

Whereas Europe is reducing the production of wind generators by 20 percent by 2020, Serbia has been persuaded that they should be built although Serbia does not have favorable winds for an economical generation of electricity from them. Whereas Europe is funding and building large hydro power plants as environmental projects, Serbia has been persuaded that they are environmentally damaging – and, because of this, Serbia should build wind generators and small hydro power plants from which the electricity is subsidized in the amount which is two to three times higher than the present electricity generation prices.

Large hydro power plants are the cheapest source of electricity in the world, as well as the largest and the cheapest individual source of clean and sustainable energy. The European Investment Bank, as well as the World Bank, is investing again in the construction of large hydro power plants as environmentally friendly projects (they are no more considered environmentally damaging). The EU countries have undertaken to produce 20 percent of renewable energy by 2020, whereas, already today, Serbia generates more than 21 percent of renewable energy – owing to large hydro power plants for the most part.

Large hydropower plants and thermal power plants are the main source of electricity in Serbia and the reason for its lowest price in Europe. Instead of building the less efficient wind generators (because of the weak wind in our country) and the expensive ideas about using bio-mass as a renewable energy resource, Serbia should turn to the construction of large hydro power plants again, for which it has the hydro potential, and the construction of which simultaneously enables the greatest participation of domestic companies.

When comparing the costs of construction of hydro power plants worldwide, it should be said that, in addition to the difference in the type and size of hydro power plants, as well as the location conditions, these costs also differ with respect to the countries in which they are built (which includes different labor costs, the costs of financing and bureaucratic process, as well as other costs).

According to the International Energy Agency (IEA) estimate from 2010, mentioned in a study prepared by IRENA, the cost of hydro power plant construction worldwide ranged from 900 to 2.100 dollars (USD) for one kilowatt of installed capacity (IEA, 2010.b).

A large study (Lako et al., 2003) which included 250 hydro power plant projects worldwide, with the total capacity of 202 GW, found that the average costs of hydro power plant construction were only around 1.000 dollars for one kW of installed capacity, i.e. around one million dollars per megawatt of installed capacity of hydro power stations.

They estimate that the costs of construction of small hydro power plants (up to 20 MW) were a little bit higher, depending on various local conditions. Small hydro power plants usually have the service life of around 40 years, whereas the service life is up to 80 years in large hydro power plants.

The capacity factor – what percentage of electricity they actually generate with respect to

the full installed capacity -is higher in large hydro power plants than in the small ones.

Construction Costs of Large Hydro Power Plants - Recent Examples from the World

The costs of construction of large hydro power plants represent the most important item in forming the price of electricity that they generate, and this is why they are of primary importance, in addition to the location conditions (the annual inflow of water).

As an illustration of the costs of construction of large hydro power plants, we will mention several recent examples from the world:

It is estimated that the large hydro power plant Boguchany, with the capacity of 3.000 megawatts, on the river Angara in the Russian Siberia, which has been completed recently (22/12/2014), cost around 2.6 billion dollars.

Although large hydro power plants cost less per one MW of installed capacity than the small ones, the construction of this hydropower plant was extremely successful - the construction costs were somewhat lower than 0.9 million dollars per megawatt (MW) of installed capacity.

The European Investment Bank (EIB) has recently (in July 2014) granted a loan of 381 million dollars to the Austrian company Illwerke AG, for the construction of the pumped storage hydro power plant Obervermuntwerk 2, with the capacity of 360 MW.

According to the stated data, the construction costs would be around one million dollars per MW of installed capacity of the hydro power plant.

EIB has described this large hydro power plant project as a support for the 'environmentally friendly power', i.e. as positive from the environmental protection point of view - which represents a change in the investor attitude towards the construction of large hydro power plants.

A recent estimate for the hydro power plant Leningradskya, near Saint Petersburg in Russia, with the capacity of 1560 MW, the construction of which should cost 3.025 billion dollars - indicates towards the construction price of around 1.93 million dollars per megawatt of installed capacity of the hydro power plant.

The cooperation between the Rushydro and the Chinese company Three Gorges Corporation, for the construction of four hydro power plants with the capacity from 300 to 600 MW, in the Far East (the area of the Amur river), with the total capacity of around 2.000 megawatts, has a somewhat higher price per MW of installed capacity because of the difficult terrain and the additional flood protection of the area.

The total costs are estimated at 5.03 billion dollars (USD) - which amounts to around 2.5 million dollars per megawatt of installed capacity.

Power Plants Construction in Serbia - Comparable Construction Costs and Capacity Factors  
No possibility of constructing large hydro power stations in Serbia is mentioned in the Serbian public. According to some local estimates the construction of the pumped storage hydro power plant Đerdap 3 in Serbia would cost around one million euros per megawatt of

installed capacity.

According to the available data on the construction of small hydro power plants in Serbia, their cost ranges from 2.22 to 3.13 million dollars per megawatt of installed capacity - which is two to three times more expensive than the average construction of large hydro power plants in the world which, otherwise, also have a higher capacity factor.

Nowadays, in Serbia, the word is spreading that large hydro power plants have adverse effects on the environment and they are not considered ecological plants.

The World Bank, the most important international creditor of such projects, has changed the attitude after ten years - and in 2013, it started financing the construction of large hydro power plants as environmentally friendly!

The comparison of cost for the construction of hydro power plants with the cost of construction of thermal power plants and wind generators is indicative - particularly if their capacity factor is also included (how much electricity per unit of installed capacity they actually produce):

The cost of construction of the new power unit B3 in TPP Kostolac (of 350 MW), which is built from a loan which China has granted to Serbia, amounts to only 1.44 million euros for one MW of installed capacity, i.e. only 1.3 million euros for the construction of the thermal power unit without the costs of expanding the coal mine. The average annual electricity generation in thermal power stations, per one MW of installed capacity, is otherwise higher than the average electricity generation in hydro power stations, so, for instance, the reconstructed Unit B1 in the TPP Kostolac will reach the capacity factor of the outstanding 85.6 percent (of the full installed capacity).

According to available data, the announced construction of wind farms in Serbia should cost around 1.866 million dollars per megawatt of installed capacity of a wind generator, whereas their capacity factor is certainly below 20 percent .

In other words, the reconstructed power unit B1 in the TPP Kostolac will generate four times more electricity per megawatt of installed capacity than the planned wind generators in Serbia.

According to the data from 2013, the global average efficiency (capacity factor) of hydro power plants was around 40 percent and less than 25 percent when it comes to wind generators.

Large hydro power plants in Serbia otherwise have a significantly higher capacity factor. According to the publicly available data the hydro power plant 'Đerdap 1' in Serbia, with 1025 MW of installed capacity, generates around five billion kilowatt-hours of electricity annually - which means that it has the capacity factor of around 56 percent.

Besides currently generating more energy/electricity from renewable resources in our energy mix than the EU countries (today, Serbia generates 21.5% of renewable energy, the EU countries are only planning 20 percent by 2020), Serbia generates by over 60 percent

more of this energy than the USA, which obtain only 13.2 of electricity from renewable resources (of which more than a half from hydro power plants).

Where is Serbian Energy Sector Going?

The national renewable energy policy is based on the wrong information that, because of the commitments towards Europe, Serbia should increase the percentage of renewable energy to 27 percent by 2020, i.e. to a level which is higher than the one to which the EU countries have obliged themselves (only 20 percent!).

When it comes to renewable energy, today, Serbia is pressured by Europe which has less renewable energy than us on the average. Whereas Europe is reducing the production of wind generators by 20 percent by 2020, Serbia has been persuaded that they should be built- although Serbia does not have favorable winds for an economical generation of electricity from them. Whereas Europe is funding and building large hydro power plants as environmental projects, Serbia has been persuaded that they are environmentally damaging - and, because of this, Serbia should build wind generators and small hydro power plants from which the electricity is subsidized in the amount which is two to three times higher than the present electricity generation prices.

They have succeeded, as it seems, in persuading the local government that there is something wrong with the national electric power industry and that major reforms are required there - probably because power utility EPS produces the cheapest electricity in Europe. , transmits [Serbia-energy.eu](http://Serbia-energy.eu)