Avoided costs as a method to calculate effective

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Abstract

The basic concept of avoided costs in electric utility has been considered for many years. As a method was formulated and applied at the end of the seventies. In 1978 US Congress passed the Public Utility Regulatory Act (PURPA), as amended by The Energy Policy Act of 1992 (EPAct) which in fact has promoted independent producers (qualifying facility-qf) generating energy in cogeneration. PURPA has imposed the obligation an utilities to purchase electricity from self-sufficient producers at „avoided costs" prices and by this PURPA has put small – non-conventional sources and environmentally friendly companies in the way to enter the former monopolistic energy market.

The calculation of avoided costs was originally applied mainly in order to compute the costs of alternative sources of electricity and to define the market values of electricity generated by various sources. As the result of the recent market liberalisation, the calculation of avoided costs is now commonly applied by the electric companies as an important supporting method enabling to take economic decisions in electricity investment and investments plans.

The definition of avoided costs

Avoided cost category was defined by the Public Utility Regulatory Act Sec. 210 Definition. According to above definition avoided cost is fixed and running cost on an electric utility system which can be avoided by obtaining energy or capacity from qualifying facilities. Following this definition avoided cost is incremental costs of generating and delivering electric power that will not has incurred if an alternative source(s), more effective, is added to system. Therefore, avoided cost is the net savings that result when we cover additional demand by more effective source. The calculation of net savings depends on whether only direct/internal costs are taken into account, or whether indirect/external cost are included as well[1].

Alternative resources are a broad range of possibilities:

- non conventional producers, including: cogeneration, renewable sources such as wind, solar, geothermal, biomass etc.,

- independent sources, local distributors using DSM measures and programs,

- conventional efficiency supply – side source, eg. municipal owned.

Calculations of avoided costs in energy systems must be consistent with the Integrated Resource Planning (IRP) methodologies, in order to identify the most cost-efficiency resources and to minimize the cost of providing energy to consumers.

Primary approach to calculate avoided costs

There are several avoided costs calculations methods for an alternative source. All based on the difference in revenues requirements that would result from the added alternative source to the utility system. The most popular are three of them:

- the „Ideal" avoided cost methodology,

- the „Proxy" plant,

- the differential revenue requirements methodology (DDR).

The main goal in this method is to calculate avoided cost of each alternative source added to utility system and to define the cheapest one. Starting point means identification of all potential alternative sources, one by one starting from least-cost one.

The avoided cost of the added alternative source is found on the way[2]:

1) creation an optimal supply plan (without alternative source) to meet expected load in each year of the planning period,

2) computation of the annual revenue requirements for this plan,

3) creation a new optimal supply plan to meet annual loads, with alternative source (impacts being considered),

4) computing the annual revenue requirements for this new plan,

5) calculation the annual differences between the revenue requirements of this two plans.

Finally to find the annual energy and capacity cost level for planning years it is necessary to simulate for two plans: first without and second with alternative sources using IRP methodology.

The „proxy" plant has been used to define avoided cost for an alternative source, which are equal to avoiding costs of building and operating a new own generating plant. In this case two simultaneously build plans, one with and second without alternative source will differ in only by one respect – the cost of construction and maintenance „proxy" plant. In this method is very important that the operating characteristic of the proxy plant closely match those of the alternative resource under consideration.

A variant of this approach is „peaker" methodology. By using this method it's possible to calculate postponement value of adding new manufacturing units to meet new peak demand in planning time[3].

The differential revenue requirements methodology is a complex approach of defined avoided cost of each alternative sources or group of sources. The approach estimates the avoided costs of each alternative source by using the avoided costs of the decrement that approximates the impact of that sources on the load. Two plans for each load level differ from each other by the net load impact of the decrement[4]. Advantages connected with DSM are taking into consideration, as well.

Together with development of competitive energy market new methods of avoided costs approach has been established. One of them „competitive bidding programs" shoves avoided cost as the most attractive and not accepted offer. Main advantage is defining avoided costs according to the value resulted from bidding market. In another method „spot market pricing" electricity value first of all has resulted from marginal cost[5].

All of approaches need to account a lot of information concerning, operating characteristic, the timing of the sources added to the utility system, location on the utility grid etc.

Components of avoided costs

The avoided cost of alternative source should be composed of direct cost, indirect economic costs and opportunity cost as well.

The most discussed costs in avoided costs calculation are: generation fixed costs (capacity costs), generation variable costs (energy costs), transmission and distributions costs, line loses costs, direct environmental costs, environmental externality costs, direct and indirect economic costs.

Generation fixed costs (capacity) include capital costs for new generation capacity which are multiplied by annual factor for recovery (depreciation) of the investment, taxes, insurance costs, etc and fixed maintenance costs. They depend on the characteristic of the resources.

Variable (energy) costs include fuel costs and variable operation and maintenance cost and other such as the costs of substances necessary to electricity generation in power plant. The energy costs depend on the time of the day (e.g. peak or off-peak) and prices of the fuel, power stations age etc.

Transmission, distribution and line losses costs include:[6]

1. transmission and distribution system construction costs,

2. transmission and distribution system operation and maintenance costs,

3. generation related line losses costs.

The transmission and distribution costs vary by total load and number of costumer. The line loses cost depends on time of the day, season, distance between power station and point of consumption, etc.

In avoided cost methodology is important to take into account direct and externality environmental cost. Direct environmental cost are connected with emissions allowances and pollution related with power plant. Eternality cost are additional damages to the environment beyond those captured by taxes on direct costs. They have created at energy source construction, extraction and transportation of fuel, combustion and final electricity consumption phase.

Direct and indirect economic costs are impacts locally or sometimes nationally of undertaking projects. That may be either positive or negative. For example, if a utility builds a power plants, it will pay taxes, the employment on local market increase, rising income of local communities as well the co-operative orders with local companies increase. Finally additional revenues will re-spend on roads, education, health protection etc. It is very difficult to estimate economic and opportunity cost and they are rarely mentioned in calculating of avoided cost.

The calculation of avoided costs in the world power industry

The calculation of avoided costs was originally applied in the USA, mainly in order to compute the costs of alternative sources of electricity and to define the market values of electricity generated by various sources. As the result of the recent market liberalisation, the calculation of avoided costs is now commonly applied by the electric companies in most of the highest developed countries of the world. In 1990s the steps to develop and apply the avoided costs calculation were taken also in Polish electric power system.

In the system level applications, the calculation of avoided costs is being applied for the integrated system planning, with the use of models specially designed for the analyses of energy situation and forecasting of the energy requirements within the time horizon of 20-30 years. Such procedure leads to the selection of the development variants by the criteria of least cost, minimum degradation of environment, security and reliability of supply, ensuring simultaneously the assumed financial results of the activity.

At the local markets, cooperating with the system level market, the calculation of avoided costs is applied in order to estimate the value and to define the prices of electricity generated by various local sources, and the prices applied in the contracts between the market actors, i.e. generators, distribution companies, consumers and independent suppliers. The activity of the increasing numbers of actors and the growing competition between them leads to the cooperation between the local markets and with the system market. The Third Party Access in principle gives the chance of gaining the

advantages to the local generators and consumers. The avoided costs are in this context defined as the cost differences between the electricity purchased from the alternative source and the electricity purchased from the local generator.

The calculation of avoided costs is applied not only in the electricity industry but also in the other network-bound systems (gas, water). It is used for various economic decision making, and particularly for the analyses concerning:

· development plans for the network systems: electricity, gas, water and sewage,

· selection of the most efficient alternative source,

· calculations of the value of electricity in the system,

· calculations of the investment projects efficiency,

· calculations of the modernisation projects efficiency,

· calculations for the network investments, taking into account the influence of distributed generation sources on the electric grid operation.

In case of investment projects, the calculation of avoided costs is applied as the basis for the selection of more efficient investment options, i.e. the cheaper options or the options which would generate the higher revenues. An example of such application is the evaluation of the proposed investment project which as one option would consist of the separate power plant and separate heat plant, and as second option would provide for the construction of Combined and Heat Power plant for the simultaneous production of both forms of energy. Both investment options were evaluated for the 20-year period of plants operation. The results were compared and the avoided costs were calculated for the investment phase and for the plants operation phase.

In case of the modernisation projects efficiency evaluation, the calculation of avoided costs was applied for comparison between the coal fired CHP unit and the comparable gas fired unit. The advantage of the avoided costs calculation is that it takes into account the whole life cycle of the equipment and that both the avoided costs for the investment phase and the avoided costs for the operation phase are calculated.

The category of avoided costs is applied also for the comparison between the various options of electricity purchase, when the aim is the lowest cost purchase and the differences between various option costs are the avoided costs. The possible options of purchase may be for example the electricity from cogeneration or the electricity from brown coal fired power plant instead of the electricity from hard coal fired plant.

The calculation of avoided costs is useful also for the evaluation of the DSM programme effects, evaluation of using the renewable sources and in the analyses concerning the quality standards of electricity generation.

The avoided costs calculation is the basis for the selection of the most efficient projects, i.e. the projects with lower capital expenditures and lower operation costs through the whole life cycles of the equipment. The environment protection advantages may be also achieved if the environmental cost components are taken into account in the calculation of avoided costs. Moreover, the application of avoided costs calculation leads to the increased market participation of the independent electricity generators. Such generators, using the alternative and distributed technologies, may provide the cheaper electricity and be competitive in comparison with the large generators.

The first proposal to apply the category of avoided costs for the Polish electric system was put forward in 1992 by the consulting company RCG/HAGLER, Bailly, in the pricing study for Polish power industry. Currently the calculation of avoided costs is applied in Polish power industry for the system

calculations, for the analyses of electricity costs at the local markets, and as a background for making various economic decisions.

In summary it should be underlined that the calculation of avoided costs constitutes the important supplement to the formerly applied methods of economic evaluation in the electric power sector, both in the operational activity and for the modernisation and investment projects. The traditional cost calculation, applied in the bookkeeping by the electric companies, makes it possible to evaluate the economic aspects of companies activity, provides the basis for the calculation of financial results, taxation etc. On the other hand, the calculation of avoided costs is one of the evaluation methods for the planned and future projects, making possible the assessments at the system level and supporting the integrated planning of energy sources development in relation to the investment projects, modernisation projects and the other types of economic decisions.

The calculation of avoided costs is a good tool for evaluating the efficiency of discussed projects and investment plans in the energy sector. Application of this tool enables to minimise the failure risks associated with the projects and allows to select the most efficient solutions. For the decision making process, the category of avoided costs supplements the other methods of economic evaluation in the power industry. Due to cost comparison through the whole life cycles, the method of avoided costs allows to make decisions which ensure the better economic results. One of the advantages of the avoided costs calculation is also taking into account besides the direct costs also the costs which indirectly influence the project.

The calculation of avoided costs, applied by the leading economies of the world, gives the additional capabilities of cost comparison and advantage comparison of various projects. It is a good tool for the optimum decision making and should be applied at a wider scale also in Polish power industry. Its application brings various technological, economic and environmental advantages. The main technological advantage is the development of new cheaper and more environment friendly technologies of electricity generation. The economic advantages are first of all the lower costs of electric system operation, therefore lower consumer prices of electricity and higher competitiveness of national economy at the international markets. Therefore it is purposeful to develop further and to apply the calculation of avoided costs in Poland.

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