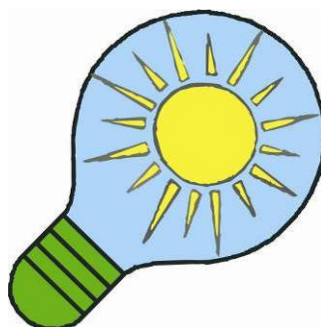




TMC GROUP  
KNOWLEDGE  
MANAGEMENT  
CORPORATION



**V International Renewable Energy Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011**

[www.elektrovoivodina.rs](http://www.elektrovoivodina.rs)  
[www.peec.uns.ac.rs](http://www.peec.uns.ac.rs)

**PROGRAM and  
ABSTRACTS**



*Within the Manifestation Energy Days 2011  
25-27 October 2011, Novi Sad*



*Ladies and Gentlemen, dear friends,*

*In the forthcoming months in which Serbia's accession to EU is expected, it is good opportunity to take into considerations the necessity of changes in the energy sector, particularly in the area of clean energy technologies. The potential available to Serbia is limited but substantial. So far, the existing potential has not been utilized because of the lack of proper organization and systemic approach to solving energy problems. Additionally, not much has been invested in the development of new energy technologies and their introduction in practical use.*

*It is necessary to make changes in the systemic approach to the energy sector and institutional building of infrastructure which will be capable of bringing necessary and desirable changes in the whole energy sector.*

*The fifth International Renewable Energy Forum titled CLEAN ENERGY TECHNOLOGIES - 2011 will take place at a time for strategic decisions. The New energy law of the Republic of Serbia was adopted by Serbian Parliament in August 2011 and it initiates a series of changes in Serbian energy sector. The future energy system has to be sustainable in terms of environmental and climate impact and also in terms of supply, industrial viability and societal acceptance. A resolution of this dilemma is imperative. Changes will, by necessity, happen on many different time scales from ongoing actions. The challenges encompass many levels of complexity, from natural science research and engineering to social sciences, systems solution and actions and agreements at the global political level. This question of global future energy supply has to be addressed with objectivity and competence, without ideological bias. Serbia has to find the way how to use potential to optimize the necessary interdisciplinary cooperation and communication in energy research, development and support to industrial innovation.*

*From the very beginning the FORUM series, launched in 2007, promotes, consolidates and communicates the vitally necessary synergy of scientific and technical competence with knowledge on environmental and social implications.*

*This forum will provide participants with a view and a vision on how the future of energy in Serbia could look like. It will be the forum to define the role of energy science and research in the transformation process towards the future sustainable European energy system.*

*Dr. Tihomir Simić,  
President of Program Committee*

The V International Renewable Energy Forum **CLEAN ENERGY TECHNOLOGIES – 2011** chairmen and moderators are as follows:

**Dr Tihomir Simić**, Chairman, *Elektrovojvodina*, Novi Sad  
**Ivo Vajgl**, Co-chairman, *INEA – Institute for European Affairs*, Dusseldorf

**Opening ceremony (first day)**

**Dr Tihomir Simić**, Moderator, *„Elektrovojvodina“*, Novi Sad  
**Dietmar Reich**, Co-moderator, *INEA – Institute for European Affairs*, Dusseldorf  
**Radoslav Striković**, Co-moderator, *Provincial secretariat for energy and mineral resources*, Novi Sad  
**Prof. dr Dušan Gvozdenac**, Co-moderator, *Faculty of technical sciences, Provincial Energy Efficiency Center*, Novi Sad  
**Thierry Le Boucher**, Co-moderator, *EDF Démász*, Hungary

**First session**

**Prof. dr Srđan Kolaković**, moderator, *Faculty of technical sciences*, Novi Sad  
**Veroslav Janković**, co-moderator, *Provincial secretariat for energy and mineral resources*, Novi Sad  
**Dietmar Reich**, Co-moderator, *INEA – Institute for European Affairs*, Dusseldorf  
**Dušan Muškatirović**, Co-moderator, *Siemens Ltd*, Belgrade  
**Bojan Kovačić**, Co-moderator, *Serbian Energy Efficiency Agency*, Belgrade

**Second session**

**Doc. dr Jovan Petrović**, Moderator, *Faculty of technical sciences, Provincial Energy Efficiency Center*, Novi Sad  
**Branislava Zubić**, Co-moderator, *Provincial secretariat for energy and mineral resources*, Novi Sad  
**Prof. dr Vladimir Strezoski**, Co-chairman, *Telvent DMS Ltd*, Novi Sad  
**Dr Petar Zagorčić**, Co-chairman, *Elektrovojvodina*, Novi Sad  
**Giovanni Costa**, Co-chairman, *Schneider Electric Serbia Ltd*, Belgrade

**Third session**

**Prof. dr Slobodan Sokolović**, Moderator, *Faculty of technical sciences*, Novi Sad  
**Prof. dr Ljubomir Gerić**, Co-moderator, *Faculty of technical sciences*, Novi Sad  
**Veroslav Janković**, Co-moderator, *Provincial secretariat for energy and mineral resources*, Novi Sad  
**Ljubo Mačić**, Co-moderator, *Energy agency of the Republic of Serbia*, Belgrade

**Fourth session**

**Mr Nikola Novaković**, Moderator, *Elektrovojvodina*, Novi Sad  
**Marijana Cupać**, Co-moderator, *Elektrovojvodina*, Novi Sad  
**Borut Česnik**, Co-moderator, *TSN Ltd*, Maribor

**Fifth session**

**Doc. dr Jovan Petrović**, Moderator, *Faculty of technical sciences, Provincial Energy Efficiency Center*, Novi Sad  
**Prof. dr Dušan Gvozdenac**, Co-moderator, *Faculty of technical sciences, Provincial Energy Efficiency Center*, Novi Sad  
**Nada Radovanović**, Co-moderator, *Provincial secretariat for energy and mineral resources*, Novi Sad

# PROGRAM

**First Day (Wednesday, October 26, 2011)**  
**Vojvodina Parliament,**  
**Vladike Platona bb, 21000 Novi Sad**

08:30 – 09:30	<b>Registration of participants</b>
09:30 – 10:30	<b>Ceremonial opening of the Forum - 2011: CLEAN ENERGY TECHNOLOGIES</b> <b>Welcome speech</b>
	<b>SITUATION AND PERSPECTIVES OF ENERGY SECTOR DEVELOPMENT IN SEE REGION</b> <b>Tihomir Simić</b> <i>Chairman of the Program Committee FORUM - 2011</i>
	<b>Gianni Pittella</b> <i>European Parliament Vice-President - video message</i>
	<b>Aca Marković</b> <i>President of Executive Board of EPS</i>
	<b>Radoslav Striković</b> <i>Provincial Secretary for Energy and Mineral Resources</i>
	<b>Dušanka D. Sremački</b> <i>Provincial Secretary for Architecture, Urban planning and Civil engineering</i>
	<b>Ljubo Mačić</b> <i>President of Council of Energy Agency of Republic of Serbia</i>
	<b>Tadej Slapnik</b> <i>Parliament member of Republic of Slovenia</i>
	<b>Dietmar O. Reich</b> <i>INEA - Institute for European Affairs, Dusseldorf</i>
	<b>H.E. Mette Kjuel NIELSEN</b> <i>Danish Ambassador</i>
	<b>H.E. Toshio TSUNOZAKI</b> <i>Japan Ambassador</i>
	<b>H.E. Nils Ragnar KAMSVAG</b> <i>Norway Ambassador</i>
	<b>H.E. Yossef LEVY</b> <i>Israel Ambassador</i>
	<b>WELCOME SPEECH AND OPENING OF THE FORUM</b> <b>Bojan Pajtić</b> <i>Prime Minister of the Provincial Government</i>
10:30 – 11:00	<b>Coffee break</b> <b>Press conference</b> <b>Mutual photograph (Parliament Hall )</b>

**First Day (Wednesday, October 26, 2011)**  
**Vojvodina Parliament,**  
**Vladike Platona bb, 21000 Novi Sad**

<b>FIRST SESSION</b>	
11:00 – 11:15	<b>EUROPEAN ENERGY LAW AND ITS IMPACT ON SERBIA – PROGRESS, PERSPECTIVES AND POSSIBILITIES</b> <i>Dietmar O. Reich</i> <i>INEA-Office Brussels</i>
11:15 – 11:30	<b>FUTURE PATHS FOR RENEWABLE ENERGIES</b> <i>Hermann Wallenborn</i> <i>Wallenborn Projektentwicklung GmbH &amp; Co, Lampersdorf, Germany</i>
11:30 – 11:45	<b>NEW DIRECTIONS IN DEVELOPMENT OF CITY ENERGY SYSTEMS</b> <i>Rene Jensen</i> <i>Danish Energy Agency, Copenhagen, Denmark</i>
11:45 – 12:00	<b>ENERGY LAW OF THE REPUBLIC OF SERBIA</b> <i>Gordana Hajvazović</i> <i>Ministry of Infrastructure and Energy, Belgrade, Serbia</i>
12:00 – 12:15	<b>NUCLEAR FUNDAMENTALS REMAIN</b> <i>Zoran V. Stošić</i> <i>AREVA, Erlangen, Germany</i>
12:15 – 12:30	<b>ROLE OF THE EXECUTIVE AGENCIES FOR ENERGY EFFICIENCY WITH VIEW ON ACTIVITIES OF THE SERBIAN ENERGY EFFICIENCY AGENCY</b> <i>Bojan Kovačić</i> <i>Serbian Energy Efficiency Agency, Belgrade</i>
12:30 – 12:45	<b>EXPERIENCE OF BELARUS IN APPLIANCE OF CLEAN ENERGY TECHNOLOGIES IN THE FIELD OF RENEWABLE ENERGY SOURCES AND ENERGY EFFICIENCY</b> <i>Grigory Gromyko</i> <i>Commercial Counselor, Belarus Embassy</i>
12:45 – 13:00	<b>ENERGY EFFICIENCY AGENCY and FUNDS FOR FINANCING ENERGY EFFICIENCY IN BULGARIA</b> <i>Ognjan Siderov</i> <i>Counselor for economic and regional cooperation, Bulgarian Embassy</i>
13:00 – 14:15	<b>Lunch</b> (Vojvodina Parliament, Representatives Club)

**First Day (Wednesday, October 26, 2011)**  
**Vojvodina Parliament,**  
**Vladike Platona bb, 21000 Novi Sad**

<b>SECOND SESSION</b>	
14:15 – 14:30	<b>"GREEN" PORTFOLIO AS A FRAME FOR THE SOCIETY'S SUSTAINABLE DEVELOPMENT WITH AN EMPHASIS ON WIND ENERGY IN SERBIA</b> <b>Dušan Muškatirović</b> <i>Siemens, Belgrade, Serbia</i>
14:30 – 14:45	<b>ENERGY PLANT VITOKGK AND GAS GENERATOR HEAT VITOMODUL - CONDENSING GAS BLOCK</b> <b>Bojan Grujički</b> <i>Viessmann, Belgrade, Serbia</i>
14:45 – 15:00	<b>DMS - BASIS FOR INCREASING OF THE PENETRATION OF GREEN DISTRIBUTED GENERATION IN DISTRIBUTION NETWORKS</b> <b>Vladimir Strezoski, Dragan S. Popović, Duško Bekut, Goran Švenda</b> <i>Telvent DMS Ltd. Power Engineering, Novi Sad, Serbia</i>
15:00 – 15:15	<b>RENEWABLE ELECTRICAL ENERGY SOURCES</b> <b>Slobodan Joković</b> <i>Schneider Electric, Belgrade, Serbia</i>
15:15 – 15:30	<b>NEW TECHNOLOGIES IN THE PRODUCTION OF MOTOR FUELS FROM RENEWABLE ENERGY SOURCES</b> <b>Borivoj Adnađević</b> <i>Faculty of Physical Chemistry, Belgrade, Serbia</i>
15:30 – 15:45	<b>ZÖLDFORRÁS BIOGAS POWER PLANT PROJECT</b> <b>Gabor Lehoczki</b> <i>EDF DEMASZ, Hungary</i>
15:45 – 16:00	<b>COMPARISON OF ECONOMIC DATA AND ENERGY WASTE BETWEEN SERBIA AND OTHER COUNTRIES OF EUROPE</b> <b>Francis Pelmont</b> <i>GIRUS, France</i>
16:00 – 16:15	<b>Coffee break</b>

***First Day (Wednesday, October 26, 2011)***  
**Vojvodina Parliament,**  
**Vladike Platona bb, 21000 Novi Sad**

---

**THIRD SESSION**

---

16:15 – 17:15 **Discussion**

---

17:15 – 17:45 **Conclusions and Message for the Public**

---

**Second Day (Thursday, October 27, 2011)**  
**“Master” Congress Centre,**  
**Hajduk Veljkova 11, 21000 Novi Sad**

<b>FOURTH SESSION (1)</b>	
09:00 – 09:15	<b>APPLICATION OF MEDIUM VOLTAGE CELLS FOR SMALL POWER PLANTS</b> <i>Borut Česnik, Goran Pješčić, Zoran Nedoh</i> <i>TSN Ltd, Maribor, Slovenia</i>
09:15 – 09:30	<b>MONITORING OF SYSTEMS BASED ON RENEWABLE ENERGY SOURCES</b> <i>Nebojša Misković</i> <i>Saga Ltd, Belgrade, Serbia</i>
09:30 – 09:45	<b>SUSTAINABLE ASSET, RESOURCES AND MAINTENANCE MANAGEMENT BY SOFTWARE TOTAL OBSERVER</b> <i>Boško Milosavljević, Zoran Miškov</i> <i>ION Solutions Ltd, Novi Sad, Serbia</i>
09:45 – 10:00	<b>PREVENTION OF UNAUTHORIZED USE OF ELECTRICITY IN THE DISTRIBUTION NETWORK</b> <i>Kosta Majkić</i> <i>Majkić Ltd, Indjija, Serbia</i>
10:00 – 10:15	<b>GREEN POWER PLANTS FOR THE REQUIREMENTS OF INDUSTRIAL PARK BANJA LUKA</b> <i>Marko Mijić, Miroslav Tuvic, Dragiša Zečević</i> <i>ELNOS BL Ltd, Banja Luka, Bosnia and Herzegovina</i>
10:15 – 10:30	<b>INFORMATIC SOLUTIONS IN THE SERVICE OF ENERGY EFFICIENCY</b> <i>Viktor Moldvaji, Vladimir Knežević</i> <i>Smart Ltd, Novi Sad, Serbia</i>
10:30 – 10:45	<b>Coffee break</b>

<b>FOURTH SESSION (2)</b>	
10:45 – 11:00	<b>DISPATCHER CENTERS AND MODERN TECHNOLOGIES – REQUIREMENTS, POSSIBILITIES AND PRACTICE</b> <i>Aleksandar Car, Tatjana Vračarić, Aleksandar Mihajlov, Zvezdan Krunic, Pavel Zima</i> <i>IMP – AUTOMATIKA, Belgrade, Serbia</i>
11:00 – 11:15	<b>MEDIUM VOLTAGE PLANTS' CONTROLLING AND MONITORING AS PART OF THE SMART GRID CONCEPT</b> <i>Goran Krstić, Dragan Timotić, Marko Iskrin</i> <i>ENERGOTEHNIKA – JUŽNA BAČKA Ltd, Novi Sad, Serbia</i>
11:15 – 11:30	<b>APPLYING THE SYSTEM OF GEOPROBES AND HEAT PUMPS FOR AIR CONDITIONING (HVAC) IN "ENERGOTEHNIKA – JUŽNA BAČKA" Ltd. NOVI SAD</b> <i>Mirko Miličković, Nikola Vasić</i> <i>ENERGOTEHNIKA – JUŽNA BAČKA Ltd, Novi Sad, Serbia</i>
11:30 – 11:45	<b>ADVANCED NETWORKS CONCEPT IN ELECTRICAL DISTRIBUTION SYSTEM</b> <i>Željko Popović, Bratislava Radmilović, Vladan Gačić</i> <i>Elektrovojvodina Ltd, Novi Sad, Serbia</i>
11:45 – 12:00	<b>EUROPEAN FUNDS AND CLEAN ENERGY</b> <i>Jiri Novotny</i> <i>AllowanceS Ltd, Belgrade, Serbia</i>
12:00 – 12:15	<b>ENERGY SAVING LIGHT BULBS</b> <i>Filip Orlović</i> <i>Megaman ESL Ltd, Belgrade, Serbia</i>
12:15 – 13:00	<b>Coffee break</b>

**Second Day (Thursday, October 27, 2011)**  
**“Master” Congress Centre,**  
**Hajduk Veljkova 11, 21000 Novi Sad**

<b>FIFTH SESSION - Joint Session with the Energy Efficiency Group</b>	
13:00 – 13:15	<b>ENERGY EFFICIENCY AND GUIDELINES FOR THE DEVELOPMENT OF THE DISTRICT HEATING SYSTEM IN NOVI SAD</b> <i>Jovan Petrović, Branka Gvozdenc Urošević, Dušan Gvozdenc, Miroslav Kljajić</i> <i>Faculty of Technical Sciences, Provincial Energy Efficiency Center, Novi Sad, Serbia</i>
13:15 – 13:30	<b>PERSPECTIVES OF SOLAR ENERGY PLANTS INTEGRATED IN THE DISTRICT HEATING AND CENTRAL SANITARY HOT WATER PREPARATION SYSTEMS</b> <i>Bojan Grujički</i> <i>Viessmann, Belgrade, Serbia</i>
13:30 – 13:45	<b>DANISH EXPERIENCES IN THE APPLICATION OF DISTRIBUTED COGENERATION IN UTILITY ENERGY</b> <i>Gerner Christensen</i> <i>Danish Energy Agency, Copenhagen, Denmark</i>
13:45 – 14:00	<b>DISTRIBUTED COGENERATION IN DISTRICT HEATING SYSTEMS – EXAMPLES AND EXPERIENCES</b> <i>Dragan Zukić</i> <i>Cummins, Belgrade, Serbia</i>
14:00 – 14:15	<b>URBAN PERSPECTIVE ON DISTRICT COOLING – A CHANCE OF ADDITIONAL CHP PLANTS' SOURCE OF INCOME</b> <i>Primož Škerl</i> <i>Termoelektrarna toplarna Ltd, Ljubljana, Slovenia</i>
14:15 – 14:30	<b>GAS ENGINE DRIVEN DECENTRALIZED ENERGY SYSTEM SOLUTIONS WITH MTU ON SITE ENERGY – EXAMPLE GERMANY</b> <i>Martin Stiehle</i> <i>MTU Friedrichshafen GmbH, Friedrichshafen, Germany</i>
14:30 – 15:00	<b>Discussion</b>
15:00 – 16:00	<b>Cocktail</b>



# **ABSTRACTS AND EXTENDED ABSTRACTS**





V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## EUROPEAN ENERGY LAW AND ITS IMPACT ON SERBIA - PROGRESS, PERSPECTIVES AND POSSIBILITIES

**Dr. Dietmar O. Reich<sup>1</sup>**

*INEA, Brussels*

*Official Representative to the EU*

### 1. European Energy Law and Its Impact on Serbia

The European Energy Law is going to have a great impact on Serbia and its Renewable Energy Sector.

The EU-legislation will affect Serbia in various ways:

- The Energy Community is extending the European Union ("EU") internal energy market to South East Europe and beyond on the ground of a legally binding treaty. Serbia, as a member of the Energy Community, has thus committed to implement the relevant EU regulations concerning the Energy sector step-by-step.
- The Stabilization and Association Process for Serbia and the EU is expected to be resumed soon. Therefore, the EU will supervise Serbia in adopting EU Energy Law, which is one condition for the accession of Serbia to the EU.

The Energy Sector is of great importance to the EU and thus one of its major policies. Even before the treaty of Lisbon of Dec. 1<sup>st</sup>, 2009, which gave the EU a foundation of competence for energy policy, a great part of national energy policy was influenced by Brussels. Nowadays, national energy law is mostly ruled by European directives or regulations. This leads to a limited scope for action of the national legislator who only retains the competence to choose the way of implementing the EU-law. These provisions will apply to Serbia after becoming an EU member as well.

The Stabilization and Association Process provides that the EU will monitor Serbia's implementation of the European Energy Law. According to that, Serbia has to set up an independent Energy Regulatory Agency, to continue environmental audits on energy plants and to impose sanctions where necessary.

### 2. Competition to Achieve Energy Aims

Europe's strategic goal is secure, affordable and greener energy. In accordance with Article 194 of the treaty on the functioning of the European Union, the EU will:

- (a) ensure the functioning of the energy market;
- (b) ensure security of energy supply in the Union;
- (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
- (d) promote the interconnection of energy networks.

---

<sup>1</sup> e-mail: [dietmar.reich@bblaw.com](mailto:dietmar.reich@bblaw.com)

### **3. Unbundling**

To achieve the common purposes, the EU focused on antitrust-issues in the energy sector. The existing competition problems were followed with groundbreaking decisions. These cases led to a third internal market package for electricity and gas. As a major issue, the EU obligated the member states to implement rules concerning the separation of the energy production and the distribution arms of large integrated energy companies (legal and functional unbundling). The deadline for implementing these directives in national law expired on March 3<sup>rd</sup>, 2011. However, there are still several member-states that have not fulfilled this obligation.

By separating the production of energy and the network operation, the expectation is to solve any conflict of interest between producers, suppliers and transmission system operators. These regulations create incentives for the necessary investments and guarantee the access for new market entrants under a transparent regulatory regime.

The European Commission engaged antitrust-procedures against dominating energy companies (E.ON, RWE, GdF Suez, Distrigaz), even though the third internal market packet has not been implemented in national law. To avoid sanctions, they had to open their distribution grids voluntarily. As an example, E.ON committed itself in 2008 to separate most of its energy grid. With the third legislative package for Energy, the separation of energy production and the control of the energy grids will become obligatory.

### **4. Challenge for Energy Contracts**

On the other hand, the market-opening in the energy sector caused many problems. Especially the former monopolists struggle as they are bound by long-term supply contracts. These contracts were concluded in times when it was easy for the energy companies to estimate and plan their future energy. This was due to the fact that their customers had no other choice than to purchase from them. Now their demand is decreasing, because the customers can obtain gas or electricity from other sources.

### **5. Open Markets to Boost Renewable Energies**

The majority of investors in development of renewable energies are small and mid-cap companies and they are highly dependant on having access to the local grids. But achieving this aim is a major challenge since the grids are usually controlled by large corporations with low interest in gaining new competitors.

Consequently, for boosting renewable energies it is necessary to open the markets and to split the control over the grids. For that, the EU created an initiative for competitiveness which faced a strong opposition within the national interests. Nonetheless, these actions are necessary in the development process.

### **6. Outlook**

The EU members agreed on the strategy *Europe2020*. Energy is one of its flagship initiatives. As a way to cut down the emissions of carbon dioxide, renewable energies should be increased by a total of 20 percent within the next 9 years. To achieve this objective, each Member State has adopted its own national targets. These are monitored and sanctioned by the EU.

Therefore the member states have introduced programs to promote renewable energies. This is mostly done by fixed "Fed-In-Tariffs" for power which is generated by renewable energy sources. These Fed-In-Tariffs are in accordance with the actual costs of production of each energy source. For some years, such fixed Fed-In-Tariffs have been guaranteed in Serbia as well.

Other EU-programs promote research in new energies and the development of infrastructures that connect the member states. Renewable Energies require the extension of the existing energy-grids to transport wind-energy from the north to the south and solar-energy from the south to the north. Serbia will play a major role in transit-ways due to its geographic position. This will lead to the increased interest of international investors; esp. long-term investors like pension funds are looking for infrastructure investments.

The strategy Europe2020 also foresees the increase of energy efficiency by 20 percent. For example Smart Grids are promoted by rules, stating that costumers should be equipped with intelligent meters.

Under specific conditions, Energy Projects can be sponsored by Pre-Accession-Funds. These funds are intended to support future member states with the adjustment of their living conditions.

The next step will be to harmonize the national funding of renewable energies. This would make southern countries more interesting for foreign investors, e.g. in solar parks. EU-member states like Germany have spent high subsidies for solar power.

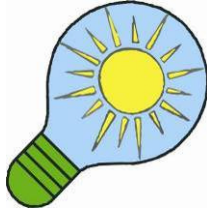
Without the liberalization of the distribution networks, it would not be possible for renewable technologies to grow. Besides, the opening of markets could be an improvement even for the traditional power companies. On the one hand, they are able to access other distribution grids to sell the energy *supraregional*. On the other hand, they have a wider range for choosing their own suppliers.

The European Energy Law will have a significant influence on Serbia. The actual member states had years to adapt to the process of market opening. They moved slowly and had problems with the new regime. But initiative of the EU paves the way for new, modern energy technologies, innovations and modern environmental technology.

## 5. Conclusion

Serbia is on the right green energy track but needs to consider the following:

- a) The adoption process of EU Energy Law has to be in advance to prepare a full EU-membership.
- b) The energy industries have to amend existing contracts in the light of open markets.
- c) The national legislator has to increase programs of government aid for new energies to meet their objectives regarding Europe2020.
- d) Energy projects might be co-financed by the EU in the future.



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## FUTURE PATHS FOR RENEWABLE ENERGIES

**Hermann Wallenborn<sup>2</sup>**

*Wallenborn Projektentwicklung GmbH & Co. KG  
Baeyerhöhe 20, 01665 Klipphausen, Germany*

### 1. Introduction

Serbia counts as a popular country for investments within the Balkan States. This is mainly due to increasing growth figures and the continuation of talks to join the European Union. Investments from foreign countries have increased by 300% in comparison to the previous year.

With a high number of planned investments over the next years and great potential for alternative energies, Serbia seems to provide ideal prerequisites for the extension of the renewable energy sector.

The Wallenborn Group, in conjunction with its network of renowned business partners is presenting itself as a competent partner with the necessary experience for the realisation of the renewable energy development in Serbia.

### 2. Methods

Firstly, the negative assumed aspects of wind power and renewable energies are being discussed and compared to the advantages and opportunities. The result is then being analysed by looking at Serbia and its economical and political situation within Europe.

The Wallenborn Group examines how it can match its experience and competences with the requirements of a potential partner for a successful cooperation in the renewable energy sector in Serbia.

### 3. Results & discussion

The use of renewable energies is an investment into our future. The finiteness of our natural reserves combined with the risk of traditional ways of energy production, for example, nuclear power, and the consequences of the environmental pollution, the global warming lead to the necessity to consider alternative ways to use and produce energy.

Alternative energies can only origin from nature itself, without the burning of fuels – possible alternatives come from the sun, water, wind and energy from plants.

In the discussion about the use and extension of wind power in particular, the assumed negative aspects are being compared to the advantages and opportunities.

---

<sup>2</sup> e-mail: [info@wallenborn-projekt.de](mailto:info@wallenborn-projekt.de)

Whilst the operational costs of wind power production are similar to those of traditional fuels, there is a clear difference in the social costs. The tax payer pays for energy produced from coal, oil or gas up to 31.1 Euro Cent per kWh, however, wind power costs only 0.0051 Euro Cent per kWh.

The risk for birds is being minimised through an audit procedure at pre-planning stage. There is no erection of wind power plants in neither predestined bird rest areas, nor flight paths or breeding grounds.

Through advanced technologies, disco and light effects as well as shadow casting and noise pollution are being reduced or nearly eliminated.

A decision has to be made as to whether we prefer clean air or a "beautiful" landscape and the consequences thereof, such as global warming and natural disasters, like floods or the current example of Fukushima.

Wind power creates work places in different areas, such as production, construction and operation of the plants. Up until now, 235,000 work places have been created in Germany; and at the same time, it provides a contribution to the communities, which ultimately benefits all residents.

With its positive international outlook, Serbia is planning investments of 14 billion Euros up until 2017 for the energy sector. Alongside the capital Belgrade, Novi Sad, situated in the region Vojvodina, has great potential.

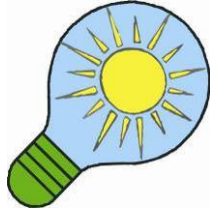
The wind power potential in Serbia is being estimated to 2.3 Trillion kWh per annum, which makes 7% of the current annual production. The hydro power potential is being estimated to 25 TWh per annum, and the solar radiation lies 40% over the European average. Based on estimations, the biomass potential is sufficient to fulfil 20% of the energy demand in Serbia.

With the necessary experience gained through the planning, development, construction and operation of the currently largest wind farm in Croatia with 42 MW, it appears that the Wallenborn Group differentiates itself as the ideal partner for the realisation of renewable energy development in Serbia.

The cooperation with world market leaders in the wind power sector guarantees a reliable and excellent management of the projects right from the planning phase through to the end-of-life cycle of the wind farm.

#### **4. Reference**

- [1] „Overview of the Serbian Market of Renewable Energy“, 28. Juni 2011, [www.exportinitiative.bmw.de](http://www.exportinitiative.bmw.de)
- [2] „Country Report für Investoren und Exporteure Serbien“, Juni 2011, [www.ksv.at](http://www.ksv.at)
- [3] [www.klimawandel-global.de](http://www.klimawandel-global.de)
- [4] [www.wallenborn-projekt.de](http://www.wallenborn-projekt.de)



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## NUCLEAR FUNDAMENTALS REMAIN

**Zoran V. Stosic<sup>3</sup>**

Vice President Marketing and Sales South–East Europe  
AREVA NP  
Paul–Gossen–Str. 100, 91052 Erlangen, Germany

### **Abstract - Fukushima: Accident due to a Natural Disaster**

*Tōhoku earthquake (Great East Japan Earthquake) occurred at 14:46 JST (05:46 GMT) on 11<sup>th</sup> March 2011. With magnitude of 9.0 Mw and duration of approximately 6 minutes it was the most powerful known earthquake to hit Japan, and one of the 5 most powerful earthquakes in the world overall since modern record–keeping began in 1900. The earthquake moved the main island of Japan by 2.4 m, the eastern parts of Japan by 3.65 m closer to North America, speed up Earth's rotation, cutting the day by 1.8  $\mu$ s due to redistribution of the planet's mass and shifted Earth's figure axis by 25 cm. Tsunami waves, which reached heights of up to 40.5 m in Miyako (Tōhoku's Iwate Prefecture), travelled up to 10 km inland in the Sendai area. Fukushima was hit by a tsunami as high as 15 m.*

*6 Fukushima Dai–ichi reactors shut down: units 1 to 4 stopped; partial core meltdown and damaged buildings occurred. Units 5 and 6 were in outage and preceded with safe shutdown, neither core nor containment was damage. 8 other reactors in 3 different sites stopped.*

*What went wrong on the damaged units?*

- *The initiating occasion was a combination of exceptional and sudden natural events,*
- *Loss of cooling function,*
- *Hydrogen release leading to explosions,*
- *Plant contamination makes on–site intervention more difficult,*
- *Measurement means were insufficient,*
- *Crisis management made difficult due to the wideness of the catastrophe.*

*As of 5<sup>th</sup> September 2011, due to accident and cold shut down affected by tsunami, outage for the periodic inspection or the equipment replacement and shutdown due to the government request, only 11 units out of 54 are in operation in Japan.*

### **1. Safety Authorities' Actions Worldwide**

Considering the accident at the Fukushima NPPs (Nuclear Power Plants) the Council of the EU declared that *“the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk assessment (“stress tests” ); ... the assessments will be conducted by independent*

---

<sup>3</sup> e-mail: [Zoran.Stosic@areva.com](mailto:Zoran.Stosic@areva.com)

*national authorities and through peer review; ... the EC (European Council) will assess initial findings by the end of 2011, on the basis of a report from the Commission".*

During their plenary meeting on the 22<sup>nd</sup> and 23<sup>rd</sup> of March, WENRA (Western European Nuclear Regulators Association) members decided to provide *"an independent regulatory technical definition of a "stress test" and how it should be applied to nuclear facilities across Europe"*.

On April 21<sup>st</sup> WENRA Task Force proposed the "stress tests" specifications. A "stress test" is defined as *"a targeted reassessment of the safety margins of NPPs in the light of the events which occurred at Fukushima: extreme natural events challenging the plant safety functions and leading to a severe accident."*

The ENSREG (European Nuclear Safety Regulators Group) and EC agreed on May 24<sup>th</sup> on the scope and methodology for planned *"comprehensive risk and safety assessments"* of power reactors in the EU. In addition, actions needed for: access to earthquake-/flood-proof external storage; externally accessible connections for mobile equipment; segregated leads to feed fuel-pool from outside.

Resistance to terrorist or other malevolent acts will be assessed separately.

## **2. Impact on Nuclear Power around the Globe**

Governments around the world took pragmatic approach – public confidence is not a given – to earn it and keep it: no compromise on safety and continuous improvement – it has to be regained.

Safety checks of nuclear plants (existing and planned) worldwide are launched.

UK, Czech Republic, Poland, China, India, Finland, South Africa... confirmed their New Build programs. Some short-term delays are planned as part of the safety check process. Italy cancelled its new build program by referendum. No ongoing construction is stopped, except Japan. Germany and Switzerland decide to gradually phase-out nuclear.

Worldwide WIN-Gallup poll (made in 47 countries in April 2011) shows majority still favours nuclear, even with Fukushima still fresh in their minds. In Japan, the majority turned against nuclear but a majority still favours the nuclear option in the U.S., France or China. A second worldwide poll by IPSOS (made in 24 countries also in April 2011) has shown an opposite result. Nonetheless, a sizeable share of the "against" are not in favour of closing existing plants, their confidence must be regained.

The fundamentals for nuclear industry remain unchanged, because:

- Need for new electricity production capacities is unchanged to meet growing demand (energy demand multiplied by 2 by 2050),
- Climate change remains a priority (greenhouse gas emissions cut by half by 2050),
- Need for an increased security of supply in a changing geopolitical environment,
- Limitation of resources – short and middle term perspectives show rising prices of fossil energies,
- Regarding construction and operating costs, marginal impact on Generation 3 new builds, as well as limited impact on existing plants,
- Access to financing restricted to nuclear projects with high level of safety, in line with safety authorities requirements,
- Nuclear technology leaders and experts provide highest standards for safety and security.

So, the context post-Fukushima creates new challenges but nuclear perspectives remain solid. On 27<sup>th</sup> July 2011 the IAEA Director-General Yukiya Amano said: "Despite Fukushima Dai-ichi, global use of nuclear power will continue to grow in the coming decades and will remain an important option for many countries".

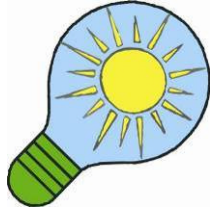
Compared to the status on 2<sup>nd</sup> March 2011, on 8<sup>th</sup> October 2011 there were worldwide:

- 11 reactors (9.29 GWe, i.e. 2.46% of installed capacity) less connected on grid,
- 1 reactor more under building/construction (first concrete for reactor poured, or major refurbishment under way),
- 4 reactors less on order or planned (approvals, funding or major commitment in place, mostly expected in operation within 8–10 years), and
- 4 reactors more proposed (specific program or site proposals, expected operation within 15 years).

This illustrates the impact of Fukushima on the world nuclear power sector.

The U.S. DOE's (Department of Energy) EIA (Energy Information Administration) releases on 15<sup>th</sup> September 2011 "International Energy Outlook 2011" stating that

- Global nuclear energy generating capacity is projected to rise from current 368 GWe to 644 GWe by 2035, and
- Electricity generation from nuclear power is projected to increase from current 2.63 GWh to 4.9 GWh in 2035.



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## THE ROLE OF EXECUTIVE ENERGY EFFICIENCY AGENCIES WITH A SPECIAL EMPHASIS ON ACTIVITIES OF THE SERBIAN ENERGY EFFICIENCY AGENCY

**Bojan Kovačić<sup>4</sup>**

*Energy Efficiency Agency of the Republic of Serbia,  
Omladinskih brigada 1, 11070 Novi Beograd, Serbia*

### **Abstract**

*Many countries in the world, particularly in Europe, have differently organized and structured specialized executive energy efficiency agencies at the national, regional or local level. It is common for all these agencies that there is strategic need in their countries for the improvement of conditions and measures for rational use of energy and energy carriers. The Serbian Energy Efficiency Agency (SEEA) was established in 2002 within the energy sector reform and its current status was defined in 2004 in the Energy Law. By proposing incentive measures for increasing energy efficiency and by promoting the importance of energy efficiency primarily at the consumption side, as well as by managing programs and projects for rational and wider use of energy from renewable sources (one of the key factors for sustainable development), the Agency contributes to the improvement of socially responsible behavior towards energy in all structures of the state and the society.*

**Keywords:** *energy efficiency, energy efficiency agency, Serbian Energy Efficiency Agency*

### **1. Introduction**

In recent times, Serbia, the same as many other countries in the Central and South-Eastern Europe, has made (and we can say that it is still making) the first steps towards the establishment of the system for organized improvement of energy efficiency on the side of consumption. This complex process is filled with numerous objective and subjective barriers. However, only by systemic and synergetic approach to these problems, it will be possible to expect a major stride out towards the improvement of energy efficiency indicators. In that respect, it is necessary to fulfill certain prerequisites in order to ensure sustainability and sufficient appropriateness of the whole process.

One of basic prerequisites, particularly for countries at the state of development in which Serbia is today, is to define the place and the role of a national agency which will deal with activities in the area of energy efficiency.

---

<sup>4</sup> e-mail: [bojan.kovacic@seea.gov.rs](mailto:bojan.kovacic@seea.gov.rs)

## **2. Role and Activities of Energy Efficiency Agency**

What has European best practice shown as necessary is the development of not only national but also regional and local (for example, municipal) energy efficiency agencies. In that respect, it is desirable that geographically close regions (cities and municipalities) join together and unite efforts in the implementation of various programs and projects. In the sections below, the assumed basic roles of energy efficiency agencies will be discussed.

### **2.1 Activities Related to the Preparation of Legal Regulations**

The starting point for the improvement of energy efficiency is defining and adopting and then, implementing the adequate framework of laws and bylaws in this area. The existing legal framework in Serbia is not sufficiently binding for energy consumption sectors with respect to the increase of energy efficiency. Therefore, the government intends to enact the law which will govern the rational use of energy in order to enable the realization of identified priority technical measures [3]. Drafting of this law which is within the competence of the ministry in charge of the energy has been finished. The law will define more precisely obligations of all energy subjects from various sectors with respect to the energy efficiency and include qualitatively new solutions, for example, obligation to determine the existing state of energy consumption in companies at the annual level, as well as their obligations in case of exceeding the prescribed maximum level of consumption. The energy efficiency agencies should start initiatives for enacting and assisting competent state bodies in drafting bylaws. With reference to the above, the Serbian Energy Efficiency Agency has actively participated in numerous activities so far.

### **2.2 Education and Raising Awareness**

The rational use of energy does not represent only the responsibility of the government but also the responsibility of every individual. This requires comprehensive social action and raising awareness about these problems in all targeted social groups. The energy efficiency agencies should also affect the change of beliefs, attitudes, habits, and behavior of energy consumers, create new patterns and routines, particularly in case of socially irresponsible practice of wasting energy, advocate the concept of socially responsible behavior and rational relation towards energy and energy sources, as well as towards natural resources as a whole. The cooperation with non-governmental organizations is of great importance with an aim to promote the importance of energy efficiency and renewable energy sources through direct contacts with citizens.

Special attention should be devoted to the youngest and future generations because it is easiest to educate them during the process of growing up and schooling. The Serbian Energy Efficiency Agency participates in the process of improving the educational process in Serbia.

### **2.3 Realization of Demonstration, Innovation and Research and Development Projects**

The final result of demonstration projects should be the assessment of effects of applied measures for increasing energy efficiency. In our country, demonstration projects are important because acquired experiences in these projects can be useful for to beneficiaries when they apply for financial resources for other projects particularly those from European funds. The SEEA has realized 29 demonstration projects from the Program of the European Agency for Reconstruction in the area of building construction, public lighting, district heating, public water supply system and renewable energy sources. Also, we technically manage the realization of projects in the area of public buildings with the financial support of the World Bank which can also be viewed as demonstration ones. The SEEA has so far supported and participated (and it is still participating) as a partner in ten development and

research projects from the National Energy Efficiency Program within the Technological Development Program of the ministry in charge of science.

#### **2.4 Promotion and Information**

By the implementation of their missions, energy efficiency agencies must strive to improve environmental conditions for investments in energy efficiency, contribute in the transfer of knowledge and current “best practices” and permanently increase interests of all energy consumers through better provision of information. The SEEA has so far organized and participated in a large number of events in the country and abroad.

#### **2.5 Cooperation with Different Social Structures**

Some of the instruments which are available to the government for the purpose of creating favorable environment for the improvement of energy efficiency are subsidies, new forms of finance, for example, realization of public-private partnerships or introduction of a finance model from savings (ESCO model) and similar things. The professional political framework should provide legal basis in the energy efficiency area, clear division of responsibilities among different levels of government, targets with respect to energy efficiency, as well as action plans with concrete implementation steps. All this should be supported by corresponding resources, effective and distinctive competences, political support, etc.

#### **2.6 International Cooperation**

At present time, international and especially regional cooperation represents not only the need but also a necessity. All the countries in our region are confronted with similar problems when the improvement of energy efficiency is concerned. Also, they are trying to resolve these problems in the similar way with the support of the South East European Energy Community. By signing the Treaty on South East European Energy Community, Serbia has confirmed its readiness to conduct reforms in the energy sector, as well. Also, Serbia has signed the Energy Charter Treaty thus fulfilling all necessary requirements to become the full member of the Energy Charter Conference. This Treaty represents a multilateral treaty providing guidelines for the creation of a wider European energy market and strengthening its efficient functions which include not only trade and protection of investments but also energy efficiency.

### **3. Essential Aspects for the Improvement of Energy Efficiency**

One of the essential prerequisites for the improvement of energy efficiency in Serbia is the introduction of energy management in all sectors of consumption. Local self governments should be the first in implementing energy efficiency measures because their success will motivate households, business companies and industries to improve their energy efficiency, as well. All this should lead to the improvement of the quality of municipal services.

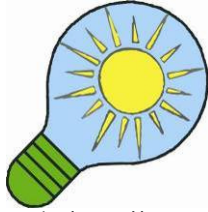
Incentives are an important element for the development of the market for energy efficiency services. These incentives can be different: subsidies, tax and customs benefits, voluntary agreements, favorable loans, etc. On the other hand, failure to fulfill obligations with respect to energy efficiency should involve certain sanctions. The support for incentives should also be accomplished through the national energy efficiency fund to be established in line with the Implementation Program of the Energy Development Strategy until 2015 in Serbia.

#### **4. Conclusion**

The improvement of energy efficiency is a continuous process which requires organized and systemic approach of relevant government institutions and social organizations, local self governments, companies and all individuals. Energy efficiency agencies, national, regional and local, should play a key role in this process. Their role is also to influence other subjects in the society and in the country to use energy rationally, that is, to conduct activities from their competence in order to achieve that. The scope of activities done by energy efficiency agencies is comprehensive and manifold starting from the implementation of demonstration projects and various studies over international cooperation to information and raising awareness in the society .

#### **5. References**

- [1] Status of Energy Efficiency in the Western Balkans - Final Report of the Stocktaking Exercise, Austrian Energy Agency, Vienna, 2009
- [2] B. Kovačić: Preconditions and Manners for Improving Energy Efficiency in Serbia, II Regional Conference "Industrial Energy and Environment Protection IEEP 2010", Proceedings, Zlatibor, 2010
- [3] Implementation Program of the Energy Development Strategy in Serbia until 2015 in the Period 2007-2012, "Official Gazette RS", No. 44/05, Belgrade, 2005., revision 2010
- [4] National Sustainable Development Strategy, Serbian Government, 2008



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## EXPERIENCE OF BELARUS IN APPLIANCE OF CLEAN ENERGY TECHNOLOGIES IN THE FIELD OF RENEWABLE ENERGY SOURCES AND ENERGY EFFICIENCY

**Grigory Gromyko<sup>5</sup>**

*Embassy of the Republic of Belarus to the Republic of Serbia*

### **Abstract**

*It is common knowledge, that during Soviet period Republic of Belarus used to be an Assembly for the Soviet Union. We proud to have some very big industries. For example, about 1/3 of the World output of dump trucks is produced in Belarus, 11% of Potash fertilizers, 9% of Flax, 6% of Tractors, from 5 to 7% of world production of Combine harvesters, etc.*

*The problem is that industries are energy consuming and we are not so rich in oil and gas.*

*This led us to develop a state policy in the field of efficient use of fuel and energy resources including renewable energy sources.*

*In 2010 Belarus cut down the GDP energy intensity by more than 30% over 2005. Only in January-August 2011 GDP energy intensity was reduced by about 7%.*

*All necessary measures were taken to reach this parameter. The Department for Energy Efficiency developed proposals for the implementation of the national project Alternative Energy in 2011-2015. The project envisages the construction of **hydro electric power plants, small CHP plants, and biogas plants.***

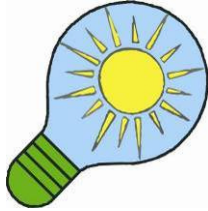
*An increasing use of local fuels, waste products, secondary, alternative and renewable energy resources plays a significant role in the country's energy-efficiency measures.*

*Worth mentioning is the fact that most of those projects are supposed to attract foreign investment and technologies and enjoy significant support of the President and the Government of the Republic of Belarus.*

*Foreign partners wishing to cooperate with Belarus in the field of clean energy technologies can apply directly to the Department for Energy Efficiency in Minsk or through Belarus Embassy to Serbia.*

---

<sup>5</sup> e-mail: belarus\_serbia@mail.ru



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## "GREEN" PORTFOLIO AS A FRAME FOR THE SOCIETY'S SUSTAINABLE DEVELOPMENT WITH AN EMPHASIS ON WIND ENERGY IN SERBIA

Dušan Muškatirović<sup>6</sup>  
Siemens d.o.o. Belgrade, Serbia

### **Abstract**

*The simplest definition of energy efficiency is the reduction of energy consumption per unit of product and/or service. The very fact that such concept can be applied in various areas of human activities indicates that there is no universal solution but every problem requires special approach. The answer to this task is the companies' "green" portfolio, the same as the one of the company Siemens.*

*Thanks to considerable investments in research and development of new "green" technologies in combination with existing products, systems and solutions joined in a so called "green" portfolio, the company Siemens is in the position to provide to potential users different possibilities for applying the concepts of energy efficiency and environment protection. The use of this "green" portfolio in projects such as the production of energy from renewable sources, treatment of wastewaters and flue gases, as well as in various approaches to the improvement of energy efficiency open possibilities for new further investments in these areas and confirm that such projects represent to a large extent the basis of sustainable development.*

*One of the main tasks of employees in the firm Siemens in Serbia is also public promotion of energy efficiency concepts in the sense of proposing different solutions for the problems facing the citizens in our country in places in which they live and work. The implementation of these projects creates opportunities for engaging domestic knowledge and industry which can also be a strong trigger for their engagement outside the borders of our country. This is yet another aspect of sustainable development not only for the country but also for some of its regions.*

*One of the areas in this portfolio which is expected to make considerable progress in future years is the use of wind power. In this field, Siemens has a special reason to promote this technology intensively in Serbia primarily due to the fact that the crucial product for wind power plants is made in our county – in Subotica.*

*The wind power has not been used much in Serbia and there are many reasons for that in various spheres. However, the adoption of the new Energy Law and gradual stabilization of the economic sector will make investments into wind farms very attractive in the near future. This has been recognized by the Public Enterprise Electricity Industry of Serbia (JP*

---

<sup>6</sup> e-mail: [dusan.muskatirovic@siemens.com](mailto:dusan.muskatirovic@siemens.com)

*Elektroprivreda Srbija) which in the “White Book” addresses these projects as perspective and very important.*

**Keywords:** *energy efficiency, “green” portfolio, sustainable development, wind energy in Serbia*



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## ENERGY PLANT VITOKGK AND GAS GENERATOR HEAT VITOMODUL - CONDENSING GAS BLOCK

**Bojan Grujički**<sup>7</sup>  
VISSMANN Ltd, Belgrade, Serbia

### 1. Introduction

Energy plant VitoKGK and gas heat generator Vitomodul - Condensing Gas Block are new concepts, created in response to market demands for a modern, flexible and fast solutions.

**Energy plant VitoKGK** is concept more efficiency, lower investment and maintenance costs and high flexibility. VitoKGK fully decentralized concept allows the application of heat distribution than traditional district heating systems. Energy plant are placed at the free surface in the central part of the heat consumption and represents the final product approved for use on natural gas and / or liquid fuel, intended for heating up to 50,000 m<sup>2</sup>.

**Vitomodul - Condensing Gas Block** is a new highly efficient solution for heating buildings in which the current concepts, or too expensive, or procedural and technical complication, or even impossible. It allows all those who need to heat commercial or residential buildings, an area of 500-3000 m<sup>2</sup>, to do so quickly and easily with minimal investment and exploitation costs and with full comfort heating the gas. Vitomodul the product is planned for outdoor installation with the possibility of placing on a flat roof or the facade of the building, fired by natural gas or propane.

### 2. Description

Energy central provides functions:

- Coverage of consumption of 3.5 MW, 4.5 MW and 5.2 MW (optional)
- Boiler and separate hydraulic circuit network;
- Initial water temperature control at the exit from the headquarters;
- Protection from the cold end of the boiler;
- Maintain the differential pressure hot-water network;
- Pressurization
- Evacuation of combustion products
- Digital remote control without constant supervision
- Measurement of heat
- Measurement of the raw water (optional)
- The basic elements of VitoKGK are hot water boilers Viessmann, coupled with modulated Weishaupt burners, and complete hydraulic and other electrical equipment. The complete plant is located in fireproof construction tested capable of setting up and transport with full equipment.

---

<sup>7</sup> e-mail: [GuB@viessmann.com](mailto:GuB@viessmann.com)

The Gas generator - Vitomodul provides:

- The work of the plant in condensing mode, over 90%, operation time,
- Covering the consumption of 17 to 315 kW,
- Regulating range forces in accordance with external conditions,
- Greater flexibility and exploitation conditions
- High environmental and fire safety,
- Minimal space,
- Simpler, shorter and less expensive procedure of documentation, obtaining licenses, certificates, etc,
- Technical seamless transition when converting a gas boiler,
- Lower total cost of investment and operation in comparison with other known solutions,
- The basic element is the heat of the gas generator and gas hydraulic top link cascades Viessmann condensing boilers Vitodens 200-W. The boilers are placed in a fireproof structure tested, with controlled condensate drain and protected from freezing.
- Both concepts have been produced by equipment that complies with EU technical declarations, and by the relevant institutions, Mechanical Engineering in Belgrade, declared as quality products.

### **3. Analysis and Conclusion**

While cost-benefit analysis, we took an average example of kindergarten about 2500 m<sup>2</sup> and compared Vitomodula with other current concepts, comparing the concept Energy plant with classical solution with gas boiler of 5 MW

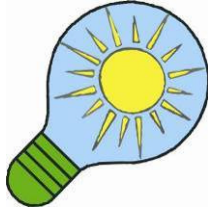
In the analysis took into account all the investment and operation costs incurred at each of the concepts.

Investment:

- Equipment
- The cost of heating between the source-consumer
- Heat exchanger station
- Project Cost
- Cost of license and assent

Exploitation:

- Cost of energy (affecting the efficiency of equipment, precision control, the inertia of the system ...)
- Cost of personnel
- Cost of maintenance
- Analysis of both concepts is shown that there are dramatically lower investment and operating costs compared to other known solutions, allowing the existence and application of these concepts more than justified.
- Energy plant and Vitomodul in addition to cost-effectiv and stand:
- Quick and efficient installation
- The ability to use energy leasing or loan
- Fully automatic operation with remote monitoring and control
- Absolute compliance with the European Declaration for energy facilities, with CE / TUV mark
- High efficiency and reliability



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## DMS – BASIS FOR INCREASING OF THE PENETRATION OF GREEN DISTRIBUTED GENERATION IN DISTRIBUTION NETWORKS

Vladimir Strezoski<sup>8</sup>, Dragan S. Popović, Duško Bekut,  
Goran Švenda

Telvent DMS LLC for power engineering, Novi Sad, Serbia

### **Abstract**

*Modern Smart Distribution Grid Concept forces electric power distribution utilities to integrate distributed generation as much as possible. The renewable generation is of prime interest. Within this generation, the "green" solar and wind are the most important. This paper proves that Distribution Management System is a unique powerful tool for realizing of two imperatives of modern distribution utilities: 1) absorption of as much of available green generation as possible and, consequently, 2) increasing of the limit of distributed generation integration. The proof is obtained by the description of a set of power applications (analytical calculations) integrated in the Distribution Management System, which are necessary for realizing of the two noted imperatives.*

### **1. Introduction**

Modern (electric power) distribution utilities are faced with high penetration of distributed generators (DGs). The most attractive are those which use green – solar and wind energy (Green Distributed Generators – GDGs). This penetration is strongly forced by modern societies (Green Energy Acts) as a part of the Smart Distribution Grid (SDG) concept introduction. Thus, the following two *imperatives* are established in modern distribution utilities:

1. Absorption of the GDGs production (absorption of the available GDGs production as much as possible),
2. Increasing of the GDG integration limit (increasing of the limit of the GDG penetration into distribution network to the maximal extent).

The main goal of this paper is to prove that both imperatives can be realized only by application of Distribution Management System (DMS). The penetration of the GDGs into distribution network influences more or less its operation. The stronger this penetration is, the higher the level of this influence is. Human experience and rules of thumb [1], single line voltage drop compensation (SLVDC), provided by on-load tap changing supply transformers (LTCs) and voltage regulators (VRs), as well as reactive power (Var) resources [2], are not enough for the realization of both above stressed imperatives of modern distribution utilities. This is the consequence of the fact that the DGs do not influence only voltage profiles of distribution networks. Their influence on circuit breakers/fuses capacities, relay protection setting and coordination, relay protection concept, optimal network configuration, network operation and development planning are also very significant issues. Thus, beside the voltage/reactive power (Volt/Var) control, it is necessary to use special and complex tools to resolve all these issues. All these tools are integrated into the DMS.

<sup>8</sup> e-mail: vladimir.strezoski@telventdms.com

## 2. Levels of GDGs penetration and DMS application

The operation of GDGs is intermittent. Figure 1 presents typical production profiles (GDGs production models) of a photo voltaic (PhV) DG for three different profiles of daily insolation [3]. Wind GDGs production models are similar, but they are protracted over all 24 hours of the day.

When the GDGs penetration into a distribution network is high, their intermittence significantly influences the network equipment operation. Consequently, the GDGs penetration can be classified as shown in Table 1.

With a small number of exceptions, DGs with higher ratings are usually three-phase and they are usually connected to medium voltage (MV) network through corresponding transformers; DGs with smaller ratings are usually single-phase and they are usually connected directly to low voltage (LV) network.

To absorb as much of the available generation as possible and, consequently, to increase the GDG penetration limit, different tools (procedures) for network management and planning of its development have to be applied. All these tools are integrated into the DMS.

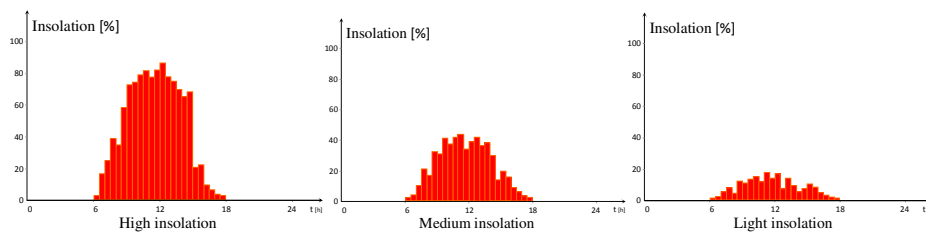


Figure 1. Typical productions of a PhV DG for three different profiles of daily insolation

Table 1. Levels of GDGs penetration

Level No.	Influence to:	Comment
1	No influence	The number of GDGs is so small that they do not influence the network equipment functionality.
2	Circuit breakers/fuses capacities	It is necessary to increase the circuit breakers/fuses capacities.
3	Volt control devices resetting	It is necessary to reset the automatic voltage regulators (AVRs) of load tap changing transformers (LTCs) and voltage regulators (VRs), and Var resources as well.
4	Relay protection operation and concept	It is necessary to reset the relay protection and relay protection concept due to the appearance of reversal power flow.
6	Network reconfiguration	It is necessary to reconfigure the network to change the GDGs connections from one feeder to adjacent one.
7	Network reconstruction	It is performed when other measures cannot keep the network state within specified current and voltage limits.

The DMS is the basic platform of the modern SDG concept. It is applied for distribution network management and development planning in an optimal way from the point of view of a wide range of criteria. Basically, the DMS integrates real-time Supervisory Control and Data Acquisition (SCADA) system, Network Data Base and Network Mathematical Model, as well as a set of power applications (analytical calculations). DMS power applications which are the most important for the considered matter, together with their functionalities, are

listed in Table 2.

*Table 2. DMS power applications and their functionalities*

<b>No.</b>	<b>DMS power application</b>	<b>Functionality</b>
1	<i>State Estimation</i>	The application is used in real-time condition for the assessment of current network state in presence of the GDGs production. It is supported by the Weather Information System (WIS).
2	<i>Power Flow</i>	It is a basic DMS power application used for the calculation of network state, for specified loads, the GDGs production and network root voltage.
3	<i>Fault Calculation</i>	It is another basic DMS power application used for the calculation of network state in fault (short-circuit) condition, in presence of GDGs.
4	<i>Circuit Breakers/Fuses Capacity</i>	The application is used for checking of the breakers and fuses capacities against network short-circuit currents, in presence of GDGs.
5	<i>Relay Protection</i>	The application is used in two modes: 1) for (re)setting and (re)coordination of relay protection and 2) for the selection of the new protection concept necessary in distribution networks with reversal power flows (e.g., introducing of distance protection).
6	<i>Volt Control</i>	The application for managing of remotely controlled LTCs and VRs, as well as for setting of their AVR, taking into account the GDGs operation.
7	<i>Volt/Var Control</i>	The application is used for the optimization of network state taken into account different levels of the GDGs operation.
8	<i>Network Reconfiguration</i>	The application is used for the elimination of technical limits violation caused by the GDGs operation.
9	<i>Switching Sequence Management</i>	The application is used for performing of the set of switching operations which are necessary to transfer the network from current to target topology (e.g., to transfer a part of a feeder with the GDGs to an adjacent feeder).
10	<i>Optimal Network Reinforcement</i>	The application is used for solving of a local network problems caused by the GDG operation.
11	<i>Volt/Var Devices Planning</i>	The application is used for optimal planning of new Volt/Var resources in accordance with a specified criterion. One of the main optimization constraints is the specified GDGs integration level.
12	<i>Network Development Planning</i>	The application is used for optimal medium- and long-term network development planning. The optimization constraint that is of prime interest for the matter considered in this material says: a network of a specified supply transformer has to be designed to provide the integration of a specified quantity of GDGs of a specified type (e.g., solar and/or wind).

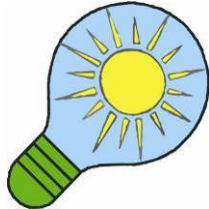
### 3. Conclusion

The experience about the operation of modern distribution networks shows that the rules of thumb and voltage control by application of LTC and VRs provided by SLVDC (and Var resources also) are not enough to realize both imperatives of modern distribution utilities regarding the integration of green energy in their networks: 1) absorption of the GDGs production and 2) increasing of the GDG integration limit. This is the consequence of the fact that DGs do not influence only voltage profiles of distribution networks. Their influence on circuit breakers/fuses capacities, relay protection setting and coordination, relay protection concept, optimal network configuration, network operation and development planning, is also a very significant issue. Thus, it is necessary to use special and complex tools to resolve all these issues. The exposed

material proves that the DMS is a unique powerful tool for coping with all these issues and realizing of both noted imperatives.

#### **4. References**

- [1] R. A. Shayani, M. A. G. de Oliveira: Photovoltaic Generation Penetration Limits in Radial Distribution Systems; *IEEE on PS*; **26**(3), 2011, pp 1625-1631.
- [2] F. A. Viawan, A. Sannino, J. Daalder: Voltage control with on-load tap changers in medium voltage feeders in presence of distributed generation; *Electric Power Systems Research*; **77**, 2007, pp 1314-1322.
- [3] C. Vincent: Distributed Energy Resources Integration Challenges and Opportunities, Global Center of Competency for Energy and Utilities, IBM, 2005



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## NEW TECHNOLOGIES IN THE PRODUCTION OF MOTOR FUELS FROM RENEWABLE ENERGY SOURCES

**Borivoj Adnađević<sup>9</sup>**

Faculty for Physical Chemistry,  
11158 Beograd, Studentski trg 12-16, Serbia

### **Abstract**

*The development of the energy sector in Serbia until 2015 and the Implementation Program of the Energy Development Strategy of the Republic of Serbia in the AP Vojvodina until 2012 in the area of motor fuels are critically analyzed.*

*The potentials of the AP Vojvodina are presented relevant to the production of bio-ethanol and motor fuels (petrol and diesel) on the basis of renewable raw materials: lignocelluloses materials, coal, oil shale and micro algae and combustion gases.*

*Physicochemical and technological-technical grounds for new procedures of generating motor fuels by microwave pyrolysis and hydrothermal liquefaction are presented.*

*The effects of various degrees of purification and hydro-processing of pyrolytic oils obtained by microwave pyrolysis on the yields and quality of motor petrol synthesized by catalytic cracking of pyrolytic oils are tested.*

*The influence of basic technological parameters such as pressure, temperatures, types and concentrations of catalysts on the quality of bio-oils obtained from hydrothermal liquefaction of micro algae and swine manure are also presented.*

*New strategic directions of the energy development in the AP Vojvodina in the area of motor fuels and practical activities aimed at their implementation are proposed.*

**Keywords:** oil shale, swine manure, micro algae, pyrolysis and hydrothermal liquefaction.

### **1. Introduction**

Biofuels are solid, liquid or gas materials which contain renewable biomass or which are obtained from it. The first generation of liquid biofuels (corn bio-ethanol, soy bio-diesel) was produced and is still being produced by means of biomass serving as human and animal food and because of that, this has been the subject matter of critical debates ever since. As a raw material for the production of the second generation biofuels (bio ethanol and bio diesel) various waste lignocelluloses materials are used such as sawdust, corn stalks, straw, sugar beet shreds, palm and jatropha oils.

Liquid biofuels of the third and fourth generations – bio-oils will be produced from a so called non-traditional raw materials such as algae, bacteria, yeasts and CO<sub>2</sub> and in the next ten years, they will become dominant motor fuels and raw materials for the production of organic matters.

---

<sup>9</sup> e-mail: bora@ffh.bg.ac.rs

The basic achievements in the generation of the second, third and fourth generations of bio-petrol and bio-diesel were presented in papers at international forums on renewable energy sources in 2009 and 2010 (1, 2).

This paper deals with physicochemical and technological-technical basis of new processes for obtaining biofuels of the third generation – microwave pyrolysis of oil shale coupled with catalytic cracking of pyrolytic oils and hydrothermal liquefaction of micro algae and swine manure.

## 2. Materials

Oil shale from Aleksinac Basin is used as the raw material for obtaining pyrolytic oil by means of microwave pyrolysis.

Micro algae of the species *Botryococcus UTEX 572* from the Culture Collection of Algae at the University of Texas, Austin and swine manure from the private pig farm in Indija are used as raw materials for hydrothermal liquefaction. The contents of ash, sulphur and nitrogen compounds, Konradson coke in the pyrolytic oil is determined by standard ASTM methods. The degree of pyrolytic oil conversion, petrol fraction and coke yields are determined by MAT-test (ASTM,D-3907-8). The contents of moisture, organic matters and ash in *Botryococcus braunii* and swine manure are determined by gravimetric methods.

The elementary composition (contents of CHNO) *Botryococcus braunii*, swine manure and obtained bio-oils is determined by LECO Elemental Analyzer Model CHNS-932. The calorific value of bio-oil is determined by Parr's Calorific Bombs, Model 1351. The viscosity coefficient of bio-oil is measured on Brookfield's Viscometer.

The microwave pyrolysis of oil shale is done on the apparatus whose construction is given in the paper Adnađević (3). The construction and description of the laboratory reactor with the fixed layer of catalyst for the catalytic hydro-processing and cracking of the pyrolytic oil is shown in the paper Adnađević (3).

Hydrothermal liquefaction of *Botryococcus braunii* and swine manure is done in the device which is described in the paper Adnađević and Popović (4).

## 3. Results, Elaboration and Conclusion

The influence of hydro-processing of pyrolytic oil on the conversion degree of pyrolytic oil into petrol and the yield of petrol fraction and coke are presented in the Table 1.

Table 1. Influence of Hydro-Processing on Pyrolytic Oil on the Conversion Degree of the Yield of Petrol Fraction and Coke ( $T=510^{\circ}C$ ,  $p=1\text{ atm}$ , volumetric speed  $=14h^{-1}$ )

Stage of Processing	Degree of Conversion %	Yield of Petrol Fraction %	Yield of Coke %
Pyrolytic oil	25	30	12
Separation of ash and coke	38	41	7
Separation of ash and coke and hydro-processing	78	70	3
Gas oil	75	68	3.5

As it can be seen on the basis of results given in the Table 1, the hydro-processing of pyrolytic oil obtained by means of microwave pyrolysis of oil shale is a rational process which generates high quality raw material for catalytic cracking, that is, the production of high octane motor petrol .

The Table 2 shows the influence of temperature on the conversion and physicochemical characteristics of bio-oil obtained from hydrothermal liquefaction of micro algae *Botryococcus braunii* (p= 18 Mpa)

*Table 2. Influence of Temperature on Conversion and Physicochemical Features of Bio-Oil Obtained from Hydrothermal Liquefaction of Micro Algae Botryococcus Braunii*

<b>Characteristics</b>	<b>200°C</b>	<b>250°C</b>	<b>300°C</b>	<b>320°C</b>	<b>350°C</b>	<b>300°C</b>
Conversion	65	83	95	89	60	97
C %	77	80	85	82	83	86
H %	15	15	14	14	14	13.9
N %	0	0.5	1.0	2.5	1.5	0.1
O %	8.0	4.0	0	1.5	1.5	0
Calorific value MJ/kg	46.3	48.1	49.1	47.8	48.12	49.3
Viscosity Coefficient , 50C, nPas	230	78	75	76	77	65

Maximum conversion degree of micro algae into bio-oil of 97% is achieved at the temperature of 300°C by using 5% of catalyst. The calorific value of obtained bio-oil with and without catalyst significantly exceeds (25%) the calorific value of traditional fuels such as heavy fuel oil, diesel and motor petrol.

The influence of contact time of swine manure during hydrothermal liquefaction on the bio-oil yield is given in the Table 3 (T= 320°C, p= 10 Mpa).

*Table 3. Influence of Contact Time of Swine Manure at Hydrothermal Liquefaction on Bio-Oil Yield*

<b>Contract Time (min)</b>	<b>Yield (%)</b>
5	14
10	20
15	30
30	28
45	28
60	20

Hydrothermal liquefaction of swine manure at T= 320°C and p= 10 Mpa with the contact time of 15 minutes generates maximum yield of bio-oil of 30% with calorific values close to calorific values of traditional fuels.

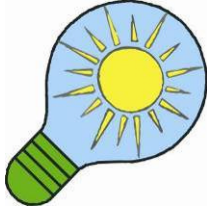
On the basis of presented results, it is possible to conclude the following:

- Non-traditional bio-renewable raw materials: waste lignocelluloses materials, manures of different origin, low quality coals, oil shale and combustion gases represent realistic and cost effective raw materials for obtaining the new generation of motor fuels and hydrogen.
- Coupled microwave pyrolysis with catalytic cracking in a fluid layer and hydrothermal liquefaction of biomass are new highly efficient processes of transformation into biofuels and bio-energy carriers.

- Obsolete and irrational strategic concepts in the production of biofuels, bio-energy carriers and raw materials for organic syntheses should be rejected as soon as possible and new technologies and products should be included in the development on time.

#### 4. References

- [1] B. Adnađević: New Bio-Renewable Raw Materials and Technologies for Obtaining Motor Oils and Chemicals, III International Forum on Renewable Energy Sources, "New Clean Technologies", N.Sad, 2009
- [2] B. Adnađević: Catalytic Conversion of CO<sub>2</sub> into Motor Fuels, IV International Forum on Renewable Energy Sources, "Energy Safety and New Technologies", N.Sad, 2010
- [3] B. Adnađević: Review of Basic Achievements in the Development of Zeolite Catalysts and Novel Catalytic Processes, Monographs "New Challenges in Catalysis", ed. P. Putanov, Sasa Brand in N. Sad, pp 70-95, 1997
- [4] B. Adnađević, A. Popović: Hydrothermal Transformation of Sawdust into Synthetic Coke-Mechanism and Influence of Experimental Parameters, *Energy Source, Part A: Recovery, Utilization and Environmental Effects*, **31**(10), pp 807-813, 2009



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## ZÖLDFORRÁS BIOGAS POWER PLANT PROJECT

Gabor Lehoczki<sup>10</sup>  
EDF DEMASZ, Hungary

### **Abstract**

*The idea of establishing a biogas power plant in Szeged dates back to several years. This meant realizing the research results of the University of Szeged and the cooperation of some local agricultural companies.*

*The objective of the cooperation is to establish a cogeneration renewable power plant based on biogas produced from pig manure and as a result to generate and supply electricity and heat.*

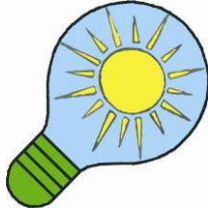
*All the circumstances are set for this in the North of Szeged as the conditions for an establishment that is successful financially and energetically efficient are most likely to be found here. A pig farm is located here that would supply the environmentally harmful pig manure being an important base material for the power plant; nearby there is a lucern dryer which shall use the heat produced in the plant. Maize silage being another important base material for the operation of the plant is also grown nearby this area.*

*The Biotechnological Department of the University of Szeged developed a method that is more efficient than all the other known methods to produce biogas. EDF DÉMÁSZ financially supported the improvement of the method. In order to verify the results of the successful laboratory and demonstrative experimental results the University of Szeged and EDF DÉMÁSZ decided together to finance and prepare the establishment of a prototype biogas plant and then founded Zöldforrás Energia Project Company.*

*The objective of the „Zöldforrás Biogas Power Plant” project is to establish an economically operating biogas power plant in the region of Szeged. The plant shall rely on local characteristics and assists the decreasing of negative environmental effects. Moreover it wishes to create the conditions for the establishment of an industrial experimental base for the biotechnological research works in Szeged in order to facilitate the development of biogas technology in Hungary. EDF DÉMÁSZ plans with a 25-year-long duration of the project.*

---

<sup>10</sup> e-mail: [gabor.lehoczki@edf.hu](mailto:gabor.lehoczki@edf.hu)



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## APPLICATION OF MEDIUM VOLTAGE CELLS FOR SMALL POWER PLANTS

**Borut Česnik**<sup>11</sup>, *IMP-ten-telekom, Vojkova 58 Ljubljana*  
**Goran Pješčić**, *Elektrošumadija Savića Mlin 2, Mladenovac*  
**Zoran Nedoh**, *TSN d.o.o., Šentiljska 49 Maribor, Slovenia*

### **Abstract**

*We would like to present several configurations for medium voltage cells in a block intended for a switchgear at the connecting point of a small power plants.*

*We would like to devote the most of our attention to the basic configuration (feeder-feeder-coupling-metering-transformer cell) and to the protection which is envisaged for this configuration.*

*We would also like to present the configuration which has an outlet for own consumption (feeder-feeder-house-coupling-transformer cell) . This configuration has been developed especially for the requirements of small bio-gas fired power plants. We would also like to present shortly the configuration for smaller power plants (feeder-metering-transformer) or special configurations (water-transformer) which do not have measurements.*

**Keywords:** *MV cells, MV switch disconnecter, power plant switchgear assembly*

### **1. Introduction**

It is well known to everybody that the global energy picture shows a very poor situation. The reason for that is the huge growth of population, as well as the growth of energy consumption per capita. We are destroying the environment with conventional energy processes in particular with gas emissions which cause the occurrence of acid rains and the creation of greenhouse effects.

The very fact itself that we constantly dispose with lower availability of electrical energy is pushing us to develop new possibilities for energy production. In so doing, we must take into account not only economic and energy reasons but also the effects on the environment and the climate.

Taking into considerations the above stated, as a logical solution appears air-insulated disconnecter.

For the connecting point of small power plants to the electrical network, a special medium voltage block has been developed for the connection of small power plants to the network which consists of cells with standard configuration. Every small power plant has its own specificities which must be taken into account when designing the medium voltage part of the power plant.

---

<sup>11</sup> e-mail: [b.cesnik@imp-tentelekom.si](mailto:b.cesnik@imp-tentelekom.si)

## 2. Configuration of Disconnecter Blocks (Plants)

All presented configurations consist of cells with fixed disconnector devices (CN4K) and cells with withdrawable units, that is, trolleys (type CN2V).

The basic configuration is the switch disconnector block composed of cells shown in the Figure 1.

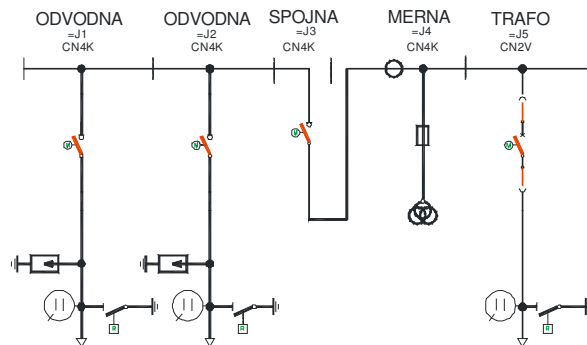


Figure 1. Basic Configuration of Medium Voltage Cells for the Connecting Point of Small Power Plants

The first two cells are for the distribution (passing TS) and their network. The coupling cell gives an opportunity to separate the part which serves for the distribution from the part which is intended for the power plant. In this way, we have enabled safe operations at the MV part of the power plant which is used as the connection to the network also in case of voltage presence in the passing part (input –output).

The metering cell is standard withdrawable unit consisting of power and voltage transformers which are protected by fuses at the integral holder.

All the above listed cells are of the type CN4K with fixed disconnector device (power disconnector).

The transformer cell is of the type CN2V and has installed vacuum circuit breaker on a withdrawable unit (trolley). It is equipped with a guard circuit relay which is chosen so that it corresponds to the requirements of the disconnector point. The circuit breaker on the withdrawable unit enables very quick and simple maintenance and servicing. Such a configuration has proved to be as the most suitable for small power plants.

In case the power plant has large own consumption, we advise to choose the configuration presented in the Figure 2.

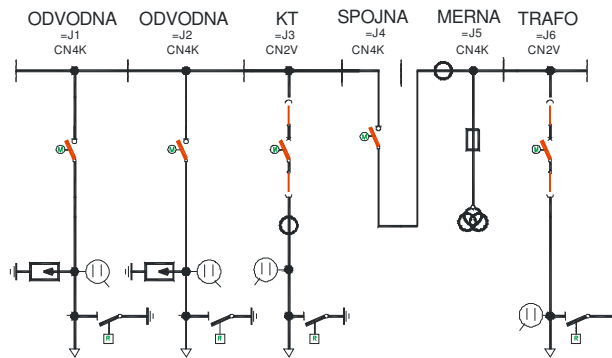


Figure 2. Configuration of Medium Voltage Disconnecter Block for Power Plants with Large Own Consumption.

Such an arrangement of disconnector cells is usually used for disconnector points of biogas fired power plants. For the purpose of consumption during the biogas generation, it is logical to choose cell configuration for own consumption.

In case the distribution company does not require making of the disconnector point of small power plant as the passing transformer station, as logical solution appears to be the configuration presented in the Figure 3.

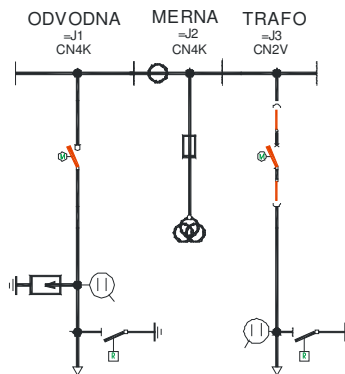


Figure 3. Configuration of Medium Voltage Cells for Power Plants as End TS

In this way, the number of feeder cells has been reduced, the configuration has been optimized and the coupling cell has been removed. In practice, it has been proved that for this disconnector block with end transformer station, it is not a problem to get a permit for the disconnection which is necessary for maintenance and servicing.

In case there are several smaller producing units at different locations, we should select the configuration without measurements (Figure 4).

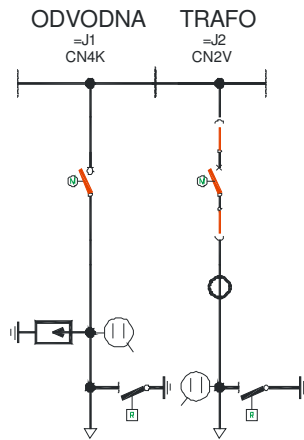


Figure 4. Configuration of Medium Voltage Cells without Metering

If we make a simplification and instead of circuit breakers, electricity transformers and protection which belongs to this set we use the configuration with the power disconnector and fuses, the configuration will be as the one presented in the Figure 5.

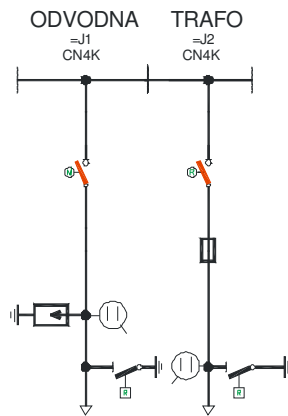


Figure 5. Configuration of Medium Voltage Cells in Switch Disconnecter without Metering

Transformer cells in this configuration do not allow installation of a motor drive in a device as in the case of previously described configuration. These simple configurations are usually used for smaller units of solar power plants which are then led to the collecting pint of the power plant where measurements are done.



Figure 6. Configuration of Medium Voltage Cells and Corner Connection Due to Limited Space in the Station

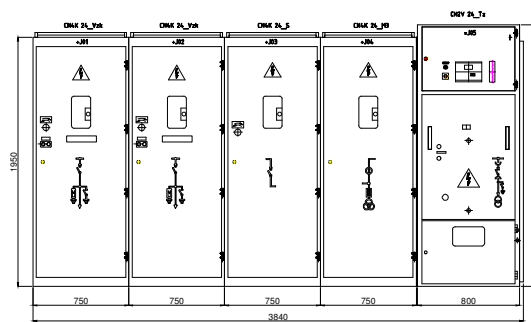


Figure 7. Configuration of Medium Voltage Cells for the Basic Configuration of the Voltage Level of 20 kV

### 3. Conclusion

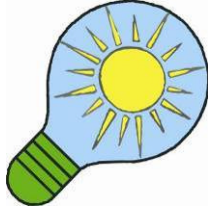
For the requirements of connecting points for small power plants, the switch disconnector block composed of air insulated cells is highly recommendable. The simple structure enables the user to perform himself most of the operations associated with maintenance and servicing. Due to its modularity, the user can change configuration and thus adjust to new requirements. Also, this is the way in which new units can be added.

The design of the switch disconnector block enables installation of equipment of various manufacturers.

As opposed to plants with SF<sub>6</sub> devices, we do not have any problems with environmental impacts either at the time of utilization or at the time of disposal. All materials used for making the switch disconnector block are not harmful for the environment or people themselves.

### 4. References

- [1] JP Elektro Ljubljana, Internal Documentation
- [2] JP Elektro Celje, Internal Documentation
- [3] TSN d.o.o., Internal Documentation



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## MONITORING OF SYSTEMS BASED ON RENEWABLE ENERGY SOURCES

Nebojša Misković<sup>12</sup>

SAGA d.o.o. Beograd, Milentija Popovića 9, Belgrade

### Abstract

*In the recent years, smart grids for electrical energy systems and the focus on renewable energy sources have become the most interesting topic in the energy domain. While the industry is primarily dealing with the adoption of interoperable standards for metering devices and defining rules and specificities which justify large investments into smart grids and smart metering, these projects have changed their character and have become primarily ICT projects. This domain is particularly prominent in the systems which are based on renewable energy sources as they have spatial dimension, absence of any sort of obsolete infrastructure, and also the need of continuous monitoring of the system's performances because of their temporal component. Since care is taken especially of communication routes, data center consolidation, software performances and the system's integration, such as billing and CRM, these projects have become in planning and implementation, in fact, ICT projects.*

**Keywords:** ICT, DATA center, monitoring, mobile operators, M2M

### 1. Introduction

The systems based on renewable energy sources have a strongly pronounced spatial dimension. No matter whether they concern wind power plant parks which occupy hectares of space or solar panels which can be installed on every building, the basic feature is that there are many individual units and, as a rule, no communication route, link or connection which can join them into one network. A step forward in relation to conventional energy sources, energy sources based on renewables have also prominent temporal dimension since their utilization varies depending either on the time of the year, season or seemingly fully without any rules as, for example, biogas fired plants. Therefore, the need of monitoring and/or control and managing is greater than in case of conventional energy sources. As the only solution, mobile operators are imposed since for years they have based access to users by grid coverage of more than 90% of territory and 95% of population. On the other side, within the care for users, distribution companies have during years made considerable investments in the consolidation of the billing system, users interface, such as call centers, portals and introduction of complex AMI/MDM systems requiring the consolidation of data centers in the full meaning of the word from necessary adaptations of existing system rooms to modern Tier3/Tier 4 data centers with the famous figure of "5 nines" enabling system accessibility.

---

<sup>12</sup> e-mail: [aleksandar.djordjevic@saga.rs](mailto:aleksandar.djordjevic@saga.rs)

## 2. Methods

In official publications of groups for standards, EU working groups and telecommunication industry itself, the ICT domain has become crucial in considerations of energy efficiency and as one of basic objectives specified in the Plan 20/20/20. A large problem for the introduction of a system based on renewable energy sources is the inability of efficient monitoring of a large number of single energy sources. The basic question here is: Has the problem of coverage been overcome?

At the same time, there is a struggle to ensure adequate communication infrastructure since modern data centers are available only to large service providers. To what extent it is possible to expect that grid technologies and accompanying infrastructure are ready to offer to distribution companies the things they need and for which they are ready to pay. However, to one service provider investment in a data center is justifiable since the same building will be the node for multimedia and internet communication. How much is DSO ready to pay for a system which is only a support for his basic activity?

Finally, what ICT can do for faster market deregulation and complete transparency in the transport and supply of electrical energy.

## 3. Elaboration

In the past year, a lot of things were changed among mobile operators. 3G grids with the focus on data transfer have fully matured and now they can be used as a supplementary link in a standard and reliable way by the mobile network. The number of M2M (machine to machine) SIM cards issued in Europe doubles at the annual level and this is not the only thing. Accompanying systems enable activation and changes of card purposes without any intervention of the operator and unique bills allow introduction of systems without additional loads to either an operator or a user.

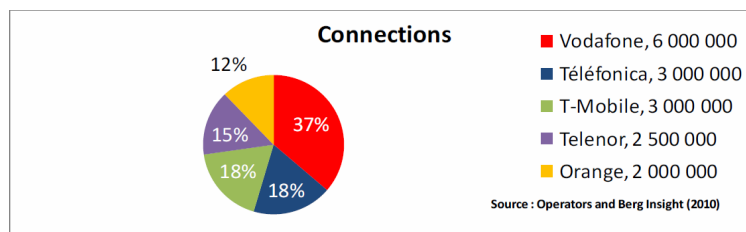


Figure 1. Number of M2M Connections of Largest European Operators

The regulations have followed trends with operators and, for example, there is a unique IMSI range for M2M SIM cards. On the other side, operators have understood that for obtaining electromagnetic systems, it is necessary to do something else. Large Pan-European operators have made a special core of mobile networks for servicing M2M traffic for the purpose of service reliability and separation of critical business traffic from standard traffic of residential users. The industry has reacted positively and the problem whether it is possible to make does not exist any more but how to exploit to the maximum what the mobile operators are ready to offer. Therefore, in the systems based on renewable energy sources, the mobile operators' networks are considered to be primary choice and represent one of preconditions for further development of this branch.

On the other hand, there are some questions concerning the consolidation of the data center. In spite of great advancements in grid technologies and availability of new, cheap and efficient systems for the infrastructure of data centers, the largest assistance has been again provided by the ICT industry through efficient solutions based on virtual infrastructure and managed service operators which enable access to high-tech with maximum availability to every, even the smallest producer. Every producer of alternative energy is limited by a micro position which is the source of energy itself and which gives little space for considerable investments into ICT which is in the present situation is not even necessary .

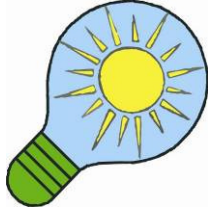
For this reason, the ICT has become an initiator of the development of alternative energy industry. Thanks to reliable infrastructure, numerous models have been devised primarily by the EU and its corresponding bodies which advocate bringing together small energy producers and their easier access to the market. The High-Level Advisory Group on ICT for Smart Electricity Distribution Networks has made recommendations for the formation of virtual power plants (VPP). The VPP concept is not a technology in itself but mutual joining of various producers through corresponding applications. The VPP is in itself based on several different sources of energy at different locations and in different ownership which will ensure access to the distributing company similar to the one of a classical generator and with some advantages, as well.

#### **4. Conclusion**

The ICT and modern communication technologies have become the initiator of development of new electrical energy networks and have also brought special and essential value which ensures that systems based on renewable energy sources are positioned at the market not only through the objectives of the Directive 20/20/20 but also through their realist position and market value. While telecommunication industry has continued with providing new opportunities in line with its role, the EU and its working committees have continued with experimental projects (Microgrids, More Microgrids, DISPOWER, CRISP, FENIX) which favor and expand the ICT domain in the electrical energy sector. However, a special contribution of the ICT domain concerns the monitoring of systems based on renewable energy sources even to such an extent that sometimes, with a dose of courage, these project are called ICT projects. Since the success has been absolute, the key influence of the ICT is expected now on the development of the distribution networks for electrical vehicles, as well in the segment of the house networks and smart household appliances

#### **5. References**

- [1] Managed Global M2M Connectivity Services, Vodafone Group
- [2] Smart Grid Deployment. Iberdrola in Spain, Alberto Sendin, Smart Metering SEE 2011
- [3] ICT for a Low Carbon Economy Smart Electricity Distribution, July 2009
- [4] 3GPP Mobile Standard (available online at [www.3gpp.org](http://www.3gpp.org))
- [5] Analysis of State-of-the-art Smart Metering Communication Standards, Klaas De Craemer, Geert Deconinck
- [6] Functional requirements and Technical Specification for AMI/MDM System – Public Enterprise Electricity Industry of Serbia (JP Elektroprivreda Srbije) May 2010
- [7] Kema Consulting, “Smart Meter Requirements - Dutch Smart Meter Specification and Tender Dossier V2.31,” Jan. 2009



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## SUSTAINABLE ASSET, RESOURCES AND MAINTENANCE MANAGEMENT BY SOFTWARE TOTAL OBSERVER

**Boško Milosavljević<sup>13</sup>**, ION Solutions Ltd, Novi Sad

**Zoran Miškov**, PD Elektrovojvodina Ltd, Novi Sad

### **Abstract**

*Various aspects for the optimization of business processes in modern business operations which are aimed at increasing efficiency, reducing costs and rising the quality always have as a starting point the formation of a database which should be used for establishing analytics and formulation of metrics. This database should provide an overall set of information which will be further used for analyses and identification of areas for improvements and savings.*

*Traditional information systems which are focused on specified business processes and which in their reporting-presenting layer focus on the activities within one process do not enable rendering high quality information and obtaining the set of derived information which are crucial for a decision making process.*

*Modern information systems for asset management are integrated with respect to the inclusion of not only processes which are realized on a daily basis by the use of software but also with respect to the inclusion of other (legacy) information systems in order to create the set of data which will enable the analysis of business operations without any restrictions relevant to the context in which they have been generated or collected.*

*TotalObserver is a software solution intended for efficient asset management for medium and large users with geographic, organization and cost diversified structure. It belongs to integrated solutions with open interface towards other information and technical systems. It has already proved its applicability to our business systems in over 10 integrations for the largest property owners in our country.*

*Registration of property, organization and monitoring of maintenance and advanced (cross-context) tracking of costs are key elements of the project task which the team has been faced with.*

**Keywords:** *Asset management, property management, maintenance, facility management*

### **1. Introduction**

Taking into considerations the size of the Company "Elektrovojvodina" Ltd. (EV), the importance and size of resources which this company owns, the number of people, economic subjects and institutions which depend on the availability of the network and the quality of work of employees in the EV, it can easily be concluded that managing property owned by this company is of crucial importance.

If the focus of first aspect of high quality management is identification of business processes and their formalization then, for certain, the focus of the second aspect not less important is usually optimization of these processes.

---

<sup>13</sup> e-mail: [bosko.milosavljevic@ionsolutions.net](mailto:bosko.milosavljevic@ionsolutions.net)

The team for integration has been faced with the task which can be sublimated in the following:

- Identification of main cost points
- Identification of business process which are main holders of costs
- Analysis of standard procedures
- Integration of procedures into software solution
- Development of reports which enable the analysis of spending

## **2. Methods**

The PMI methodology has been observed in guiding the project of integration while the very realization of required software modules has been done according to the "Scrum" methodology.

## **3. Results, Elaboration and Conclusion**

The result of integration is the software solution which will introduce the support for planning regular maintenance, tracking implementation of plans, execution of regular and breakdown maintenance of both electrical energy facilities and other property of "Elektrovojvodina". On the basis of these operating data and with the connection to the company's information systems, the TotalObserver will be able to provide complete analytics required for the overall consideration, measurement and assessment of performances for this business process. This will provide an exceptionally powerful and flexible tool to both operational and strategic management in the decision making process.

## **4. Elaboration**

With reference to the needs for process management in "Elektrovojvodina" Ltd, it is necessary to integrate the information system which will meet the following requirements:

- Identification and registration of all capital property owned by the company
- Implementation of the system for annual and operational (time) planning of maintenance and the support for the planning of the utilization of resources
- Implementation of the system for managing maintenance not only for prevention but in case of breakdowns as well
- Implementation of the system for advanced monitoring of costs and the use of material and non-material resources
- Connection with the existing information systems
- Complete harmonization with the company's quality management system

TotalObserver is a software solution intended for efficient asset management for medium size and large users with geographic, organization and cost diversified structure. It belongs to integrated solutions with open interface towards other information and technical systems. It has already proved its applicability to our business systems in over 10 integrations for the largest property owners in our country.

Registration of property, organization and monitoring of maintenance and advanced (*cross-context*) tracking of costs are key elements of the project task which the team has been faced with.

## **5. Conclusion**

The project of the integration of the solution for asset management in "Elektrovojvodina" Ltd. has methodologically and in implementation encompassed the following:

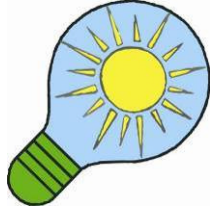
- In line with the previously made analysis of standard procedures, a well positioned solution has been realized in the sense of processes to which it provides operational support and those to

which it provides analytical support through the connection with other company's information systems

- Informatic and information basis has been set up for identification of business processes and activities which are main bearers of costs with respect to the maintenance of electrical energy and other facilities
- The procedures of interest have been integrated in the software TotalObserver, primarily the procedures for planning and maintenance, as well as procedures for monitoring and analysis
- Advanced reports have been developed in real time in order to ensure permanent analysis of costs in the context of activities
- The analysis of existing business processes necessary for centralized integration has led to the recognition of their weaknesses and a series of initiatives for the improvement of both basic and accompanying business processes

## **6. References**

- [1] Implementing Enterprise Resource Planning and Knowledge Management Systems in Tandem: Fostering Efficiency and Innovation Complementarity – S. Newell, J.C. Huang, R.D. Galliers, S.L. Pan; January 2003
- [2] Top Reasons to Implement Property Management Software – ION Solutions, November 2010.
- [3] Mechanisms for Sharing Knowledge in Project-Based Organizations - Wai Fong Boh, December 2006



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## PREVENTION OF UNAUTHORIZED USE OF ELECTRICITY IN THE DISTRIBUTION NETWORK

**Kosta Majkić<sup>14</sup>**  
*Majkić Ltd, Inđija, Serbia*

All the problems with which the Electricity Industry of Serbia (EPS) is struggling at the domestic market have inspired me to show some solutions which MAJKIC LTD created and which has changed the domestic energy market and helped EPS to make higher income.

Serbia is a potential member of EU and needs to make many changes in the period of transition. These changes will very positively affect all segments of the market. The economic situation will be stronger and with new standardization, the export of all goods will be possible to EU countries. The inhabitants will have higher salaries and domestic standards will also be much higher and the quality of life will be better.

On the industrial side, especially for the energy sector, Serbia has adapted to the market. A lot of investments have been made here but there are many things which are still slow in this part of the industry. My central point here is the problem of electricity in Serbia. Electricity is being stolen and causes problems which affects lower income for the EPS.

This is a realistic situation and with reference to my experience, targeting this problem has been very interesting to me. My first impression concerns the number of people who are trying to cheat and cut the cost by means of illegal options. The statistics show that from 2% to 5% of population steals electricity. More than 10% of the customers do not pay electricity at all and the debt sometimes exceeds 10,000 €.

The next thing which I have found out is the way how the customers steal electricity. There are more than 55 ways which have been detected so far to steal electricity. These are: mechanical, electrical, some magnet instrument blocking the system for accurate metering electricity consumptions, etc. All these things have caused big problem to the EPS (which covers the whole market of Serbia) and to the government which had to prepare laws in order to control all these things.

So, I started to prepare in advance and collect material in order to provide solutions for the Serbian government to take measures against electricity thieves. It was not so easy because there a lot of things the EPS has changed but after a very short period of time customers would find new options to cut the costs for electricity.

I wanted to find something new that will really work without any problems.

This is the system MAJK ED 3. This system does not make any changes to the electricity network of Serbia and also prevents losses. The first step is the selection of main problems which should be prevented. Here are some of them:

- To set up a system untouchable for customers
- To be protected from any kind of thefts and unauthorized changes
- To be useful for employees of the EPS

---

<sup>14</sup> e-mail: [office@majkic.rs](mailto:office@majkic.rs)

- To make quick income which is the most important for the EPS

The system covers all above points and therefore, I have presented it as something innovative and good for the domestic market. I have been involved directly in the development processes.

The first option was MAJK ED 1 which was very useful and practical for use but without hi-tech options. Through the pilot project, it was a good option for making income but without strong protection system.

During the development, I have understood that the best solution at one moment can be replaced by something even better because in real life, customers show reactions which are good for the development and it is always good to be one step in front of other companies which are trying to make something similar or better. The next solution was MAJK ED 2. This solution resolved all those things in such a way to protect the electricity network. With more options for use and more difficulties of theft this system was presented as a new solution which was much better.

Customers could not change anything. It was a sign that something good has been done and now MAJKIC LTD is able to present the final version.

However, the basic idea has been adopted by the EPS, which finally started to make income for the company. This is a very good feedback for the MAJKIC LTD and the moment for the company to start making something which will really become a good product.

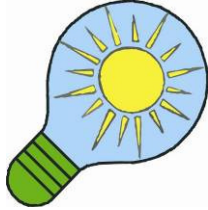
MAJK ED 3 is the best option for the protection of electricity network system in Serbia. By following these three phases of development, I have seen and recognized which points are the most important and how to avoid all bad influences in order to make the best solution.

My personal opinion is directly affected by all these things which have given me the chance to learn and see that creating a new product from zero is very difficult. This means, the investment of a lot of money, spending a lot of time (months and years) and you are not sure whether the result will be positive. Sometimes, all this can be very risky and the company which prepares the project must create a good team for risk management and decision making.

This product shows very important influences on both sides:

For MAJKIC LTD this is a big step forward in creating something that is very important for the government.

My recommendation in this case can be very practical and interesting for both MAJKIC LTD and EPS regarding the joint venture and conquering the world market. It is easier for MAJKIC LTD with already developed hi-tech project to proceed through the government company such as the EPS which has strong influence all around the world to sell this product. This is a great chance to make an entrance at the world market. The main target will be the market of the East Europe, South America, Africa, Middle and Far East. These are not developed countries which have the same problems with the part of population which makes a problem and steals from electricity companies.



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## GREEN POWER PLANT FOR THE REQUIREMENTS OF INDUSTRIAL PARK BANJA LUKA

Marko Mijić<sup>15</sup>, Miroslav Tuvic, Dragiša Zečević  
ELNOS BL Ltd., Banja Luka, Bosnia and Herzegovina

### **Abstract**

*This paper presents the feasibility study for the construction of renewable energy sources at the location of planned technological business park in Banja Luka. Projections of the technological business park's requirements for electrical and thermal energy are shown together with estimated production of electrical energy by the installation of photo panels on the roofs of buildings, as well as the wind atlas which has led to the conclusion that there is no sufficient potential for the construction of wind power plant. Then, energy and economic analysis for the utilization of animal and wood wastes which are disposed at the nearby dump site is given for the construction of a biomass plant for the production of thermal and electrical energy. At the end, there are recommendations and conclusions.*

**Keywords:** Solar energy, wind potential, biomass, cost-benefit analysis

### **1. Introduction**

The use of renewable energy sources is closely related to the increase of energy efficiency which is explained within the adopted EU Directives formulated as "20-20-20 by 2020" (20% share of renewable energy sources, 20% reduction of consumption, 20 % reduction of CO<sub>2</sub> emissions until 2020). For this reason, the city's development agency "CIDEA" Banja Luka together with companies "ELNOS BL" Ltd. and Institute "IEE" Ltd. Banja Luka have launched the preparation of the study for the construction of the "Green Power Plant" for the requirements of the Technological Business Park (hereinafter referred as TBP). The location of the planned TBP is in the northeast part of the City of Banja Luka. Totally planned area for industry is around 205.5 ha. The estimate of maximum annual simultaneous load is made on the basis of the preliminary design for the TBP in line with the applicable regulations in this field and amounts to 18626 kW. Total heat losses of the technological business park amount to 54275 MW (the heat loss estimate has been made according to DIN 4701). The above mentioned study includes the analysis of the justification for the construction of renewable sources of electrical energy at the location of the technological business park and shows the results of the cost-benefit analysis in order to obtain technical and economic elements which will be the basis for a decision making process about further activities related to the construction of mentioned energy facilities.

---

<sup>15</sup> e-mail: Marko.Mijic@elnosbl.com

## 2. Analysis of Possibilities for Using Solar Energy

The installation of photovoltaic panels is anticipated on the roof with the area of 30 000 m<sup>2</sup>. The Figure 1 shows the map with average annual sun irradiation in Bosnia and Herzegovina (kWh/m<sup>2</sup>) based on which it is determined that the average annual irradiation for the region of Banja Luka varies from 1125 to 1500 kWh/m<sup>2</sup>. The project analysis is done by means of the software PV-Sol and data about irradiation and radiation are taken from the website of the PV GIS. In the relevant analysis, the use of the prefabricated structure "Schirocco" Germany, photovoltaic panels (modules) produced by "Sovello" (SOVELLO SV-X-210, with the power of 210 W per module) are taken into consideration. For covering the complete roof surface, it is necessary to install 4536 panels with the total power of 952.56 kW. Technical solution with the installation of 84 invertors of the type SMA SMC 10 000TL ( $\eta=0.98$ ,  $P_n=10$  kW) and total nominal power of 840 kW is chosen.

Table 1. Data about Photovoltaic Power Plant Obtained by Software PV-Sol

Location:	Banja Luka	
Climate Data Record:	Banja Luka	
PV Output:	952,56	kWp
Gross/Active PV Surface Area:	7.117,66 / 7.114,07	m <sup>2</sup>
PV Array Irradiation:	10.030.243	kWh
Energy Produced by PV Array	1.118.565	kWh
Grid Feed-in:	1.118.565	kWh
System Efficiency:	11,1	%
Performance Ratio:	83,3	%
Inverter Efficiency:	95,7	%
PV Array Efficiency:	11,8	%
Specific Annual Yield:	1.174	kWh/kWp
CO2 Emissions Avoided:	990.783	kg/a

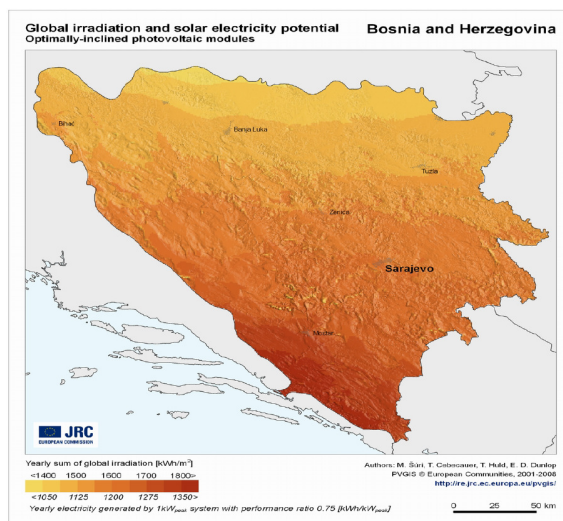


Figure 1. Map of Sun Irradiation in Bosnia and Herzegovina



Figure 2. Block Diagram of Photovoltaic Power Plant

Actively used surface (surface required for the installation of photovoltaic panels) is cca 7120 m<sup>2</sup>. Taking into account active surface, the totally installed power of the photovoltaic power plant amounts to 952.56 kWp out of which the outgoing power amounts to 1118.565 kWh. The value of the total investment for the construction of the above mentioned photovoltaic power plant is cca 3,000,000.00 € (without VAT). With the average annual irradiation of 1174 kWh/kWp and privileged tariff of 0.285 €/kWh (the expected subsidy of the regulatory commission of the Republic of Srpska), the period of 20 years is considered in the cost-benefit analysis and the conclusion is that the investment will be repaid for approximately in 9 - 10 years.

### 3. Analysis of Possibilities for the Construction of Wind Power Plant

The analysis of possibilities for the construction of wind power plant at the wider location of the technological business park is made for 10 locations on the basis of data from the Wind Atlas which has been prepared by the company Sander+Partner GmbH. On the basis of information about the wind potential, it is concluded that there are no possibilities for the construction of the wind power plant. Namely, every wind generator is designed for certain wind velocity ( $v_{cut-in}=2.5-4.5$  m/s,  $v_n=10-16$  m/s,  $v_{cut-out}=20-30$  m/s). For very small velocities, the wind generator is not cost efficient.

Table 2: Average Wind Velocities in the Period 1978-2007,  $h=50m$

Naziv lokacije	Geografska širina (°)	Geografska dužina (°)	Prosječna brzina vjetra (m/s)
Lokacija 1	44° 52' 45.37" ≈ 44,879°	17° 11' 25.63" ≈ 17,190°	3,6
Lokacija 2	44° 52' 51.13" ≈ 44,881°	17° 10' 15.79" ≈ 17,171°	4,0
Lokacija 3	44° 54' 16.50" ≈ 44,905°	17° 9' 16.93" ≈ 17,155°	4,0
Lokacija 4	44° 54' 49.51" ≈ 44,914°	17° 13' 42.56" ≈ 17,228°	3,8
Lokacija 5	44° 54' 49.73" ≈ 44,914°	17° 11' 2.61" ≈ 17,184°	3,8
Lokacija 6	44° 58' 16.50" ≈ 44,971°	17° 1' 19.89" ≈ 17,022°	4,6
Lokacija 7	44° 50' 4.33" ≈ 44,835°	17° 9' 10.55" ≈ 17,153°	3,4
Lokacija 8	44° 52' 10.95" ≈ 44,870°	17° 2' 21.54" ≈ 17,039°	3,6
Lokacija 9	44° 57' 28.17" ≈ 44,958°	17° 5' 8.32" ≈ 17,086°	4,0
Lokacija 10	44° 51' 54.80" ≈ 44,865°	17° 4' 38.40" ≈ 17,077°	3,8

### 4. Analysis of Possibilities for the Biomass Plant

The location of the technological business park is in the close vicinity of the waste dump which opens the possibility of using wastes for energy purposes. The proposed technical solution is based on wood wastes as supplementary fuel and animal wastes as primary one. Since there is the growth of annual quantities of animal wastes, it is possible to make projections of waste generation in the next periods, possible quantities of heat energy which can be obtained from this waste, as well as the quantity of wood waste as supplementary fuel (Table 3).

Table 3. Projections of Possible Quantities of Thermal Energy količine toplotne energije

Year	Obtained Energy		Initial Fuel
	MWh/g	MW	m3/g
2010	16174	3.693	3974
2011	19610	4.477	6128.1
2012	28648.4	6.541	8952.6
2013	39527.4	9.025	12352.3

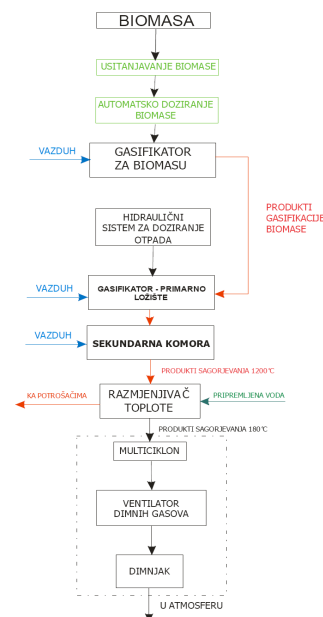


Figure 3. Block Diagram of Animal Wastes Incineration

**4.1)** Hot water boiler house of 4.5 MW with pre-insulated pipeline to the TBP. The total investment will amount to 1,017,470.456 €. By taking into account operating costs, equipment maintenance costs and assuming that only part of produced thermal energy will be sold to the clients in the TBP during the heating season and the remaining will be thrown into the surroundings, it is obtained that the payback period of the investment is 4.5 years (with the utilization of hot water in summer months for cooling by introducing the "intercooler" system, the payback period will be lowered to 3.5 years)

**4.2)** In case of the solution with hot water boiler of 4.5 MWt and preinsulated pipeline to the TBP and the production of electrical energy by means of ORC (Organic Rankine Cycle), the total investment will be 2,631,898.00 €, including operating costs, maintenance costs and the same conditions for the supply of thermal energy as in the previous case, the payback period of the investment will be 3.4 years.

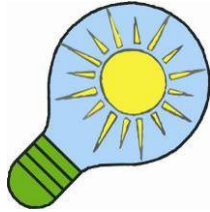
**4.3)** In case of the adjustment of the previous case into the system with the production of electrical energy by means of the steam motor, the investment will be 1,416,278.00 € and the payback period will be 3 years.

## **5. Conclusion**

At the relevant area it is recommended to construct the photovoltaic system on the roofs of buildings. The construction of wind power plant is not justified. The most favorable option for the production of electrical and heat energy for the TBP is the construction of the biomass fired plant according to the example 4.2 and the recommended model of financing is ESCO (Energy Service Company).

## **6. References**

[1] *Study for the Construction of "Green Power Plant" for the Requirements of the Technological Business Park Banja Luka*, ELNOS BL Electrical Energy, Institute IEE, Banja Luka, March 2011



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## DISPATCHER CENTERS AND MODERN TECHNOLOGIES – REQUIREMENTS, POSSIBILITIES AND PRACTICE

**Aleksandar Car**<sup>16</sup>, *IMP, Belgrade, Serbia*

**Tatjana Vračarić**, *IMP, Belgrade, Serbia*

**Aleksandar Mihajlov**, *IMP, Belgrade, Serbia*

**Zvezdan Krunić**, *Elektrovojvodina, Novi Sad, Serbia*

**Pavel Zima**, *Elektrovojvodina, Novi Sad, Serbia*

### **Abstract**

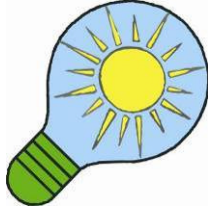
*The modern technology open new approach in implementation of Dispatching Center. Demands in Dispatching control are specific and therefore right choose of solution must be carefully applied. This task need detailed analysis of all possible solutions, and demands and therefore this task is very complicated*

*In this paper we present one such performed task. We will show all consider solution and demands, with analysis and decision.*

*As result we will present example of realization in DDC Elektrovojvodina, Novi Sad.*

---

<sup>16</sup> e-mail: [aleksandar.car@pupin.rs](mailto:aleksandar.car@pupin.rs)



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## MEDIUM VOLTAGE PLANTS' CONTROLLING AND MONITORING AS PART OF THE SMART GRID CONCEPT

Goran Krstić<sup>17</sup>, Dragan Timotić, Marko Iskrin

"Energotehnika-Južna Bačka" Ltd., Novi Sad

### **Abstract**

*The new generation of electrical energy networks should enable the increase of the share of electrical energy produced from renewable sources accompanied by increased reliability and energy efficiency of systems.*

*Medium voltage plants (MV Plants) join the distribution network with the rest of the electrical energy system and therefore, it is necessary to upgrade controlling and monitoring of these strategic facilities [4]. This paper describes the role of the managing system in MV plants on the road to the implementation of smart grids.*

*By presenting the example of already constructed plant equipped with remote monitoring and managing for the purpose of connecting to the distribution network of a small biogas power plant of the company Alltech in Senta. For this purpose, "Energotehnika-Južna Bačka" has produced and installed the equipment which enables remote monitoring and control of the plant. This company is planning to increase its participation in the construction of such facilities.*

**Keywords:** smart grid, smart grid technology, renewable energy sources, energy efficiency and energy system's development concept

### **1. Introduction**

The reserves of fossil fuels which mostly provide present day's energy demands are final and exhaustible and they are rapidly exploited. On the other side, all the predictions show that energy demands will be growing by unrelenting intensities in the future. Therefore, the better utilization of energy obtained from renewable energy sources, energy efficiency and optimization of energy consumption represent not only economic but also environmental and political issues. Electrical energy as the most precious form of energy deserves better attention.

In order to accomplish the above specified objectives, a lot has been invested in researches and improvement of electrical networks towards so called smart grids at the global level. The very notion of smart grids has been fairly widely defined by leading world's organizations in this area (*Department of Energy-DOE, IRED-EU*). In any case, it implies massive integration of information and communication technologies, control software and equipment which should enable better control of the existing network in the situation when the concept itself of traditional electrical energy system's functioning is

---

<sup>17</sup> e-mail: goran.krstic@entjuba.rs

functioning is changing. Namely, the concept of electrical energy generation in large blocks and one-directional current has been changed by the appearance of distribution generators. In addition to that, in the conditions of deregulated market, a consumer takes an active role in managing his consumption.

## 2. The System's Components for MV Plant Automation

The automation of a distribution system implies [3] every type of automation (hardware and/or software) which is used in planning, engineering, construction, running and maintaining distribution systems including the connection with the transmission system, connections with distributed energy sources (generators) and automated connections with end users (buyers).

Key functionalities of modern plant controlling systems are the localization of breakdown points, isolation of breakdown points and restoration of supply (*FDIR - Fault Detection Isolation and Restoration*) and regulation of voltage circumstances (*IVVC - Integrated Voltage and Var Control*) at the medium voltage output.

In order to ensure functionalities, in the controlling process it is necessary to integrate [2]:

1. Intelligent devices (*Intelligent Electronic Devices-IEDs*) for indications, measurements, and managing of system and equipment parameters. Voltage and current sensors, measuring transformers, controlling assemblies of motor drives for switch disconnecter devices, devices for fault detection and indication, etc.
2. Communication equipment for the acquisition of signals from the plant and their forwarding to *SCADA/DMS* system, as well as forwarding of commands to controlling elements (for example, assembly equipment). This function is performed by a remote station - *RTU* (Remote Terminal Unit). In addition to that, the *RTU* leaves an opportunity to implement local logic (for example, the function of changing the supply direction (*ATS*)), local storage of data about the status of the assembly equipment and the value of acquired signals.
3. Application programs at various levels within the system. Superimposed *SCADA* system in combination with *DMS* and other software enables significantly higher degree of automation, improvement of performances and distribution system monitoring.

## 3. The Example of MV Plant Output Automation

One of classical examples of the automation of the *MV* plant output has been implemented for the purpose of connecting small biogas power plant for the company "*Alltech*" in Senta to the distribution network. The delivered electrical energy plant of 20kV produced by *SIEMENS* of the type *8DJH* is equipped with device for remote monitoring and controlling and the equipment for signal acquisition and communication with the remote center is installed in the cabinet of the remote station.

Each output cell contains: indicators for fault current and voltage, controlling units for the drive and indications of the state of switch disconnectors, devices for measuring outgoing feeder (current metering transformer and current transmitter). The cabinet of remote station contains *RTU* of the type *Motorola ACE 3600* with accompanying input-output cards and additional converters for the communication with other devices. In case of the shortage of network supply for communication equipment, the sensors in output cells and motor drive of switch disconnectors are supplied through the device for uninterrupted supply which signalizes the state of batteries, absence of network voltage, fault of battery charger, etc.

The presented system for controlling and monitoring of the *MV* plant is robust and enables simple expansion and connection to the central *SCADA/DMS* system. Installed *RTU* combines options for local

processing and (as programmable logic controller - PLC) and superior communication options of the RTU. Through the serial and *Ethernet* connections, it is possible to connect with other IEDs, analogous and digital radio station, etc. It supports several protocols (*DNP3.0, MODBUS, IEC60870-5-101...*) for the automation of distributed plants.

#### 4. Conclusion

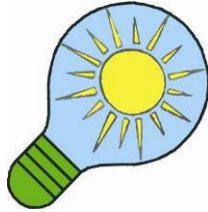
It will be necessary for the future smart grid to contain integrated solution for numerous challenges, such as requirements for massive integration of renewable energy sources, occurrence of new customers (for example, electrical automobiles), and requirements for reliable and efficient supply. The smart grid concept implies integration of two components. The first component – software has the task of making certain conclusions on the basis of gathered data with reference to the condition of the drive and to generate controlling commands. Gathering of such data, as well as the conduction of controlling actions is ensured by another component which is the subject matter of this paper. Modern distribution systems are becoming increasingly more and more dynamic because of numerous factors such as, for example, integration of a larger number of distributed generators in the distribution network [1], less predictable because of which their monitoring and controlling are necessary in real time. In order to make something like that work, it is necessary to increase the level of automation of elements in the distribution network at all levels including medium voltage level. This implies the introduction of devices such as: remote station, control unit of disconnecter motor drive, fault detection and indication equipment and current and voltage sensors and communication equipment.

On the road to the development of smart grids, the communication at all levels of controlling (*IED, RTU, SCADA*) is of crucial importance. The standardization of communication protocols which is underway will be the basis for the application of the *smart grid* technology and guidelines for producers who are going to use it in their devices. The introduction of above mentioned standard will enable not only easier application but also maintenance of *smart grid* technology which will lead to its faster development.

With great interest, “Energotehnika-Južna Bačka” is following the development of production and the construction in the area of green technologies at the global level and *getting ready sincerely for the participation at the domestic market*. In line with the above stated, the company has designed and installed air conditioning system based on geothermal energy, has started with the introduction of the standard ISO 50001 (energy management system) which, among other things, provides the framework for the promotion of energy efficiency, promotes best practices in the energy management and insists on the best practice in energy management, enables integration with other management systems, etc. In this way, “Južna Bačka” wants to make its contribution to the better management of energy resources within the company and to share experiences with other participants at the market in the construction and management of renewable sources.

#### 5. References

- [1] Jurgen Heckel: “Smart Substation and Feeder Automation for a Smart Distribution Grid”, CIREC, Prague, 8-11 June 2009
- [2] Jiyuan Willem du Toit, Paul Backscheider: “Distribution Substation Automation in Smart Grid”.
- [3] “System for Automation of Switch Disconnecter Equipment Manipulations in Medium Voltage Distribution Grid”.
- [4] “IEC Smart Grid Standardization Roadmap” June 2010; Edition 1.0.



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## APPLYING THE SYSTEM OF GEOPROBES AND HEAT PUMPS FOR AIR CONDITIONING (HVAC) IN “ENERGOTEHNIKA – JUŽNA BAČKA” Ltd. NOVI SAD

**Mirko Miličković<sup>18</sup>, Nikola Vasić**  
„Energotehnika-Južna Bačka” Ltd, Novi Sad, Serbia

### **Abstract**

*The paper describes designing, construction and utilization of the system of geoprobes and reversible heat pumps in "Energotehnika-Južna Bačka" Ltd., Novi Sad for heating, ventilation and air conditioning (HVAC). It is especially explained why such a system of geoprobes and reversible heat pumps belongs to climatically most independent and environmentally clean ones and by all means systems with renewable energy sources.*

*The construction of this system is envisaged in two stages and the paper presents experience during the construction and the exploitation in the first stage of air conditioning in the administrative building with an outline of the next stage. The system uses stable geothermal energy of soil.*

*At the end, some experiences related to the system's exploitation and maintenance are presented together with energy efficiency effects in the last three years.*

**Keywords:** *renewable energy sources, geothermal energy, heat pumps, geoprobes and energy efficiency*

### **1. INTRODUCTION**

The system of geoprobes and heat pumps belongs to renewable energy sources and it is based on the utilization of geothermal energy (the thermal energy of the soil). The endeavors of the management of "Energotehnika - Južna Bačka" to use an economical, ecological and high quality solution in the company for air conditioning and to implement European trends in the application of new technologies in our country has brought about the idea to build this type of the plant. The important features of this system for air conditioning are economic efficiency and unique opportunity for the repayment of the investment, durability and simple and economical periodical maintenance of equipment and completely environmentally friendly system.

The installation of the air conditioning system has been planned in two stages. The completion of the first stage has provided air conditioning of the administrative building since 2007. In the second stage, it is anticipated to provide air conditioning in the restaurant, kitchen and workshops for the production

---

<sup>18</sup> e-mail: [Mirko.Milickovic@entjuba.rs](mailto:Mirko.Milickovic@entjuba.rs)

of electrical cabinets. The Feasibility Study was prepared before the commencement of works and the decision about the investment. The preparation of the study and design documentation required also the knowledge of energy data about the soil at the location of "Energotehnika - Južna Bačka". Therefore, the geophysical borehole logging was done with probes of netted polyethylene of the type rh-a – produced by "Rehau" with double U-pipes in order to perform the test of thermal sensitivity. The first probe was placed at the depth of 100 meters. After measuring the energy (cca 7.5 kW), it was decided to go to the depth of 125 meters in order to increase the thermal energy. At this depth, significantly higher energy was obtained (cca 8.5kW). The values of obtained thermal energy at this locality are 30-40% higher than known values obtained in Germany, Switzerland and in other European counties. This is yet another confirmation that Vojvodina is one of the richest areas regarding the thermal energy potential in Europe. In addition to the preparation of the above documentation, it was also necessary to prepare the design of research rights, possibilities for soil utilization and obtain other approvals from competent authorities, such as the Institute for the Protection of Monuments and the Provincial Secretariat for Environment Protection and Sustainable Development. Then, the pilot project of the plant was prepared. The completed design documentation was a novelty for both the designers and competent services in our country at that time and a prerequisite for obtaining an official approval – permit for the commencement of construction works .

## 2. DESIGN CHARACTERISTICS OF THE FIRST STAGE OF AIR CONDITIONING

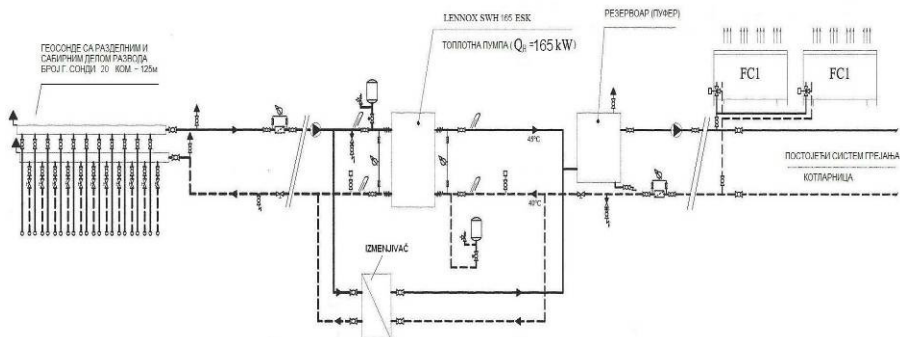
The system is intended for air conditioning of the Administrative Building with the area of 1600 m<sup>2</sup> and consists of two closed circulation circles: **primary and secondary** which are designated in the drawing of the system.

The primary part of the systems has been devised on the geothermal transfer of soil heat onto fluid flowing through the pipes of the probe (emulsion of water and ecological propylene glycol in the relation 3:1) towards the heat pump and vice versa. The boreholes are drilled to the depth of e **125m** (head  $\varnothing$ 142mm) and pipes with the diameter of  $\varnothing$ 32mm are inserted. The space in the borehole between pipes-probes in the ground is filled with thermal-**chem** mass which is a good conductor of heat from the ground by the fluid to the heat pump. In the yard, 20 probes have been placed.

The probes are connected with collectors  $\varnothing$ 42mm leading to the central concrete shaft. In the shaft, the pipeline is connected to the main supply – return pre-insulated pipe of  $\varnothing$ 110mm. The heat exchange in the heat pump is proportional to the required temperature for air conditioning of the building.

The secondary part of the system serves for the distribution of energy for air conditioning of the administrative building. It consists of central reservoir, pipes, electric motor pumps and fan-coil efficient heat exchanger for low temperature systems. Demineralized water is used as a medium for heat transfer.

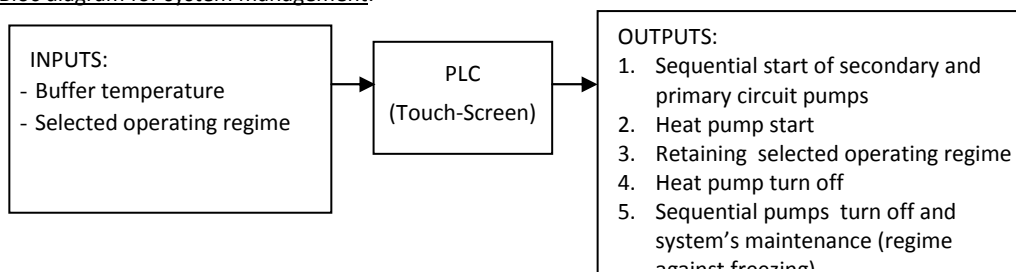
A special advantage of this system for air conditioning is an additional passive system for space cooling (free-cooling) which serves for cooling in the period May - June. In this regime, the heat pump is turned off and the heat exchange from primary to secondary circuit is done by the heat exchanger. Cooling in this regime is efficient at outside temperatures up to 28<sup>0</sup>C.



### 3. SYSTEM MANAGEMENT

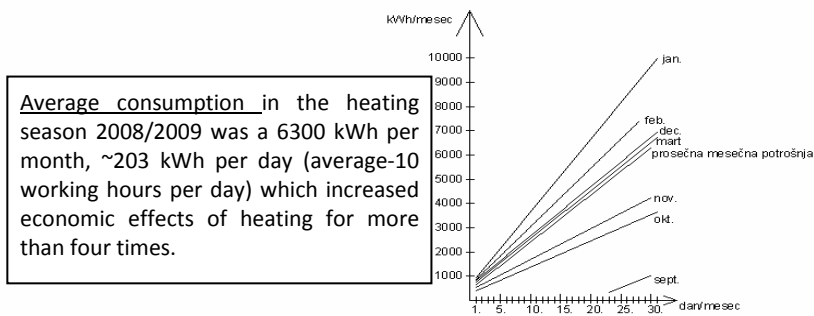
Automaton as the system's upgrading is the result of engineering efforts in the company "Energotehnika – Južna Bačka" and it is achieved by the installation of programmable logic controller (PLC) which raised the effect of the system's operations level. The adjustment of a desirable regime of air conditioning is resolved by a software and it is done by means of direct data input into the PLC with a touch screen. This enables termination of the system's operating regime at annual, monthly, and daily levels in line with the planned working hours of employees, as well as easy adjustments in case of changes. The selected regime of air conditioning is automatically maintained by monitoring the temperature of heating –cooling liquid in a buffer. The correct sequence of pumps turning on and turning off is ensured when starting and turning off the system so that it is prevented that heat pump operates without the operation of pumps for the flow of heating – cooling fluid (in case of need it is also enabled to run the system manually).

Bloc diagram for system management:



### 4. EXPERIENCES IN THE EXPLOITATION OF THE AIR CONDITIONING SYSTEM

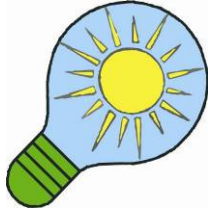
The evidence of the consumption of electrical energy in the past period of three years and comparative analysis with previous systems (strict heating, gas boiler and split systems) in "Energotehnika – Južna Bačka" for air conditioning shows that the invested one 1 kWh electrical energy produces 5 kWh of energy for heating and cooling (around 4 kWh of free of charge energy from the ground which is shown in the diagram below).



Periodical maintenance of the system is simple and economical – more economical than maintenance costs of previous systems.

At the Fair for **Energy - Electronics and Telecommunications** held in 2008 in Novi Sad, this pilot project was awarded the **gold medal** in the competition for the most recent technologies in the area of renewable energy sources.

Taking into considerations the fact that for several years the developed countries have had laws on the compulsory use of one of renewable energy sources in the construction of buildings, our company is therefore planning to launch own engineering for the construction of such energy plants on the turn key principle.



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## ADVANCED NETWORK CONCEPT IN ELECTRICAL DISTRIBUTION SYSTEM

Željko Popović<sup>19</sup>, Bratislava Radmilović, Vladan Gačić  
"Elektrovojvodina" Ltd, Novi Sad, Serbia

### Abstract

*In the last decade, the electrical energy sector has been faced with changes within the new global trends known as advanced (smart, intelligent) grids (Smart Grid(s)), which have considerable impact on the operations of distribution systems (DS) [1]-[5].*

*The strategic reasons for the introduction of the SG solution in the world are associated with the fulfillment of the following global objectives:*

- *Fulfillment of 20/20/20 objectives in the EU until 2020 [1]-[3],*
- *Ensuring the highest possible degree of energy independence [4],[5],*
- *Improvement of the reliability of supply [4],[5],*
- *Application of new technologies [1] – [5].*

*In the near future, the fulfillment of these objectives will force the complete electrical energy system, including the DS, to adapt to, among other things, distributed production of electrical energy on a wider (massive) scale, and enable widespread utilization of renewable energy sources, massive use of vehicles on electric drive and simultaneously ensure high degree of reliability and safety. As a consequence, the DSs in the SG environment should define new strategic objectives and therefore, (re) define crucial business processes in order to ensure the fulfillment of these objectives.*

**Keywords:** *Smart grid(s), electrical distribution system, business processes*

### 1. Strategic Objectives of the SG Concept in the Distribution System

Strategic objectives arising from above mentioned global objectives which should be achieved by introducing the SG concept in the DS are to:

- *Integrate distribution generators of various sizes and technologies (solar generators, wind generators, small hydropower plants, biomass generators, etc. ) in the distribution network (medium voltage or low voltage) in order to ensure the largest possible production of electrical energy from these sources;*
- *Optimize the operations of the distribution network by using grid infrastructure by means of smart grid elements (DG, electrical energy stores (ES), micro networks, electric vehicles, AMI systems, "intelligent" devices with buyers integrated as Home Area Network (HAN), various sensors), load management programs (DR), as well as software for DN operation management;*
- *Ensure to buyers of electrical energy more information and enable their participation in the optimization of DS/EES operations – through various scenarios of load management enabling*

<sup>19</sup> e-mail: zeljko.popovic@su.ev.rs

active impact of consumers on the DN drive. Provide information – communication infrastructure and intelligent devices and software required for the implementation of active role of consumers in the DS operations (Home Area Network (HAN), “smart” devices with consumers, energy boxes (EB), EMS systems in buildings and micro networks);

- *Upgrade reliability and safety of the customers’ supply and the quality of supplied electrical energy* by using DG, various intelligent devices and sensors in the network, as well as various software tools and information and communication infrastructures.

## **2. (Re) Defining Business Processes in the DS in the SG Environment**

The introduction of new technologies and setting up new strategic objectives will also lead to changes in business processes in the DS. The most important elements which should be (re) defined in crucial business processes in the DS in order to ensure the fulfillment of above mentioned strategic objectives in the SG environment are:

- *Planning the development of distribution networks* by observing the DG impacts, electric vehicles, the DR and micro networks on the process of DN development planning, as their impact on the prediction of load growths.
- *Operational management in the distribution network (in normal and breakdown conditions)* by observing the influence of DGs with various powers, technologies and levels of penetration within the DN, influence of micro networks and systems and devices for DN automation (AMR/AMI systems, IED, various sensors, RTU and other managing devices, ...).
- *Operational planning and optimization* when managing planned breaks in the supply of electrical energy in the presence of the DG (isolation of work points, restoration of supply, return to normal connection status and adjustment of relaying), prediction of consumption and production of the DG for the requirements of managing planned breaks, determining optimum connection status in the presence of the DG, adjustment of relaying in the DN due to the change of the connection status in the network with the DG, utilization of DR programs and micro networks for reducing peak loads in the DN elements in normal operating conditions of the DN for the purpose of delaying investments.
- *Asset management and maintenance* with the implementation of software tools (OMS systems) which will take into account data from AMI and SCADA systems, various sensors and IED in the DN.
- *Relationship with buyers* where it is necessary to define the application of the DR and the micro network in the optimization of the DN operations and analyze effects of advanced elements (Energy Management System (EMS) in buildings and industries, HAN and PEV) on other processes in the DS.
- *Measuring infrastructure management (reading and checking)* with the realization of advanced systems for measurements (AMI/AMM), as well as software tools for managing, storing and applying data obtained from these systems.

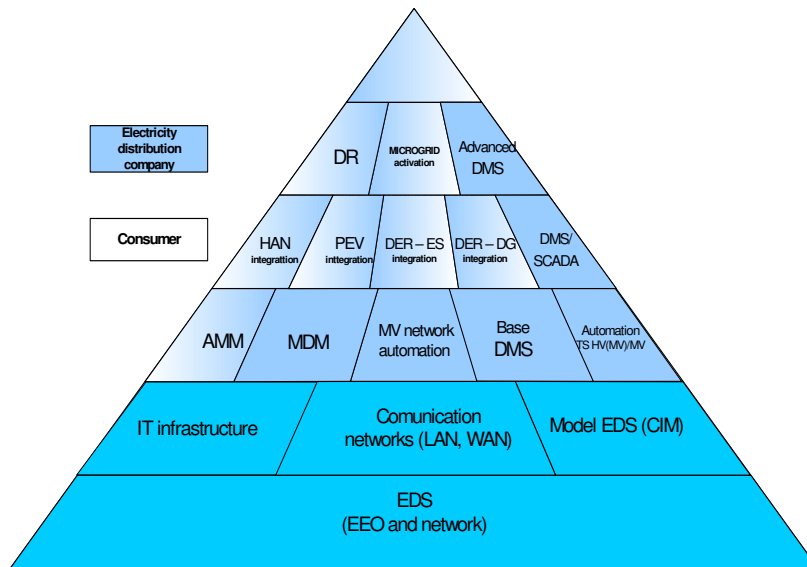


Figure 1. SG Concept in Distribution System

The most important elements on which the SG concept is based can be presented in the manner shown in the Figure 1. In order to enable integration of these elements, it is necessary to define and realize components which represent foundations of the SG concept encompassing the communication infrastructure and information systems.

- *Communication systems* - should be based on applicable standards in the area of protocol utilization, safety and data protection and to satisfy functional requirements which arise from the requirements of previously defined business processes.
- *Information systems* - software systems and services should be standardized in order to ensure functionalities of previously defined business processes, that is, enable management of large quantities of data (data from "real-time" systems, from statistical databases and manually updated by the system user) with the high degree of privacy protection and data safety.

The Electricity Industry of Serbia (EPS) has placed the modernization and construction of its distribution networks and automation of business processes in the spirit of the SG concept as one of its strategic corporate objectives. In that respect, many activities have been initiated which refer to defining basic components of the SG concept: information and communication systems, SCADA, DMS and AMI/MDM systems. The above specified steps are described in details in documents [6], [7].

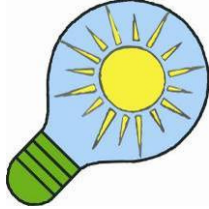
### 3. Conclusion

The full implementation of the SG concept will lead to significant changes in the DS at all levels. Therefore, for successful implementation of efficient, economical and sustainable SG solution in the DS, it is necessary to:

- Define clear strategy for the SG development in the DS,
- Define clear organizational structure which should promote, coordinate and follow the development and realization of the SG solution and projects in the DS,
- Coordinate and accept enacted standards and recommendations in the SG area and intensify their application in practice,
- Involve into European procedures for the enactment of documents, recommendations and implementation of pilot projects in this area,
- Educate and raise knowledge levels and skills of employees.

### 4. References

- [1] European Commission, European Technology Platform SmartGrid, "Vision and Strategy for Europe's Electricity Networks of the Future", 2006
- [2] European Commission, European Technology Platform SmartGrid, "Strategic Research Agenda for Europe's Electricity Networks of the Future", 2007
- [3] European Commission, European Technology Platform SmartGrid, "Strategic Deployment Document for Europe's Electricity Networks of the Future", 2010
- [4] Electric Power Research Institute (EPRI), "Report to NIST on the Smart Grid Interoperability Standards Roadmap", 2009
- [5] National Institute of Standards and Technology (NIST), "NIST Framework and Roadmap for Smart Grid Interoperability Standards: Release 1", 2009
- [6] Expert Team of the Electricity Industry of Serbia (EPS) for smart grids, "Functional Requirements and Technical Specifications AMI/MDM Systems", 2010
- [7] Expert Team of the Public Enterprise Electricity Industry of Serbia (JP EPS) for Smart Grids, "Analysis of the Current Situation of the Controlling Function and Remote Monitoring System, Analysis and Drive Optimization of Electrical Energy Facilities and Equipment of all Voltage Levels in the Company for DEE", 2010



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## EUROPEAN FUNDS AND CLEAN ENERGY

**Jiri Novotny**<sup>20</sup>

*Allowances Ltd, Belgrade, Serbia*

### **Abstract**

*Main topic will be the financial support of energetic projects from EU funds. Focus will be on the side of the energetic investments on the field of renewable energy resources, specific needs and natural conditions of the regions and their surroundings.*

*Emphasized will be also energy savings projects in terms of thermal insulations, energy efficient sources, including renewable but also traditional resources.*

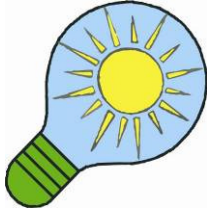
*In terms of above mentioned projects will be presented possibilities and conditions for preparation of the successful projects applications and methods, how to manage good energetic project.*

*Last but not least we will provide the attendants with information on schedule; contact points and basic data about preparation of the projects in the energetic area.*

*We expect also some reserved time for potential questions and discussion.*

---

<sup>20</sup> e-mail: [allowances@jtv-mac.com](mailto:allowances@jtv-mac.com)



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## ENERGY SAVING LIGHT BULBS

Filip Orlović<sup>21</sup>

Megaman Energy Saving Lamps Ltd, Belgrade

### **Abstract**

*The most recent researches show that the emission of carbon dioxide is twice higher than the earth globe can assimilate. The concentration of carbon dioxide in atmosphere has reached the record figure in the last 100 years having increased by 25% which significantly affects global warming.*

*Lighting is the basic need of people and therefore, an extensive use of energy saving light bulbs represents quick and simple way of reducing environment pollution. In comparison to incandescent light bulbs, energy saving light bulbs give the high quality light by consuming 80% less electrical energy and they emit less carbon dioxide. In addition to that, energy saving light bulbs emits less heat which contributes to lower electrical energy consumption for air conditioning which has further favorable impact on the reduction of emissions of carbon dioxide and sulphur dioxide in the atmosphere causing global warming.*

*Many countries and regions have applied the energy efficiency policy and introduced compulsory systems of designating products in order to provide additional information on the consumption of electrical energy and efficiency and motivate consumers to buy energy saving products.*

*Ever since its establishment in Germany in 1994, the company MEGAMAN has been placed among leading companies in the production of energy saving light bulbs in Europe thanks to unique design and innovations and by applying new technologies and by introducing new standards. MEGAMAN provides more than 400 models of energy saving light bulbs in different sizes, shapes, light colors and simple characteristics in order to ensure maximum utilization of light in both residential and commercial rooms.*

*Energy saving light bulbs which last as much as 10 times longer than incandescent light bulbs and also consume less electrical energy not only contribute to the environment protection but also make substantial financial savings.*

**Keywords:** *environment protection, energy saving light bulbs, electrical energy saving, simple technologies, financial savings*

The environment protection implies a set of different procedures and measures which prevent the pollution of the environment in order to preserve the biological balance.

Substantial increase of carbon dioxide and sulphur dioxide in the atmosphere has led to the need to undertake all measure for energy saving in order to preserve out planet Earth, that is, to protect the

---

<sup>21</sup> e-mail: orlovic@megaman.co.rs

environment. One of measures for saving electrical energy is the use of MEGAMAN energy saving light bulbs of the most recent generation.

By means of different measures, many countries in the world have already regulated the utilization of energy saving light bulbs so that they are compulsory in all public buildings, there are significant tax relieves for their purchase, and there are countries such as Australia which have completely banned the sale of classical incandescent light bulbs.

Unfortunately, there are no tax relieves or stimulations for the purchase of these bulbs in Serbia and the statistics say that only by the use of one energy saving light bulb in every of 2.5 million households in Serbia, the annual saving will be 16 million euros. The energy saving light bulb cost about 350 dinars whereas an ordinary incandescent one costs slightly more than 25 dinars. However, on the long run, the energy saving light bulbs are much more cost efficient.

MEGAMAN is one of the leading companies in the world which produces electrical energy saving light bulbs of the most recent generation. It was established in Germany in 1994. Ever since it appeared at the market, MEGAMAN has been placed among leading companies in the production of energy saving light bulbs in Europe thanks to the unique design and innovations and by applying new technologies and by introducing new standards. The objective of MEGAMAN is that new technologies gradually replace incandescent ones, that is, that incandescent and halogen light bulbs are substituted by light bulbs of the most recent generation which consume less electrical energy and less pollute the environment. This represents one of the main priorities of the company. The philosophy of MEGAMANA is *BETTER IDEAS, BETTER LIFE*.

At the beginning of 1996, MEGAMAN took over the leading position in the production of energy saving light bulbs with Classic and Candle series which provide better choice even for decorative light. By following the market and the response of buyers themselves to energy saving light bulbs, at the end of 2001, Megaman launched at the market the new type of energy saving light bulbs which could completely replace classical halogen light bulbs.

By seeing that the market is satisfied and that it follows the new trends regarding new sources of light and in order to reduce environment pollution, MEGAMAN has also launched a series of other energy saving light bulbs with own unique technologies such as:

Ingenium, Amalgam, Booster, EMF, Dimming, Fast Warm Up and many other.

As opposed to other manufacturers, at the beginning of 2008, MEGAMAN stopped using liquid mercury for filling energy saving light bulbs but exclusively amalgam.

Amalgam is an alloy of mercury with some other metals which is stable at room temperature and thus safe for people and the environment.

MEGAMAN energy saving light bulbs contain less than 1.6mg of liquid mercury although the standard prescribes less than 5mg of liquid mercury.

In this way, MEGAMAN is protecting against harmful effects of Hg- mercury all participants who take part in the production and transport of light bulbs, the same as their end user. Light bulbs filled with amalgam are easy to dispose off and do not pollute soil and water even if they are not recycled.

In the pursuit of the best possible solutions, MEGAMAN launched a new type of the sources of light which save electrical energy, the LED technology, in 2009.

The objective of the company MEGAMAN is the production of ecological products which provide better energy efficiency, reduction of negative environmental effects, avoidance of harmful materials, provision of higher durability and service life and the utilization of recycled matters and recycling.

As the result of the program "environmental design", the company MEGAMAN has been successful in creating durable products with simultaneous reduction of the use of natural resources. Environment pollution has been reduced by means of water based glues , substitution of traditional glazing method by silicon protection and recycling of tube glass because of the use of amalgam instead of liquid mercury.

The environment protection is one of the main objectives of MEGAMAN. All MEGAMAN energy saving light bulbs at the European market with cathode tubes do not contain lead and use water based glues which is in compliance with the ROHS standard. Also, ecological materials are used such as amalgam which does not emit harmful gases at room temperature thus making MEGAMAN the best choice in the domain of energy saving light bulbs.

From all above stated, it can be concluded that not only energy but also financial savings are obvious in the exploitation of energy saving light bulbs and that invested money is paid back on the average for 12 months. Therefore, in the long period of time, energy saving light bulbs are better choice than standard incandescent light bulbs.

## **References**

[1] Database and articles published by the company MEGAMAN



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## ENERGY EFFICIENCY AND GUIDELINES FOR THE DEVELOPMENT OF THE DISTRICT HEATING SYSTEM IN NOVI SAD

Jovan Petrović<sup>22</sup>, Branka Gvozdenc Urošević, Dušan  
Gvozdenc, Miroslav Kljajić

Faculty of Technical Sciences, Provincial Energy Efficiency Center,  
Novi Sad, Serbia

### **Abstract**

*The district heating systems in our cities and settlements have had routine development guidelines for a long period of time. Hot water boilers, two pipe and three pipe hot water networks are primarily used as energy sources in these systems for energy supply depending on the fact whether the district heating system includes central sanitary hot water preparation or not. Some systems are connected to larger cogeneration plants. These plants have been built to serve electricity industry and not as a development component of district heating systems.*

*The growing problems in the area of unstable existing stability in the nature, increasingly prominent impact of greenhouse gases effects and understanding that the final exhaustion of fossil fuels is becoming an alarming problem nowadays impose the necessity of using all available manners to reduce the share of primary energy in the satisfaction of final energy requirements.*

*Heating of buildings is one of the most important items in the countries' energy balances thus making district heating systems exceptionally suitable for systemic changes which can produce considerable results. Therefore, every measure, starting from the increase of energy efficiency in buildings, transportation systems and existing devices for energy transformation through the introduction of new energy more efficient technologies and integration of renewable energy sources can contribute to the final objective, the reduction of fossil fuel portion intended for meeting final energy needs.*

*This paper deals with possibilities of improving existing district heating systems and conditions for their implementation.*

**Keywords:** district heating system, energy efficiency, energy technologies

### **1. Introduction**

The existing concepts of district heating systems depend on numerous factors. The decisive ones concern the concentration of blocks with higher residential densities, the elevation difference of certain areas, distance from primary energy sources, general structure of economic and other activities in a city, the position of the city in relation to main infrastructural corridors of other energy systems, etc. The most important of these are transportation corridors for gas pipelines and transmission

---

<sup>22</sup> e-mail: jovanpet@uns.ac.rs

transmission systems of electrical energy networks.

In such circumstances, the development of district heating systems in cities is carried out as the whole or very often as the sum of separated block or multi-block units. This inevitably affects preferences. However, dominant orientation is towards hot water boilers as energy sources and hot water delivery systems of indirect or combined type.

In our circumstances, other combinations are sporadic. Somewhere, steam boilers have been retained with heat exchangers as a technology reaching the end of its utilization. There are solutions with the connection to large cogeneration plants. However, even the very name of the plant indicates that this concerns the plants which have been built in order to satisfy the requirements of the electricity industry and that heating system in such circumstances is a secondary activity. Their utilization is most often conditioned by requirements of the electrical energy system. In practice, there are almost no plants which have been built for the purpose of distributed cogeneration as the basic energy technology in the system. The changes in operational concepts of these systems are inevitable.

## **2. Research method**

The paper has employed the method of analyzing the present district heating systems in the region which represent entire organizational, political, economic, social and cultural multinational environment.

This concerns the region of Vojvodina with 2,031,992 inhabitants living at the territory covering 21,506km<sup>2</sup>. At this territory, there are 17 district heating enterprises with totally connected thermal power for heating and preparation of sanitary hot water of 1,169.6 MW [1]. Single connected thermal power of these systems varies in the range from 3 MW to 868 MW. In addition to that, in six smaller towns, there are block boiler houses with totally 10 MW of connected thermal power.

The analysis of the current situation of boiler units, as crucial energy equipment in thermal plant power systems, has been done by random sampling [2] and [3] which has included 25% of all boiler units in Vojvodina. This is a good representation for assessing the whole situation. More detailed investigations of other elements of district heating systems have been done taking the system in Novi Sad as an example. This system includes approximately 75% of totally connected thermal power of all users of thermal power plants' services in Vojvodina.

## **3. Investigation results**

In the region of Vojvodina, there are totally 391 registered boilers for the production of steam, hot or warm water (according to the data from 2006) [6]. These boilers are in the industrial sector (312), utility energy (thermal power plants) (43), combined power plants (TE-TO) (17) and healthcare institutions (19). If only larger thermal power plants are taken into account, their thermal power is around 1,100 MW. Hot water boilers are dominant in them although some contain an insignificant number of steam boilers which have been turned into hot water boilers.

In the district heating systems, there is hot water network with various types of substations. The terrain in the cities of Vojvodina is flat and this is suitable for the utilization of direct thermal substations. Their presence is dominant.

When we talk about applied energy technologies, these systems also include three cogeneration plants in Novi Sad, Zrenjanin and Sremska Mitrovica. Their basic characteristics are given in the Table 1.

In the district heating systems of cities in Vojvodina, there are no cogeneration plants for distributed production of electrical and thermal energy. Thermal power plants have recognized the importance of their implementation but traditional approach to the construction of thermal sources, scarce financial resources and unresolved issues of the connection of these plants to the electrical energy system in the past have made their utilization in the heating system failing to find their place.

*Table 1. Basic Indicators of the Condition of Cogeneration Plants in PD "Panonske TE-TO"*

	Number of			Power MW <sub>e</sub> – MW <sub>t</sub> – t/h	Year of Exploitation Start	Nominal Exploitation Time h	Utilization until 31.12.2005	Average Usability Degree until 2005
	Blocks	Boilers	Turbo- Generator s					
TE-TO NS	2	3	2	245-332-320	1981/84	200,000	30.4%	≈ 59%
TE-TO ZR	1	2	1	120-140-310	1989	200,000	8.1%	≈ 48%
TE-TO SM	1	4	1	32- 40- 200	1979	200,000	56.0%(1)	≈ 58%(2)

*Note: (1) Only turbo-generator (2) Degree of electrical energy production cost efficiency  $e \approx 21,3\%$*

The similar situation is also with other energy technologies. The expansion of power plants' activities to district cooling of buildings has been realized only in one case in the Novi Sad system. The potential of hot sanitary water is used as a driving energy for the integration of absorption cooling machine and the production of freezing water. This water is used in the central air conditioning system.

For the time being, the renewable energy sources are finding their place in the district heating systems with difficulties. Barriers are similar for all renewables. On the one side, there are routine habits of technical and other experts in thermal power plants but also certain resistance towards new solutions. When we also include the fact that there are scarce financial resources for investments, it becomes clear why the technologies for the utilization of renewable energy sources have not yet become an integral part of the district heating systems.

#### 4. Conclusion

Among other things, this paper should launch comprehensive debate about possible guidelines for further development of thermal power plant systems. It is assumed that the plants for distributed cogeneration, absorption cooling machines, solar energy, biomass and municipal wastes energy, geothermal energy and other energy resources have their place in the district heating systems. It is necessary to find ways, remove barriers and enable prevailing increase of energy efficiency in district heating systems.

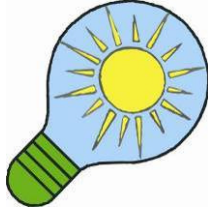
#### 5. Acknowledgement

We take this opportunity to express our thanks for the ability to work on projects to the:

- Provincial Secretariat for Science and Technological Development of the AP Vojvodina Government for the project: *"Planning Energy Systems in the Cities of Vojvodina by Means of Modern Energy Technologies"*
- Ministry of Science and Technological Development of the Republic of Serbia's Government for the project: *"Energy Systems in Public Buildings"*

#### 6. References

- [1] Petrović J, Gvozdenac D, Gvozdenac Urošević B: *District Heating System of Novi Sad – 50 years*, Novi Sad Thermal Power Plants , Novi Sad, pp 52, 2011
- [2] Gvozdenac D. et al : *Program of the Economic Development of the AP Vojvodina – The Energy Efficiency Project (EEP)*, Provincial Energy Efficiency Centre of the Faculty of Technical Sciences Novi Sad, pp 135, 2006
- [3] Petrović J. et al: *The Program of the Economic Development of the AP Vojvodina – The Energy Efficiency Project (EEP) – The Energy Efficiency Increase in Industrial Boilers and Utility Energy Boilers*, Provincial Energy Efficiency Centre of the Faculty of Technical Sciences Novi Sad, pp 49, 2008
- [4] Gvozdenac D, Marić M, Petrović J: *Current Consumption of Energy and Perspectives for the Introduction of Modern Technologies in Industry and Utility Energy in Vojvodina*, Provincial Energy Efficiency Centre of the Faculty of Technical Sciences Novi Sad, pp 109, 2004
- [5] Group of Authors: *Program of Economic Development of the AP Vojvodina – Innovated EX POST Analysis of the Economy in the AP Vojvodina*, Executive Council of the AP Vojvodina, Novi Sad, pp 273, 2006
- [6] Petrović J, Gvozdenac D, Kljajić M: *The Assessment of the Current Situation in Boiler Houses in the Industrial and Municipal Energy of Vojvodina*; Zlatibor, IEEP'08, Rad II-08, 2008
- [7] Kljajić M, Gvozdenac D, Petrović J: *Possibilities for Increasing Energy Efficiency of Boilers in the AP Vojvodina*; Zlatibor, IEEP'08, Paper II-08P, 2008
- [8] Ćirić R, Gvozdenac D, Petrović J: *Basic Technological Directions in the Area of Energy Efficiency and Renewable Energy Sources in the AP Vojvodina*; Zlatibor, IEEP'08, Paper V-03, 2008



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## PERSPECTIVES OF INTEGRATED SOLAR POWER PLANTS IN DISTRICT HEATING SYSTEMS AND CENTRAL HOT WATER PREPARATION

Bojan Grujički<sup>23</sup>

VIESSMANN Ltd, Belgrade, Serbia

### **Abstract**

*Application of solar thermal systems in district heating began in seventies, and intensive development of these plants ranges from the nineties. As a result there are in Europe almost 130 large solar collector system with an area greater than 500m<sup>2</sup>, which are used in district heating, hot water systems and cooling systems. These experiences are a valuable material for future development of large solar systems in Serbia. Increasing energy efficiency and system reliability, reduced pollution environment, operating and maintenance costs, and heating business - distribution and collection of heat, are excellent preconditions for the synergy of these systems. On the other hand - the very performance of the system, the ability to post collector fields and seasonal batteries, and legal factors in Serbia brought many questions that need a precise answer. Given their experience and knowledge Viessmann is actively involved in this process - both at the level of feasibility studies, and in all phases of large solar plants in Serbia - design, execution, setting the parameters of operation, maintenance - as well as measuring and analyzing the parameters of work. Experiences and results related to the study – District heating company "Heating" Pancevo, residential building in Krusevac, and erected large solar plant in health center of Pirot are certainly good way to continue.*

**Keywords:** Solar systems, sanitary hot water, district heating systems

### **1. Introduction**

The enormous potential in terms of solar energy in Serbia will certainly point that it is one of the key for ensuring the energy needs in the future. Annual growth of number of installed solar systems points that clearly. On one hand lack of local experience in this field causes the use of knowledge of countries that have been most active in the last thirty years in terms of solar technology – e.g. Germany, Austria, Denmark and Sweden. On the other hand - the difference in potential in terms of solar energy and numerous other characteristics - require the integration of local factors in the final solution. The potential is practically limitless - especially interesting are the large and constant consumers of energy - from special-purpose facilities (hospitals, gerontology and sport centers, etc..), to apartment buildings and remote systems for central heating and hot water systems.

---

<sup>23</sup> e-mail: GuB@viessmann.com

## 2. Methods

Experiences and data of the association Intelligent Energy Europe - Solar District Heating were used to support market development of solar systems in district heating. The results given are the product of specialized simulation software package for simulation of solar thermal systems - TSOL Pro 4.5, while the techno-economic analysis is conducted in accordance with VDI 2067. The results of measurements that are processed in working memory are part of the record of the functional parameters of the solar plant work at the Health Center Pirot downloaded from Viessmann solar controller type Vitosolic 200 SD4.

## 3. Results, development and conclusion

Experiences and results of the installed large solar thermal plants in Europe indicate a certain increase in the number of such plants in the future. Large solar thermal systems in remote and central heating systems and domestic hot water - depending on model - can have an annual solar coverage level to 50%. The European plan is that in terms of capacity to reach 10% of total installed capacity of boilers in district heating. Today in Serbia there are no installations of this type, but is almost certainly expected their introduction, given the trend in fossil fuel prices and increasingly stringent environmental requirements. The first example might be a JKP "Grejanje" in Pancevo with the feasibility study on solar energy application for remote system for hot water systems. The basic idea is to use free space neighboring "Grejanje" Pancevo to set the collector field and to use the existing pipe networks as reservoirs. Given the concept of derived system the idea is to increase the coverage level of solar heat by replacing the existing, or folding the return temperature, which would be further heated through the solar system. It was initially planned to set up a pilot plant with the degree solar coverage to 5% to analyze the parameters, while in the second phase is planned to increase solar system capacity. The study suggests that the solar system size of 900m<sup>2</sup> and the installed capacity of 635 kW, brought savings of 92 000m<sup>3</sup> of natural gas and reduce CO<sub>2</sub> emissions by nearly 200 tonnes per annum. Investment in this plant is estimated at 440 thousand euros, while its pay-back period was app. 8.4 years with an estimated life span of 25 years. An interesting potential in this area consists of residential buildings, especially buildings with central heating and domestic hot water preparation. Performed analysis indicate the short period of pay-back of such systems - but the lack of support of municipalities and state on this issue, and not yet developed the concept of the existence of the entity for the production, distribution and collection of energy from renewable sources results in a minimum number of such plants. So far almost all large solar plants in Serbia are related to hot water in large and constant consumers of the same type - hospitals, kitchens, senior centers and hotels. Installations are carried out in accordance with the latest standards in this field, and gain additional experience by measuring and monitoring parameters. A concrete example is the Health Center Pirot, and the conclusions that come to mind are - excellent safe operating parameters and rapid pay-back of the plant, but the bad input parameters for the design of the plant (the absence of accurate measurements of energy consumption) and lack of adequate staff for maintenance of the installation.

## 4. References

- [1] Viessmann Ltd, Viessmann GmbH- technical documentation



V International Renewable Energy  
Forum  
CLEAN ENERGY TECHNOLOGIES - 2011  
Novi Sad, 26-27 October 2011

## URBAN PERSPECTIVE ON DISTRICT COOLING – A CHANCE OF ADDITIONAL CHP PLANTS' SOURCE OF INCOME

Primož Škerl<sup>24</sup>

Termoelektrarna toplarna Ltd, Ljubljana, Slovenia

### **Abstract**

*District cooling is tried and proven technology to increase summer heat consumption of CHP plants that supply district heating systems with heat. Besides district cooling also insures CHP plants' additional income. But it is not the easiest business to start from scratch. The present paper/presentation exposes one of possible approaches on starting the cooling business and presents some existing and forthcoming district cooling projects & our experience in City of Ljubljana, Slovenia.*

**Keywords:** District Cooling, Absorption, Summer Heat Application, CHP

### **1. Introduction**

Outside of heating season (i.e. in transitional season and summer time) the CHP plants driving the district heating grid are under-used. There is not enough heating demand to enable CHP plants' full load operation at best, and at worst the CHP plants operate under their technological minima, forcing them to run as partially condensing power plants – an operating regime usually not preferred by plants' operators and owners.

One of the most appealing options to help increase the summer heating load is introduction of district cooling systems.

### **2. Methods**

First a (loose) definition: district cooling (DC) system is a system, where at least one cooling station generates cooling and supplies it to two or more customers via a cooling grid (pipelines).

Cooling generation depends on resources at hand and always offers specific solutions: nordic countries utilize deep cold seawater via heat exchangers, French utilize central electric chillers with river heat rejection. The cooling generation that is of most interest to our geographical latitude usually requires heat driven chillers that use absorption principle based cooling cycle. The so-called absorption chillers utilize heat to produce cooling. The more cooling is required the more heat gets consumed in the process – a trait that corresponds perfectly with aims of district heating and CHP plants' operators to produce/utilize more heat in the summer time.

There are two basic concepts of district cooling:

---

<sup>24</sup> e-mail: primoz.skerl@te-tol.si

- Cooling is produced **centrally** in a single cooling station close to the heat source and extensive cooling grid is put in place to connect consumers to the cooling station.
- Cooling is produced **decentralized** in one or more cooling stations to supply nearby consumers, whereas existing district heating grid serves to supply heat to the remote cooling station(s).

Both concepts have their advantages and disadvantages: While first concept can utilize high exergy heat in form of steam together with (relatively) low temperature heat sink (i.e. river or sea water) to improve on cooling production efficiency (i.e. COP – Coefficient of Performance), the extensive cooling pipework is hard to implement in existing urban environment due to large-diameter pipelines required for low-delta-T large-flow cooling energy transfer.

The second concept has lower attainable COPs and as consequence higher specific operating and investment costs, but can be installed almost anywhere within reach of district heating system (usually hot water) and close to the consumers (if space permits). Heat is usually rejected via open cooling towers.

Also a mixture of both concepts is possible.

The most important step in designing a DC system is **proper consumer identification**. The investor would aim to connect consumers that have highest ratio of annual cooling energy requirement vs. peak cooling power. The reason is maximization of revenue compared to investment cost. Obviously the best consumers will be the ones utilizing cooling all year long, 24/7 as base load: computing data centres and industrial cooling. Next in line would be shopping centres, followed by high-frequency public buildings and commercial structures. The last place would go to schools and private accommodation buildings as they are (at least partially) vacant during high summer and so their consumption/power ratio is the lowest.

After identification of potential consumers the basic element of investment decision making, **feasibility study**, has to be made. The feasibility study ought to address several key questions:

- Assessment of customers' wishes, requirements and limitations (mutual cooperation),
- What is the current cooling solution in place - not applicable for newly planned buildings (mutual cooperation)?
- What are the current cooling solution's costs (also hidden costs)?
- What is the REAL available cooling load (potential phase approach)?
- Several concepts/configurations considered to find optimum solution. Its preliminary design is performed.
- What is the customers' expected cooling cost considering all applicable investment influences, including the required Internal Rate of Return and Net Present Value?
- Define ratio of fixed vs. variable cooling costs to best manage the risks involved.
- Comparison of current cooling solution and proposed DC solution, their SWOT analysis.
- key points to be addressed by contract agreement.
- Other relevant open issues subject to local conditions (i.e. legislative framework in place and its impact on the project, environmental issues,...)

When these key questions are answered the investor gets a better picture of planned investment and its financial impact. The general decision on the project's feasibility can be met at this stage. Usually at this point the feasibility study is upgraded to the more detailed **investment program** level, where a single optimum solution is considered in detail and the results are reliable enough to be used for commercial purposes.

If project is feasible the next important stage, **commercial discussions** with potential customers can start taking place. The aim is to converge investor's and clients' goals to a common agreement. The successful conclusion is crowned by preparation and signing of formally binding agreements/contracts by all parties involved to ensure the long term cooperation, which is always a requirement with infrastructural projects such as DC.

As the legal/commercial framework is now in place, the investment/technical side of the project can be initiated.

## FORUM PROGRAM AND ADVISORY COMMITTEE

Dr. Tihomir Simić	“Elektrovojvodina” Novi Sad
Prof. Dr. Dušan Gvozdenac	Faculty of Technical Sciences Novi Sad
Ivo Vajgl	INEA - Institute for European Affairs, Dusseldorf
Prof. Dr. Simeon Oka	Editor-in-Chief of THERMAL SCIENCE Journal
Dr. Jovan Petrović	Faculty of Technical Sciences Novi Sad
Prof. Dr. Ljubomir Gerić	Faculty of Technical Sciences Novi Sad
Prof. Dr. Vladimir Katić	Faculty of Technical Sciences Novi Sad
Prof. Dr. Srđan Kolaković	Faculty of Technical Sciences Novi Sad
Nada Radovanović	Provincial Secretariat for Energy and Mineral Resources, Novi Sad
Dejan Milosavljević	„Thingl” ltd, Novi Sad

## FORUM TECHNICAL COMMITTEE

Dr. Jovan Petrović	Faculty of Technical Sciences Novi Sad
Prof. Dr. Dušan Gvozdenac	Faculty of Technical Sciences Novi Sad
Marijana Cupać	“Elektrovojvodina” Novi Sad
Dr. Damir Đaković	Faculty of Technical Sciences Novi Sad
Branislava Zubić	Provincial Secretariat for Energy and Mineral Resources, Novi Sad
Miroslav Kljajić	Faculty of Technical Sciences Novi Sad

## FORUM IS SUPPORTED BY



Government of the Autonomous Province of Vojvodina  
Provincial Secretariat of Energy and Mineral Resources



ECONOMIC ASSOCIATION FOR ELECTRIC POWER DISTRIBUTION  
**Elektrovojvodina doo**  
НОВИ САД

ELEKTROVOJVODINA Ltd.  
Novi Sad

## ORGANIZERS



TMC GROUP  
KNOWLEDGE  
MANAGEMENT  
CORPORATION



NOVI SAD  
Provincial Energy Efficiency  
Center

## FORUM POOL

**SIEMENS**

Siemens Ltd. Belgrade  
21, Omladinskih Brigada Street  
11070 Belgrade, Serbia

**Schneider**  
Electric

Schneider Electric Serbia Ltd.  
38, Vladimira Popovića , Avenue 19  
11070 Belgrade, Serbia



ДРУШТВО СА ОГРАНИЧЕНОМ ОДГОВОРНОШЋУ ЗА ИЗГРАДЊУ И ОДРЖАВАЊЕ ЕНЕРГЕТСКИХ ОБЈЕКТА  
**ЕНЕРГОТЕХНИКА – ЈУЖНА БАЧКА НОВИ САД**

21113 Нови Сад, Пут новосадског партизанског одреда 1, телефон 02148-77-922, телефакс 021442-167



Energotehnika – Južna Bačka, Ltd.  
1, Put novosadskog partizanskog odreda  
21113 Novi Sad, Serbia



INSTITUT MIHAJLO PUPIN ,IMP-AUTOMATIKA Ltd,  
15, Volgina Street  
11000 Belgrade, Serbia

---

**TELVENT DMS**

**TELVENT DMS** Novi Sad,  
4, Sremska Street  
21000 Novi Sad, Serbia

---

**VISSMANN**  
climate of innovation

**Viessmann Beograd Ltd**  
Tabanovačka 3  
11010 Belgrade, Serbia

---



**Elnos BL Ltd, Banja Luka**  
Blagoja Marjanovića Moše 6  
11070 Belgrade, Serbia

---



**SAGA Ltd.**  
9, Milentija Popovića Street  
11070 Belgrade, Serbia

---

**TSN** TOVARNA STIKALNIH NAPRAV  
SWITCHGEAR MANUFACTURER  
SILOVENSKA, 2000 Maribor, Šentiljska A8, tel: 386 2 228 68 00, fax: 386 2 222 91 10  
www.tsn.si, e-mail: info@tsn.si

**TSN Maribor Ltd.**  
49, Šentiljska cesta  
2000 Maribor, Slovenia

---

**TERMONET**

**TERMONET Ltd**  
27, Gospodar Jovanova  
11000 Belgrade, Serbia

---



**ION Solutions Ltd.**  
8, Vladike Platona Street  
21000 Novi Sad, Serbia

---



**Smart Ltd, Novi Sad**  
5, Trg mladenaca  
21000 Novi Sad, Serbia

---



**Majkić Ltd**  
22, Vojvode Putnika  
22320 Indjija, Serbia

---

**Allowance**   
Prvom klasom u svet dotacija

**Allowances Ltd.**  
32, Cara Dušana Street  
11070 Belgrade, Serbia

---



**GIRUS Ltd.**  
116 boulevard DIDEROT  
75012 Paris, France

---



**Megaman Energy Saving Lamps Ltd.**  
61, Gandijeva Street  
11070 Belgrade, Serbia

---