# Contribution to the Formulation of Economically Efficient Subsidy Policy in the Area of Small Hydro Power Plants

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**Abstract**

This paper analyzes the economic aspects of subsidy policy in the area of small hydro power plants. It confronts the current practice with the theory and proposes an economically effective solution. It is the first of a series of contributions devoted to providing subsidies to producers of renewable energy to which, among others, belong running water, biofuels, wind and solar radiation. It is based on the results of three case studies dealing with the analysis of the economic efficiency of small hydro power plants, which are solved by the "case-based reasoning" approach. The first two studies relate to the already completed and operating hydro power plants on the rivers Sázava and Litavka in the Czech Republic. Their parameters and other required data are accessible at http://www.eis.cz. The third analyzed project is in the planning stage and has not yet been implemented or subsidized. Calculations are based on budgeted data and are used for demonstration and illustration of the proposed criteria of the effective economic subsidy policy.

**Keywords:** natural resource, economic resource, renewable resource, payback period, NPV, IRR, economic efficiency, subsidy policy

## Introduction

As we know the general economic view of all sources, both non-renewable (such as oil and natural gas) and renewable (of which the renewable energy sources play a particularly important role – rivers, biofuels, wind, solar radiation, etc.), distinguishes between the term "natural resource" and "economic resource". Any "natural" resource becomes economically attractive and thus "economic" only if it fulfills the following two conditions:

1. *There are technologies that enable the obtaining (mining) and utilization of a natural resource*;

2. *Existing prices and conditions enable the economically meaningful usage of the resources.*

In the case of today's essential non-renewable resources the first premise of transforming the mentioned natural resources into economic ones is not significantly hindered. According to experts, the current technology has advanced in such a way that there is little to improve in this regard (see Dozolme 2012). The problem lies rather in the second premise: As a result of a decrease of the stock of these resources their strategic importance increases. The idea of local governments concerning their deposited wealth is reflected both in their applied requirements when determining the conditions for the authorization of mining, and by the prices and mode of payment for the rendered mining rights. The agreement or disagreement on this issue often influences the future of deposited wealth being used for the benefit of all. A useful tool that can help to solve this problem is presented in Hašková and Kolář (2012).

In the case of renewable energy sources today the situation is different. Meeting the second premise is widely supported by various incentives and subsidies. Special technologies (small hydro power plants, biofuel boilers, wind turbines, photovoltaic solar panels, etc.) allow transforming the energy potential of these sources into electrical energy, and therefore utilizing it meaningfully. The problem with these sources lies rather in the fact that even though they may limit the undesirable externalities of traditional producers, they can not compete with their economic efficiency. If we place the utmost emphasis on the integration of renewable energy sources with the willingness to cover the potential economic losses through subsidies to the producers of these energy sources, we face the problem of how to minimize these losses by appropriately allocating subsidies and how best to use the given amount of subsidies. The primary aim of this paper is to help to solve this problem as demonstrated in the case of small hydro power plants.

The financial analysis examining the effectiveness of individual producers' projects offers various tools for the suitable solving of this issue (see Brealey, Myers and Marcus 2011). The simplest, and in practice often used criterion is the simple payback period (SPP). However, this criterion works reliably only in the case of the payback period being longer than the lifetime of the project (so that the invested capital will not ever be paid back), and this results in excluding the project from the game. In the opposite case, the shorter simple payback period does not say much about the economic efficiency of the project. A more appropriate tool than the previous one is the internal rate of return of the project (IRR) but it does not say explicitly what amount of subsidy is adequate. That can be ascertained from the budgeted net present value (NPV) of the project.

In the following we build on the requirement of a 7% rate of return on investment in small hydro power plants and we calculate the values of these criteria for three considered projects. From their comparative analysis and from other assumptions we formulate the criterion of the efficient allocation of subsidies. All necessary calculations and tables are taken from the bachelor thesis of the student Ivo Chládek (see Chládek 2011), in which they are justified in detail and where other relevant information can be found.

### Project $SHP_1$ (small hydro power plant)

The project deals with the renewal and modernization of the former power station on the river Sázava in the locality of Okrouhlice (see Chládek 2011; Czech energy agency 2006a). The expected lifetime of the project is 30 years; the electric power of the generators is 90 kW. From the average data collected during the previous operation time the following table has been constructed, interpreting the calculation procedure of the expected annual cash flow:

Table 1: The forecast of components of the annual cash flow (in CZK) generated by $SHP_1$ over 30 years

| | **Period in years** | 0 | 1 | 2 | 3–11 | 12–30 |
|---|---|---|---|---|---|---|
| 1 | Capital investments | 1,892,448 | 2,450,000 | | | |
| 2 | Income from sale | | | 490,000 | 490,000 | 490,000 |
| 3 | Operating costs | | | 40,000 | 40,000 | 40,000 |
| 4 | Depreciation of buildings over 30 years | | | 26,495 | 64,343 | 64,343 |
| 5 | Depreciation of technologies over 10 years | | | 134,750 | 257,250 | 0 |
| 6 | Profit before tax (2–3–4–5) | | | 288,755 | 128,407 | 385,657 |
| 7 | Tax rate 24% (line number 6 × 0.24) | | | 69,301 | 30,818 | 92,558 |
| 8 | Net profit (6–7) | | | 219,454 | 97,589 | 293,099 |
| 9 | Cash flow from operation (4+5+8) | | | 380,699 | 419,182 | 357,442 |
| 10 | Net cash flow (9–1) | -1,892,448 | -2,450,000 | 380,699 | 419,182 | 357,442 |

The amount of 1,892,448 CZK represents the construction expenditures; the amount of 2,450,000 CZK the technology expenditures. The project financing was carried out from investors' resources and from a ČEA subsidy (Czech Energy Agency) that amounted to 1.2 million CZK.

### Estimation of simple payback period (SPP) of investment in $SHP_1$

On the website www.eis.cz/dokumenty/822_3_0_12003-12-04_15-20-25.doc we can read that on the basis of some unspecified economic evaluation in the case of $SHP_1$ the simple payback period is 6.41 years ((4,342,448 − 1,200,000) / 490,000 = 6.413). This approach to calculations does not reflect reality, which reveals that on the river Sázava the payback periods of SHP lie in the range of between 15 to 20 years of operation. Therefore, the above stated value of the return rate can not be taken into account.

When estimating the real simple payback period (SPP) we proceed from the following condition

$$\sum_{i=2}^{X} CF_i \leq 4,342,448 < \sum_{i=2}^{X} CF_i + CF_{X+1} \tag{1}$$

in which 4,342,448 = 1,892,448 + 2,450,000 and $CF_i$ is the amount shown in the last line of Table 1 in the i-th period. Hence X = 11. Because of that, it applies for the simple payback period (SPP):

$$SPP = X - 1 + (4,342,448 - \sum_{i=2}^{X} CF_i / CF_{X+1} \tag{2}$$

from which we get

$$\boldsymbol{SPP = 11 - 1 + (4,342,448 - 4,153,337)/357,442 = 10.53 \quad \text{years}}$$

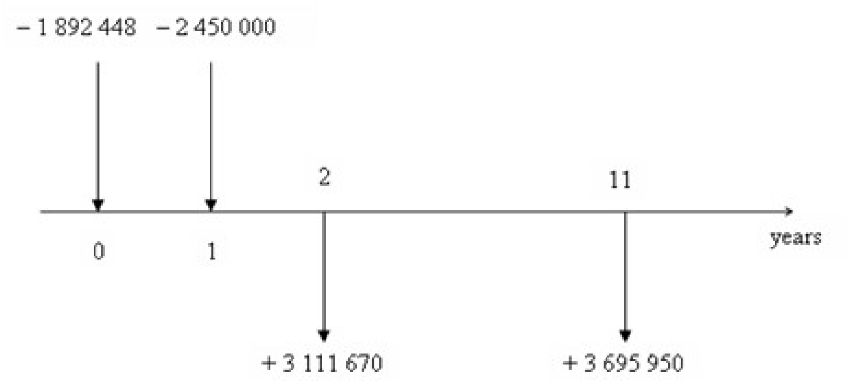
As the simple payback period (ten and a half years) is much shorter than the expected lifetime of the project (thirty years), there is a good chance for the return of the invested capital and a good chance that the project could be acceptable (economically efficient). However, it is necessary to determine with the calculation of its NPV (net present value) whether it promises the desired average of an annual return rate of 7% for every crown spent.

## Estimation of NPV and IRR of the $SHP_1$ project

The last line of Table 1 shows that in the period of 3 to 11 years the estimated incomes generated by the project have the character of a nine-year annuity with annuity payments in the amount of 419,182 CZK. They are followed by the period of the nineteenth annuity (12 to 30 years), with annuity payments in the amount of 357,442 CZK. For the purpose of calculating NPV it is convenient to represent the first annuity with its equivalent payment in the amount of FV(2) = 419,182 × 6.515 = 2,730,971 in period 2 and the second annuity with the equivalent payment in the amount of FV(11) = 357,442 × 10.34 = 3,695,950 in period 11. The constants 6.515 = (1 – 1 / $1.07^9$) / 0.07 or respectively 10.34 = (1 – 1 / $1.07^{19}$) / 0.07 are nine or respectively nineteen years annuity factors at a discount rate of 7%.

Thus, we obtain the following scheme of the modified time structure of the $SHP_1$ project cash flow:

Figure 1: The scheme of the modified time structure of $SHP_1$ project cash flow




We obtain the modified incomes $CF_2 = CF_2 + FV(2) = 380,699 + 2,730,971 = 3,111,670$ in period 2 that was formed by increasing the original payment $CF_2$ by the $FV(2)$ nine year annuity and $CF_{11} = FV(11)$. With the required yield of 7% for NPV of this flow we get (and thus of the project $SHP_1$):

$$\boldsymbol{NPV = -1,892,448 - 2,450,000/1.07 + 3,111,670/1.07^2 + \\ +3,695,950/1.07^{11} = -1,892,448 - 2,228,720 + \\ +2,717,853 + 1,755,576 = +291,261\ \mathrm{CZK}}$$

Due to the fact that NPV of the project is positive, IRR has to be greater than the discount rate of 7%. For a more accurate estimation we solve the equation

$$\sum_{i=0}^{30} CF_i/(1+IRR)^i = 0 \qquad (3)$$

In the case of $SHP_1$ for IRR 7.96% < IRR < 8% applies. This implies that even in the event of a necessary overhaul (NO) of equipment in the middle of the projec's lifetime the investment yield would not drop below 7% if the future actual costs of the NO did not exceed the amount of 800,000 CZK (291,261 × 1.0715 = 291,261 × 2.759 = 803,589). As we can see, the investment in $SHP_1$ is a relatively lucrative business, so the subsidy from ČEA in the amount of 1.2 million CZK was not needed and can be regarded as a not entirely deserved and necessary "gift" to the investor.

### Project $SHP_2$ (small hydro power plant)

The subject of the second project analysis is the installation of a small hydro power plant in the village Chodouň near Zdice on the river Litavka instead of the former mill (see Chládek 2011; Czech energy agency 2006b). The expected lifetime of the project is 30 years; the maximum electrical power of the generator is 30 kW. From the average data collected during the previous operation

Table 2: The forecast of components of the annual cash flow (in CZK) generated by $SHP_2$ over 30 years

| | Period in years | 0 | 1 | 2 | 3–11 | 12 | 13 | 14–30 |
|---|---|---|---|---|---|---|---|---|
| 1 | Capital investments | 860,000 | 940,000 | | | | | |
| 2 | Income from sale | | | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 |
| 3 | Operating costs | | | 33,000 | 33,000 | 33,000 | 33,000 | 33,000 |
| 4 | Depreciation of buildings over 30 years | | | 12,040 | 29,240 | 29,240 | 29,240 | 29,240 |
| 5 | Depreciation of technologies over 10 years | | | 51,700 | 98,700 | 0 | 0 | 0 |
| 6 | Profit before tax (2–3–4–5) | | | 53,260 | -10,940 | 87,760 | 87,760 | 87,760 |
| 7 | Tax rate 24% (line number 6 × 0.24) | | | 12,782 | 0 | 0 | 18,494 | 21,062 |
| 8 | Net profit (6–7) | | | 40,478 | -10,940 | 87,760 | 69,266 | 66,698 |
| 9 | Cash flow from operation (4+5+8) | | | 104,218 | 117,000 | 117,000 | 98,506 | 95,938 |
| 10 | Net cash flow (9–1) | -860,000 | -940,000 | 104,218 | 117,000 | 117,000 | 98,506 | 95,938 |

Table 3: The forecast of components of the annual cash flow (in CZK) generated by $SHP_3$ over 30 years

| | **Period in years** | 0 | 1 | 2 | 3–11 | 12 | 13–30 |
|---|---|---|---|---|---|---|---|
| 1 | Capital investments | 5,000,000 | 7,000,000 | | | | |
| 2 | Income from sale | | | 1,200,000 | 1,200,000 | 1,200,000 | 1,200,000 |
| 3 | Operating costs | | | 360,000 | 360,000 | 360,000 | 360,000 |
| 4 | Depreciation of buildings over 30 years | | | 70,000 | 170,000 | 170,000 | 170,000 |
| 5 | Depreciation of technologies over 10 years | | | 385,000 | 735,000 | 0 | 0 |
| 6 | Profit before tax (2-3-4-5) | | | 385,000 | -65,000 | 670,000 | 670,000 |
| 7 | Tax rate 24% (line number 6×0.24) | | | 92,400 | 0 | 20,400 | 160,800 |
| 8 | Net profit (6-7) | | | 292,600 | -65,000 | 649,600 | 509,200 |
| 9 | Cash flow from operation (4+5+8) | | | 747,600 | 840,000 | 819,600 | 679,200 |
| 10 | Net cash flow (9-1) | -5,000,000 | -7,000,000 | 747,600 | 840,000 | 819,600 | 679,200 |

time the table 2 has been constructed, showing the calculation procedure of the expected annual cash flow.

The amount of 860,000 CZK represents the construction expenditures, the amount of 940,000 CZK the technology expenditures including audit. The project was financed by firm resources and from a state subsidy in the amount of 180,000 CZK.

In contrast to Table 1 we see that after the first year of profitable $SHP_2$ operation the next nine years accumulate an annual loss of 10,940 CZK. Then it generates a profit again, and the accumulated loss in the total amount of 9 × 10,940 = 98,460 CZK is used to reduce a taxable income in future years: In the 11th year of operation (period 12) the 87,760 CZK is applied, by which the firm resets its tax base and pays no tax. With the rest of 98,460 – 87,760 = 10,700 CZK it reduces the tax base in period 13 to 87,760 – 10,700 = 77,060 CZK, from which it pays tax of 0.24 × 77,060 = 18,494 CZK. In the resulting cash flow (line 10 of Table 2) two annuities can be traced: The first one (ten-year) with an annuity payment of 117,000 CZK starts in period 3 and the second one (seventeen-year) with an annuity payment of 95,938 CZK starts in period 14.

### Estimation of simple payback period (SPP) of the investment in $SHP_2$

When estimating a simple payback period of the investment in $SHP_2$ we emerge from the relations (1) and (2) for $SHP_1$, where the value of 4,342,448 is replaced by the value of 1,800,000 = 860,000 + 940,000 and the $CF_i$ amounts are taken from the last line of Table 2. From such a modified condition (1) we get X = 17 and from it the following modified equation (2) for SPP applies:

$$\boldsymbol{SPP = 17 - 1 + (1,800,000 - 1,756,476)/95,938 = 16.45 \text{ years}}$$

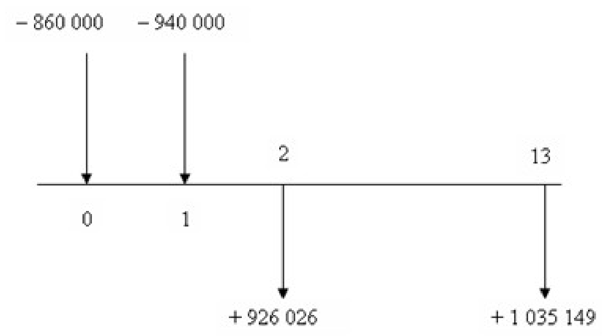
Since the simple payback period SPP = 16.45 of the project $SHP_2$ is significantly shorter than its expected lifetime (thirty years), it is meaningful to continue with the calculations of NPV and IRR.

### The estimation of NPV and IRR of the project $SHP_2$

Analogously as in the case of the project $SHP_1$ we can use the above mentioned existence of two annuities in the cash flow generated by the project $SHP_2$ (the last line of Table 2) to simplify the technique of NPV calculation. The first (ten-year) annuity payment can be replaced by its equivalent payment in the amount of FV(2) = 7.024 × 117,000 = 821,808 in period 2 and the second annuity (seventeen-year) by its equivalent payment in the amount of FV(13) = 95,938 × 9.763 = 936,643 in period 13. The constants 7.024 = (1 – 1 / 1.0710) / 0.07 or respectively 9.763 = (1 – 1 / 1.0717) / 0.07 are ten or respectively seventeen-year annuity factors at a discount rate of 7%.

Thus, we obtain the modified incomes $CF_2 = CF_2 + FV(2) = 104,218 + 821,808 = 926,026$ and $CF_{13} = CF_{13} + FV(13) = 98,506 + 936,643 = 1,035,149$. This corresponds to the following scheme of the modified time structure of the cash flow:

Figure 2: The scheme of the modified time structure of $SHP_2$ project cash flow




$$\boldsymbol{NPV = -860,000 - 940,000/1.07 + 926,026/1.07^2 + +1,035,149/1.07^{13} = -860,000 - 878,505 + 808,827 + +1,035,149 \times 0.415 = -500,091\text{CZK}}$$

Because of the fact that NPV of the project is negative, its IRR has to be lower than the discount rate of 7%. IRR's more accurate estimation is derived from the solution of equation (3) for $CF_i$ of Table 2, which for IRR 3.84% < IRR < 4% applies. In order to achieve the required 7% annual rate of return on investment the subsidy needed would be an amount exceeding five hundred thousand CZK. The subsidy of 180,000 CZK does not help much; it only moderates the loss slightly.

## The project $SHP_3$ (small hydro power plant)

Unlike the previous two already realized projects, in this case we deal with an assessment of a hypothetical project of a variation close to reality of an often occurring investment opportunity specified in more detail in Chládek (2011). The calculation of the budgeted cash flow of the project, in which the maximum electrical power of the generator is 90 kW, is summarized in Table 3.

Similar to $SHP_2$ the project $SHP_3$ accumulated after the first year of profitable operation an annual loss for the following nine years due to the adopted depreciation policy; this time in the amount of 65,000 CZK per year. Thereafter it generated a profit, and the accumulated loss in the total amount of 9 × 65,000 = 585,000 CZK was used to reduce a taxable income in the following year. By reducing the tax base to 670,000 – 585,000 = 85,000 CZK the firm paid a tax of 0.24 × 85,000 = 20,400 CZK. In the resulting cash flow (line 10 of Table 3) two annuities can be found, of which the first one (nine-year) with an annuity payment of 840,000 CZK starts in period 3. The second one (eighteen-year) starts in period 13 with an annuity payment of 679,200 CZK.

**Estimation of simple payback period (SPP) of the investment in $SHP_3$**

When estimating the simple payback period of the $SHP_3$ investment we emerge from the relations (1) and (2) for $SHP_1$, where the value 4,342,448 is replaced by the value 12,000,000 = 5,000,000 + 7,000,000 and the amounts of $CF_i$ are taken from the last line of Table 3. From such a modified condition (1) we get X = 15 and from it the ensuing modified equation (2) for SPP then follows:

$$\boldsymbol{SPP = 15 - 1 + (12,000,000 - 11,844,000)/679,200 = 14.23 \text{ year}}$$

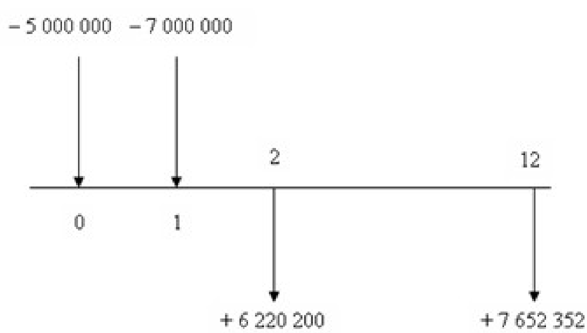
Since the forecasted simple payback period SPP on investment in the project $SHP_3$, compared to its estimated operation lifetime, is less than a half, it makes sense to continue with the calculations of NPV and IRR.

**Estimation of NPV and IRR of the $SHP_3$ project**

Analogously as in the case of previous projects, we can use the above mentioned existence of two annuities in the cash flow that are generated by the project $SHP_3$ (last line of Table 3) in order to simplify the NPV calculation technique. The first (nine-year) annuity payment can be replaced by its equivalent payment in the amount of FV(2) = 840,000 × 6.515 = 5,472,600 in period 2. The second (eighteen-year) by its equivalent payment of FV(12) = 679,200 × 10.06 = 6,832,752 in period 12. The constants 6.515 or respectively 10.06 are nine or respectively eighteen-year annuity factors at a discount rate of 7%.

Thus, we obtain the modified incomes $CF_2 = CF_2 + FV(2) = 747{,}600 + 5{,}472{,}600 = 6{,}220{,}200$ and $CF_{12} = CF_{12} + FV(12) = 819{,}600 + 6{,}832{,}752 = 7{,}652{,}352$. This corresponds to the following scheme of the modified time structure of the cash flow:

Figure 3: The scheme of the modified time structure of $SHP_3$ project cash flow



$$\boldsymbol{NPV = -5,000,000 - 7,000,000/1.07 + 6,220,200/1.07^2 + +7,652,352/1.07^{12} = -2,711,449\ \mathrm{CZK}}$$

Since NPV of the project is negative, IRR has to be lower than the discount rate of 7%. We get a more accurate estimation from a solution of equation (3) for $CF_i$ from Table 3, which for IRR 4.45% < IRR < 4.5% applies. To achieve 7% of annual rate of return on the investment it would be necessary to subsidize the project with an amount of nearly three million CZK.

## Discussion

From the financial analysis of the three small hydro power plant projects $SHP_1$, $SHP_2$ and $SHP_3$ it unequivocally follows that if these projects should offer to investors the equivalent conditions in terms of the required 7% of average annual appreciation of investment, then the project $SHP_1$ should not be subsidized at all (the advantage at the starting point ensuring the investor an abnormal income of 291,261 CZK), the project $SHP_2$ should be subsidized by at least half a million CZK and the $SHP_3$ project by the amount of close to three million CZK. These amounts were revealed by net present value (NPV) calculations of the projects. NPV criterion, derived from the principle of utility maximization of wealth, is the most convincing and most easily interpretative criterion for the evaluation of investment efficiency. The considered projects are evaluated according to their effectiveness as follows: $SHP_1$, $SHP_2$, $SHP_3$.

Simultaneously, we also assessed the three projects according to the simple payback period (SPP) of investments and, implicitly, according to the internal rate of return (IRR), which was not a problem due to the fact that the cash flows of the projects changed the sign only once. The advantage order according to SPP is: $SHP_1$ (10.53 years), $SHP_3$ (14.23 years), and $SHP_2$ (16.45 years). The sequence of preference according to IRR is: $SHP_1$ (8%), $SHP_3$ (4.5%), $SHP_2$ (4%). We see that the criteria for SPP and IRR give the same order of preference that differs from the NPV criterion.

Can we conclude on the basis of prioritizing $SHP_3$ over $SHP_2$ from two of the three used criteria that NPV criterion need not be taken into account? It depends on what we mean by "efficiency". Its standard interpretation says that it is the degree of optimal allocation of resources; the optimal allocation means deploying resources to projects where they generate the greatest benefit. Here the resource is the investor's money and the question is what the benefit should be. If it is the increase of the monetary value of the investor's wealth, then NPV dominates. Otherwise, we would have to justify why it is advantageous for us to pay more than two million CZK for the reduction of SPP for two years or for a shift of half a percentage point on the percentage scale of advantageousness.

Another question is in what way to allocate subsidies, if we want with them to even up the profitability of projects to the required 7% and (according to the current environmental doctrine) to involve to the maximum possible extent the renewable sources of energy (small hydro power plants) in the game, knowing that the subsidies are a limited resource and not attainable by all. The NPV criterion gives the answer to even this question: It is the pursuit of the maximum increase of the installed capacity from the one thousand CZK spent on the subsidy – **installed capacity in kW / (–NPV in thousand CZK)**. This increase for $SHP_2$ was 0.06 kW / thousand CZK (30 / 500.091 = 0.06), and for $SPH_3$ it was 0.033 kW / thousand CZK (90 / 2711.449 = 0.033). As we can see, it is almost twice as efficient to subsidize $SHP_2$ than $SHP_3$.

### The environmental point of view on small hydro power plants

Hydropower is considered to be the most significant renewable resource for electrical power production in the world. It provides 19% of the planet's electricity (Paish 2002). Small hydro power plants are usually constructed on watercourses with no dam or water reservoir. This energy production is considered to be cost-effective and environmentally friendly as it shows advantages in terms of $CO_2$. However, often unknown to the public these eco-projects are likely to generate some undesirable environmental impacts, which are rarely evaluated and calculated within the project. It concerns the local landscape changes and riverine species. The evaluation performed in (Pinho et al. 2007) revealed many technical and methodological deficiencies in a large number of examined eco-projects. The majority of underestimated cases in the pre-calculations were: (1) Reservoirs may prevent the transit of fish, so the natural flow of silt down the river will be discontinued harming ecosystems. (2) It is necessary to clear the trees from large water tanks; otherwise the methane gas produced by decaying wood is as rich in $CO_2$ emissions in as a fossil-fuel plant with similar output.

A number of studies deal with the occurrences of these problems (Prchalová et al. 2009); however, the financial side of things is being neglected. As a result the evaluation of "green energy" benefits from SHPs cannot be as straightforward as is commonly presented. This is demonstrated in (Li et al. 2014), where the ecological losses of 5 large hydropower projects and 10 small hydropower stations were analyzed and the results were taken into account in the calculation of NPV criterion. The holistic financial analysis covering all relevant standpoints often reveals significant aspects of the eco-projects from the environmental point of view as shown in (Maroušek et al. 2014a, 2014b; Maroušek 2014c).

## Conclusion

The conclusion that emerged from the previous discussion does not only apply to small hydro power plants, but to renewable energy sources in general. If we place the emphasis on the maximum utilization of renewable energy sources together with the fact that we are willing to cover potential economic losses resulting from it by subsidies, then it is the financial analysis of the effectiveness of these projects based on NPV criterion, which shows the right way.

The subsidy policy is then *economically efficient* if and only if:

- Only the projects that would reach the negative NPV without subsidy at the discount rate of the promised (in our case 7%) expected value of the annual return during the lifetime of the project are funded.
- The projects are funded in the amounts of the PV, which equals to –NPV; this balances the NPV of the subsidized projects to the desired zero (NPV = 0).
- In the case of a limited amount of subsidy funds the grant applicants are satisfied according to the order given by the value of the criterion kW / (–NPV).

Aside from evaluating the gains and losses generated by the SHP project it is necessity to express the financial impact of environmental changes and adjusts the pre-calculation according to these estimates.

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# Příspěvek k formulaci ekonomicky efektivní dotační politiky v oblasti malých vodních elektráren

Příspěvek analyzuje ekonomickou stránku dotační politiky v oblasti malých vodních elektráren. Konfrontuje stávající praxi s teorií a navrhuje ekonomicky efektivnější řešení. Jedná se o první ze série příspěvků věnovaných problematice poskytování dotací producentům energie z obnovitelných zdrojů, k nimž mimo jiné patří tekoucí voda, biopaliva, vítr a sluneční záření. Opírá se o výsledky tří případových studií analýzy ekonomické efektivnosti malých vodních elektráren, řešených přístupem „case-based reasoning“. První dvě studie se týkají již realizovaných a fungujících vodních elektráren na řekách „Sázava“ a „Litavka“ v ČR. Jejich veřejně přístupné parametry a jiná potřebná data lze nalézt na stránkách http://www.eis.cz. Třetí analyzovaný projekt je ve stadiu záměru a dosud realizován ani dotován nebyl. Výpočty zde vychází z rozpočtovaných údajů a slouží k demonstraci a ilustraci navrhovaného kritéria ekonomicky efektivní dotační politiky.

**Klíčová slova:** přírodní zdroj, ekonomický zdroj, obnovitelný zdroj, doba prosté návratnosti, NPV, IRR, ekonomická efektivnost, dotační politika

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