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The debate as a teaching aid in the mirror of the establishment of the hydroelectric power station of Ikervár

The article presents the debate about the establishment of the hydroelectric power station of Ikervár forming a notion in this way of the social-economic and technological-educational development of Hungary and of the Western-Transdanubian region of the period and of the development of scientific professional training.

During the debate they had to decide whether to apply further the source of energy existing at that time (coal-gas) or to yield to use electricity produced by the novelty, the power of water.

The topic of the essay and the debate which can be organized about it can be used in education, in its modernization and the preparation of students for the future.

The aim of the author is to present the questions concerning the topic not only in a scientific but in an educational way as well and to publish them possibly.

Introduction

The history of technology gets little space in national public education and higher education, in spite of the fact that the Hungarian engineers contributed a lot to the economic development with several inventions. The situation was a bit improved by the changing educational view after the political restructuring which hoisted it into the curriculum, into the framework of way of life and practical knowledge (NAT, 1995.), but it did not get to the place it could deserve. This article is an essay which was born as the result of engineering work, but its lesson for the coming generation is how we possess the environment around us and to what extent we are responsible for that. I would like to throw light on the absurdity of the situation formed presenting the debates before the building of the hydroelectric power station of Ikervár. During the debates several questions cropped up through which the technical cultural, technological development and the level of education of the age can be studied.

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1. The establishment of the economic-social background

During the decades following the Compromise in 1867 large-scale economic development took place in Hungary the consequence of which was that the previously agricultural country started to industrialize. It took over the technical-technological innovations of the age and in several cases the inventions of the Hungarian engineers carried on with their development.

It was the most spectacular in the field of the construction of the railway lines: while the total length of railway line was only 2,283 kms in 1867, it amounted to 11,251 kms in 1890 (Kozári, 2005). Large-scale steam engine production started in Hungary, the big railway stations were built in Budapest and minister Gábor Baross had the railway nationalized (Kósa, 2006).

The engineering industry of the country developed as well: it could be observed in the field of the production of engines, ships, agricultural machinery, war material and war equipment, tractors and aeroplanes and in the field of electrical engineering (Frisnyák, 1995). Mining and metallurgy also developed and cheap and fast transportation became possible both at home and internationally as well. The latter one was helped by the first domestic river and water regulation as well (Viczián, 1905).

Several factories were established besides Ganz factory, which had been recognized internationally as well and they played an important role in the field of Hungarian industry: Röck, Schlich-Nicholson Machinery – Waggon and Shipbuilding Company PLC., Láng, MÁVAG, Weapon- and Machine Factory, Machine Factory of the National Railways, Kühne, and the Danube Steam Engine Shipbuilding Factory in Óbuda (Németh, 1999).

Several domestic inventions which carried on with the development were born during this period: the transformer, the carburettor, three phase electric railway traction, telephone news, the rigid airship and the tungsten lamp.

However, this process was not an unified one which would have been extended to the whole country. While Budapest evolved into a cosmopolitan city, only few bigger towns developed in the country, but this development could hardly be perceived on the territories of small villages or farms.

West Hungary could be regarded as an exception in this respect. On one hand the vicinity of the capital, on the other hand of Austria provided the necessary background for its development.

The economic changes induced social changes as well. As a consequence of the development, the layer of the middle classes appeared and grew in number, mainly bankers and traders who played an active part in the introduction of novelties.

At the same time the effect of the still existing aristocracy could be felt as well, because large estates were in majority in the Transdanubian region. Within this layer aristocratic people with innovative view open to novelties could be found in large number, who stood beside a case with their property and respect, which naturally facilitated the introduction of a novelty.

In the case of the Hydroelectric Power Station of Ikervár count Lajos Batthyány and count Géza Batthyány were these persons and besides them deputy-lieutenant Antal Károlyi, László Bánó and Béla Szüts engineers and Sebő Edelman physics teacher of a main grammar school and Jenő Gothard astronomer provided the necessary professional support. This case was to produce electricity utilizing the power of River Rába and to supply the village Ikervár, the Batthyány estate, the towns of Szombathely, Sárvár and Sopron and the settlements in between and to operate the electric railways of Szombathely and Sopron with its help.

2. The Hungarian antecedents

The utilization of the power of water was not unknown in Hungary, either because watermills had already operated on the rivers or suitable reaches in the previous decades with the help of which cereals grown had been ground. It is evident from the register of mills that the people used several types of mills most suitable for the natural characteristics of the given area, the ratio of which changed and modified continuously due to technical development during the years (Paládi-Kovács, 1991). Later on, following the patterns of the mills utilizing the experience gained from their operation, the production of electricity started with the help of water. The Hungarian Ganz Factory had already been recognized internationally by then and it transported machines, equipment to different parts of the world and established power stations (Zipernowsky–Déry–Bláthy, 1896).

The use of electric energy was not unknown in Hungary at that time because in 1884 public lighting was solved with the utilization of electric light bulbs in Temesvár and the lighting of the Country-Wide Exhibition of Budapest was provided in this way as well with the help of the Hungarian invention, the transformator and in 1888 some streets of Mátészalka

were lit with the help of electric energy. The first tram started its operation in 1887 and in 1896 the first underground railway of the continent in Budapest as well (Németh, 1999).

The power station of Nagyszeben was built in 1896 under the leadership of Oskar von Miller engineer, the electric machines and turbines of which were produced by Ganz and this power station also provided electricity for the settlement Nagydisznód, so the textile industry there could be mechanized (Füßl, 2005).

3. The beginning

The members of the Batthyány family grew cereals on their estate in Ikervár, which was ground in the watermills there. The dam of the river made of brushwood was regularly damaged by the annual floods or ruined totally, which meant further expenses for the family, the standstill of grinding during the time of the repairs meant shortfall of income. Count Lajos Batthyány, the owner of the estate at that time charged László Bánó and Béla Szüts engineers – who had already surveyed the water conditions of Hungary earlier – with the elimination of this problem recurring annually. According to the calculations of the engineers River Rába – due to its favourable geographical conditions – could produce 1000 HP performance instead of the 120 HP used for the operation of the mill on the given reach, which could be utilized with the building of a power station (Siklós, 1987) (Fuli, n. d.).

In order to realize the plan in practice a meeting was called on 8-9 July, 1894 by the parties interested, during which the tasks to be done both in connection with the power station and the utilization of energy produced by it were discussed in details (Kalocsai, 1997).

For the realization of this monumental plan it was necessary to inform the population concerned, that is why a long article was published entitled „*Great Plans*” in the issue of *Vas megyei Lapok* (Papers of Vas County) on 15 July, 1894. The aim of the project was drafted in it: „*Szombathely must be supplied with electricity for electric lighting, an electric railway and the distribution of electricity for small industry produced by the power of the water of River Rábal...*”.

According to the plans the water gained from River Rába would be returned not directly to the riverbed but to Herpenyő, which lay even lower, so in this way not only the fall of River Rába, but the level difference between the two rivers could be utilized as well. As the biggest fall of the river – about 8 metres - was at Ikervár, the power station was planned to be built here, while in Szombathely the high voltage electricity led here was transformed into low voltage one in an engine room and this was transported to the consumers. They could use

electricity produced not only for lighting but for doing different agricultural work as well (for example ploughing, threshing) and the electric railway could be operated with its help both in Szombathely and Sopron. According to the calculations 1,200 HP natural resource was available for that (Nagy tervek, Vas megyei Lapok, 1894).

4. The debates about the establishment of the power station

The agreement of the population was also necessary for the realization of this large-scale plan. For its realization – counting on the interest aroused by the article – called an informative meeting in the great hall of the County Hall of Szombathely at 10.00 on 22 July, 1894 where they could answer the emerging questions and objections in detail.

Béla Szüts stressed the reliability and favourable geographical characteristics of River Rába, Jenő Gothard showed the advantages of electricity (stressing mainly comfort), and Sebő Edelmán described the development possibilities of the town and the neighbouring settlements, which would be provided by the power station built there (Az elektromos világítás ügyében tartott értekezlet, Vas megyei Lapok, 1894).

After the favourable reception Lajos Batthyány, Sebő Edelmán and Jenő Gothard handed in a petition to the local government of Szombathely for the „*Establishment of electric public transport vehicle and application of electric lighting*” (Villanyos közúti forgalmi eszköz létesítése, Vas megyei Lapok, 1894), which was debated by the representatives on the general assembly held on 18 October. The petition induced a huge debate inside the local government. First Zsigmond Ungár spoke and reminded the audience, that he had already suggested the supply of the town with electric lighting in January but he did not get an answer for that yet. The second speaker was royal councillor Ferenc Eredics, who directed attention to the dangers: „*if the pylon on which the cable can be found falls down because of a storm or other reason, the greatest tragedy will happen to both humans and animals as well*”. That is why he suggested the setting up of a committee, which would make its decision concerning the case after the examination of the case. If his suggestion is not accepted, then he will ask the general assembly to give permission for the building of the electric system in town in the case of the application of underground cables. The third person to speak was Vilmos Pick representative, who called the petition unfounded and unnecessary.

Sebő Edelmán answered these objections disproving them one after the other and pointing to the fact that the cables would run under the eaves of the houses and not on pylons,

so there would be no danger in connection with that. At last the petition was accepted 29:26 by the general assembly (Városi közgyűlés, Vas megyei Lapok, 1894).

Financial support was also necessary for the realization of the plan, that is why subscription for shares was advertised at the end of 1894, the consequence of which was that more than one million forints was collected by February (A villamos művek létrehozásához, Szombathelyi Újság, 1895).

Following this, on 28 March, 1895 the inaugural meeting of the Electric Shareholding Company of Vasvármegye was held in Szombathely (A villamos tanácskozás, Vasvármegye, 1895). This was not successful, though because negotiations were still going on with foreign investors in the background, who asked for the application of Swiss equipment and of the Thury-system in the power station of Ikervár in return for the financial support (Bodányi, 1910).

After the agreement, on 29 August, 1895 the inaugural meeting of the shareholding company took place again in Szombathely, which was successful this time (a VEM Rt. alakuló közgyűlésének jegyzőkönyve) and the Companies of Registry registered the company on 7 September, 1895 under the number 9671/1895 (Fuli, n. d.). The president, the members of the board of directors were elected and the aim, the organization, the operation and the volume of the capital were also put down in the statutes (a VEM Rt. tervezete).

László Bánó made an estimate for the costs of the construction, the final amount of which was 1,600,000 crowns (Péchy, 1971).

After these the building itself started under the leadership of László Bánó, while the earthwork and the concrete work were done by Luigi Melocco and Giovanni Lenarduzzi entrepreneurs, and the supervision by Mihály Kató engineer (Péchy, 1971).

5. The result of the successful debate: the hydroelectric power station completed

Works went on quickly and the formal opening of the barrage happened on 7 May 1896 (Az ikervári elektromos-művek nagy vízduzzasztójának ünnepélyes megnyitása, Vasvármegye, 1896), during the summer the dwelling house for the mechanics, the office and the turbine plant buildings were ready (A vasvármegyei elektromos művek, Szombathelyi Újság, 1896), at the end of the year the great turbine started its operation as well (Az ikervári villamos művek, Szombathelyi Újság 1896).

The power station was built with 3 Jonval-type turbines, to each of which 2–2 direct current dynamos were connected, with which it could produce a maximum performance of

585kW under the conditions of 65A constant current strength and maximum 9.000V voltage (Fuli, n. d.).

The amount of energy produced exceeded the demand, so the representatives of the shareholding company had negotiations with the leaders of Szombathely and Sárvár about the supply of the towns with electricity (A vasvármegyei elektromos művek, Vasvármegye 1895), which were successful and the company provided electricity for these settlements later.

It can be said that as a consequence of the debates, discussions the territories concerned started to develop due to the new mode of production introduced joining with the national tendency of the age in this way. In the following years the lives of people became more and more comfortable, their work safer and safer mainly in the field of electric threshing thanks to the wider use of electricity, the usage of machines helped the development of technological-technical education as well.

Nowadays, when sustainable development is becoming of primary importance in which renewable energy sources get a great role, for example the usage of hydroelectric power, it is conceivable that it is useful to get acquainted with the excellent figures and products of the past so as to be able to utilize the experience in the future. That is why it is worth dealing with the history of technology and that is why it should be important to put more emphasis on it in national public and higher education.

6. The application of debate in modern education, in the modernization of education

Especially, as continuous changes take place in the world today in the fields of economics, society and environment alike, with which education has to keep pace so as to be able to prepare the students for the resoluteness in the future among changed circumstances and in their future workplace as well (Kovács, 2003). Several methods are at hand for the teachers for that. Besides the traditional presentation, explanation, narration, short presentation of students, demonstration, homework new methods have appeared as well like discussion, the project method, the cooperative learning methods, simulations and games. These methods lay the emphasis on the participation of students in the process of the lesson to a greater extent rather than on the monologues of the teachers, helping in this way the easier acquisition of the teaching material and the discussion of questions and problems which crop up (Falus, 1997).

That is why I could use the topic mentioned in the article in the following way: a debate could be organized about the question in a secondary schools in class 11 within the

framework of from-master lessons, when the students divided into two groups argue for and against the topic. The topic is nothing else but the utilization of renewable energy sources opposed to the utilization of nuclear energy. During the debate the students have to touch upon the following questions: the importance of sustainable development, its place in common talk today, the advantages and disadvantages of the utilization of nuclear energy – mentioning as examples the catastrophe in Chernobyl, its direct effects and its effects today, renewable energy sources and their utilization, their advantages and disadvantages – mentioning as an example the hydroelectric power station of Ikervár, which has been producing electricity for more than a hundred years without polluting the environment.

Naturally, preparatory lessons would be necessary for this during which the processes going on today, their reasons and expected consequences would be mentioned and the effect of human activity on the environment as well.

After that the two groups – separately at this time – discuss their arguments, choose a person from among them respectively who are going to present them as speakers. While the speaker is talking, the others are listening silently, they cannot interrupt but they can write down their thoughts, their comments which they are going to express later, during the contribution.

After the two speakers have told their arguments, the members of the groups can ask their questions, tell their remarks and have a debate on the topic on the basis of this.

Both the speakers and the discussants have a given amount of time (5–5 and 2–2 minutes respectively), after it has been over, they can finish the sentence which they have started shortly, but they cannot go on talking and the order of the discussants is decided in advance (according to the seats, the list of names or other viewpoints).

The teacher acts as a moderator all the time: he/she tells the rules, the time framework, counts the time and after it has expired he/she takes the words from the speakers. He/she directs the students' attention to behave in a sportmanlike way, to pay attention to the other, to refrain from offending remarks and to the fact that it is not the winning which is important but the debate itself, convincing and the practice of contrasting arguments. The teacher controls during the debate if it is necessary, he/she corrects and after the time has gone, he/she summarizes, analyses and evaluates the participants' behaviour, then closes the debate. It is important that the closure should be satisfactory for everybody and it should process the experience gained for everybody. That is why it is worth discussing what has happened and what has been said after the closure of the debate, in which it is worth touching upon what happened during the debate, what helped and what hindered it, what they learnt about the

topic and about themselves during the debate, what was the most difficult during that time, what could be done differently, how the knowledge gained could be applied in the future.

It can be useful if the students think it over again at home and make a reflection about for the next lesson (Szivák, 2010).

I think that both the topic and the debate itself help the students to prepare for their future life, they will be able to pay more attention to each other and to their environment alike. Furthermore, they learn that people are different, so they can form different opinions about the same topic and they have to respect all the opinions. Besides this they learn the form of cooperative learning and processing together, which will be very useful later on at their workplaces where they will have to work in teams (Kagan, 2001).

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