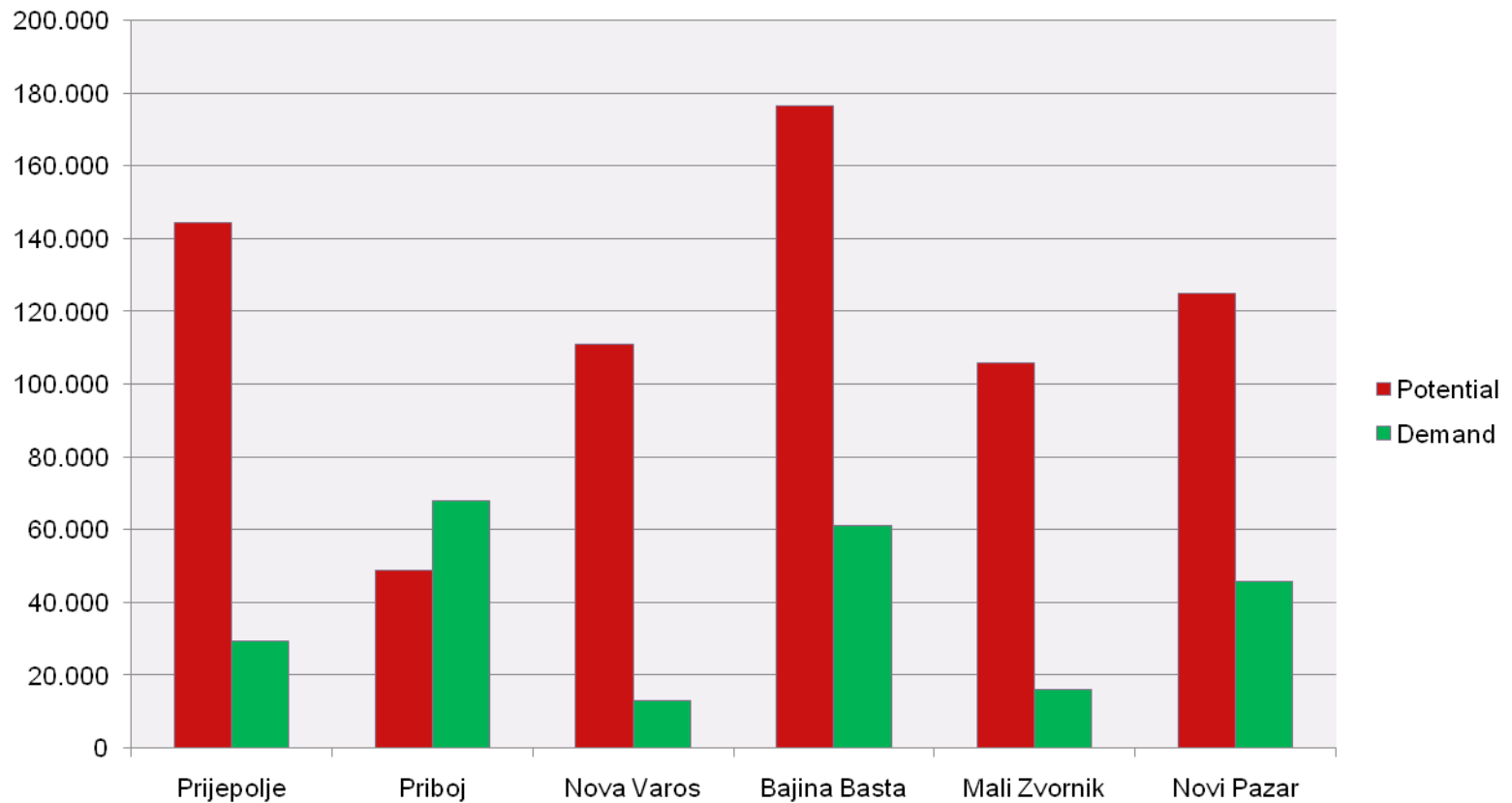


Methodology

- The net effects on local economy (GDP and employment) are estimated with **adapted Biomass Socio-Economic Multiplier model (BIOSEM)**.
- The BIOSEM model is a result of the FAIR Program of DG IV under the European Commission's Fifth Framework Program. It is a quantitative economic model that captures the income and employment effects arising from the deployment of bio-energy plants in rural communities.
- Using a traditional ***Keynesian Income Multiplier approach***, the BIOSEM technique makes predictions about the income and employment effects arising from the installation of a bio-energy plant and production of bio-fuels.



Woody biomass potential vs. demand





Fuel costs in Serbia (in Euros), 2016

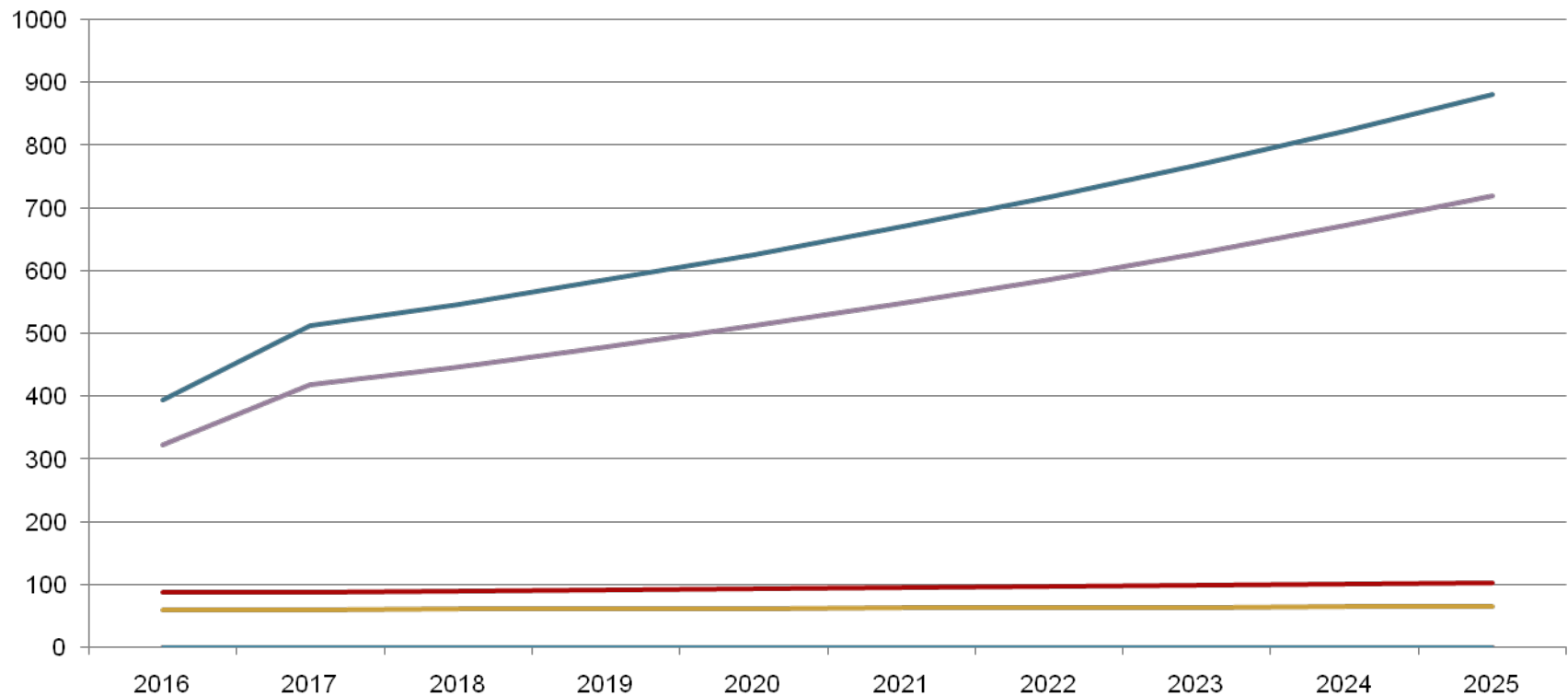
<i>Fuel</i>	<i>Price (2016 average)*</i>
Coal	87 Euros/ton
HFO	395 Euros/ton
Natural gas**	322 Euros/thousand m ³
Wood chips (m=30%)	60 Euros/ton

* All prices are with VAT included

** Price of natural gas includes not only the price of cubic meter of gas, but also the fee for capacity reservation and transport charged by "Srbija gas".



Fuel prices in Serbia (in Euros), forecast 2016-2025



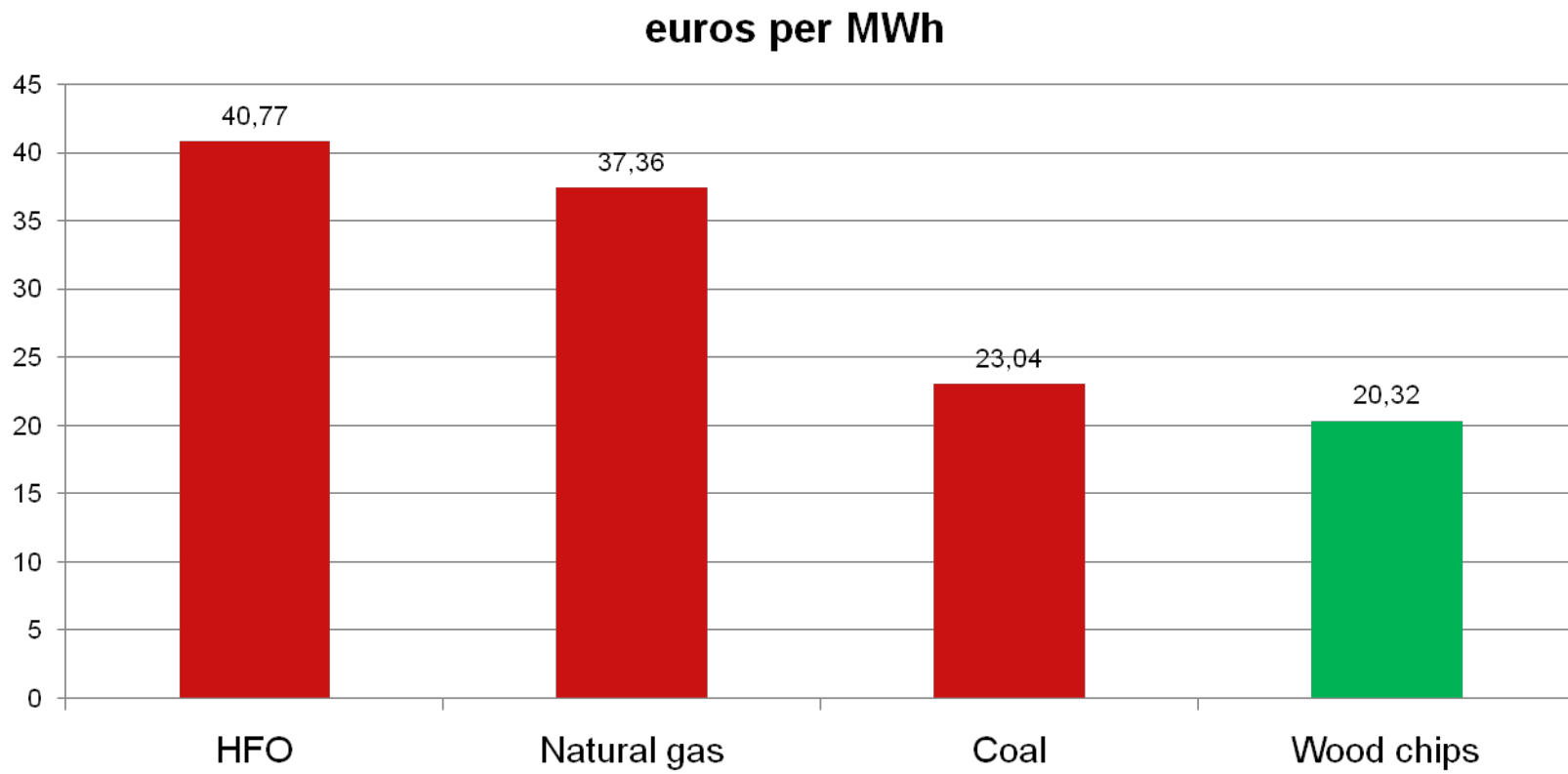


THERMAL ENERGY FUEL COSTS WITH DIFFERENT FUELS





Fuel costs per MWh of different fuels





POTENTIAL FUEL COSTS SAVINGS





Bajina Bašta

	Coal	HFO	Wood chips	Savings	Cumulative savings
2016	96,570	417,120	292,920	220,770	220,770
2017	96,570	541,728	292,920	345,378	566,148
2018	98,790	578,688	297,645	379,833	945,981
2019	101,010	619,872	302,369	418,513	1,364,494
2020	103,230	662,112	302,369	462,973	1,827,467
2021	105,450	708,576	307,094	506,932	2,334,400
2022	107,670	758,208	311,818	554,060	2,888,460
2023	109,890	812,064	311,818	610,136	3,498,596
2024	112,110	870,144	316,543	665,711	4,164,307
2025	114,330	931,392	316,543	729,179	4,893,487



Nova Varoš

	HFO	Wood chips	Savings	Cumulative savings
2016	125,610	62,580	63,030	63,030
2017	163,134	62,580	100,554	163,584
2018	174,264	63,589	110,675	274,259
2019	186,666	64,599	122,067	396,326
2020	199,386	64,599	134,787	531,113
2021	213,378	65,608	147,770	678,883
2022	228,324	66,617	161,707	840,590
2023	244,542	66,617	177,925	1,018,514
2024	262,032	67,627	194,405	1,212,920
2025	280,476	67,627	212,849	1,425,769



Priboj

	HFO	Wood chips	Savings	Cumulative savings
2016	770,250	383,760	386,490	386,490
2017	1,000,350	383,760	616,590	1,003,080
2018	1,068,600	389,950	678,650	1,681,730
2019	1,144,650	396,139	748,511	2,430,241
2020	1,222,650	396,139	826,511	3,256,752
2021	1,308,450	402,329	906,121	4,162,873
2022	1,400,100	408,519	991,581	5,154,454
2023	1,499,550	408,519	1,091,031	6,245,485
2024	1,606,800	414,708	1,192,092	7,437,577
2025	1,719,900	414,708	1,305,192	8,742,768



Prijepolje

	Coal	HFO	Wood chips	Savings	Cumulative savings
2016	38,715	256,750	165,420	130,045	130,045
2017	38,715	333,450	165,420	206,745	336,790
2018	39,605	356,200	168,088	227,717	564,507
2019	40,495	381,550	170,756	251,289	815,796
2020	41,385	407,550	170,756	278,179	1,093,975
2021	42,275	436,150	173,424	305,001	1,398,975
2022	43,165	466,700	176,092	333,773	1,732,748
2023	44,055	499,850	176,092	367,813	2,100,561
2024	44,945	535,600	178,760	401,785	2,502,346
2025	45,835	573,300	178,760	440,375	2,942,720



Mali Zvornik

	Natural gas	Wood chips	Savings	Cumulative savings
2016	142,324	76,920	65,404	65,404
2017	184,756	76,920	107,836	173,240
2018	197,574	78,161	119,413	292,653
2019	211,276	79,401	131,875	424,528
2020	226,304	79,401	146,903	571,431
2021	241,774	80,642	161,132	732,563
2022	259,012	81,883	177,129	909,692
2023	277,134	81,883	195,251	1,104,944
2024	297,024	83,123	213,901	1,318,844
2025	317,798	83,123	234,675	1,553,519



Novi Pazar

	HFO	Wood chips	Savings	Cumulative savings
2016	442,005	220,320	221,685	221,685
2017	574,047	220,320	353,727	575,412
2018	613,212	223,874	389,338	964,750
2019	656,853	227,427	429,426	1,394,176
2020	701,613	227,427	474,186	1,868,362
2021	750,849	230,981	519,868	2,388,231
2022	803,442	234,534	568,908	2,957,138
2023	860,511	234,534	625,977	3,583,115
2024	922,056	238,088	683,968	4,267,083
2025	986,958	238,088	748,870	5,015,954



EFFECTS OF FUEL SWITCH TO BIOMASS ON LOCAL INCOME AND EMPLOYMENT





BIOSEM model results

	Prijepolje	Priboj	Nova Varoš	Bajina Bašta	Mali Zvornik	Novi Pazar	Total
Direct labor income, net (EUR)	17,220	27,960	7,608	31,680	7,488	22,320	114,276
Direct profit, net (EUR)	4,305	6,990	1,902	7,920	1,872	5,580	28,569
Total income* (EUR)	37,099	59,644	16,528	67,761	16,318	47,631	244,981
No. of direct jobs	5	10	2	8	2	6	33
No. of indirect jobs	5	8	2	9	2	6	32
No. of induced jobs	3	6	1	7	1	5	23
No. of total new jobs	13	24	5	24	5	17	88



Induced income effects

DHS	Annual wood chips cost (EUR)	Induced income effect (EUR)
Prijepolje	165,420	248,130
Priboj	383,760	575,640
Nova Varoš	65,580	98,370
Bajina Bašta	292,920	439,380
Mali Zvornik	76,920	115,380
Novi Pazar	220,320	330,480
TOTAL	1,204,920	1,807,380



THANK YOU FOR YOUR ATTENTION

