

BALKAN SEMINAR ON NATIONAL APPROPRIATE  
MITIGATION ACTIONS – NAMA  
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POTENTIAL NAMA PROJECTS TO BE  
REALIZED IN PUBLIC ENTERPRISE  
ELECTRIC POWER INDUSTRY OF  
SERBIA

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Construction of a 790 MW Ultra Supercritical  
Lignite Thermal Power Plant Nikola Tesla – Unit B3

- **Description**
- It is foreseen as condensing type, ultra supercritical steam parameters, with a river water cooling system, mainly designed to operate as the base load. Total power of the unit should be approximately 730 MW at the net connection. The unit will use lignite from the open pit mine Kolubara. The lignite will be delivered as homogenized coal of stated mean calorific value of 6,900 kJ/kg. Minimum expected annual operating time is 7,600 h/year.
- The NAMA will contribute to climate change mitigation as the highly efficient plant emits less GHG than existing TPPs. By its operation, it reduces GHGs that would be otherwise emitted by less efficient grid-connected TPPs in the absence of the mitigation action. The plant is expected to become the first ultra supercritical power plant in Serbia and will result in technology transfer of state-of-the-art clean coal technology

Technical data

- Data in this table are of indicative nature. Preliminary technical analysis currently ongoing and the detailed technical data will be available by March 2013.

Parameter	Value	Unit
Unit power, total/net	~ 790/730	MW
Net Unit efficiency	≈ 43	%
Net specific heat consumption	< 9,000	kJ/kWh
Boiler efficiency	~ 88	%
Live steam flow rate	> 2,000	t/h
Operating range	40 – 100	%
<b>Emissions of harmful combustion products</b>		
NO <sub>x</sub> (at 6% O <sub>2</sub> )	≤ 200	mg/Nm <sup>3</sup>
SO <sub>2</sub> (at 6% O <sub>2</sub> )	≤ 200	mg/Nm <sup>3</sup>
CO <sub>2</sub>	≤ 262	g/Nm <sup>3</sup>
Particles	≤ 30	mg/Nm <sup>3</sup>

Location

- TPP Nikola Tesla B is located on the right hand bank of the Sava River, 59 km upstream of Belgrade. The new power plant is located between the villages of Skela and Usce.



## Expected Mitigation Potential

- Ex-ante and ex-post calculation of GHG emission reduction is conducted based on the approved CDM methodology, ACM0013 – “Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology.”
- Baseline emissions**

Baseline emissions are calculated by multiplying the electricity generated in the project plant using lignite fossil fuel ( $EG_{PJ,y}$ ) with a baseline CO<sub>2</sub> emission factor ( $EF_{BL,CO2}$ ), as follows:

- $BE_y = EG_{PJ,y} * EF_{BL,CO2}$
- $EF_{BL,CO2} = 3.6 * EF_{FF,CO2} / \eta_{BL}$
- $BE_y = 3.6 * 0.10962 / 34.6 * 6,004,000 = 6,847,892 \text{ tCO}_2$

## **Project emissions**

- Project emissions are the CO<sub>2</sub> emission from combustion of lignite at the new power plant. The CO<sub>2</sub> emissions from electricity generation in the project plant ( $PE_y$ ) can be calculated as follows:

- $PE_y = EG_{PJ,y} * EF_{PJ,CO2}$
- $EF_{PJ,CO2} = 3.6 * EF_{FF,CO2} / \eta_{PJ}$
- $PE_y = 3.6 * 0.10962 / 43.0 * 6,004,000 = 5,510,164 \text{ tCO}_2$
- Emissions reductions**
- $Er_y = BE_y - Pe_y = 6,847,892 \text{ tCO}_2 - 5,510,164 \text{ tCO}_2$
- $ER_y = 1,337,728 \text{ tCO}_2 / \text{year}$

## Measurement, Reporting, and Verification (MRV)

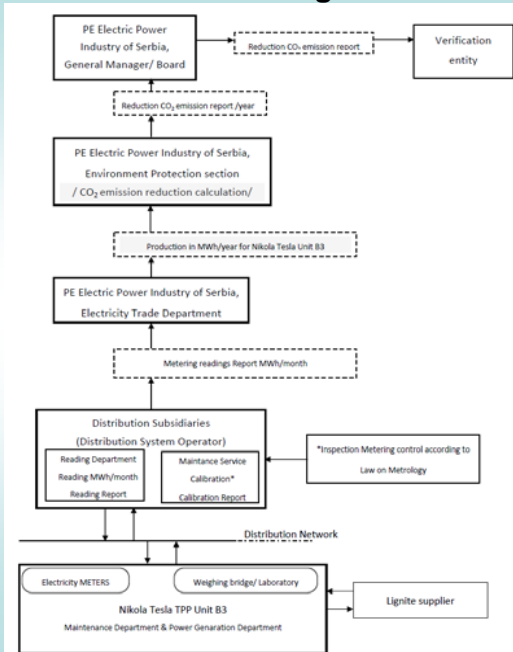
- Data and parameters to be monitored:**

<b>Data / Parameter</b>	EG <sub>y</sub> [MWh]
Description	Electricity generated by the project power plant in year <i>y</i>
Measurement procedures	Measured continuously by electricity meter equipped at the power plant and recorded daily.
Monitoring frequency	Monthly compiled and aggregated data is recorded on computer.
QA/QC procedures	The electricity meters will be periodically calibrated according to the relevant national industrial standards and regulations. Meter readings will be compared to electricity sales receipts.

<b>Data / Parameter</b>	FC <sub>lignite,y</sub> [ton/ year]
Description	Annual lignite fuel consumption at the power plant in year <i>y</i>
Measurement procedures	Measured continuously by weighing bridge at the power plant and recorded daily.
Monitoring frequency	Monthly compiled and aggregated data is recorded on computer.

<b>Data / Parameter</b>	NCV <sub>lignite,y</sub> [GJ/ton]
Description	Weighted average net calorific value of lignite fuel in year <i>y</i>
Measurement procedures	Laboratories in the power plant will measure the value for each fuel delivery.
QA/QC procedures	Laboratories will have ISO accreditation and data will be checked according to international standard.

## NAMA Monitoring Structure



## Contribution to Sustainable Development

- Economic development of the region - Construction of the TPP Nikola Tesla B3 will bring construction of new infrastructure; it also contributes to the power system stability and supply security.
- Employment - Construction of the TPP Nikola Tesla will provide work for many domestic companies. After commissioning and connection to the network, new work places will be available at the power plant and following facilities, as well as the chance for engagement of the companies from the sector of services and maintenance on long-term basis.
- Energy resources – Generation of TPP Nikola Tesla B3 will, due to the higher energy efficiency of the plant, reduce coal consumption for power generation, and significantly reduce need for electricity import.
- Result in reduced emission levels of CO<sub>2</sub>, SO<sub>x</sub> and NO<sub>x</sub>, comparing to the existing thermo power plants in Serbia.

## Implementing Schedule

Time span	Activity	
2013 – 2016	Preparatory period	Feasibility Study with Preliminary Design – including Revision by the State Revision Committee, Main Designs, preparation of tender documents, bidding and contracting procedures
2017 – 2020	Implementation	Construction, commissioning, trial operation and guarantee tests.

Expected **cost of implementation**: EUR 1,200 million  
(more accurate expected cost will be available by March 2013)

**Implementing Entity**: PE Electric Power Industry of Serbia (EPS)

Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

## Construction of 9 new small hydropower plants (HPPs) in Serbia

- **Description**
- The NAMA involves construction of 9 new small hydropower plants (HPP) throughout Serbia. The total capacity of 9HPP is 30.40 MW with possible electricity production of 108.3 GWh/year. All of the electricity generated will be supplied to the Serbian electricity grid, which is currently composed mostly of carbon-intensive lignite-fired thermal power plants.
- The NAMA will contribute to climate change mitigation as the hydro power as renewable energy source does not emit any greenhouse gases (GHGs) during operation, and reduces GHGs that would otherwise be emitted from grid-connected power plants in the absence of the mitigation action.

## Technical data

### List of HPPs

Nº	HPP name	Location	Watercourse	Capacity (MW)	Expected Generation (GWh/y)	Investment (Million €)
1	Rovni	Valjevo	Jablanica	1.25	5.2	1.612
2	Svrackovo	Arilje	Veliki Rzav	7.65	22	9.28
3	Jezero	Surdulica	Bozicki tunnel	1	4.85	2.98
4	Mala Vrla 1	Surdulica	Vrla, Gradska reka	0.47	1.83	0.8
5	Zavoj	Pirot	Visocica	0.58	2.94	1.112
6	W. s.		Water supply	4.9	4.88	1.0
7	Banjica	Sicevo	Nisava	2.3	12	5.9
8	Stalac	Stalac	Juzna Morava	11	48	29.0
9	Sokolja	Kraljevo	Sokolja, Gvozdacka reka	1.25	6.6	3.0
Total				<b>30.40</b>	<b>108.3</b>	<b>54.684</b>

## Location



## Expected Mitigation Potential

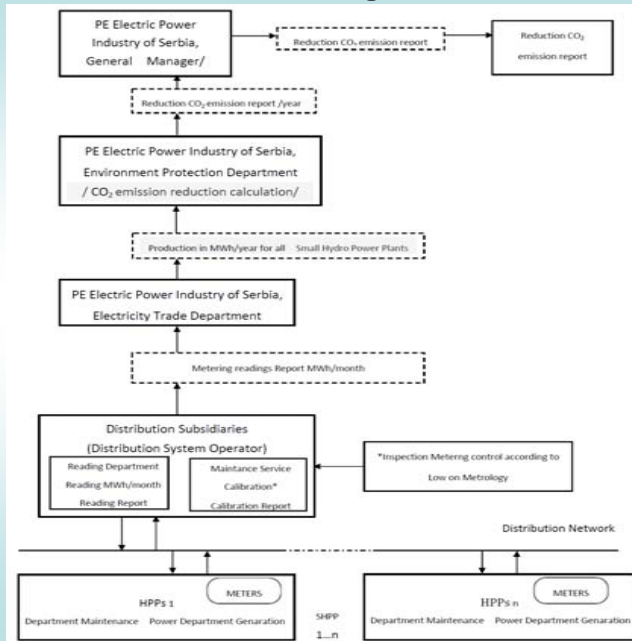
- Approved CDM methodology, AMS-I.D. “Grid connected renewable electricity generation”
- **Baseline emissions**  
Baseline emissions are calculated by multiplying the electricity generated in the project plants using grid emission factor:
  - $BE = EG_{\text{baseline}} * Ef_{\text{grid}}$
  - $BE = 108,300 \text{ MWh} * 0.945 \text{ tCO}_2/\text{MWh} = 102,343 \text{ tCO}_{2\text{eq}}$
- **Project emissions** for small hydro power plants i zero
- **Emissions reductions**  $ER_y = 102,343 \text{ tCO}_2/\text{year}$

## Measurement, Reporting, and Verification (MRV)

- **Data and parameters to be monitored:**

Data / Parameter	EG <sub>y</sub>
Unit	MWh
Description	Quantity of electricity supplied to the grid by 9 HPPs
Source of data	Operation centre at generation system
Measurement procedures	Measured continuously by electricity meter equipped at each of the HPPs and recorded daily.
Monitoring frequency	Monthly Compiled and aggregated data is recorded on computer.
QA/QC procedures	The electricity meters will be periodically calibrated according to the relevant national industrial standards and regulations. Meter readings will be compared to electricity sales receipts.

## NAMA Monitoring Structure



## Contribution to Sustainable Development

- The NAMA is expected to contribute to sustainable development of Serbia and co-benefit in the following manners:
  - » Utilization of renewable energy sources
  - » Reduction of impact on environment
  - » Creation of local employment opportunities
  - » Awareness raising among general public about clean energy

## Implementing Schedule

2013 to 2016

Expected **cost of implementation**: EUR 54.684 million

Simple payback period: 12.1 years  
 FIRR: 6.0% (for 40 years)  
 NPV: - 9,130 EUR

**Implementing Entity**: PE Electric Power Industry of Serbia (EPS)

Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

## Modernization and Capacity and Efficiency Increase of Unit B2 in Thermal Power Plant Nikola Tesla B

- Rehabilitation and modernization of the steam turbine, condensing plant and cooling system unit, boiler (the firing system and the combustion process by introducing "Low NOx" burners) and auxiliary equipment
- Efficiency improves from 31% to projected 34%
- Capacity increase of 47 MW (620 MW unit)
- **GHG Annual reduction** (based on the approved CDM methodology): 355,142 tCO<sub>2e</sub>
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- Implementing Entity: PE Electric Power Industry of Serbia (EPS)
- Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

### **Modernization and Capacity and Efficiency Increase of Unit A3 in Thermal Power Plant Nikola Tesla A**

- Rehabilitation and modernization of the steam turbine, condensing plant and cooling system unit, boiler (the firing system and the combustion process by introducing "Low NOx" burners) and auxiliary equipment
- Efficiency improves from 31% to projected 33%
- Capacity increase of 30 MW (305 MW unit)
- **GHG Annual reduction** (based on the approved CDM methodology): 91,796 tCO<sub>2e</sub>
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- Implementing Entity: PE Electric Power Industry of Serbia (EPS)
- Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

### **Replacement and Construction of a New Natural Gas Cogeneration Plant CHP Novi Sad**

- The new high-efficient natural gas fired combined cycle (CCGT) cogeneration plant will generate 450 MW<sub>e</sub> of electricity supplied to the national grid of Serbia and 300 MW<sub>th</sub> of heat supplied to district heating plants of Novi Sad municipality, which will replace the existing inefficient cogeneration plant fueled by natural gas and heavy oil.
- **GHG Annual reduction** (based on the approved CDM methodology): 1,019,380 tCO<sub>2e</sub>
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- Implementing Entity: PE Electric Power Industry of Serbia (EPS)
- Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

### **Construction of a Super-Critical Lignite Power Plant TPP Kostolac B**

- Construction of a new lignite fired thermal power plant in TPP Kostolac B. The new unit B3, will have an installed capacity of 600 MW<sub>e</sub> (547 MW at TPP threshold)
- Project efficiency 40,8% what is significantly higher than efficiency of a conventional sub-critical lignite power plant in Serbia.
- **GHG Annual reduction** (based on the approved CDM methodology): 1,390,533 tCO<sub>2e</sub>
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- Implementing Entity: PE Electric Power Industry of Serbia (EPS)
- Contact person: Mr. Mihajlo Gavric, Manager of Environmental Protection Sector

Thank you