

## **Appendix 01.**

### **TENT B2\_ESPs Overview and Upgrade Data**

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Assessment

#### 1. General Information

Nominal Load	(MW)		618,4
Turbine Manufacturer		Compagnie Electro Mechanique (ALSTOM)	
Turbine Heat Rate	(KJ/Kwh)		7.773
Turbine efficiency	(%)		46,31
Boiler Manufacturer		RAFACO S.A.	
Boiler Type		Pulverized Lignite Fired, Once Through, SULZER Type, model BB-1880	
Lignite Mills		6 Mills, EVT, type N-400.42,	
Boiler Maximum Continuous Rating	(Kg/s)		256
Boiler Efficiency	(%)		87,5
Unit Efficiency	(%)		40,52
Electrostatic Precipitators		2, 2_Chamber, LURGI, type BS 672	
Induced Draft Fans		2, TLT-Turbo GmbH (KKK), type KKK-AN42e6	
Air Pre Heaters		2, LURGI, Rotary (Ljungstrom) Horizontal type,	

#### Required Collection Area after ESPs Refurbishment and steam turbine upgrade (calculations according to current ESP's design data)

Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		75.815
Required ESPs Collection Area increase	(%)		2,56

#### Required Collection Area after ESPs Refurbishment and steam turbine upgrade (calculation based on operation data)

Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		83.367
Required ESPs Collection Area increase	(%)		12,78

#### Calculation based on operation data without including the steam turbine upgrade

Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		78.697
Required ESPs Collection Area increase	(%)		6,46

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Assessment

2. Fuel / Ash Characteristics			
2.1 Design Data			
Low Calorific Value	KJ/Kg		6.720
Moisture	(%)		47,79
Ash	(%)		19
Sulphur Content	(%)		
	(%)		
2.2 As Fired Fuel Data (avarage values)			
Low Calorific Value	KJ/Kg		8.108
Moisture	(%)		50,05
Ash	(%)		14,40
Sulphur Content	(%)		0,39
Carbon fixed	(%)		14,82
Volatiles	(%)		23,48
N+O <sub>2</sub>	(%)		10,12
3. Ash Analysis (as measured, average values)			
SiO <sub>2</sub>	(%)		56,67
Al <sub>2</sub> O <sub>3</sub>	(%)		23,78
Fe <sub>2</sub> O <sub>3</sub>	(%)		5,85
CaO	(%)		5,89
MgO	(%)		2,08
Na <sub>2</sub> O	(%)		0,54
K <sub>2</sub> O	(%)		1,05
TiO <sub>2</sub>	(%)		0,66
P <sub>2</sub> O <sub>5</sub>	(%)		0,06
SO <sub>3</sub>	(%)		1,61

# THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

## ESPs Efficiency / Performance Assessment

### 4. ESPs Characteristics

#### 4.1 General Information

ESPs Manufacturer		LURGI, Germany	
ESPs type			
ESPs type		2- Chamber	
Year of commissioning			1.985

#### 4.2 Technical Characteristics

##### 4.2.1 Mechanical

Nr of ESPs	(pcs)		2
Nr of Chambers / ESP	(pcs)		2
Nr of Fields (Zones)	(pcs)		4
Nr of Sections / Chamber	(pcs)		4
Nr of Sections / ESP	(pcs)		8
Total Nr of Sections	(pcs)		16
Chamber Length	(mm)		19.370
Chamber Width	(mm)		15.200
Flue gas duct cross section downstream Chamber	(m <sup>2</sup> )		19,80
Flue gas duct cross section upstream Chamber	(m <sup>2</sup> )		27,36
Collection Electrodes, type		CSV (13.750mmx510mm)	
Collection Electrodes, effective height	(mm)		13.750
Collection Electrodes Plates (Sections) effective length	(mm)		3.360
Total Chamber effective length	(mm)		13.440
Collection Electrodes spacing	(mm)		300
Nr of flue gas passages / Chamber	(pcs)		50
Nr of Collection Electrodes / ESP	(pcs)		2.800
Total Nr of Collection Electrodes	(pcs)		5.600
Collection Area / Chamber	(m <sup>2</sup> )		18.480
Collection Area / ESP	(m <sup>2</sup> )		36.960
Total Collection Area	(m <sup>2</sup> )		73.920
Casing utilization factor	(%)		69,39
Active cross section / Chamber	(m <sup>2</sup> )		206,25
Effective Volume / Chamber	(m <sup>3</sup> )		2.772

Attached to Visual Inspection Report of the ESP of TPP-NT B2

4.2 Technical Characteristics			
4.2.1 Mechanical			
Discharge Electrodes, type		wires, "star" type	
Discharge Electrodes, length	(mm)		3.000/4.500
Discharge Electrodes total effective length / ESP	(m)		280.800
4.2.2 Electrical			
Transformer - Rectifiers, manufacturer		Merlin Guerin	
Nr of Transformer - Rectifiers / ESP	(pcs)		8
Total Nr of Transformer - Rectifiers	(pcs)		16
Secondary Voltage, maximum	(KV)		61
Secondary Current, maximum	(mA)		2.000
Apparent Power / Transformer - Rectifier	(KW)		134
Power factor, $\cos\phi$			
Voltage Controller, manufacturer / type		Marlin Guerin, electronic / analog type	
Mains Voltage	(V)		380

Attached to Visual Inspection Report of the ESP of TPP-NT B2

THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2			
ESP's Efficiency / Performance Assessment			
5 ESPs Operational Data			
5.1 Current Design Operational Data			
Fuel (lignite) consumption (calculated)	(t/h)		817
Flue Gas Volumetric Flow (actual)	(m <sup>3</sup> /h)		5.126.400
Flue Gas Volumetric Flow (0 °C, 1013 mbar, dry)	(m <sup>3</sup> /h)		2.356.452
Flue gas Temperature	(°C)		170
Flue Gas Pressure	(KPa)		-50,00
O <sub>2</sub>	(%)		5,46
CO <sub>2</sub>	(%)		
Dust concentration on flue gas upstream ESPs (0 oC, 1013 mbar)	(g/m <sup>3</sup> )		54,80
Dust concentration on flue gas upstream ESPs (0 oC, 1013 mbar)	(mg/m <sup>3</sup> )		100
ESP's efficiency	(%)		99,82
Pressure drop across ESP	(Pa)		
Temperature drop across ESP	(° K)		
Ash quantity collected in Zone I	(Kg/h)		108.000
Ash quantity collected in Zone II	(Kg/h)		21.500
Ash quantity collected in Zone III	(Kg/h)		3.070
Ash quantity collected in Zone IV	(Kg/h)		750
Specific Collection Area (SCA)	(m <sup>2</sup> )		51,91
Flue gas velocity inside ESPs	(m/s)		1,73
Treatment Time	(s)		7,79
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)		76,61
5.2 Current Operational Data as measured (average values)			
Lignite Lower Calorific Value	KJ/Kg		8.108
Moisture content in lignite	(%)		50,05
Ash content in lignite	(%)		14,40
Lignite consumption (calculated)	(t/h)		678
Moisture content in flue gas	(%)		18,85
O <sub>2</sub> content	(%)		7,00
Flue gas temperature	(°C)		168
Flue gas pressure	(Pa)		-2.076
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m <sup>3</sup> /h)		3.225.583
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m <sup>3</sup> /h)		2.617.599
Flue gas velocity downstream ESP	(m/s)		19,03
ESP's Efficiency	(%)		99,82

## Attached to Visual Inspection Report of the ESP of TPP-NT B2

Dust concentration (0 °C, 1013 mbar, wet)	(mg/m <sup>3</sup> )		36
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m <sup>3</sup> )		66
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /h)		5.321.235
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /s)		1.478
Flue gas velocity into ESP	(m/s)		1,79
Effective Collection Area	(m <sup>2</sup> )		73.920
Specific Collection Area	(m <sup>2</sup> / m <sup>3</sup> /s)		50,39
Treatment Time	(s)		7,56
Migration Velocity (Dutsch-Anderson)	(cm/s)		13,45
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)		92,02
<b>5.3 Estimated Operational Data After Steam Turbine Upgrade</b>			
Upgraded Nominal Load	(MW)		680
Boiler Maximum Continuous Rating	(Kg/s)		572
Lignite (reference) consumption (calculated)	(t/h)		899
Flue Gas Volumetric Flow (approx. calculated, reference data)	(m <sup>3</sup> /h)		5.637.050
Flue Gas Volumetric Flow (approx. calculated, reference data)	(m <sup>3</sup> /s)		1.566
Flue Gas Volumetric Flow (0 oC, 1013 mbar, reference data)	(m <sup>3</sup> /h)		2.591.183
Lignite (as measured) consumption (calculated)	(t/h)		745
Flue Gas Volumetric Flow (approx. calculated, as measured data)	(m <sup>3</sup> /h)		5.851.293
Flue Gas Volumetric Flow (approx. calculated, as measured data)	(m <sup>3</sup> /s)		1.625
Flue Gas Volumetric Flow (0 oC, 1013 mbar, as measured data)	(m <sup>3</sup> /h)		2.878.343
Flue gas temperature	(°C)		165
Flue gas Pressure	(KPa)		
O <sub>2</sub>	(%)		6
<b>5.4 Required ESPs Efficiency After Refurbishment</b>			
Dust emission level requirement (Directive 2001/80/EC, 0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/Nm <sup>3</sup> )		50
Required ESPs collection efficiency	(%)		99,91
<b>5.4 Required Collection Area After ESPs Refurbishment</b>			
<b>5.4.1 Calculation based on design data and steam turbine upgrade</b>			
Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		75.815
Required ESPs Collection Area increase	(%)		2,56
<b>5.4.2 Calculation based on operation data and steam turbine upgrade</b>			
Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		83.367
Required ESPs Collection Area increase	(%)		12,78
<b>5.4.3 Calculation based on operation data without steam turbine upgrade</b>			
Required ESPs Collection Area to meet Directive's 2001/80/EC limits	(m <sup>2</sup> )		78.697
Required ESPs Collection Area increase	(%)		6,46

Attached to Visual Inspection Report of the ESP of TPP-NT B2

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1986

Date		1986_1		1986_2	
ESP		ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	616	614	619	621
<b>Lignite Analysis</b>					
Lower Calorific Value (Hd)	(KJ/Kg)	8.163	7.949	8.892	8.420
Moisture (W)	(%)	51,6	53,4	50,8	53,3
Ash (A)	(%)	11,07	9,96	9,04	8,19
Volatiles content	(%)	22,3	21,89	24	23
Carbon content	(%)	15,03	14,75	16,16	15,5
Sulphur content	(%)	0,45	0,42	0,44	0,46
<b>Ash Chemistry</b>					
SiO <sub>2</sub>	(%)				
Fe <sub>2</sub> O <sub>3</sub>	(%)				
Al <sub>2</sub> O <sub>3</sub>	(%)				
Na <sub>2</sub> O	(%)				
K <sub>2</sub> O	(%)				
<b>ESPs Operational Characteristics (as measured)</b>					
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	5,50	13,1	5,10	6,20
Flue gas temperature	(°C)	151	153	149	152
Flue gas pressure	(Pa)	-2078	-2078	-2078	-2078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m <sup>3</sup> /h)	1.290.203	1.524.338	1.292.668	1.356.747
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m <sup>3</sup> /h)	1.047.000	1.237.000	1.049.000	1.101.000
Flue gas velocity downstream ESP	(m/s)	17,00	15,95	17,25	17,85
ESPs Efficiency	(%)	99,89	99,93	99,36	99,93
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m <sup>3</sup> )				
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m <sup>3</sup> )	28	14	127	12
<b>ESPs Operational Characteristics (calculated)</b>					
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /h)	2.045.398	2.427.973	2.039.642	2.155.963
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /s)	568,17	674,44	566,57	598,88
Flue gas velocity into ESP	(m/s)	1,38	1,63	1,37	1,45
Effective Collection Area	(m <sup>2</sup> )	36.960	36.960	36.960	36.960
Specific Collection Area	(m <sup>2</sup> / m <sup>3</sup> / s)	65,05	54,80	65,23	61,72
<b>Treatment Time</b>	<b>(s)</b>	<b>9,76</b>	<b>8,22</b>	<b>9,79</b>	<b>9,26</b>
<b>Migration Velocity (Deutsch-Anderson)</b>	<b>(cm/s)</b>	<b>10,47</b>	<b>13,26</b>	<b>7,74</b>	<b>11,77</b>
<b>Effective Migration Velocity Factor (Matts-Ohnfeldt)</b>	<b>(cm/s)</b>	<b>71,34</b>	<b>96,30</b>	<b>39,12</b>	<b>85,51</b>



## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1987

Date		1987	
ESP		ESP-1	ESP-2
Load	(MW)	621	
Lignite Analysis			
Lower Calorific Value (Hd)	(KJ/Kg)	7.990	7.990
Moisture (W)	(%)		
Ash (A)	(%)	13	13
Volatiles content	(%)		
Carbon content	(%)		
Sulphur content	(%)		
Ash Chemistry			
SiO2	(%)		
Fe2O3	(%)		
Al2O3	(%)		
Na2O	(%)		
K2O	(%)		
ESPs Operational Characteristics (as measured)			
Moisture content in flue gas	(%)	18,85	18,85
O2 content	(%)	5,50	5,80
Flue gas temperature	(°C)	162	170
Flue gas pressure	(Pa)	-2078	-2078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.719.039	1.509.550
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(Kg/m³)	1.395.000	1.225.000
Flue gas velocity downstream ESP	(m/s)	20,35	18,60
ESPs Efficiency	(%)	99,88	99,88
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)		
Dust concentration (0 °C, 1013 mbar, dry, 6% O2)	(mg/m³)	36	43
ESPs Operational Characteristics (calculated)			
Flue gas volumetric flow (as measured)	(m³/h)	2.795.921	2.500.337
Flue gas volumetric flow (as measured)	(m³/s)	776,64	694,54
Flue gas velocity into ESP	(m/s)	1,88	1,68
Effective Collection Area	(m²)	36.960	36.960
Specific Collection Area	(m²/ m3/s)	47,59	53,22
Treatment Time	(s)	7,14	7,98
Migration Velocity (Dutsch-Anderson)	(cm/s)	14,1	12,6
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	95,0	85,0

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1988

Date		1988			
ESP		ESP-1.1	ESP-1.2	ESP-2.1	ESP-2.2
Load	(MW)	623			
Lignite Analysis					
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	8.051			
Moisture (W)	(%)	52,2			
Ash (A)	(%)	10,87			
Volatiles content	(%)	22,07			
Carbon content	(%)	14,86			
Sulphur content	(%)	0,35			
Ash Chemistry					
SiO <sub>2</sub>	(%)				
Fe <sub>2</sub> O <sub>3</sub>	(%)				
Al <sub>2</sub> O <sub>3</sub>	(%)				
Na <sub>2</sub> O	(%)				
K <sub>2</sub> O	(%)				
ESPs Operational Characteristics (as measured)					
Moisture content in flue gas	(%)	20	20,1	20,1	19,7
O <sub>2</sub> content	(%)	6,60	6,50	6,50	6,60
Flue gas temperature	(°C)	170	160	159	168
Flue gas pressure	(Pa)	-2.408	-2.403	-2.346	-2.353
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m <sup>3</sup> /h)	854.371	875.352	784.225	779.567
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m <sup>3</sup> /h)	683.497	699.406	626.596	625.992
Flue gas velocity downstream ESP	(m/s)	19,83	19,83	17,71	17,99
ESPs Efficiency	(%)	99,79	99,52	99,87	99,81
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m <sup>3</sup> )	47	106	28	41
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m <sup>3</sup> )				
ESPs Operational Characteristics (calculated)					
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /h)	1.420.817	1.420.840	1.268.960	1.288.978
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /s)	394,67	394,68	352,49	358,05
Flue gas velocity into ESP	(m/s)	1,91	1,91	1,71	1,74
Effective Collection Area	(m <sup>2</sup> )	18.480	18.480	18.480	18.480
Specific Collection Area	(m <sup>2</sup> / m3 /s)	46,82	46,82	52,43	51,61
Treatment Time	(s)	7,02	7,02	7,86	7,74
Migration Velocity (Deutsch-Anderson)	(cm/s)	13,2	11,4	12,7	12,1
Effective Migration Velocity Factor (Matt's-Ohnfeldt)	(cm/s)	81,2	60,9	84,2	76,1

Attached to Visual Inspection Report of the ESP of TPP-NT B2

**THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2****ESPs Efficiency / Performance Tests 1989**

Date		1989	
ESP		ESP-1	ESP-2
Load	(MW)	617	
<b><u>Lignite Analysis</u></b>			
Lower Calorific Value (Hd)	(KJ/Kg)	8.183	8.183
Moisture (W)	(%)		
Ash (A)	(%)	11	11
Volatiles content	(%)		
Carbon content	(%)		
Sulphur content	(%)		
<b><u>Ash Chemistry</u></b>			
SiO2	(%)		
Fe2O3	(%)		
Al2O3	(%)		
Na2O	(%)		
K2O	(%)		
<b><u>ESPs Operational Characteristics (as measured)</u></b>			
Moisture content in flue gas	(%)	18,85	18,85
O2 content	(%)	6,80	6,50
Flue gas temperature	(°C)	156	178
Flue gas pressure	(Pa)	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³ /h)	1.684.535	1.896.488
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³ /h)	1.367.000	1.539.000
Flue gas velocity downstream ESP	(m/s)		20,45
ESPs Efficiency	(%)	99,92	99,93
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)		
Dust concentration (0 °C, 1013 mbar, dry, 6% O2)	(mg/m³)	32	29
<b><u>ESPs Operational Characteristics (calculated)</u></b>			
Flue gas volumetric flow (as measured)	(m³ /h)	2.702.025	3.197.947
Flue gas volumetric flow (as measured)	(m³ /s)	750,56	888,32
Flue gas velocity into ESP	(m/s)	1,82	2,15
Effective Collection Area	(m²)	36.960	36.960
Specific Collection Area	(m² / m3 /s)	49,24	41,61
<b>Treatment Time</b>	<b>(s)</b>	<b>7,39</b>	<b>6,24</b>
<b>Migration Velocity (Dutsch-Anderson)</b>	<b>(cm/s)</b>	<b>14,5</b>	<b>17,5</b>
<b>Effective Migration Velocity Factor (Matts-Ohnfeldt)</b>	<b>(cm/s)</b>	<b>103,3</b>	<b>126,8</b>

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1990

Date		1990_1		1990_2		1990_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	601		608		595	
Lignite Analysis							
Lower Calorific Value (Hd)	(KJ/Kg)	7.771	7.771	8.489	8.489	8.448	8.448
Moisture (W)	(%)						
Ash (A)	(%)	14	14	12	12	13	13
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
Ash Chemistry							
SiO2	(%)						
Fe2O3	(%)						
Al2O3	(%)						
Na2O	(%)						
K2O	(%)						
ESPs Operational Characteristics (as measured)							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O2 content	(%)	6,90	8,10	7,20	6,50	6,70	6,70
Flue gas temperature	(°C)	142	160	140	158	141	160
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.562.539	1.768.330	1.515.712	1.728.897	1.471.349	1.722.736
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.268.000	1.435.000	1.230.000	1.403.000	1.194.000	1.398.000
Flue gas velocity downstream ESP	(m/s)	17,55	20,45	16,60	20,00	16,20	19,90
ESPs Efficiency	(%)	99,92	99,93	99,93	99,92	99,86	99,93
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O2)	(mg/m³)	32	29	22	26	51	25
ESPs Operational Characteristics (calculated)							
Flue gas volumetric flow (as measured)	(m³/h)	2.424.577	2.862.872	2.340.586	2.786.107	2.277.580	2.789.056
Flue gas volumetric flow (as measured)	(m³/s)	673,49	795,24	650,16	773,92	632,66	774,74
Flue gas velocity into ESP	(m/s)	1,63	1,93	1,58	1,88	1,53	1,88
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	m²/ m3 /s	54,88	46,48	56,85	47,76	58,42	47,71
Treatment Time	(s)	8,23	6,97	8,53	7,16	8,76	7,16
Migration Velocity (Dutsch-Anderson)	(cm/s)	13,0	15,6	12,8	14,9	11,2	15,2
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	92,7	113,5	92,8	106,5	73,9	110,6

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1991

Date		1991_1		1991_2		1991_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	601		601		601	
<u>Lignite Analysis</u>							
Lower Calorific Value (Hd)	(KJ/Kg)	7.741	7.741	9.161	9.161	8.822	8.822
Moisture (W)	(%)						
Ash (A)	(%)	16	16	11	11	12	12
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
<u>Ash Chemistry</u>							
SiO2	(%)						
Fe2O3	(%)						
Al2O3	(%)						
Na2O	(%)						
K2O	(%)						
<u>ESPs Operational Characteristics (as measured)</u>							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O2 content	(%)	7,10	7,90	6,70	6,60	6,70	7,20
Flue gas temperature	(°C)	157	170	157	169	158	171
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³ /h)	1.532.964	1.678.373	1.525.570	1.670.980	1.558.842	1.587.184
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³ /h)	1.244.000	1.362.000	1.238.000	1.356.000	1.265.000	1.288.000
Flue gas velocity downstream ESP	(m/s)	17,60	19,70	17,30	19,55	17,80	18,60
ESPs Efficiency	(%)	99,85	99,87	99,71	99,87	99,92	99,95
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O2)	(mg/m³)	64	56	77	34	23	15
<u>ESPs Operational Characteristics (calculated)</u>							
Flue gas volumetric flow (as measured)	(m³ /h)	2.464.632	2.779.967	2.452.745	2.761.475	2.512.064	2.634.858
Flue gas volumetric flow (as measured)	(m³ /s)	684,62	772,21	681,32	767,08	697,80	731,91
Flue gas velocity into ESP	(m/s)	1,66	1,87	1,65	1,86	1,69	1,77
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	53,99	47,86	54,25	48,18	52,97	50,50
Treatment Time	(s)	8,10	7,18	8,14	7,23	7,95	7,57
Migration Velocity (Dutsch-Anderson)	(cm/s)	12,0	13,9	10,8	13,8	13,5	15,1
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	78,3	92,3	62,9	91,7	96,0	114,4

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1992

Date		1992_1		1992_2		1992_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	608		603		620	
Lignite Analysis							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	8.247	8.247	7.266	7.266	7.593	7.593
Moisture (W)	(%)						
Ash (A)	(%)	15	15	19	19	14	14
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
Ash Chemistry							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
ESPs Operational Characteristics (as measured)							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	6,30	6,90	7,00	7,10	6,60	6,60
Flue gas temperature	(°C)	169	170	171	175	167	166
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.505.853	1.661.121	1.547.751	1.685.767	1.615.527	1.728.897
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.222.000	1.348.000	1.256.000	1.368.000	1.311.000	1.403.000
Flue gas velocity downstream ESP	(m/s)	18,10	20,20	18,50	20,70	19,25	20,80
ESPs Efficiency	(%)	99,96	99,91	99,95	99,63	99,97	99,65
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	19	44	20	135	11	154
ESPs Operational Characteristics (calculated)							
Flue gas volumetric flow (as measured)	(m³/h)	2.488.586	2.751.391	2.569.396	2.823.717	2.657.756	2.837.803
Flue gas volumetric flow (as measured)	(m³/s)	691,27	764,28	713,72	784,37	738,27	788,28
Flue gas velocity into ESP	(m/s)	1,68	1,85	1,73	1,90	1,79	1,91
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m³/s)	53,47	48,36	51,78	47,12	50,06	46,89
Treatment Time	(s)	8,02	7,25	7,77	7,07	7,51	7,03
Migration Velocity (Dutsch-Anderson)	(cm/s)	14,6	14,5	14,7	11,9	16,2	12,1
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	114,5	101,7	111,6	66,5	131,4	68,2

Attached to Visual Inspection Report of the ESP of TPP-NT B2

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

## ESPs Efficiency / Performance Tests 1993

Date		1993_1		1993_2		1993_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	570		583		595	
Lignite Analysis							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	7.359	7.359	7.829	7.829	7.532	7.532
Moisture (W)	(%)						
Ash (A)	(%)	18	18	15	15	17	17
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
Ash Chemistry							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
ESPs Operational Characteristics (as measured)							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	6,90	7,10	6,90	7,00	7,50	7,80
Flue gas temperature	(°C)	173	178	171	183	170	176
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³ /h)	1.505.853	1.661.121	1.547.751	1.685.767	1.615.527	1.728.897
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³ /h)	1.222.000	1.348.000	1.256.000	1.368.000	1.311.000	1.403.000
Flue gas velocity downstream ESP	(m/s)	18,10	20,20	18,50	20,70	19,25	20,80
ESPs Efficiency	(%)	99,96	99,91	99,95	99,63	99,97	99,65
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	19	44	20	135	11	154
ESPs Operational Characteristics (calculated)							
Flue gas volumetric flow (as measured)	(m³ /h)	2.511.099	2.801.061	2.569.396	2.874.124	2.675.871	2.902.424
Flue gas volumetric flow (as measured)	(m³ /s)	697,53	778,07	713,72	798,37	743,30	806,23
Flue gas velocity into ESP	(m/s)	1,69	1,89	1,73	1,94	1,80	1,95
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	52,99	47,50	51,78	46,29	49,72	45,84
Treatment Time	(s)	7,95	7,13	7,77	6,94	7,46	6,88
Migration Velocity (Dutsch-Anderson)	(cm/s)	14,8	14,8	14,7	12,1	16,3	12,3
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	115,5	103,5	111,6	67,7	132,3	69,8

Attached to Visual Inspection Report of the ESP of TPP-NT B2

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests 1994

Date		1994_1		1994_2		94_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	571		603		550	
Lignite Analysis							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	8.358	8.358	7.412	7.412	6.996	9.966
Moisture (W)	(%)						
Ash (A)	(%)	15	15	19	19	23	23
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
Ash Chemistry							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
ESPs Operational Characteristics (as measured)							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	7,20	7,30	7,10	7,40	8,10	8,00
Flue gas temperature	(°C)	167	173	170	166	185	162
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.518.176	1.587.184	1.603.204	1.605.669	1.609.365	1.703.019
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.232.000	1.288.000	1.301.000	1.303.000	1.306.000	1.382.000
Flue gas velocity downstream ESP	(m/s)	17,55	18,65	18,85	18,65	19,45	19,70
ESPs Efficiency	(%)	99,96	99,93	99,98	99,97	99,87	99,82
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	16	26	11	18	23	132
ESPs Operational Characteristics (calculated)							
Flue gas volumetric flow (as measured)	(m³/h)	2.497.602	2.646.723	2.655.460	2.635.537	2.755.895	2.769.866
Flue gas volumetric flow (as measured)	(m³/s)	693,78	735,20	737,63	732,09	765,53	769,41
Flue gas velocity into ESP	(m/s)	1,68	1,78	1,79	1,77	1,86	1,87
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	53,27	50,27	50,11	50,49	48,28	48,04
Treatment Time	(s)	7,99	7,54	7,52	7,57	7,24	7,21
Migration Velocity (Deutsch-Anderson)	(cm/s)	14,7	14,5	17,0	16,1	13,8	13,2
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	114,9	105,0	144,8	130,3	91,5	83,1



## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests \_ 1995

Date		1995_1		1995_2		1995_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	616		600		584	
<u>Lignite Analysis</u>							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	7.915	7.915	7.278	7.278	7.969	7.969
Moisture (W)	(%)						
Ash (A)	(%)	16	16	18	18	13	13
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
<u>Ash Chemistry</u>							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
<u>ESPs Operational Characteristics (as measured)</u>							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	6,50	6,90	6,10	7,50	6,10	7,50
Flue gas temperature	(°C)	176	187	180	180	180	179
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.741.220	1.679.606	1.643.869	1.637.708	1.653.728	1.631.547
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.413.000	1.363.000	1.334.000	1.329.000	1.342.000	1.324.000
Flue gas velocity downstream ESP	(m/s)	20,70	20,35	20,10	19,65	20,00	19,40
ESPs Efficiency	(%)	99,26	99,72	99,65	99,88	99,49	99,84
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	335	135	179	71	188	65
<u>ESPs Operational Characteristics (calculated)</u>							
Flue gas volumetric flow (as measured)	(m³/h)	2.923.111	2.888.730	2.784.258	2.773.823	2.800.956	2.757.289
Flue gas volumetric flow (as measured)	(m³/s)	811,98	802,43	773,41	770,51	778,04	765,91
Flue gas velocity into ESP	(m/s)	1,97	1,95	1,87	1,87	1,89	1,86
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3/s)	45,52	46,06	47,79	47,97	47,50	48,26
Treatment Time	(s)	6,83	6,91	7,17	7,20	7,13	7,24
Migration Velocity (Dutsch-Anderson)	(cm/s)	10,8	12,8	11,8	14,0	11,1	13,3
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	52,9	75,0	66,9	94,3	58,7	85,9

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests \_ 1997

Date		1997_1		1997_2		1997_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	561		583		601	
<u>Lignite Analysis</u>							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	7.402	7.402	7.750	7.750	7.900	7.900
Moisture (W)	(%)						
Ash (A)	(%)	16	16	14	14	15	15
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
<u>Ash Chemistry</u>							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
<u>ESPs Operational Characteristics (as measured)</u>							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	6,40	6,40	6,10	7,40	6,10	7,60
Flue gas temperature	(°C)	176	188	176	183	176	186
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.455.330	1.636.476	1.441.774	1.680.838	1.499.692	1.703.019
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.181.000	1.328.000	1.170.000	1.364.000	1.217.000	1.382.000
Flue gas velocity downstream ESP	(m/s)	17,95	20,80	17,60	20,55	18,10	20,70
ESPs Efficiency	(%)	99,98	99,82	99,95	99,91	99,96	99,76
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	13	81	19	42	18	101
<u>ESPs Operational Characteristics (calculated)</u>							
Flue gas volumetric flow (as measured)	(m³/h)	2.443.166	2.820.668	2.420.410	2.865.720	2.517.641	2.922.634
Flue gas volumetric flow (as measured)	(m³/s)	678,66	783,52	672,34	796,03	699,34	811,84
Flue gas velocity into ESP	(m/s)	1,65	1,90	1,63	1,93	1,70	1,97
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	54,46	47,17	54,97	46,43	52,85	45,53
Treatment Time	(s)	8,17	7,08	8,25	6,96	7,93	6,83
Migration Velocity (Dutsch-Anderson)	(cm/s)	15,6	13,4	13,8	15,1	14,8	13,3
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	133,2	84,7	105,1	105,9	115,8	79,9

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests \_ 1999

Date		1999_1		1999_2		1999_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	610		606		620	
<u>Lignite Analysis</u>							
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	7.522	7.522	8.345	8.345	8.770	8.770
Moisture (W)	(%)						
Ash (A)	(%)	17	17	13	13	11	11
Volatiles content	(%)						
Carbon content	(%)						
Sulphur content	(%)						
<u>Ash Chemistry</u>							
SiO <sub>2</sub>	(%)						
Fe <sub>2</sub> O <sub>3</sub>	(%)						
Al <sub>2</sub> O <sub>3</sub>	(%)						
Na <sub>2</sub> O	(%)						
K <sub>2</sub> O	(%)						
<u>ESPs Operational Characteristics (as measured)</u>							
Moisture content in flue gas	(%)	18,85	18,85	18,85	18,85	18,85	18,85
O <sub>2</sub> content	(%)	6,70	6,40	7,30	7,70	7,60	7,50
Flue gas temperature	(°C)	170	177	174	171	161	171
Flue gas pressure	(Pa)	-2.078	-2.078	-2.078	-2.078	-2.078	-2.078
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	1.663.586	1.727.665	1.748.614	1.853.358	1.801.602	1.823.783
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	1.350.000	1.402.000	1.419.000	1.504.000	1.462.000	1.480.000
Flue gas velocity downstream ESP	(m/s)	19,75	20,90	20,75	21,90	20,40	21,05
ESPs Efficiency	(%)	99,93	99,56	99,87	98,92	99,78	99,33
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)						
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	34	211	47	382	64	188
<u>ESPs Operational Characteristics (calculated)</u>							
Flue gas volumetric flow (as measured)	(m³/h)	2.755.474	2.906.812	2.922.452	3.076.729	2.923.472	3.027.632
Flue gas volumetric flow (as measured)	(m³/s)	765,41	807,45	811,79	854,65	812,08	841,01
Flue gas velocity into ESP	(m/s)	1,86	1,96	1,97	2,07	1,97	2,04
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	48,29	45,77	45,53	43,25	45,51	43,95
Treatment Time	(s)	7,24	6,87	6,83	6,49	6,83	6,59
Migration Velocity (Dutsch-Anderson)	(cm/s)	15,0	11,9	14,6	10,5	13,4	11,4
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	109,3	64,3	97,0	47,4	82,3	57,0

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests - 2002

Date		2002_1				2002_2				2002_3			
ESP		ESP-1.1	ESP-1.2	ESP-2.1	ESP-2.2	ESP-1.1	ESP-1.2	ESP-2.1	ESP-2.2	ESP-1.1	ESP-1.2	ESP-2.1	ESP-2.2
Load	(MW)	579				576				550			
Lignite Analysis													
Lower Calorific Value (H <sub>u</sub> )	(KJ/Kg)	8.092				7.879				7.962			
Moisture (W)	(%)												
Ash (A)	(%)	13				17				12			
Volatiles content	(%)												
Carbon content	(%)												
Sulphur content	(%)												
Ash Chemistry													
SiO <sub>2</sub>	(%)												
Fe <sub>2</sub> O <sub>3</sub>	(%)												
Al <sub>2</sub> O <sub>3</sub>	(%)												
Na <sub>2</sub> O	(%)												
K <sub>2</sub> O	(%)												
ESPs Operational Characteristics (as measured)													
Moisture content in flue gas	(%)	18,30	18,30	18,40	18,40	19,00	19,00	18,90	18,90	19,00	19,00	19,00	19,00
O <sub>2</sub> content	(%)	8,00	8,00	7,90	7,90	7,10	7,10	7,30	7,30	7,80	7,80	7,80	7,80
Flue gas temperature	(°C)	168	173	168	182	158	167	159	164	156	162	158	163
Flue gas pressure	(Pa)	-2.126	-1.766	-2.135	-1.777	-2.205	-2.121	-1.954	-1.854	-2.305	-2.305	-2.043	-2.060
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³/h)	827.000	834.000	747.000	747.000	809.000	807.000	792.000	725.000	855.000	864.000	763.000	786.000
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³/h)	675.659	681.378	609.552	609.552	655.290	653.670	642.312	587.975	692.550	699.840	618.030	636.660
Flue gas velocity downstream ESP	(m/s)	19,10	19,40	17,20	17,70	18,40	18,80	18,00	16,70	19,40	19,90	17,30	18,00
ESPs Efficiency	(%)	99,95	99,84	99,91	99,95	99,92	99,92	99,90	99,91	99,93	99,92	99,92	99,93
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)	13	44	24	13	21	22	28	25	20	21	21	18
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	34				33				28			
ESPs Operational Characteristics (calculated)													
Flue gas volumetric flow (as measured)	(m³/h)	1.364.276	1.386.385	1.232.414	1.266.951	1.305.369	1.328.198	1.277.667	1.181.924	1.374.581	1.408.470	1.229.136	1.281.091
Flue gas volumetric flow (as measured)	(m³/s)	378,97	385,11	342,34	351,93	362,60	368,94	354,91	328,31	381,83	391,24	341,43	355,86
Flue gas velocity into ESP	(m/s)	1,84	1,87	1,66	1,71	1,76	1,79	1,72	1,59	1,85	1,90	1,66	1,73
Effective Collection Area	(m²)	18.480	18.480	18.480	18.480	18.480	18.480	18.480	18.480	18.480	18.480	18.480	18.480
Specific Collection Area	m² / m3 /s	48,76	47,99	53,98	52,51	50,96	50,09	52,07	56,29	48,40	47,23	54,13	51,93
Treatment Time	(s)	7,31	7,20	8,10	7,88	7,64	7,51	7,81	8,44	7,26	7,09	8,12	7,79
Migration Velocity (Dutsch-Anderson)	(cm/s)	15,7	13,4	13,0	14,6	14,1	14,2	13,2	12,4	14,9	15,2	13,2	14,1
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	120,0	86,2	91,7	111,4	100,9	101,3	91,0	86,9	107,7	108,8	95,0	103,3

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests \_ 2007

Date		2007_1		2007_2		2007_3	
ESP		ESP-1	ESP-2	ESP-1	ESP-2	ESP-1	ESP-2
Load	(MW)	618		617		619	
Lignite Analysis							
Lower Calorific Value (H <sub>a</sub> )	(KJ/Kg)	8.591	8.591	8.722	8.722	10.010	10.010
Moisture (W)	(%)	51,3	51,3	45,9	45,9	47,4	47,4
Ash (A)	(%)	13,2	13,2	16,54	16,54	9,8	9,8
Volatiles content	(%)	23,25	23,25	22,98	22,98	26,28	26,28
Carbon content	(%)	12,25	12,25	14,58	14,58	16,52	16,52
Sulphur content	(%)	0,39	0,39	0,29	0,29	0,4	0,4
Ash Chemistry							
SiO <sub>2</sub>	(%)	57,31	57,31	56,2	56,2	56,48	56,48
Fe <sub>2</sub> O <sub>3</sub>	(%)	5,7	5,7	7,28	7,28	5,57	5,57
Al <sub>2</sub> O <sub>3</sub>	(%)	24,63	24,63	24,41	24,41	25,46	25,46
Na <sub>2</sub> O	(%)	0,29	0,29	0,25	0,25	0,28	0,28
K <sub>2</sub> O	(%)	0,67	0,67	0,63	0,63	0,65	0,65
ESPs Operational Characteristics (as measured)							
Moisture content in flue gas	(%)	19,50	19,90	18,60	18,60	17,00	17,40
O <sub>2</sub> content	(%)	6,40	6,60	6,40	6,60	6,40	6,90
Flue gas temperature	(°C)	168	165	167	166	170	166
Flue gas pressure	(Pa)	-2.080	-2.003	-1.967	-1.904	-2.010	-1.910
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m³ /h)	1.612.000	1.572.000	1.615.000	1.503.000	1.586.000	1.421.000
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m³ /h)	1.297.660	1.259.172	1.314.610	1.223.442	1.316.380	1.173.746
Flue gas velocity downstream ESP	(m/s)	18,50	18,20	18,60	17,40	18,50	16,70
ESPs Efficiency	(%)	99,80	99,87	99,91	99,92	99,67	99,73
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m³)	37	56	26	31	48	58
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m³)	71	47	39	32	74	62
ESPs Operational Characteristics (calculated)							
Flue gas volumetric flow (as measured)	(m³ /h)	2.658.033	2.572.453	2.653.921	2.462.698	2.625.165	2.328.480
Flue gas volumetric flow (as measured)	(m³ /s)	738,34	714,57	737,20	684,08	729,21	646,80
Flue gas velocity into ESP	(m/s)	1,79	1,73	1,79	1,66	1,77	1,57
Effective Collection Area	(m²)	36.960	36.960	36.960	36.960	36.960	36.960
Specific Collection Area	(m² / m3 /s)	50,06	51,72	50,14	54,03	50,68	57,14
Treatment Time	(s)	7,51	7,76	7,52	8,10	7,60	8,57
Migration Velocity (Dutsch-Anderson)	(cm/s)	12,4	12,8	14,0	13,2	11,3	10,4
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	77,2	85,4	98,1	94,1	64,4	61,2

# APPENDIX 1

Attached to the Visual Inspection Report of ESP of TPP - NT B2

## THERMAL POWER PLANT "NIKOLA TESLA" B, Block B2

### ESPs Efficiency / Performance Tests (1982-2007) Overview

Date		1982 - 2007		
		Min	Average	Max
Load	(MW)	550	602	623
<b>Lignite Analysis</b>				
Lower Calorific Value (H <sub>d</sub> )	(KJ/Kg)	6.996	8.108	10.010
Moisture (W)	(%)	45,9	50,0	53,4
Ash (A)	(%)	8,2	14,4	23,0
Volatiles content	(%)	21,89	23,48	26,28
Carbon content	(%)	12,25	14,82	16,52
Sulphur content	(%)	0,29	0,39	0,46
<b>Ash Chemistry</b>				
SiO <sub>2</sub>	(%)	56,2	56,7	57,31
Fe <sub>2</sub> O <sub>3</sub>	(%)	5,57	6,18	7,28
Al <sub>2</sub> O <sub>3</sub>	(%)	24,41	24,8	25,46
Na <sub>2</sub> O	(%)	0,25	0,27	0,29
K <sub>2</sub> O	(%)	0,63	0,65	0,67
<b>ESPs Operational Characteristics (as measured)</b>				
Moisture content in flue gas	(%)	17,00	18,85	20,05
O <sub>2</sub> content	(%)	5,10	7,00	13,10
Flue gas temperature	(°C)	140	168	188
Flue gas pressure	(Pa)	-2.406	-2.076	-1.904
Flue gas volumetric flow (0 °C, 1013 mbar, wet)	(m <sup>3</sup> /h)	1.290.203	1.612.792	1.896.488
Flue gas volumetric flow (0 °C, 1013 mbar, dry)	(m <sup>3</sup> /h)	1.047.000	1.308.800	1.539.000
Flue gas velocity downstream ESP	(m/s)	15,95	19,03	21,90
ESPs Efficiency	(%)	98,92	99,82	99,98
Dust concentration (0 °C, 1013 mbar, wet)	(mg/m <sup>3</sup> )	19	36	77
Dust concentration (0 °C, 1013 mbar, dry, 6% O <sub>2</sub> )	(mg/m <sup>3</sup> )	11	66	382
<b>ESPs Operational Characteristics (calculated)</b>				
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /h)	2.039.642	2.660.617	3.197.947
Flue gas volumetric flow (as measured)	(m <sup>3</sup> /s)	566,57	739,06	888,32
Flue gas velocity into ESP	(m/s)	1,37	1,79	2,15
Effective Collection Area	(m <sup>2</sup> )	36.960	36.960	36.960
Specific Collection Area	(m <sup>2</sup> / m <sup>3</sup> /s)	41,61	50,39	65,23
Treatment Time	(s)	6,24	7,56	9,79
Migration Velocity (Deutsch-Anderson)	(cm/s)	7,74	13,45	17,46
Effective Migration Velocity Factor (Matts-Ohnfeldt)	(cm/s)	39,12	92,02	144,78

Note: Due to non availability of flue gas moisture / pressure data for the years :  
1986,1987, 1989, and 1990 to 1999 have been used the mean values of the existing data