

CDM PROJECT OPPORTUNITIES IN SERBIA

SUMMARY TABLE

PROJECT TITLE	REDUCTION [tCO_{2eq}/y]	PARTNERS	STATUS
METHANE RECOVERY			
1 LANDFILL GAS COLLECTION AND UTILIZATION AT THE LANDFILL "JOVANOVAČ"	11.000	Municipality of Kragujevac, Public Utility Company "Cistoca"	Project idea
2 AWMS METHANE RECOVERY PROJECT – "PIK – BECEJ"	21.000	PIK – Becej	Project idea
3 CDM PROJECT ACTIVITY IN BROWN COAL MINE "SOKO", SOKOBANJA, SERBIA	54.000	RMU "Soko" Sokobanja	Project idea
RENEWABLE ENERGY			
4 GRID CONNECTED ELECTRICITY GENERATION USING WIND ENERGY	26.000	Vetroelektrane Balkana d.o.o.	Project Idea
5 POWER AND HEAT PRODUCTION FROM WOOD BIOMASS	16.000	Municipality of Ljubovija	Project Idea
ENERGY EFFICIENCY			
6 ENERGY EFFICIENCY MEASURES IN HIPOL A.D. FACTORY	11.500 / 19.500	HIPOL a.d.	Project Idea
CARBON SEQUESTRATION			
7 AFFORESTATION OF BARE SOILS IN CENTRAL SERBIA	6.500	Public Company "Srbijasume"	Project Idea

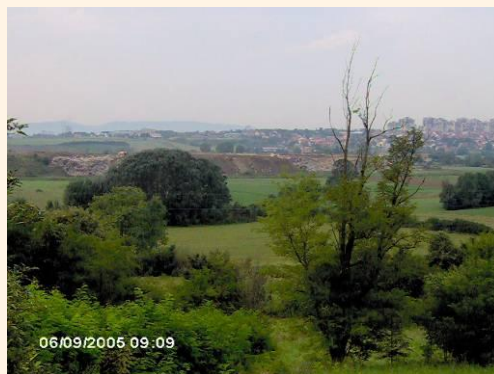
Project title
Ref. No. 1

LFG COLLECTION AND UTILIZATION AT THE LANDFILL “JOVANOVAC”

Project
description

The objective of the project is reduction of current methane emission from the landfill “Jovanovac” through landfill gas (LFG) collection and utilization. Emission reduction would be achieved through conversion of methane into carbon dioxide during combustion of recovered LFG and through replacement of grid electricity with electricity produced from LFG, which is regarded as a CO₂ neutral fuel.

Landfill site “Jovanovac” is located, 3 km North-East from the City of Kragujevac, near to the river Uglješnica. It has been operational since 1963. The landfill receives all collected municipal solid waste (MSW) of the Municipality of Kragujevac, serving a population of approximately 129.000 inhabitants. The landfill covers 15 ha of land at 164 m above mean sea level, which according to the geographic characteristics may be classified as a plain. Amount of MSW carried into the landfill is estimated at 200 t/day, with more than 50% of biodegradable fractions. Until today, more than a million ton of MSW has been disposed at the landfill (see the picture below) making an average depth of landfill body of around 15m. Separate collection of paper and PET has been envisaged for year of 2009. Landfill closure is planed for 2009. Closure will be performed in accordance with the design “Remediation, closure and broadening of the landfill site Jovanovac in Kragujevac”. In order to prevent open fires and explosion, the design envisages installation of 89 vertical wells for LFG venting. Each well covers radius of 30 meters and gas is being vented due to the difference of gas pressure in the landfill body and in the atmosphere. In compliance with the abovementioned design, 17 wells have been installed until now. In the absence of a gas collection and utilization system, gas is currently released to the atmosphere. The Municipality of Kragujevac is interested in electricity production from LFG but it is yet to be defined if it is going to be sold to the grid or used for own purposes.



Total capacity of the power generators depends on the LFG flow. First approximation of available gas quantities shows that it is possible to install 0,3 MW electricity generation unit.

The operator of the landfill, Public Utility Company of Kragujevac “JP Cistoca”, has no means to implement activities presented in the project proposal by itself due to investment and technological barriers.

The legislation requiring compulsory collection and flaring or utilization of the LFG from MSW disposal sites does not exist, neither in the legal framework of the Municipality Kragujevac nor in the Republic of Serbia. The only existing requirement is to vent the LFG in order to avoid the explosion risk.

Applied
methodology

Methane emission reductions from the landfill have been calculated according to AMS - III.

	G. – “ Landfill methane recovery- Version 6 ”. Emission reduction due to the potential electricity generation may be calculated according to AMS - I. A. – “ Electricity generation by the user – Version 13 ” or AMS – I.D. – “ Grid connected renewable electricity generation – Version 13 ” depending of if it is going to be sold to the grid or used for own purposes
<i>GHG offset</i>	It is estimated that the project has a capacity to reduce methane emissions of 11.000 tCO_{2eq} per year through methane recovery and additional 2.100 tCO₂ per year from electricity production.
<i>Sustainability</i>	Besides contributing GHG emission reduction the proposed project would contribute to: <ul style="list-style-type: none"> ▪ Reduction of explosion risk and odour ▪ Introduction of a new technology ▪ Promotion of a new landfill management practice
<i>Current status</i>	Project idea
<i>Estimated investment cost</i>	Around 600.000 € (including, collection, energy generation, engineering cost and CDM cost)
<i>Local partners</i>	Municipality of Kragujevac and Public Utility Company “Cistoca”

Project title:
Ref. No. 2

AWMS METHANE RECOVERY PROJECT – “PIK – BECEJ”

Project
description:

The proposed project activity intends to improve current Animal Waste Management System (AWMS) established on the one of the oldest and biggest agricultural companies in the country “PIK – Becej”. These changes encompass development of the existing open lagoon system for swine manure treatment into a recovery system. Recovered biogas prevailing with methane will be flared achieving GHG emission reduction through transformation of CH₄ into CO₂.

The present manure management is traditional, based on flushing of the manure from the barns followed by two – lagoons wastewater treatment system. Wastewater flows into the primary lagoon where anaerobic digestion takes place while solid phase settles on the bottom. Biogas produced during digestion leads to the direct release of CH₄, N₂O and CO₂ into the atmosphere and is main reason for very unpleasant odour. Every 6 – 8 years primary lagoon is cleaned and removed sludge is used as fertilizer on the cropland. After first lagoon, digested wastewater overflows into the secondary lagoon where settles and stores until application to cropland.

This project activity bundles farms belonging the same Working Unit “Pig Farming”, located within the radius of up to 15 km:

- The Organization Unit “Zalivno Polje” is located 6 km southwest of the Municipality Becej in the vicinity of industrial zone. This is commercial farm with annual production of 50.000 finishers. There are more than 30.000 animals constantly present at the farm of which the majority are market swine types, while population of breeding swine is about 2.350. As well, in the vicinity of the farm is vegetable processing factory „Flora“ with production of about 20.000 t of waste during season April-October and cascade system for wastewater treatment.
- The Organization Unit “Petefi” is located near river Cik in the vicinity of a village Backo Petrovo Selo. This is nucleus farm with production of 12.000 finishers. There are more than 8.500 animals constantly present on the farm of which breeding swine types are 755.
- The Organization Unit “Breg” is located near road Becej – Backa Topola. This is also nucleus farm with production of 30.000 finishers. There are about 20.000 animals constantly present of the farm of which breeding swine types are 2.550.

The project activity has foreseen two possible solutions for recovery system. First one is implementation of the simplest recovery system where primary lagoons will be covered with high density polyethylene material in order to collect biogas and avoid emission to the atmosphere. Then, collected biogas will be transported to enclosed flare for flaring in controlled conditions. In order to protect soil under lagoons watertight layers should be placed also.

The second possible solution for project activity is implementation of an advanced recovery system using complete mix digesters. The wastewater will be flushed into tank where it will be mechanically mixed to ensure uniform digestion. As manure decomposes, biogas is generated, collected and finally combusted. To speed digestion, waste heat from the combustion of biogas will be used to heat digester. Digested waste water will be stored and used as a fertilizer on the croplands.

Potential second project phase might include complete utilization of the biogas. It could be used as a fuel for cogeneration plant, replacing natural gas and electricity for barns heating and other processes in order to maintain intensive swine growth or it could be pumped into natural gas pipeline that exists on the farm in order to reduce usage of fossil fuel.

<i>Applied methodology</i>	AMS-III.D. – ”Methane recovery in animal manure management systems – Version 14”
<i>GHG offset</i>	It is estimated that the project has capacity to reduced GHG emissions of more than 21.000 tCO_{2eq}/y.
<i>Sustainability</i>	The following non-GHG related benefits have been identified: <ul style="list-style-type: none"> • Improvement of the soil quality protection; • Improvement of ground water protection; • Elimination of unpleasant odour in the vicinity of farms facilities; • Introducing of the advanced Animal Waste Management Systems in the county ;
<i>Current status</i>	Specific technical information have been collected through questionnaires and the local site owner agreed on the project implementation.
<i>Estimated investment cost</i>	Investment costs for implementation of simplest recovery system are more than 0,6 M€. For the decentralised advanced wastewater system investment costs are up to 6,8 M€ while costs of advanced centralised wastewater system are up to 4 M€.
<i>Local partners</i>	PIK – Becej

<p>Project title: Ref. No. 3</p>	<p>CDM PROJECT ACTIVITY IN BROWN COAL MINE “SOKO”, SOKOBANJA</p>
<p>Project description:</p>	<p>Brown Coal Mine “Soko” (hereinafter: RMU “Soko”) is located in south Serbia, in the east part of Sokobanja valley in the area of village Citluk.</p> <p>RMU “Soko” operate, together with 8 more coalmines, under the Public Utility for Underground Coal Exploitation “Resavica”, founded by Government of Republic of Serbia at 23rd of May 2005.</p> <p>First coal exploitation in the mine started 100 years ago, at 1908, but till 1946 the production was aimed only on satisfying the needs of the local population. The first organized underground exploitation of coal started at 1948 with the production from 40.000 – 60.000 t/y.</p> <p>The brown coal reserves of the RMU “Soko”, according to the investigation done in the period from 1988 to 1992, are 69,7 Mt (million tons) from which 23,4 Mt are A+B category.</p> <p>The thickness of coal stratum varies from 20-30m and the heating value of “Soko” brown coal is around 17,8 MJ/kg. The annual production of coal varies through time, from 40-60.000 t/y in 1948 to 225.000 t/y during ‘80s. The current production is from 100-150.000 t/y.</p> <p>The objective of the project is improvement of coal mine methane (CMM) management system in the RMU “Soko” in order to establish a friendly environmental solution and reduction of methane release into the atmosphere. The project would be composed of CMM capture and utilization through electricity production, thus converting methane emission into CO₂ and simultaneously reducing its GHG effect.</p> <p>The method of CMM capturing is still to be determined after more detailed investigation of the mine.</p> <p>Without the expectation of the project being register as a CDM project the proposed project would faced serious investment and technological barriers which operator of the mine Public Utility for Underground Coal Exploitation “Resavica” could not overcome.</p> <p>Under the current regulations in Serbia, highly explosive CH₄ must be drained from underground gassy mines to permit safe working of the coal production. However, no law or regulation exists to enforce the methane utilization and/or destruction by flaring.</p>
<p>Applied methodology</p>	<p>ACM0008 – “Consolidated baseline methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction by flaring or catalytic oxidation”</p>
<p>GHG offset</p>	<p>It is estimated that the project has the capability to annual GHG emission reduce through utilization of the CMM of approximately 54.000 t CO₂ eq or around 40.000 t CO_{2eq} only with methane combustion.</p>
<p>Sustainability</p>	<p>The sustainability aspects of the project activity lead to the following general conclusions:</p> <ul style="list-style-type: none"> • Implementation of the project will enable more sustainable development of the mine through environmental protection point of view and reduction of GHG emission into the atmosphere, • The project activity will reduce the electricity consumed for power generation from the power grid and thereby eliminate its associated CO₂, SO_x and NO_x emissions,

<i>Current status</i>	Specific technical information has been collected through questionnaires and site visits and the coal mine owner agree on the project implementation.
<i>Estimated investment cost</i>	Data are not available
<i>Local partners</i>	RMU "Soko" Sokobanja, managed by Public Utility for Underground Coal Exploitation "Resavica", Serbia

<p>Project title: Ref. No. 4</p>	<h2>GRID CONNECTED ELECTRICITY GENERATION USING WIND ENERGY</h2>
<p>Project description:</p>	<p>The purpose of the project activity is to produce power from a cleaner and greener energy source and in turn to reduce the dependence on fossil fuels for energy requirements. The project activity involves construction and operation of 10 MW capacity wind farm generating annually 26.519 GWh of electricity and its transmission to the national electricity grid under the responsibility of the state electricity company EPS (“Elektro Privreda Srbije”). Under this activity, the electricity generated is a renewable and as such displaces electricity produced from non-renewable resources leading to environment-friendly sustainable economic growth.</p> <p>The proposed region in Kovin municipality is recognized as wind park as is presented in the local spatial plan. The first assessment of the above-mentioned wind energy potential of the project activity has been done and presented in the pre-feasibility study. The wind farm would be located on the agricultural land that is 70 % state owned and 30% private owned. At the wind farm location, 20 kV and 6km far 110 kV power grid exist. According to some preliminary estimation this region has potential to install approx. 280 MW wind turbine generators.</p> <p>The wind speed measurement has been performed since July 1st, 2008 measuring the wind speeds on the 40 m, 50 m and 60 m heights at the micro location with the anemometers as well as the wind directions and the temperatures in the 10 min intervals.</p> <p>According to the Serbian Ministry for mining and energy the by-laws for the electricity generated from the renewable energy sources will be adopted no later than July 1st, 2009. By this regulation, the independent energy producer could sign the Power Purchase Agreement with the state company EPS which would be valid for 12 years and will guarantee the electricity price from 11,4 to 13,6 EURO cents per generated kWh.</p>
<p>Applied methodology</p>	<p>The approved baseline methodology for small scale projects AMS.I.D. “Grid connected renewable energy generation” - version 13 has been used to determine the baseline emissions and emissions reduction due to the project activity. For the estimation of the Carbon Emission Factor (CEF) the “Tool to calculate the emission factor for an electricity system”, referenced in the AMS.I.D. methodology, has been used.</p>
<p>GHG offset</p>	<p>It is estimated that the project has capacity to reduced GHG emissions on the annual level in the value of 26.000 tCO_{2eq}.</p>
<p>Sustainability</p>	<p>The sustainability aspects of the project activity lead to the following general conclusions:</p> <ul style="list-style-type: none"> • The project will displace electricity from the grid thereby helping in significant reduction of GHG emissions decreasing the consumption of lignite, whereon the national Serbian power grid is mainly based. • There will be some new business opportunities for contractors, suppliers, erectors at different phases of the project activity implementation. • Since there is no wind farm constructed in Serbia so far, the technology transfer under the project activity will force the renewable energy promotion in the country.
<p>Current status</p>	<p>The pre-feasibility study has been done so far and the wind speed measurement has been started in July 2008.</p>

<i>Estimated investment cost</i>	The preliminary estimation foresees the investment costs of 1 million EUR / MW.
<i>Local partners</i>	Vetroelektrane Balkana d.o.o. (local private engineering company and project proponent)

Project title: Ref. No. 5	POWER AND HEAT PRODUCTION FROM WOOD BIOMASS
Project description:	<p>The municipality of Ljubovija is located on the very west of the country, bordering with Bosnia and Herzegovina. Around 36 % of its territory is covered with forests, i.e. 12.000 ha. State-owned forests are managed by the public company “Srbijasume”, Management Unit “Boranja” in Loznica.</p> <p>Dominant tree species in public forests are beech (71 %) and other broadleaves and black/white pine (21 %), while dominant tree species in private forests are beech (40 %), other broadleaves (40 %) and oak (20 %). Annual cutting volume in this municipality in public forests is 7.395 m³ and in the private ones is 10.000 m³. Apart from the wood biomass available in the municipality of Ljubovija, there is also a possibility to collect forest wood residues from the National Park “Tara” located in the vicinity, which spreads over 182 m² and has 80 % of the territory covered with forests. Therefore, wood biomass coming from the annual forest cleaning in the National Park “Tara” could be also included in the project activity. Also, in the municipality of Bajina Bast, which is bordering the municipality of Ljubovija on the south, there is an existing pellets producing facility that could be taken into consideration for the partnership in the project.</p> <p>Project activity proposed in the project idea is to install a CHP facility in the municipality of Ljubovija, which would be using forest chips as fuel. The installed capacity of a CHP plant would be 2 MWel and 4 MWth. The 16 GWh of electricity produced annually would be exported to the national grid while produced heat would be distributed to the local consumers including town hall, court building, school, kindergarten, etc.</p>
Applied methodology	AMS I.C. – “Thermal energy production with or without electricity” .
GHG offset	It is estimated that the project has a capacity to reduce 16.000 tCO_{2eq} per year.
Sustainability	<p>Following non-GHG related social and environmental benefits of the project have been identified:</p> <ul style="list-style-type: none"> • Support to sustainable development of the region; • Increased rate of employment; • Promotion of renewable sources of energy and introduction of clean and efficient technologies; • Diversification of sources for power production.
Current status	Project idea
Estimated investment cost	Capital cost of the proposed CHP (steam turbine) plant has been estimated at 5.100.000 €.
Local partners	Municipality of Ljubovija and Public Company “Srbijasume”.

Project title:
Ref. No. 6

ENERGY EFFICIENCY MEASURES IN HIPOL A.D. FACTORY

Project description:

The project aims to the optimisation and energy efficiency improvement in HIPOL a.d. factory which main activity is polypropylene (PP) production and plastic processing.

The company is located in the industrial zone of the province of Vojvodina in the municipality Odzaci. Its designed production capacity is 30.000 tons/year, but Hipol a.d. produced 32.447 tons of PP in 2007. The thermal energy is supplied by the boiler house comprising 3 boilers with 11,74 MW installed capacity each. The steam consumption is 18 tons/h under the pressure $p = 12,3$ bar and temperature $t = 189$ °C. The boilers are based on heavy fuel oil (HFO) with the net calorific value of 40 – 41 MJ/kg. The HFO consumption in 2006 and 2007 were 7.926,2 tons and 7.211,7 tons, respectively. The electricity consumption for the processes needs is covered by the national power grid which was 28.452 MWh in 2007.

Two project's ideas have been considered within the industrial plant of Hipol a.d. The first one includes energy efficiency measures and the second one the fuel switch from HFO to natural gas and the installation of the natural-based cogeneration unit.

Following the latter, the foreseen energy efficiency measures are: the utilization of heat from waste gases as a product of the exothermal process of the polypropylene polymerisation, energy savings through reconstruction of the boilers and introduction of the variable speed drives. The estimated amount of the waste heat which would be recovered, has a value of 2,2. MW_{th} installed capacity generating annually 18.500 MWh of thermal energy. Currently this heat is transferred to water under the temperature of 40 °C in the heat exchanger and further to the cooling tower where the waste gases are released to the atmosphere. Using this heat the annual consumption of heavy fuel oil would be approx. 1.600 tons less.

The activity related to the energy savings in boiler house includes the change of one of the existing 27 years old boiler with the new one including optimized process regulation and installation of a new heavy fuel oil/natural gas based burner and economizer. This will result in energy saving of 15 % on the annual basis i.e. saving approx. 1.200 tons of heavy fuel oil. The replacement of the remaining two 27 years' old boilers could lead to annual energy savings of 10 % per boiler. These measures could provide savings of around 1.400 t of fuel oil.

Apart this activity the energy savings through introduction of the variable speed drives will obtain 10% less electricity consumption resulting in the annual electricity savings of approx. 3.000 MWh.

As was above mentioned, another project idea has been considered in Hipol a.d. in the case of very soon connection to the construction of 20 km long natural gas pipeline from Kula to Odzaci. The budget for this construction already exists, but implementation is not yet started. In this respect two project activities are considered: fuel switch from heavy fuel oil to natural gas in existing boiler house, and the implementation of new natural gas based co-generation plant. It is estimated that annual natural gas consumption in boilers, after fuel switch measures, would be 5,1 millions Nm³. The cogeneration plant would have an installed capacity of 2x2 MW_{el/th}, with annual natural gas consumption of approx. 7,8 millions Nm³ generating annually 32.000 MWh_{el} of electricity and 30.000 MWh_{th} of heat.

Apart the latter, company Hipol a.d owns approximately 50 ha of agriculture land. The municipality Odzaci is known as the region with developed agriculture industry, which gives a possibility for the collection of the agriculture waste and use it in the future biogas plant as one more project activity foreseen within this company. The biogas would be used for co-flaring in

	CHP.
<i>Applied methodology</i>	For the project activity related to the waste heat recovery the approved baseline methodology for small scale projects AMS.III.Q. “Waste energy recovery (gas, heat pressure) projects” - version 02 has been used, for the energy efficiency measures AMS.II.D. “Energy efficiency and fuel switching measures for industrial facilities” – version 11 and AMS III.B. “Switching fossil fuels” - version 13 for fuel switch measures. For the estimation of the Carbon Emission Factor (CEF) the tool “Tool to calculate the emission factor for an electricity system” has been used.
<i>GHG offset</i>	It is estimated that the first project idea has capacity to reduced GHG emissions on the annual level from 11.500 tCO_{2eq} up to 15.500 tCO_{2eq} . The second project activity lead to annual GHG reduction up to 19.500 tCO_{2eq} what is in total 31.000-35.000 tCO_{2eq}/year .
<i>Sustainability</i>	<p>The sustainability aspects of the project activity lead to the following general conclusions:</p> <ul style="list-style-type: none"> • The implementation of the energy efficiency measures will reduce specific energy consumption in the company, particularly reduce the consumption of the heavy fuel oil and lignite based electricity from national grid, and subsequently reduce the GHG emissions. • The expenditure for the energy will be reduced having direct economical well being • The company itself upgrades its core production process to an energy efficient and cleaner process improving also technical skills and knowledge level of the employees
<i>Current status</i>	The project is just at the level of the project idea and the data collection is in progress for the first step of the project documentation
<i>Estimated investment cost</i>	<p>1.500.000 – 2.500.000 EUR for the first project idea</p> <p>2.400.000 EUR for the second project idea</p>
<i>Local partners</i>	HIPOL a.d.

Project title: Ref. No. 7	AFFORESTATION OF BARE SOILS IN CENTRAL SERBIA
Project description:	<p>The total project area of 1.300 ha encompasses 700 ha of bare soils of state-owned land, managed by the public company “Srbijasume” and 600 ha of bare soils of privately owned land. Sites foreseen for afforestation are defined and described in the forest management plans. However, lack of funds prevents realization of these forest management plans. Present natural vegetation cover is herbaceous with sporadic appearance of shrubs i.e. the natural vegetation cover falls below the threshold used in the forest land category and is not expected to exceed this threshold without human intervention. At the locations with higher slope gradient, a threat of soil erosion exists and there is also a risk of fire.</p> <p>Proposed project activity is afforestation of bare soils with autochthon coniferous and broadleaves species including spruce, white/black pine, beech, oak, black locust, etc. Depending on tree species, first cutting activities would take place after 20 years, as an important element of plantations tending while the main cuttings would take place 80 - 120 years after establishment of plantations. Afforestation would include site preparation, planting of seedlings and weed control. Average annual above-ground biomass increment has been estimated at 5-6 m³/ha.</p> <p>Taking into account that state owned land with bare soil spreads over 80.000 ha and that afforestation rate of this land in forestry plans has been set at 800 ha/year but only if additional funds would be available, the Programme of Activities which would include afforestation of additional 800 ha per year for the two following years could be evaluated and taken into consideration.</p>
Applied methodology	AR-AMS0001 – <i>Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on grasslands or croplands.</i>
GHG offset	It has been estimated that the project has capacity to sequester, at least, 6.500 tCO₂/year .
Sustainability	<ul style="list-style-type: none"> • Appropriate selection of native species would contribute to biodiversity conservation, i.e. it would lead to increase in species diversity, while mosaic habitat formation would enhance habitat diversity; • The project would support sustainable development of rural communities by generating employment opportunities in rural communities with rather high rate of unemployment and by establishing necessary environment for of various forest products; • Result of forest cover and root development would be also reduction of soil degradation, improvements in soil stabilization and soil fertility and enhancement of the water retention capacity of the land.
Current status	Project idea
Estimated investment cost	Cost of afforestation of state-owned land with bare soil, managed by public company “Srbijasume”, is around 1.200 €/ha while afforestation of privately owned land with bare soil, through providing seedlings to the site-owners, costs around 600 €/ha. Therefore, total investment cost of the project has been estimated at 1.200.000 €
Local partners	Public Company “Srbijasume”.

