

# MEDIUM VOLTAGE COMMUNICATIONS REALITY OR MYTH?

By Andrei Panchuk and Alexei Rusanov

Today there are dozens of AMI solutions based on a variety of communications media in the market. Different combinations of these media provide particular advantages and disadvantages. Undoubtedly the most popular is the combination LV PLC + GSM/GPRS. Still, there is a natural medium, which has been overlooked by solution suppliers – the medium voltage power lines. In the following article we will try to answer two questions: Would a solution based on MV communications be viable and competitive? And are working MV communications a reality or are they a myth?

The MV system as well as the LV is a part of the utility's infrastructure. Thus, the use of this medium offers a range of advantages to the utility: the costs for maintenance are already included in the budget, there are no additional fees for its use, and finally, the infrastructure already exists – it just waits to be exploited.

Within the framework of an AMI solution, there are several basic requirements for communications channels, including reliability, ability to support high data rates, ability to transmit information over long distances and, not least, cost efficiency. If a particular medium satisfies these requirements, then it can be adapted for the use in the AMI communication network.

## RELIABILITY

Firstly the MV lines are much less noisy than the LV lines. Secondly, due to regulations in the energy sector, any breakdown in the MV segment should be managed more quickly than on the LV side.

GSM communications are based on the cellular principle, and when the cells are full there is no guarantee of the communications' reliability. Have you encountered the situation of not being able to reach relatives and friends during Christmas? The GPRS channel has a lower priority in the cellular network, which makes it even less reliable in such situations. Moreover, there are zones with weak and unreliable GSM coverage, such as in Sweden.

In contrast the MV lines are free from other communications, which guarantees the required carrying capacity every day of the year. In the framework of this solution, for reliability assurance, the router (the basic communication device in ADDAX.net) can be connected to up to four MV lines.

## SPEED

The router, or a meter equipped with MV modem, is connected

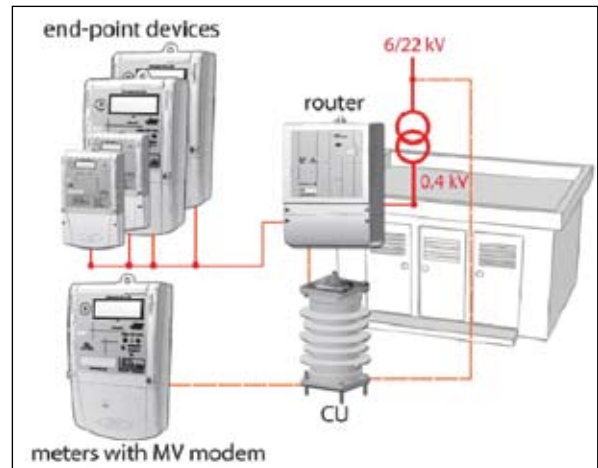


Figure 1 – Method of connection to MV PL used in ADDAX IMS

from one side to the LV PL and from the other side, through a coupling unit to the MV PL, thus overpassing the transformer (Figure 1). As a result, the translation of the signal from one medium to another does not lead to a decrease in the data rate.

The actual version is based on FSK modulation, providing a maximum speed of 4,800 bps, which is higher than on the LV side. Any request or command from the data management centre will reach the end-point in a maximum 2 minutes, which is vital in the case of industrial customers. The return to the centre will take another 2 minutes. It is important to note that this time delay is caused by the data rate limits on the LV side, as the signal transmission time on the MV side is only a matter of seconds.

ADD GRUP is developing a new version, based on the protocol DLMS/COSEM over TCP/IP where all the components of ADDAX.net, including the end devices, will be IP-based. In the new version, ADDAX.net will allow data exchange with IP-based devices manufactured by other solution and meter suppliers. The new version will be based on OFDM modulation (narrow band PLC, LV A-band Cenelec, MV A, B, C-band Cenelec) that will provide a speed up to 230 kbps over MV.

## DATA TRANSMISSION OVER LONG DISTANCES

The router transmits the signal up to 5 km. Moreover, any device in ADDAX.net performs as a repeater. As a result the signal can be transmitted over very long distances, as long as there are routers or other ADDAX.net devices every 5 km. Usually the MV/LV transformer substations are closer than that to one another.

## COST EFFICIENCY

Let's make some calculations. Taking as an example a large city with 4 million subscribers with an average of 200 metering points per substation, there will be 20,000 routers (or concentrators) communicating directly with the data management centre over GSM or GPRS. Let's compare that with an MV-based system. Each day, a router (concentrator)

	GPRS	GSM
Daily data	86,240	400,530
Weekly data	603,675	2,803,700
Monthly data	2,587,180	12,015,890
Yearly data	31,477,352	146,193,360

Table 1 - Cost of communications (in euros)

will traffic to the centre around 1,024 kB, depending on the subscribed data. Thus, the net cost of communications, based on average tariffs across Europe, will be almost €31.5 million for GPRS and €146.2 million for GSM per year (Table 1).

That is a lot of money. It is not unusual that systems based on GSM/GPRS read the data once per month. More frequent readouts would further increase the difference between the exploitation costs of GSM/GPRS and the MV channel.

In addition when the number of meters in a metering system based on GSM/GPRS increases, the cost for communication per metering point remains practically unchanged. The situation differs in an MV-based metering system, where the communications costs reduce with each newly installed meter.

If the costs of SIM cards and monthly subscription fees are added in, the total cost will be much higher. An investment in Ethernet communications between HV/MV substations and the data management centre will lead to a quick return on investment and will offer the utility data exchange networks completely free of communication charges. In most parts of Europe such Ethernet networks already exist.

So we have the answer to the first question: such a solution would be competitive on the AMI market, provided that it exists and that it is really working.

The implementation of projects based on MV communications started three years ago. The pioneer was Bulgaria (EVN Bulgaria – at that time ERP Pazarjik, ERP Stara Zagora), followed by Sweden (Umeå Energi, Sundsvall Energi, Herrljunga Elektriska, Ljusdal Elnät, Grästorps Energi, Vallebygdens Energi, Hjärtum Elförening, BTEA Bergs Tingslags Elektriska AB, Kvänumbgdens Energi), and then Estonia (VKG Elektrivõrgud OÜ).

Alexei Popov, from the Metering Department at VKG Elektrivõrgud OÜ, commented on the solution and its comparison with a GSM/GPRS solution provided by a European AMI supplier as follows: "We met three important problems with the GPRS-based system. Firstly were the high tariffs for GPRS, and in order to keep the costs of communications

reasonable we subscribed to receive basic packages of metering data. Secondly the signal was very poor on holidays. The third is a security issue – in Estonia, we have only one GSM operator that provides static IP addresses, but it also has the highest tariffs in the market. We are obliged to use dynamic IP addresses, which leads to security problems. The solution based on MV communications allowed us to receive daily the complete set of data a meter can provide. We have not met any problems related to the quality of signal over the MV channel and also we have avoided the security issues related to IP addresses, which are not applicable to MV communications."

Today ADD GRUP has experience of around 243,000 metering points communicating over medium voltage. The coverage in such projects is 99.9 percent in terms of meters reached during one communication sequence.

At present, the market is extremely fragmented, with a variety of solutions, and the customer sometimes has to install several pilot projects in order to select one or several suppliers. Why is it so simple to buy a PC but so complicated to purchase smart meters? The keywords are "openness" and "interoperability". One can switch to another computer or PC components supplier and the new computers will easily fit into one's existing network.

This is why, today, ADD GRUP has moved to offer an open solution and has already started to share its communication technology with other solution and meter suppliers. The market requires interoperability. Today's competitors will be partners tomorrow. **MI**



**ABOUT THE AUTHORS:** Andrei Panchuk joined ADD GRUP in 2002 as a marketing specialist. In 2006 he was appointed as the Head of Marketing Section. He possesses a BA degree in marketing from the Academy of Economic Studies of Moldova.

Alexei Rusanov was employed by ADD GRUP in 2005. Before joining the company he was IT lecturer in the State University of Moldova. In 2006 he was promoted to QA manager and at present he holds the position of product manager. He has a PhD in physics from the State University of Moldova.

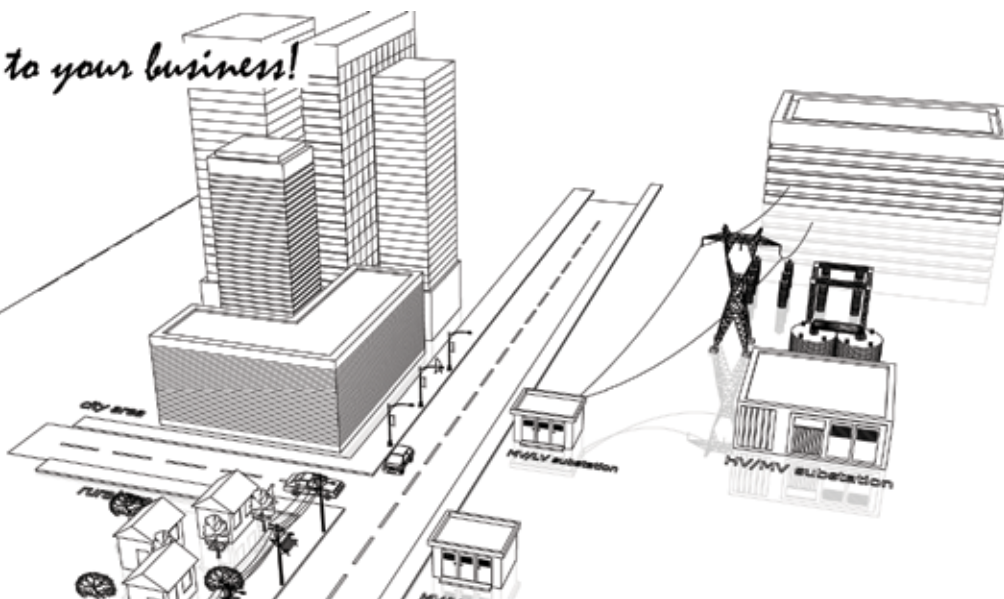


**ABOUT THE COMPANY:** ADD GRUP is a developer and manufacturer of the AMI system, ADDAX IMS, for electricity, gas, water, heat and street lighting. ADD GRUP was one of the pioneers in AMI with communications based on high speed data transmission over LV and MV PLC alongside other established communications media.

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36, Dragomirna str., Kishinev, MD-2008, Republic of Moldova, tel/fax: +373 22 58 29 48, tel:+373 22 58 29 41  
e-mail: [info@addgrup.com](mailto:info@addgrup.com) [www.addgrup.com](http://www.addgrup.com)