Storage of the geothermal energy and energy management rationalization

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Abstract: Reinterpretation of the energy management considering the international engagements and the national possibilities. Grouping of the achievable process with the geothermal energy by the fluid enthalpy. Problems of the technological possibilities and the realisation on the basis of the technological and economic considerations. Maximalisation of the life expectancity of the thermal waters-well, avoidance of the depletion. In the case of depleted well and „hot, dry stone" the technology of the exploration of the heat energy. It is essential, from the point of view of the welldefend, the reduction of the consumer fluctuation with the help of buffer reservoir and intergrated systems. Development of the consumer order of magnitude, references to the buildup of the individual and communal systems. Possibility of the storage of the energy. The connection between the geothermal and the solar enyergy utilisation systems. The technology of the storage of heat energy in the earth. Simulating with one-, two- and three dimension mathematics and „final elements method" modells. Integration of the reviewed technologies to remote control systems.

Since drastically rising of the rock oil's price in the 70's, the economy is striving to replace the conventional energy sources. Contrary to the public approach, the fossil energy-resources of the Earth are inexhaustible. More recent and recent disquieting demonstrations have been come to light nowadays, by the environmentalist, about the accumulating contraminations in the atmosphere and in the water, that cause rapid changing of the enviroment, and even cannot conclude exactly of their hurtfull effect. In 1997 the accepted Kyoto Convention legally engages the industrial advanced countries that the emission of the gases causing greenhouse-effect must be reduced till 2012 on the average with 5,2% compared to the level of the 1990. At the present political state we do not know if these convention brings changes because the biggest CO_2 emissional has broken the pact with reference to economic reasons but the summit conference in Johanessburg has given newer movement to the enviromental protection.

However apart from the conventions it is determinable that the taking out of the fossils energy sources are needed and thereupon the renewable energy sources are suitable. The natural disposes with energy which can be entered our service, for example the wind-, the solar- and the geothermal energy, those energy that Hungary disposes aboundantly.

At the moment with the renewables achievable energy quota, which is placed among the Europan Union's commitments, seems to be unrealizable because there is no well-build up infrastructure. That is why the consideration of the home energy management and the financial supporting of the realizable projects are our accentuated duty.

The possibilities of the geothermal energy utilisation:

On the basis of the energy content of the thermal-waters, we can distinquish low-, medium- and high entalphian waters. Besides the energy content, from the point of view of the appropriation, there are several other quality which determine specialities of the applicability. The utility runoff is that the volume-flow that is provided safely and without any damages by the fossilized operation of the well. The value of this is determined by the competent authorities. In chemical respect the most important thing is the mass (mg/l) of the total constituent (solid and gas), which is not only significant from the point of view utilization, but also important from the point of view of the placement of leechate. The agression of the thermal water and the instinct of the mineral aggregation are modified by the changing of the pressure, the gas content and the temperature, that is why they must is be examined again after every each interferences. Gas relaser is needed in that case if the gas content of the thermal water impetes the using, or if it endangers the life- and property safety. Usually the high metangas content is typical of the quality of the home thermal waters, as well as the soluted iron-, manganese-, ammonia content, and the instinct to the corrosion or the secession and the total high mineral content. The first three characteristic quality

necessitate the manipulation of the thermal waters before the using and the fourth quality renders more difficult the emplacement of the utilized, cooled down and maybe the contaminated thermal water.

The waters- shooting out on the temperature more than 100 °C high- and the steam can be used for the preparation of the electric energy. To this, the geothermal power plant in building in Inke is an example. We can use the high-enthalpian waters for the operation of the absorption fridges, building heating with radiators, air manipulator machinaries, and of the agricultural dryer and the preparation of the domestic hot water. The medium-enthalpian waters can be used for balneological targets, floor- or enlarged surfaced radiator heating, as well as for the homestead of the keeper of animales of the provision of the glasshouse. The low-entalpian waters can be utilized for balneological targets, for the build up the floor heating system, also for the fish-breeding.

Practical problems of the system realisation:

On the one hand the composition of natural waters are determined by those medium's chemical composition which makes contact during its way and on the other hand by that kind of factors which modify the solubility of each constituent, furthermore by the posteriourly proceeded process.

The water absorbs different way the various components and the contamination. The components of the natural waters:

- coase dispers systems, they extant are bigger than 0,1 μm. These are float, poised, sinking materials.
- colloids, from 1-100 nm. These are the organic compounds, oils, fats, oxids, sulfids and staff like that.
- molecular solution, their extent smaller than 1 nm. These are the minerals, acids, bases, gases.

These components cause the mechanical problems, which can be dissolved by the water manipluating machinaries.

Due to the required devices, by the technolgy, and the operation, leading to other cost, the using of the renewable energy in not every case is cheaper than in the case of the conventional application. But in the introduction reviewed reality make their application indispensable. In order to the quiet widespreading of the technology, we have to provide financial support.

The maximalisation of the life-expectancity of the thermal waters:

For that, the deployment of the inventories using the thermal-well's heat energy would be good investment, the long life-expectancity have to be warrant. The life time depends on the usage. The well is used up more quickly if the exploitation fluctuates or if the head of the well is closed periodically. The volume of the exploitable water have to be limited. At the begining the free outflow wells have become negative during the years, so they only can be operable by pumping henceforward. For the lifetime there are only estimates, the geoligist judge the home thermal waters resources minimum 200 years enough.

Exhausted wells, 'hot, dry stone':

For the recycling of the exhausted pair of well or for the exploitation of the heat of the stones- found in the deep-, method have been worked out, which achieves the energy mining through the extractive and represser well.

The point of this method is that between the two well-couple, which are placed 1,5-2 km far away from each other, lossless flow exfoliates if we press to the well as much as water as we take out from the other well. The pressed water will have been got from one well to another approximately within one year. During this time it will have picked up the heat of the soil- which is our aim- as well as it will have soluted mineral materials, that there is a problem with it. The disadvantage of the method is that it only can be used that kind of soilstructure where the pores- where the water is leading- will not become clogged up. This kind of soil structure is leaky, and unfortunately there is a problem with the sandstone that can be found on the Great Plain.

The reduction of the consumer fluctuation:

The heat- and the water requirement's fluctuation of the consumer side affects the lifetime of the well, therefore it have to be reduced and dissolved as far as possible.

The period of the consumption can be examined in short and long interval. The short-time, daily fluctuation especially depends on the lifecycle of the people and working hours of the industrial- and supplier institutions. The long-cycle, which can be examined by yearly resolution, depends on mainly the weather and the changing of the seasons. So it is practical to examine the possibility solutions separately.

The elemination of the daily fluctuation simply can be solved by planning. Considering one day we examine water- or the heat requirement, and from this we define the needed permanent thermal water mass flow. In that case if the efficiency would be little in the using summit, we should have to build temporary, so-called buffercontainer, or other adding of the heat energy have to be solved. The container is indispensable for other completion of the water manipulating problems. The chemicals of the water manipulationg have to be in front of the container, where the reactions are taken place.

There is no general solution for the elemination of the yearly fluctuation. Subsurface cistern were already built with experimental quality, but it was not spread because of the expenditure. Besides the cost, the emplacement is a problem too, beacuse of the size of the cistern. For the extensive application, the expenses of the investment have to be reduced, and to do this there are two possibilities. The first is not to build container, but to use some kind of natural formation. This also can be pit, leak maybe soil. The other possibilty is to reduce the volume of the container. This only can be executeable is we find that kind of environmentally sound material, which its heat storing capacity is higher than the water's. Among on low temperature phase changer materials, the paraffin seems to be obvious solution.

The problem of the yearly fluctuation can be solved with the help of the integrated systems. Those kind of inventories have to be united, which are able to operate together besides the variable requirements.

The developement of the consumer order of magnitude:

We have to make a distinction between the one- and more well systems. The systems, consisting of one well are able to supply smaller buildings, works depending on the runoff. The following example is typical of their order of magnitude: the thermal bath in Dunaföldvár operates with 12 m^3/h runoff (39°C), with one thermal water swimming pools, three, thermal water temperated exterior pool; the used thermal water is enough to the heating of the dry building and the building of the interior swimming pool (but it have not built up yet, it is in the pipeline).

In the case of bigger runoff-wells and more wells, the heat energy increases, which makes the district-heating of the piles, villages, sections of a town possible. The precise number of the building-heated with used heat- can be calculated from the available runoff, the distracted heat and from the efficacy of the utilization. The build up of the individual and communal systems depend on local facility; reference only can be given by the knowledge of the parameters.

The storage of the heat energy:

The mentioned problems can be solved if we store the unnecessary heat and when it is needed we retrieve from the storing medium. For the assignment we have to choose the proper work medium. Among the heat storing, those can come the question, whose have storing capacity. The liquid and the solid material also can be a good solution, as well as those compound which changes phase on the storing temperature.

In the case of the liquid medium we have to develop the proper tank, that is against with the main reqirement, that the heat- and the material leakage have to be impeded. The placement of the heat exchanger does not mean a problem. Among the solid medium, the quartz and the dolomit are proper. In this case the material does not drain, so we do not need special insulation. But for the proper heat transfer, we have to pay attention to the proper build up of the heat exchanger. We can store heat quantum, but their big disadvantage that they only can bear few periods, which means that they became exhausted after

several phase changing, and they are not able to uptake further heat. The paraffins' further backwards is that they consolidate which worsen the heat transfer.

The storing container can be developed in different way. In case of individual work up it also can be develop with plus excavation before the construction. It is a big advantage that the container beneath the building raise the expenses and in the heating period it reduced the transmissional heatloss of the floor, more over direction of the heat flow can be turned. The borders of the tank- shaped up from the ground- have to be insulated, because in this way the loss can be reduced. The clay is proper material, because it is good heat insulator and it resist properly the water migration. In the case of the bigger system of this build up is quite circumstantial because of the size and the cost, therefore it is worth examinig the leaks or other geological formations. The technology does not change so we have to impounde some kind of environmentally sound materials, than we adapt it to the energy change.

If we can solve the storage, plus one energy collectional opportunity arises: this is the solar energy. In the summer period it is available in large quantities, at souch times accumulator can be filled with it. In winter when the heat requirement is high and when the becoming lights is not enough, we can provide the necessity from the stored energy. The solar panel have to be proportioned to the tank's whole summer filling.

Mathematical modells:

In the case of the simpliest modell, we only have to count with the summer stored energy benefit and winter heat requirement.

However in practice there are troubles in the system. This is such as the movement of the ground water, the wind, the cooling and the heating the air, the evaporation, the ground as operates like a fridge, the night infraradiation, the heat benefit from the daytime sunshining and the heat transfer of the magma. In the second step we have to recon with this factors.

The third step in the modell creation, that the weather and the passing of the time have to be taken into consideration. We only can simulate the ground process exactly if the fourth dimension, the time is parametered. The variation of the seasons, the fluctuation of the temperature is getting into our system at this time. Because of the complexity of the modell, it is practical to use the 'final element method', which dissolves the modell and the time into unities, then it builds up the whole system from the interaction of the unity.

With simulation we can get an exact picture of the filling and the discharge of the container, of those process taken place in the environment. It is an important respect to build such a system that does not damage the environment neither with chemical material nor with heat.

Remote control systems:

The already mentioned technology can have a future if we are able to operate our systems economicly. It is costly to deploy special service, precision tools, utensils, manpower near to the building. It seems to be practical solution to supply the control together from the centre, which is placed proper distance from our geothermal systems. With the present technology we are able to provide perfect operation, interfering from the distance and in the last resort to get off to the location to repair.