



Nezavisni operator sistema u Bosni i Hercegovini
Независни оператор система у Босни и Херцеговини
Neovisni operator sustava u Bosni i Hercegovini
Independent System Operator in Bosnia and Herzegovina

REPORT
ON ANCILLARY SERVICES AND BALANCING MARKET
OPERATIONS IN BOSNIA AND HERZEGOVINA FOR 2016

Sarajevo, February 2017

Abbreviations:

SERC – State Electricity Regulatory Commission

NOSBiH – Independent System Operator in Bosnia and Herzegovina

Introduction

The Balancing electricity market is a part of the wholesale electricity market and it followed bilateral electricity market. Unlike a bilateral electricity market where the participants in electricity purchase and sale transactions may be any licensed market participant, in the balancing market one of the participants in either transaction type must be a transmission system operator.

In accordance to the Law on establishing Independent system operator in BiH, NOSBiH is responsible for managing the balancing market in BiH which is defined as ‘‘the central market for electricity purchase and sale managed by NOSBiH with the purpose to maintain continuous balance of demand and supply in real time, as well as additional mechanisms conducted by NOSBiH in order to ensure system services’’. In addition, one of NOSBiH’s operations is to provide ancillary services which are defined by the Law on establishing Independent system operator in BiH as ‘‘all services, with the exception of electricity generation and transmission, which are delivered to NOSBiH with the purpose of providing the system services including, among others, regulation of frequency and reserve, reactive power, voltage regulation and a capability of a power plant to start up without an external electricity supply. Therefore, the balancing market and the mechanism of providing ancillary services are the ‘‘tools’’ by which NOSBiH maintains balance between generation, exchange and consumption of electricity in real time, maintains required level of reserve for ancillary services of secondary and tertiary regulation and enables safe operations of the electric power system. Participation in the balancing market is set out by an agreement which NOSBiH concludes with a power market participant in line with the Market rules.

The main principles of the balancing in 2016

In Bosnia and Herzegovina, the Market rules¹ entered into force on 1st January 2016 thus establishing the market principles in the balancing processes and in allocation of the balancing costs of the power system in BiH.

An organized market of capacity reserve and balance energy was established for secondary and tertiary regulation, while in 2016 primary regulation was obligatory for the generation units connected to the transmission system, without compensations.

The control capacity market was established for secondary and tertiary regulation and the right to participate belonged to those ancillary service providers whose capacities satisfied the technical preconditions for providing mentioned ancillary services. The capacity prices were limited in line with appropriate SERC's decisions. In case that the required scope of secondary and tertiary control capacity were not provided in the market, there was a possibility to procure the missing quantities (upon NOSBiH's proposal SERC was adopting decisions on procurement of missing quantities of ancillary services). If the ancillary service providers had failed to deliver certain amount of secondary control capacity, they would incur penalty in amount which was equal to 10% of the price cap for secondary control capacity.

¹ The Market rules were drafted by NOSBiH and approved by SERC in its Decision no.04-28-9-154-3/15 of 21 May 2015

The reserved (contracted) capacity had to be offered at the balancing electricity market where power and electricity price were also offered in case of activation. At the daily balancing energy market the right to participate also belonged to the bids without reserved capacity i.e. voluntary bids.

These were the limitations at the balancing energy market²:

- Price of energy for upward tertiary control was limited to 391.17 KM/MWh in first half of 2016, i.e. to 475.55 KM/MWh in second half of 2016;
- Difference in prices of energy for upward and downward secondary control was limited to 19.56 KM/MWh in first half on 2016, i.e. to 40 KM/MWh in second half of 2016.

Imbalance price were defined according to the bids activated for balancing energy for secondary and tertiary control, and they were used in settlement of imbalance costs of balance responsible parties. Imbalance price were determined for each hour according to the most expensive bid activated (*pay-as-clear*), for realized shortage and surplus of electricity separately.

Secondary regulation

In 2016 NOSBiH had around 12 MW of secondary control capacity in off peak load periods (from midnight until 6:00 am), i.e. around 36 MW in peak load periods (from 6:00 am until midnight) which makes 38.23% and 71.34% of required secondary control capacity. The cost of delivered secondary control capacity in 2016 amounted to 8,709,830.36 KM. In 2016 three companies with their regulation resources were registered to provide ancillary service of secondary control.

Secondary regulation - off peak load (midnight - 6:00 am)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Required capacity <i>MW</i>	35	34	33	31	29	30	32	31	30	31	32	34	31,83	
Contracted capacity <i>MW</i>	35	34	33	24	29	30	32	31	30	31	32	34	31,25	
Capacity contracted at the market <i>MW</i>	0	0	16	24	16	0	0	0	16	16	16	24	10,67	
Price of contracted capacity <i>KM/MW</i>	31,55	33,72	31,59	32,60	31,55	32,60	31,55	40,32	41,67	40,19	41,67	40,32	35,78	
Contracted cost <i>x1000 KM</i>	205	199	193	141	170	176	188	233	225	233	240	255	2,458	
Delivered capacity <i>MW</i>	12	14	10	16	16	7	2	4	6	16	16	21	11,79	
Delivered capacity %	34%	40%	32%	68%	55%	25%	8%	14%	21%	51%	51%	61%	38,2%	
Capacity cost <i>x1000 KM</i>	70	80	61	95	93	44	14	33	47	118	122	155	934	
Undelivered capacity <i>MW</i>	23	20	23	8	13	23	30	27	24	15	16	13	19,46	
Penalty for undelivered capacity <i>x1000 KM</i>	-14	-12	-13	-5	-8	-13	-17	-20	-18	-12	-12	-10	-152	

The table shows average capacity values presented in 1 hour.

Capacity delivered by ASPs														
EP BiH <i>MW</i>	11	12	8	16	14	7	2	4	6	16	16	21	11,08	
EP BiH %	94%	90%	74%	100%	87%	96%	83%	100%	96%	99%	96%	100%	92,94%	
ERS <i>MW</i>	1	1	3	0	2	0	0	0	0	0	1	0	0,71	
ERS %	6%	10%	26%	0%	13%	4%	17%	0%	4%	0%	4%	0%	7,01%	
EP HZHB <i>MW</i>	0	0	0	0	0	0	0	0	0	0	0	0	0,00	
EP HZHB %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0,00%	

The table shows average capacity values presented in 1 hour.

² Price caps adopted by SERC (Decision on determination of coefficients and price caps for ancillary services)

Secondary regulation - peak load (6:00 am - midnight)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Required capacity <i>MW</i>	54	54	52	50	45	46	49	48	48	49	53	55	50,25	
Contracted capacity <i>MW</i>	54	54	52	47	45	46	49	48	48	49	53	55	50,00	
Capacity contracted at the market <i>MW</i>	40	45	46	47	40	34	34	34	34	46	46	46	41,00	
Price of contracted capacity <i>KM/MW</i>	31,55	33,72	31,59	32,60	31,55	32,60	31,55	36,85	36,75	34,01	35,68	34,74	33,60	
Contracted cost <i>×1000 KM</i>	951	951	917	827	792	810	863	987	953	930	1.021	1.066	11.066	
Delivered capacity <i>MW</i>	37	39	25	42	34	30	28	32	30	43	43	43	35,67	
Delivered capacity %	69%	73%	49%	90%	75%	65%	57%	67%	62%	88%	82%	78%	71,3%	
Capacity cost <i>×1000 KM</i>	660	695	445	745	596	525	493	638	558	804	810	809	7.776	
Undelivered capacity <i>MW</i>	17	15	27	5	11	16	21	16	18	6	10	12	14,33	
Undelivered capacity <i>×1000 KM</i>	-29	-26	-47	-8	-20	-28	-37	-35	-41	-13	-22	-27	-333	

The table shows average capacity values presented in 1 hour.

Capacity delivered by ASPs													
EP BiH <i>MW</i>	29	30	17	34	26	23	21	23	23	35	36	35	27,64
EP BiH %	77%	76%	66%	79%	77%	77%	76%	72%	76%	82%	82%	82%	76,87%
ERS <i>MW</i>	8	10	9	9	8	7	7	9	7	8	8	8	8,03
ERS %	23%	24%	34%	21%	23%	23%	24%	28%	24%	18%	18%	18%	23,13%
EP HZHB <i>MW</i>	0	0	0	0	0	0	0	0	0	0	0	0	0,00
EP HZHB %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0,00%

The table shows average capacity values presented in 1 hour.

Tertiary regulation

In 2016 NOSBiH had around 143 MW of upward tertiary control capacity and 69 MW of downward tertiary control capacity which makes 79.13% and 74.37% of required upward and downward tertiary control capacity. The cost of provided tertiary control capacity in 2016 amounted 11,112,481.89 KM for upward tertiary control and 933,772.58 KM for downward tertiary control. Reservation of downward tertiary control capacity has started on 1 April 2016. In 2016 four companies were registered as providers of ancillary service of upward/downward tertiary control. After completion of the procedure of entering into the Register of ancillary service providers in October 2016 a new generation unit, TPP Stanari in BiH, started to participate in the daily balancing market with offers for tertiary control energy.

Upward tertiary regulation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Required capacity <i>MW</i>	184	184	184	184	184	184	184	184	184	184	184	184	184,00	
Contracted capacity <i>MW</i>	184	184	184	155	184	184	184	184	184	184	184	184	181,58	
Capacity contracted at the market <i>MW</i>	130	100	150	155	155	180	140	105	135	180	184	184	149,83	
Price of contracted capacity <i>KM/MW</i>	8,68	9,28	8,69	8,97	8,68	8,97	8,68	8,68	8,97	8,48	8,97	8,68	8,81	
Contracted cost <i>x1000 KM</i>	1.189	1.189	1.189	1.001	1.189	1.189	1.189	1.189	1.189	1.163	1.188	1.188	14,050	
Delivered capacity <i>MW</i>	123	125	130	144	160	142	147	135	132	171	159	151	143,36	
Delivered capacity %	67%	68%	71%	93%	87%	77%	80%	74%	72%	93%	87%	82%	79,1%	
Capacity cost <i>x1000 KM</i>	794	805	841	932	1.035	916	950	875	853	1.108	1.029	975	11,112	
Undelivered capacity <i>MW</i>	61	59	54	11	24	42	37	49	52	13	25	33	38,23	
Penalty for undelivered capacity <i>x1000 KM</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	

The table shows average capacity values presented in 1 hour.

Capacity delivered by ASPs

EP BiH <i>MW</i>	90	75	92	99	95	94	78	66	77	119	113	117	92,91	
EP BiH %	73%	60%	71%	69%	59%	66%	53%	49%	58%	70%	71%	78%	64,68%	
ERS <i>MW</i>	33	50	38	45	45	48	50	49	37	52	47	34	43,94	
ERS %	27%	40%	29%	31%	28%	34%	34%	36%	28%	30%	29%	22%	30,77%	
EP HZHB <i>MW</i>	0	0	0	0	20	0	0	0	0	0	0	0	1,67	
EP HZHB %	0%	0%	0%	0%	12%	0%	0%	0%	0%	0%	0%	0%	1,04%	
EAL <i>MW</i>	0	0	0	0	0	0	19	20	19	0	0	0	4,84	
EAL %	0%	0%	0%	0%	0%	0%	13%	15%	14%	0%	0%	0%	3,51%	

The table shows average capacity values presented in 1 hour.

Downward tertiary regulation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Required capacity <i>MW</i>				93	93	93	93	93	93	93	93	93	93	
Contracted capacity <i>MW</i>				93	93	93	93	93	93	93	93	93	93	
Capacity contracted at the market <i>MW</i>				93	93	93	93	93	93	93	93	93	93	
Price of contracted capacity <i>KM/MW</i>				2,08	2,02	2,08	2,02	2,02	2,08	2,01	2,08	2,02	2,05	
Contracted cost <i>x1000 KM</i>				139	139	139	139	139	139	140	139	139	1,255	
Delivered capacity <i>MW</i>				82	57	77	74	63	59	69	76	66	69,17	
Delivered capacity %				89%	62%	83%	79%	68%	63%	74%	81%	71%	74,4%	
Capacity cost <i>x1000 KM</i>				124	86	115	111	94	88	104	113	99	933,77	
Undelivered capacity <i>MW</i>				11	36	16	19	30	34	24	17	27	23,83	
Penalty for undelivered capacity <i>x1000 KM</i>				0	0	0	0	0	0	0	0	0	0	

The table shows average capacity price presented in 1 hour.

Capacity delivered by ASPs

EP BiH <i>MW</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	
EP BiH %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
ERS <i>MW</i>	82	57	77	74	63	59	69	76	66	69	66	66	69	
ERS %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
EP HZHB <i>MW</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	
EP HZHB %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	

The table shows average capacity price presented in 1 hour.

Balancing energy

In 2016, 39,088 MWh of upward balancing energy was engaged (injected electric energy) with average price of 123.01 KM/MWh.

In 2016, engaged downward balancing energy (takeover of electricity from the system) amounted to 64,599 MWh. Average price for this energy was 28.86 KM/MWh taking into account energy with offered negative price also.

Engaged energy

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Energy for upward secondary control <i>MWh</i>	1.268	1.276	1.923	3.312	1.684	2.873	2.505	1.788	1.405	2.658	4.162	3.843	28.696	
Energy for downward secondary control <i>MWh</i>	12.775	8.891	4.658	3.897	5.632	3.197	2.451	3.957	5.846	4.521	3.232	3.949	63.005	
Energy for upward tertiary control <i>MWh</i>	363	112	955	546	1.396	2.194	723	50	446	839	799	1.968	10.392	
Energy for downward tertiary control <i>MWh</i>	303	0	0	161	210	375	98	75	170	0	0	201	1.593	
Balancing energy - upward <i>MWh</i>	1.631	1.388	2.878	3.858	3.080	5.067	3.227	1.838	1.852	3.497	4.961	5.811	39.088	
Balancing energy - downward <i>MWh</i>	13.078	8.891	4.658	4.058	5.842	3.573	2.549	4.032	6.016	4.521	3.232	4.149	64.599	

The cost of balancing and average prices

	Jan	Feb	Mar	Apr	Maj	Jun	Jul	Avg	Sep	Okt	Nov	Dec	2016	2016/2015
Upward - cost <i>KM</i>	221.429	65.920	393.994	287.687	532.686	716.492	366.027	184.554	151.092	315.615	466.166	1.106.441	4.808.102	
Upward - average cost <i>KM/MWh</i>	135,76	47,50	136,89	74,56	172,96	141,40	113,41	100,44	81,60	90,25	93,96	190,40	123,01	
Downward - cost (positive price) <i>KM</i>	796.562	217.375	32.977	87.621	60.132	90.764	126.802	256.009	60.646	119.255	96.172	159.439	2.103.753	
Downward - cost (negative price) <i>KM</i>	0	0	0	17.895	17.878	33.780	17.765	13.225	30.770	0	0	107.916	239.230	
Downward - average price <i>KM/MWh</i>	60,91	24,45	7,08	17,18	7,23	15,95	42,78	60,22	4,97	26,38	29,76	12,42	28,86	

Imbalance

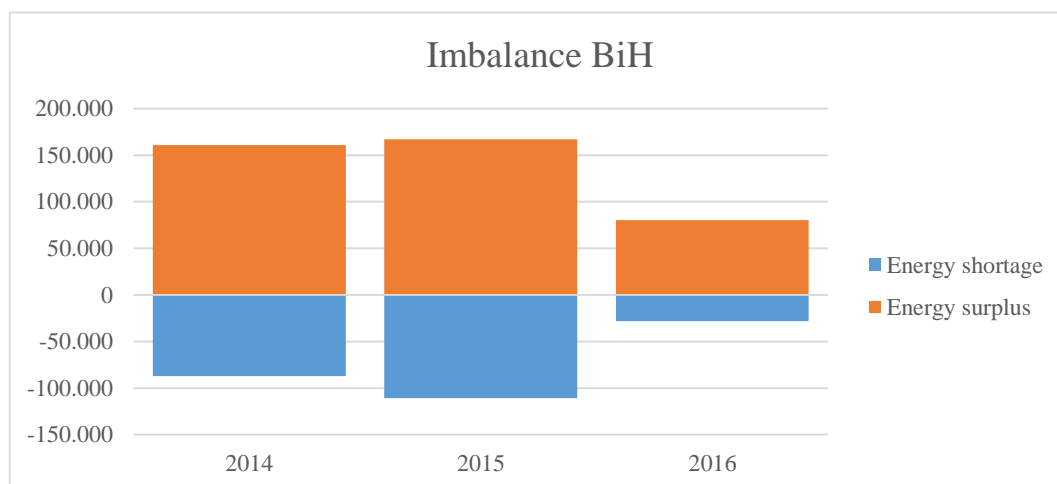
There were 8 balance responsible parties active in BiH in 2016. Average imbalance prices in 2016 were 76.17 KM/MWh for shortage and 24.00 KM/MWh for surplus of electric energy. However, these prices were moving in a wide range from 750.00 KM/MWh up to 450.00 KM/MWh, depending on the energy situation.

Imbalance

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Shortage - total <i>MWh</i>	1.201	964	3.030	1.899	2.968	2.132	1.520	819	1.633	3.026	4.341	4.625	28.159	
Shortage - max. Hourly <i>MW</i>	59	83	198	59	135	91	61	29	36	38	57	313	313	
Surplus - total <i>MWh</i>	15.075	10.241	7.909	4.003	5.321	6.071	6.595	8.609	9.359	2.587	1.555	2.985	80.310	
Surplus - max. Hourly <i>MW</i>	121	120	92	61	89	64	76	180	239	45	42	57	238,70	
Shortage - average price <i>KM/MWh</i>	92,84	51,37	41,49	51,57	55,95	72,84	99,30	110,43	68,43	80,50	84,18	102,60	76,17	
Shortage - max. price <i>KM/MWh</i>	391,17	216,00	391,17	391,17	391,17	310,00	200,00	190,00	185,00	165,00	450,00	450,00	450,00	
Surplus - average price <i>KM/MWh</i>	61,13	16,73	8,06	13,79	9,14	20,94	37,14	50,56	12,91	15,30	20,81	20,13	24,00	
Surplus - minimum price <i>KM/MWh</i>	2,05	0,00	1,96	-175,00	-85,00	-90,00	-187,00	-180,00	-181,00	1,00	0,10	-750,00	-750,00	

The new balancing system was established in 2016 and primarily consisted of market procurement and evaluation of provided balancing services, and allocation of balancing costs to those who caused them. It reduced deviations of BiH control area towards the remaining

part of the interconnection in comparison to previous period; this may be seen in the following diagram:



Imbalance BiH		Energy shortage			Energy surplus		
		2014	2015	2016	2014	2015	2016
Total	MWh	-87.222	-110.950	-28.159	160.839	166.863	80.310
Max. hourly	MW	-225	-188	-313	206	233	239

Transmission losses and compensations

In 2016 electric energy to cover transmission system losses was purchased through public procurement procedures. Total cost of this service in 2016 was 27,006,479.96 KM.

Losses and compensations														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016	2016/2015
Compensations	MWh	8.784	12.660	4.631	9.084	381	3.225	3.568	6.793	-8.146	643	-2.248	-780	38.595
Losses	MWh	32.102	27.683	30.640	23.402	23.072	22.632	27.532	26.909	25.466	30.674	31.298	32.447	333.856
Price of losses	KM/													
Reference price	MWh	91,63	95,35	78,33	78,33	78,33	88,01	113,44	113,44	107,57	105,61	95,35	95,35	95,06
Cost	^{x1000} KM	2.242	1.447	2.037	1.265	1.782	1.713	2.725	2.288	1.936	3.180	3.209	3.182	27.006

Compensations: "-" direction - reception, "+" - giving

Exchange of cross border balancing energy

On the basis of the Agreement on the provision of a joint reserve in the Slovenia-Croatia-Bosnia and Herzegovina control block, there was a reduction of capacity which was to be provided in BiH control area resulting with significant savings in costs related to reservation of control capacities. Under the same Agreement, in September 2016, 20 MWh of electric power was delivered to Slovenian power system by the price of 475.55 KM/MWh out of BiH power system.

Conclusion

Establishment of the balancing market on 1 January 2016 not only brought significant reduction of deviations of BiH control area towards the interconnection but also enhanced safety of the electric power system in Bosnia and Herzegovina.

Proper functioning of the balancing market is one of the important factors in providing conditions for establishing an organized electricity market in BiH and its integration in the regional and common European market.