

ECONOMIC FEASIBILITY OF SOLAR POWER PLANTS IN IRAQ

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Demand for electricity in Iraq has been stimulated by a growing economy and increasing number of population. In addition, electricity is subsidized in Iraq, which leads to increased demand. Nowadays the output of electricity sector in Iraq averages more than 8500 MW, while the demand is typically more than 14000 MW. Energy deficit in Iraq increased since 2003, when in the war was destroyed electricity network (Fig.1)

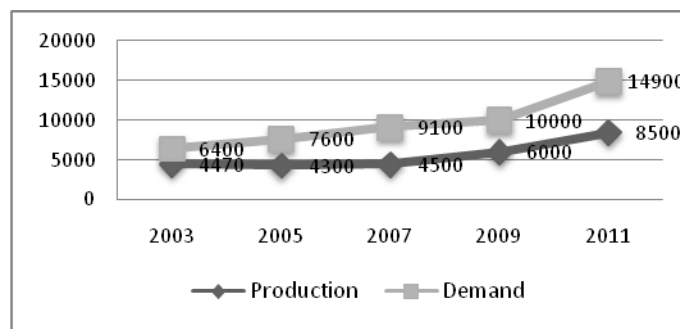


Figure 1. Dynamics of electricity production and electricity demand in Iraq, 2003 - 2011, MW

About 2400 MW of electricity Iraq gets from other neighboring countries, but that's not enough to meet the ever increasing demand. Deficit of electricity hinders the development of industry. Lack of electricity tends to affect more severely the most vulnerable groups of Iraq's society and increases their morbidity and mortality.

Iraq has 32 power plants - thermal, gas turbines, hydroelectric, and diesel power stations. The majority of the existing power plants are thermal plants that use crude oil supported by gas-fired and hydro plants. They produce approximately 80% of electricity balance of country. Thermal plants in comparison with other plants have several advantages. First, the thermal plants require less capital investment than other plants. Second, the thermal plants can be built anywhere, regardless of the availability of fuel. Third, they take up smaller area than hydroelectricity. And finally, the fourth, the cost of electricity is less than that of diesel power. However, if such benefits, they have drawbacks. The cost of electricity generated at thermal power plants (crude oil) exceeds the cost of electricity from other types of power plants (Table 1).

Moreover, fuel prices are very volatile. In addition, thermal plants significantly pollute the atmosphere, releasing into the air large amounts of smoke and soot. The maximum, daily average and annual average concentrations of pollutants in the air varied over a wide range from acceptable to the excess of the maximal allowable levels ten times at a distance of 1000 km from the thermal power plant in Basra and Baghdad. This makes actual the search for other ecologically safe energy sources.

It should be noted that there is a continental climate in most parts of Iraq and tropical climate in its southern regions. Iraq has high rate of solar energy. The specific power of the solar energy reaches up to 1900 - 2200 kWh/m².

Table 1 –The cost of electricity produced by power plants of various types

Types of power plants	Electricity cost, EUR /kWh
Thermal plants (crude oil)	0,51
Thermal plants (natural gas)	0,39
Thermal plants (coal)	0,41
Large hydropower plants	0,14
Small hydropower plants	0,27
Solar power stations	0,24
Biofuel power stations	0,52
Nuclear power plants	0,22
Wind	0,10

We compared the operating costs of the power plants at the diesel fuel and solar power.

Baseline data: estimated time of operation - 25 years.

Diesel power: peak power - 6 kW, energy consumption - 300 kWh / month, permanent power supply, the cost of diesel power station - \$ 4500, the cost of diesel fuel - \$ 0,35 / liter, fuel consumption – 1,5 liters/ hour, the resource of a diesel power - 8000 hours (1 year), battery life is 2,5 years, the price of battery - \$30, maintenance: oil , adjustment of filters - \$ 200/ year.

Solar power: peak power – 6 kW, energy consumption – 300 kWh/ month, permanent power supply, inverters cost - \$4500, average annual solar radiation of 120 kWh/m² per month, energy production of panel - 15 kWh/ month , the number of solar panels - 20 , the cost of solar panels 20 x \$355 = \$7100, solar resource batteries- 25, inverters - 10

years, the number of batteries - 8, battery life - 10 years, the cost of battery \$2000, maintenance: cleaning the solar panels, small repairs - \$50/ year.

As shown by our calculations, only the first year cost of the equipment and operating of diesel power station slightly lower than operating and equipment cost of the solar power station and at the three year of work cost will exceed the operating and equipment cost of the solar power station. Solar power plant does not emit harmful substances, does not pollute the environment, operating expenses include only periodic cleaning of the facial surfaces of solar panels and replacing corroded contacts, planned replacement of inverters and batteries every 10 years.

This gives grounds for implementation sun energy projects for electricity generation. It is interesting that the efficiency of modern solar power station nowadays reaches up to 14,4%, however 5 years ago at the height of the popularity of solar modules their efficiency does not exceed 10%. It is believed 5-10 years later, this index closer to 30%. Due to new technologies introduction quite naturally the cost of electricity will fall. Such prospects in the development of solar energy make it one of the most attractive destinations in attracting foreign investment. An important advantage of the solar power station for Iraq is the ability of local electricity generation, which could decentralize the power systems in Iraq, as a result great losses of energy could disappear when transporting electricity.