REPORT
ON ANCILLARY SERVICES AND BALANCING MARKET OPERATIONS IN BOSNIA AND HERZEGOVINA FOR 2018

Sarajevo, February 2019

Abbreviations:

SERC – State Electricity Regulatory Commission

NOSBiH – Independent System Operator in Bosnia and Herzegovina

ASP – Ancillary Service Provider

BRP – Balance Responsible Party

EPBiH – Public Enterprise Electric Utility of Bosnia and Herzegovina, d.d Sarajevo

EPHZHB – Public Enterprise Electric Utility of the Croatian Community Herzeg-Bosnia, d.d. Mostar

ERS – Mixed Holding Electric Utility of the Republic of Srpska - Parent Joint - stock Company, Trebinje

EAL – Aluminij d.d. Mostar

EFT Stanari – EFT- Coal mine and Thermal Power Plant l.t.d Stanari

EMS – Joint Stock Company „Elektromreža Srbije“ Belgrade

CGES – Electricity Transmission System of Montenegro

HOPS – Croatian Transmission System Operator

ELES – Elektro-Slovenija d.o.o. – Electricity Transmission System Operator in Slovenia

Introduction

Pursuant 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 power plant capability 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 the 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 regulated by an agreement which NOSBiH concludes with a power market participant in line with the Market Rules.

The main principles of the balancing in 2018

In Bosnia and Herzegovina, the Market Rules 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 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 in 2018 were limited in line with relevant 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. If the Ancillary Service Providers had failed to deliver certain amount of secondary and tertiary control capacity, they would incur penalty in amount which was equal to 10% of the price cap for secondary i.e. tertiary control capacity.

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.

The procurement of secondary control capacity was done symmetrically for positive and negative range of control, and the procurement of tertiary control capacity was done separately for upward and downward control.

SERC's Decision on determination of coefficients and price caps for ancillary services as of 14 September 2017 (hereinafter the 'Decision') determined horuly price caps for control capacity and delivered balance energy. The price of balancing energy for downward tertiary control is not limited.

Table 1: Ancillary services - overview for 2018

Reserve capacity and capacity cost					
		Sec. con. Offpeak load	**Sec. con. Peak load**	**Tert. con. Upward**	**Tert. con. Downward**
Required capacity	*MW*	32,58	50,50	196,00	68,00
Contracted capacity	*MW*	32,58	50,50	196,00	68,00
Contracted capacity at market	*MW*	25,00	50,50	196,00	68,00
Price of contracted capacity	*KM/ MW/h*	42,99	41,61	3,99	0,50
Contracted cost	*KM*	3.067.069	13.804.827	6.843.769	300.643
Delivered capacity	*MW*	14,47	38,12	152,70	52,96
Delivered capacity	*%*	44,41%	75,48%	77,91%	77,89%
Capacity cost	*KM*	1.362.142	10.380.357	5.949.877	235.908
Capacity not provided	*MW*	18,11	12,38	43,30	15,04
Penalty for capacity not provided	*KM*	-170.534	-349.865	-400.335	-27.661
PPU share in capacity delivered					
EP BiH	*MW*	8,40	20,57	57,86	0,00
ERS	*MW*	5,29	15,29	44,73	35,30
EP HZHB	*MW*	0,77	2,26	50,11	0,00
EAL	*MW*			0,00	
EFT Stanari	*MW*			0,00	17,67

The table shows average capacity values reduced to 1 hour.

These were the limitations at the balancing energy market in 2018:

- Price of energy for upward tertiary control was limited to 414.70 KM/MWh;
- Difference in prices of energy for upward and downward secondary control was limited to 40.00 KM/MWh in the bids for secondary control,
- The price cap for secondary control capacity amounted to 43.00 KM/MW/h
- The price cap for upward tertiary control capacity amounted to 9.00 KM/MW/h
- The price cap for downward tertiary control capacity amounted to 2.10 KM/MW/h

In line with bids activated for balancing energy for secondary and tertiary control there were created imbalance prices which were used in calculation of imbalance costs of balance responsible parties

(BRP) in BiH. Imbalance prices were determined for each hour according to the most expensive bid activated, for realized electricity deficit and surplus respectively.

Ancillary Services in 2018

Table 1 presents specific values related to ancillary services capacity in 2018. Image 1 graphically presents the share that the ASP had in providing specific ancillary services and the share of undelivered capacity on an annual basis. Detailed monthly realization of capacity for some ancillary services is shown in tables 2 - 5.

Low operational availability especially of secondary control capacity in off-peak load periods was still present. Despite this fact, during the year, there were no longer periods of large deviations of BiH Control Area towards the remaining part of the interconnection which would have caused larger disturbances or jeopardized the system's safety.

Secondary regulation

In 2018 NOSBiH had around 14 MW of secondary control capacity in off peak load periods (from midnight until 6:00 am), which makes 44% of required secondary control capacity and makes significant increase by 3,5 times in comparison to the year 2017. In peak load periods (from 6:00 am until midnight) there was average amount of 38 MW of secondary control capacity which makes 75% of the capacity required.

The cost of secondary control capacity in 2018 amounted to 11 749 499 KM. In 2018 three companies with their regulation resources were registered to provide ancillary service of secondary control.

Tertiary regulation

In 2018 NOSBiH had around 153 MW of upward tertiary control capacity and 53 MW of downward tertiary control capacity which makes 78% of required upward and downward tertiary control capacity. The cost of provided tertiary control capacity in 2018 amounted 5 949 877 KM for upward tertiary control and 235 908 KM for downward tertiary control. In 2018, 5 companies were registered as providers of ancillary service of upward tertiary control, and 4 companies as providers of ancillary service of downward tertiary control.

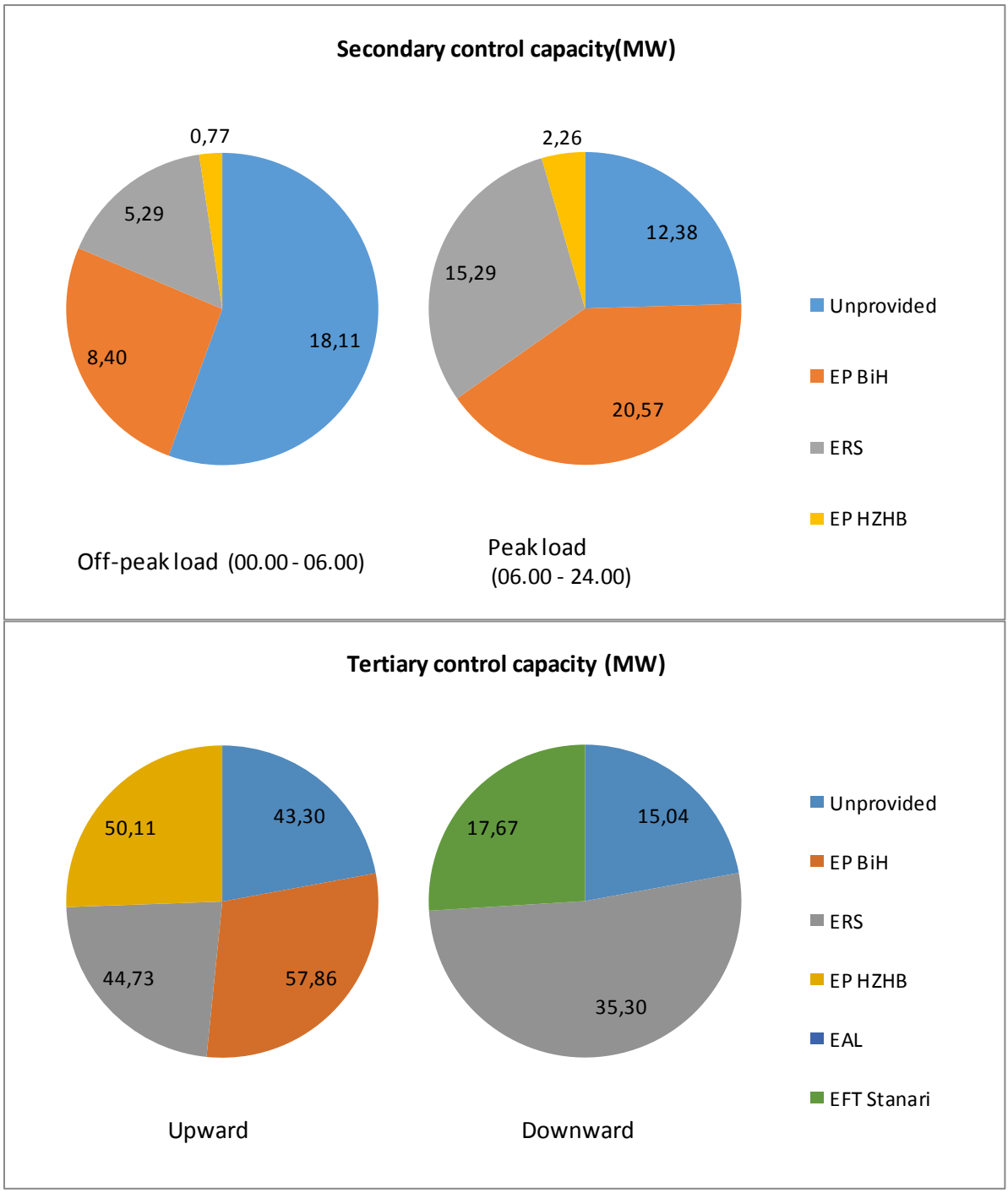

Image 1: Share of ASPs in delivered control capacity in BiH in 2018

Table 2: Report on ancillary services in BiH for 2018

Secondary control - off-peak load (00.00 - 06.00 am)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Required capacity	MW	39	35	32	31	29	31	31	32	30	31	33	37	32,58	103,13%
Contracted capacity	MW	39	35	32	31	29	31	31	32	30	31	33	37	32,58	103,42%
Capacity contracted at the market	MW	31	31	32	31	23	23	7	7	23	23	33	37	25,00	112,08%
Price of contracted capacity	KM/MW	42,99	42,99	42,98	42,98	42,99	42,99	43,00	43,00	42,99	42,99	42,98	42,99	42,99	115,03%
Contracted cost	KM	311.833	252.759	254.468	239.854	231.882	239.882	247.938	255.936	232.142	249.211	255.326	295.837	3.067.069	118,97%
Delivered capacity	MW	30	31	12	13	19	7	8	14	5	8	10	17	14,47	350,20%
Delivered capacity	%	76%	89%	38%	43%	65%	23%	27%	45%	16%	24%	30%	47%	44,41%	
Capacity cost	KM	236.129	224.852	96.034	102.141	151.056	55.079	67.080	114.423	37.577	60.869	77.376	139.524	1.362.142	373,71%
Undelivered capacity	MW	9	4	20	18	10	24	23	18	25	23	23	20	18,11	66,17%
Penalty for undelivered capacity	KM	-7.572	-2.791	-15.850	-13.777	-8.084	-18.486	-18.086	-14.151	-19.462	-18.838	-17.802	-15.635	-170.534	68,69%

Table shows average values of capacity and prices reduced to 1 hour.

Share of PPU in delivered capacity															
EP BiH	MW	19	24	7	7	12	1	1	2	1	5	7	14	8,40	233,02%
EP BiH	%	63%	77%	62%	56%	66%	15%	11%	15%	30%	66%	67%	83%	58%	
ERS	MW	8	6	5	6	5	6	7	11	2	2	3	3	5,29	1807,27%
ERS	%	29%	18%	38%	44%	25%	82%	84%	76%	43%	27%	33%	17%	37%	
EP HZHB	MW	2	2	0	0	2	0	0	1	1	1	0	0	0,77	340,08%
EP HZHB	%	8%	5%	0%	0%	9%	3%	4%	9%	26%	7%	0%	0%	5%	

Table shows average values of capacity reduced to 1 hour.

Table 3: Report on ancillary services in BiH for 2018

Secondary control - peak load (06.00 am - 24.00)

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Required capacity	MW	59	53	50	49	45	47	48	49	47	50	52	57	50,50	102,53%
Contracted capacity	MW	59	53	50	49	45	47	48	49	47	50	52	57	50,50	101,65%
Capacity contracted at the market	MW	59	53	50	49	45	47	48	49	47	50	52	57	50,50	102,35%
Price of contracted capacity	KM/MW	41,93	41,81	41,74	41,71	42,99	42,15	42,32	42,19	40,78	40,91	40,41	40,63	41,61	102,29%
Contracted cost	KM	1.380.341	1.116.819	1.164.490	1.103.722	1.079.453	1.069.891	1.133.393	1.153.542	1.034.926	1.141.356	1.134.605	1.292.289	13.804.827	103,99%
Delivered capacity	MW	52	46	19	24	33	40	41	43	36	39	39	46	38,12	106,53%
Undelivered capacity	%	88%	87%	38%	49%	73%	85%	85%	88%	78%	78%	74%	81%	75,48%	
Capacity cost	KM	1.215.660	973.812	434.721	530.144	763.692	914.015	962.995	1.010.301	801.109	888.251	839.768	1.045.891	10.380.357	108,33%
Undelivered capacity	MW	7	7	31	25	12	7	7	6	11	11	13	11	12,38	89,11%
Penalty for undelivered capacity	KM	-17.028	-15.041	-74.661	-58.188	-29.399	-15.910	-17.230	-14.556	-24.489	-26.320	-31.111	-25.933	-349.865	92,97%

Table shows average values of capacity and prices reduced to 1 hour.

Share of PPU in delivered capacity															
EP BiH	MW	32	28	4	3	15	21	22	22	29	28	22	23	20,57	81,89%
EP BiH	%	61%	60%	24%	12%	45%	52%	53%	50%	79%	72%	56%	49%	53,96%	
ERS	MW	20	18	12	18	14	16	15	17	8	11	14	19	15,29	278,99%
ERS	%	39%	40%	63%	74%	43%	41%	37%	41%	21%	28%	37%	42%	40,11%	
EP HZHB	MW	0	0	2	3	4	3	4	4	0	0	2	4	2,26	43,63%
EP HZHB	%	0%	0%	13%	14%	12%	7%	9%	9%	0%	0%	6%	9%	5,94%	

Table shows average values of capacity reduced to 1 hour.

Table 4: Report on ancillary services in BiH for 2018

Upward tertiary regulation

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Required capacity	MW	196	196	196	196	196	196	196	196	196	196	196	196	196,00	100,00%
Contracted capacity	MW	196	196	196	196	196	196	196	196	196	196	196	196	196,00	100,00%
Capacity contracted at the market	MW	196	196	196	196	196	196	196	196	196	196	196	196	196,00	100,00%
Price of contracted capacity	KM/MW	3,59	3,59	3,40	3,34	3,70	4,70	4,99	4,35	4,37	4,08	3,84	3,84	3,99	62,99%
Contracted cost	KM	524.059	473.343	495.670	471.269	540.144	663.941	727.736	634.811	615.996	596.253	541.253	559.295	6.843.769	62,99%
Delivered capacity	MW	159	143	102	150	179	187	157	162	143	139	156	155	152,70	85,29%
Delivered capacity	%	81%	73%	52%	76%	91%	95%	80%	83%	73%	71%	80%	79%	77,91%	
Capacity cost	KM	478.394	395.241	299.022	409.400	495.585	636.508	608.310	703.353	611.831	423.686	439.789	448.759	5.949.877	60,18%
Undelivered capacity	MW	37	53	94	46	17	9	39	34	53	57	40	41	43,30	255,41%
Penalty for undelivered capacity	KM	-24.924	-31.960	-121.632	-30.001	-11.682	-6.026	-25.920	-22.558	-34.621	-38.017	-25.842	-27.153	-400.335	303,49%

Table shows average values of capacity and prices reduced to 1 hour.

Share of PPU in delivered capacity															
EP BiH	MW	68	61	46	28	30	43	48	69	68	93	76	65	57,86	70,25%
EP BiH	%	43%	43%	45%	19%	17%	23%	30%	42%	48%	66%	48%	42%	37,89%	
ERS	MW	47	36	11	29	53	81	54	58	48	41	35	44	44,73	183,96%
ERS	%	30%	25%	11%	19%	30%	43%	34%	36%	34%	29%	23%	29%	29,29%	
EP HZHB	MW	44	46	45	93	96	63	56	36	26	6	45	46	50,11	69%
EP HZHB	%	28%	32%	44%	62%	54%	34%	36%	22%	18%	4%	29%	29%	32,82%	
EAL	MW	0	0	0	0	0	0	0	0	0	0	0	0	0,00	
EAL	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0,00%	
EFT Stanari	MW	0	0	0	0	0	0	0	0	0	0	0	0	0,00	
EFT Stanari	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0,00%	

Table shows average values of capacity reduced to 1 hour.

Table 5: Report on ancillary services in BiH for 2018

Downward tertiary regulation

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Required capacity	MW	68	68	68	68	68	68	68	68	68	68	68	68	68,00	103,03%
Contracted capacity	MW	68	68	68	68	68	68	68	68	68	68	68	68	68,00	103,03%
Capacity contracted at the market	MW	68	68	68	68	68	68	68	68	68	68	68	68	68,00	103,03%
Price of contracted capacity	KM/MW	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	44,97%
Contracted cost	KM	25.534	23.063	25.500	24.710	25.534	24.710	25.534	25.534	24.710	25.568	24.710	25.534	300.643	46,33%
Delivered capacity	MW	58	63	67	47	54	53	55	55	41	41	50	53	52,96	116,63%
Delivered capacity	%	85%	92%	98%	68%	80%	78%	80%	81%	61%	60%	74%	78%	77,89%	
Capacity cost	KM	21.914	21.504	25.052	17.953	20.875	19.153	20.466	20.627	14.517	15.585	18.125	20.137	235.908	53,26%
Undelivered capacity	MW	10	5	1	21	14	15	13	13	27	27	18	15	15,04	73,03%
Penalty for undelivered capacity	KM	-1.604	-761	-172	-3.241	-2.149	-2.285	-2.103	-2.036	-4.041	-4.275	-2.697	-2.297	-27.661	74,73%

Table shows average values of capacity and prices reduced to 1 hour.

Share of PPU in delivered capacity															
EP BiH	MW	0	0	0	0	0	0	0	0	0	0	0	0	0,00	
EP BiH	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0,00%	
ERS	MW	39	43	42	42	40	33	35	35	21	29	31	35	35,30	109,44%
ERS	%	68%	69%	63%	89%	74%	62%	63%	64%	50%	71%	61%	66%	66,64%	
EP HZHB	MW	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%	
EFT Stanari	MW	19	20	25	5	14	20	20	20	21	12	19	18	17,67	134,26%
EFT Stanari	%	32%	31%	37%	11%	26%	38%	37%	36%	50%	29%	39%	34%	33,36%	

Table shows average values of capacity reduced to 1 hour.

Balancing market

In 2018, for the needs of balancing the power system of BiH 43 857 MWh of upward balancing energy was engaged (injected electric energy) with average price of 134.06 KM/MWh.

In 2018, engaged downward balancing energy (takeover of electricity from the system) amounted to 60 884 MWh. Average price for this energy was 53.47 KM/MWh taking into account the energy with offered negative price also.

Imbalance

There were 7 Balance Responsible Parties (BRP) active in BiH in 2018, not counting so called 'trading BRPs' i.e. the BRPs with no imbalance realized within BiH. Average imbalance prices in 2018 were 111.27 KM/MWh for shortage and 41.40 KM/MWh for surplus of electric energy. However, these prices were moving in a wide range from -500.00 KM/MWh up to 414.70 KM/MWh, depending on the energy situation.

In comparison to previous years when the Market Rules were applied, it can be concluded that the year 2018 was characterized with larger shortage ie. smaller surplus of electric energy appearing in the system. Image 2 shows the deviations of the Control Area BiH in last five years.

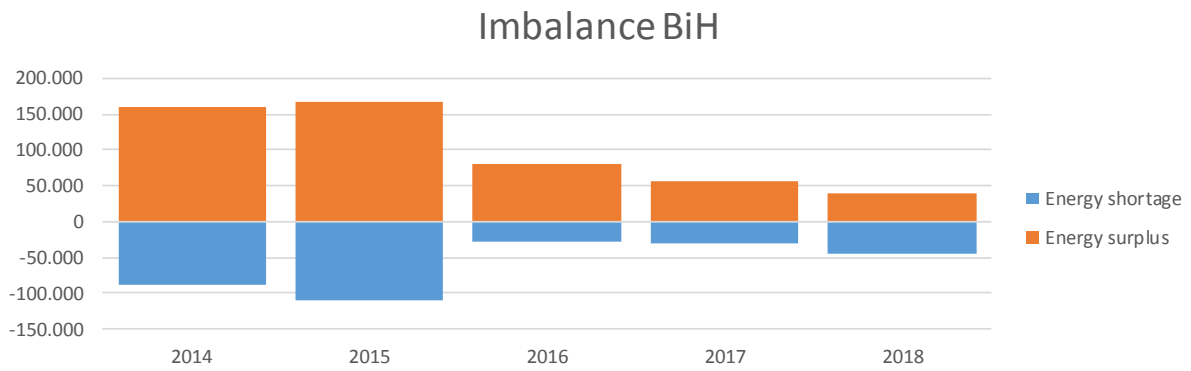

Image 2: Annual deviation of BiH Control Area

Table 6: Indicators of deviation in BiH for last five years

Imbalance BiH		Energy shortage					Energy surplus				
		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Total	*MWh*	-87.222	-110.950	-28.159	-31.200	-45.062	160.839	166.863	80.310	56.105	39.814
Max. Hourly	*MW*	-225	-188	-313	-179	-190	206	233	239	157	199

Table 7 presents engaged balancing energy values, energy prices and adequate expenses by taking into consideration cross-border engagements for the needs of BiH Control Area, exempting the energy engaged within BiH for the needs of other system operators.

Table 7: Report on balancing market in BiH for 2018

Engaged energy

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Energy of sec. reg. Upward	MWh	3.894	4.606	1.676	525	1.952	4.914	3.339	1.990	1.403	3.710	5.417	3.784	37.209	93,60%
Energy of sec. reg. downward	MWh	6.457	3.822	4.127	4.811	5.569	3.897	5.516	7.397	5.856	3.655	2.560	5.841	59.509	181,21%
Energy of tert. reg. upward	MWh	502	1.353	2.107	53	475	386	461	329	264	52	262	406	6.648	68,69%
Energy of tert. reg. downward	MWh	15	0	272	898	59	12	18	43	15	10	18	17	1.376	107,60%
Balancing energy upward	MWh	4.395	5.959	3.783	577	2.427	5.299	3.800	2.319	1.667	3.762	5.679	4.190	43.857	88,72%
Balancing energy downward	MWh	6.472	3.822	4.398	5.709	5.628	3.909	5.534	7.440	5.871	3.665	2.578	5.858	60.884	178,46%

Balancing cost and realized average prices

Upward - cost	KM	416.767	821.535	912.287	58.555	239.534	543.372	564.957	363.122	229.508	389.392	698.240	642.198	5.879.466	75,56%
Upward - average price	KM/MWh	94,82	137,85	241,14	101,47	98,70	102,54	148,68	156,61	137,69	103,51	122,95	153,28	134,06	85,16%
Downward - cost (pos. price)	KM	173.371	156.487	210.998	132.638	157.500	198.196	428.335	613.173	439.716	236.351	211.677	482.763	3.441.205	190,11%
Downward - cost (neg. price)	KM	-3.343	-473	-24.917	-114.713	-18.857	-1.167	-2.385	-9.460	-750	-500	-917	-8.334	-185.814	-50,04%
Downward - average price	KM/MWh	26,27	40,82	42,31	3,14	24,63	50,41	76,98	81,14	74,76	64,35	81,74	80,99	53,47	126,79%

Imbalance BiH

Shortage - total	MWh	3.708	7.815	7.997	2.485	3.135	4.303	2.766	1.767	1.818	3.713	3.269	2.287	45.062	144,43%
Deficit - max hourly	MW	45	158	190	95	52	90	88	57	83	161	45	47	189,70	106,24%
Surplus - total	MWh	2.431	506	4.535	5.984	2.782	2.392	2.872	3.557	4.605	2.640	3.375	4.135	39.814	70,96%
Surplus - max hourly	MW	54	42	110	56	60	55	56	199	75	114	77	60	199,50	127,33%
Price deficit - average	KM/MWh	85,52	87,90	111,44	80,55	81,91	111,31	132,07	137,35	114,46	110,02	136,02	144,38	111,27	93,46%
Price deficit - maximum	KM/MWh	350,00	414,70	414,70	414,70	250,00	390,00	414,70	414,70	414,70	414,70	414,70	414,70	414,70	87,20%
Price surplus - average	KM/MWh	17,17	22,02	35,91	3,63	13,22	34,65	62,06	69,40	54,65	53,38	61,49	66,95	41,40	92,05%
Price surplus - minimum	KM/MWh	-150,00	-20,00	-150,00	-200,00	-201,00	-100,00	-201,00	-220,00	-50,00	-50,00	-50,00	-500,00	-500,00	-100,00%

Table 8: Report on losses and compensations for 2018

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
Compensations	MWh	1.630	-5.342	-4.625	3.289	1.579	-162	-1.797	1.643	3.268	-1.760	-1.268	-326	-3.871	-17,30%
Losses	MWh	29.239	38.429	54.816	36.465	26.668	26.966	31.881	31.967	28.712	29.042	29.423	35.155	398.764	117,52%
Reference price	KM/MWh	117,10	118,80	90,50	84,47	87,89	92,84	100,83	99,86	99,73	103,80	104,83	103,88	100,38	121,34%
Cost	KM	3.233.070	5.200.009	5.379.394	2.802.344	2.205.031	2.518.602	3.395.794	3.028.201	2.537.567	3.197.212	3.217.327	3.685.793	40.400.345	153,20%

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

Table 9: Report on cross-border balancing energy exchange for 2018

Energy engaged in BiH for other TSOs needs

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2018	2018/17
XB Exchange - Import	MWh													0	0%
Price Import Average	KM /MWh														0%
Cost Import	KM													0	0%
XB Exchange - Export	MWh	2.660		360	186				100					3.306	5904%
Price Export Average	KM /MWh	185,05		231,61	187,31				293,37					193,52	41%
Cost Export	KM	492.233		83.381	34.839				29.337					639.790	2402%

Engaged cross-border energy for the needs of BiH

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018	2018/17
XB Exchange - Import	MWh		406	605										1.011	153%
Price Import Average	KM /MWh		163,61	232,20										204,66	101%
Cost Import	KM		66.428	140.481										206.909	155%
XB Exchange - Export	MWh													0	0%
Price Export Average	KM /MWh														0%
Cost Export	KM													0	0%

Transmission losses and compensations

In 2018 electric energy to cover transmission system losses and compensations was purchased through public procurement procedures. Total cost of this service in 2018 was 40 400 345 KM. The energy prices obtained in the procurement procedure were in average increased by around 21% in comparison to the year 2017 (Table 8). In addition, losses on an annual level were increased by 17.5% in comparison to last year, mostly due to the signficant increase of transmission losses in February and March 2018. Increase in price and in amount of transmission losses in 2018 caused over 53% more expenses of this service in comparison to 2017.

Cross-border balancing energy exchange

On the basis of the Agreement on the provision of a joint reserve in the Slovenia-Croatia-Bosnia and Herzegovina control block, the capacity of tertiary regulation which was to be provided in 2018 within the BiH control area was 196 MW for upward regulation and 68 MW for downward regulation. In 2017 Agreement on cross-border exchange of balancing energy was signed with Serbian Transmission System Operator – EMS, and in 2018 the same Agreement was signed with the Transmission System Operator in Montenegro – CGES.

Table 9 shows the values of exchanged cross-border balancing energy in 2018 with the expenses included. Out of the total amount of 4 317 MWh of cross-border balancing energy, the amount of 4 037 MWh was exchanged with Serbia, 180 MWh with Croatia, 100 MWh with Montenegro, and there was no exchange with Slovenia.

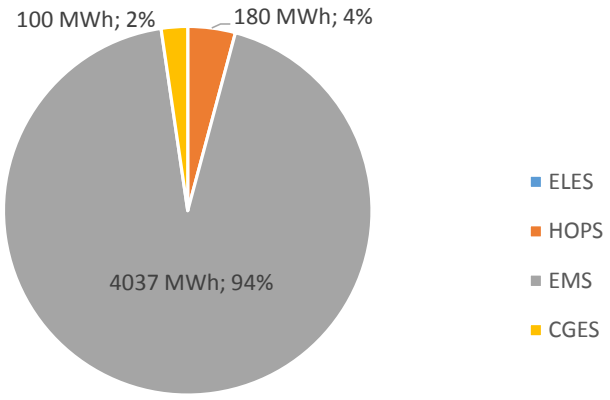

Image 3: Exchange of cross border balancing energy

Conclusion

All required ancillary services capacity for 2018, apart from the secondary control capacity in off peak load periods, were procured in public procurement procedures mostly in the annual tender. In addition, in comparison to the year 2017 there was significant price reduction on tertiary control capacity, i.e. the price of upward tertiary control was reduced by 37%, and the price of downward tertiary control was reduced by 55%. Therefore, the price of tertiary control capacity were significantly below the regulated price caps.

When compared to 2017 in 2018 the amount of delivered secondary control capacity in off peak load periods was increased by 3,5 times, and it still presents 44.4% of capacity required during the night hours. The worst realization was during the summer months, in the third quarter of the year, when only 29% of required capacity was delivered. Other services were delivered in the range of 75-80% of required capacity. Prevailing Ancillary Services Providers were three elektroprivreda companies and EFT- Coal mine and Thermal Power Plant l.t.d Stanari for downward tertiary control.

In hydrologic terms, the year 2018 was specific for relatively evenly distributed precipitation during the summer and very dry autumn.

Imbalance prices were slightly lower than the prices realized in 2017, although electricity prices in surrounding power exchanges showed an increase during the year. In addition, there is still a significant price difference in imbalance price for shortage and for surplus of energy which in 2018 amounted to 70 KM/MWh in average.

The year 2018 was also interesting for significant increase of the transmission losses in February, March and April which on an annual basis led to an increase in losses by almost 18% when compared to the year 2017. Transmission losses in May reached their usual values. It could be stated that a possible cause for this increase of losses in the above mentioned months was an increase in electricity generation in BiH along with increased electricity transitions over BiH power system. Having in mind increase in price of energy to cover transmission losses by over 21%, the total cost of energy to cover transmission losses and compensations in amount of 40 400 345 KM is thus over 53% greater than it was in 2017.

As for cross-border balancing energy exchange the most dominant were arrangements with EMS, reaching 94% of totally exchanged energy. The arrangements were mostly concluded in first four months in 2018 and in all cases it was upward tertiary control for NOSBiH or for other system operators. For the needs of BiH it was engaged 1 011 MWh of upward tertiary energy by an average price of around 205 KM/MWh which corresponds to the prices in 2017. However, there was significant reduction by almost 60% of the price of electricity delivered from BiH power system to other operators, and average price of tertiary control delivered from BiH power system was 193.5 KM/MWh.

Therefore, in 2018 the reservation costs of control capacity and the costs of engaged balancing energy were reduced and on the other hand the costs of transmission losses and compensation increased. By taking into account current system services tariff, in the balancing market of BiH in 2018 there was deficit reaching over 9.4 million of KM which led to reduction of accumulated suficit from previous period.