# METHODOLOGICAL QUESTIONS OF COST–BENEFIT ANALYSIS FOR PROJECTS CONNECTED WITH APPLICATION OF ALTERNATIVE FUELS IN PUBLIC AVIATION

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***Abstract:****. Since the energy crisis of the 1970s, almost all of, aircraft, and engine companies, as well as government entities, have been investigating the practicality of using alternative fuels in aircraft. Because of price and environmental pressures, interest in alternative jet fuels derived from nonpetroleum sources is growing in the commercial , but on the public aviation also. Economic estimation connected with the social investment is an important viewpoint for the decision makers at choosing between the individual alternatives. Significantly the economic analysis is standing out against principles and from methods adapted in case of the private investments. The divergence applies in the traditional cost-benefit analysis , as well as the term of project, and at definition of the social discount rate. In our time researches related, with the alternative fuels became important task in public aviation whose part are analysis of the economic impact of different facilities. The present search is aiming so that we set up an undivided model , to which economic analyses are can be accomplished with its use. The article wishes methodological demands of elements of the model to introduce , which composed basis of the future research.*

***Keywords:*** *alternative fuel, cost benefit analysis, social discount rate, scenario analysis, modelling*

## 1. INTRODUCTION

In recent years, there has been an increasing interest in application of alternative fuels in commercial and public aviation as well. There were significant technical achievements over the last three years for sustainable alternative fuels for aviation. While the technological feasibility for alternative jet fuels is proven, in moving forward, there is a need for investment in biorefineries, and the development of new generations of biofuel and its production technologies[1].

At decisions related hereby the distinguished importance economic viewpoint analysis and valuation of the application. The decision at the public aviation means choosing between alternatives, in contradistinction to the profit maximization at the commercial aviation.

In our study, we will examine the decision backgrounds of public projects where decisions regarding the allocation of public funds were made on the basis of financial-economic aspects.

The goal of public projects is to create value for the narrower or broader community. In general we say that the objective is to increase social utility and welfare.

The difference of the application of basic method in private and public projects is provided by the fact that in many respects public projects concern different fields and time-spans and different social classes [2].

The main differences of public and private projects is the complex approach to the effects of public projects. The evaluation of public projects stands for the consideration of community, environmental and natural values.

The other basis difference is that the public projects have a positive effect on social utility which is typically felt in the long-term as well, for instance through environmental-natural effects.

## 2. COST–BENEFIT ANALYSIS

The incorporation of the intergenerational equity objective has rendered the traditional Cost–Benefit Analysis (CBA) approach obsolete for the evaluation of projects presenting an important number of environmental externalities and for those whose impacts extend throughout a long period of time.

Cost–Benefit Analysis (CBA) approach into an obsolete tool for the evaluation of certain types of projects, particularly those exhibiting many environmental externalities and those whose effects extend throughout a long period of time. A series of changes in the CBA is being proposed in the literature, in order to adapt the analytical context to the demand for sustainability, resulting in what is alternatively denominated Extended or Environmental Costs Benefits Analysis (ECBA). [1]

In case of the long-term analyses has to take into consideration, that almost every factors of analysed process can be changed. The scenario technique is allowed to spin the solution. As example we are allowed to set the following scenarios:

*Scenario 1*. Baseline scenario including technological developments.

*Scenario 2*. Scenario with energy security constraints and increase in petroleum price over the next 15 years (or more).

*Scenario 3*. Low petroleum price: scenario with energy security constraints and low petroleum price. As the price of petroleum is uncertain, this study develops a sensitivity analysis to improve the understanding of petroleum's influence on portfolio results. Recent developments in the global market have resulted in a dramatic decrease in petroleum prices for this reason, a low-petroleum-price scenario is being investigated.

*Scenario 4.* Decrease the price of biofuels because of development of its production technology , and the mass production .

In our time the entire life-cycle approach gains ground on cost-benefit analysis . Life-cycle analysis (LCA) includes all stages in a product’s life — from the extraction of law materials through the materials’ processing, manufacture, distribution, use, and disposal or recycling. For this analysis, we have to account for all the stages in the life cycle of aviation fuels, including feedstock recovery and transportation, fuel production and transportation, and fuel consumption in an aircraft.

The exploration and recovery activities from the well to fuel production and the subsequent transportation to the pump constitute the well-to-pump (WTP) stage. The combustion of fuel during aircraft operation constitutes the pump-to-wake (PTWa) stage. These two stages combined comprise the well-to-wake (WTWa) fuel cycle [3].

As shown in Fig. 1, the WTWa analysis system boundary includes feedstock recovery and extraction of mineral oil(e.g., crude recovery, corn farming and harvesting, and corn stover harvesting), feedstock transport, fuel production (e.g.,petroleum refining to jet, ethanol production, ETJ production,) , fuel transportation and distribution, and aircraft fuel combustion.

The jet fuel combustion stage is also referred to as the pump-to-wake (PTWa) stage, while the rest of the stages together (socalled the upstream stages) are the well-to-pump stage.

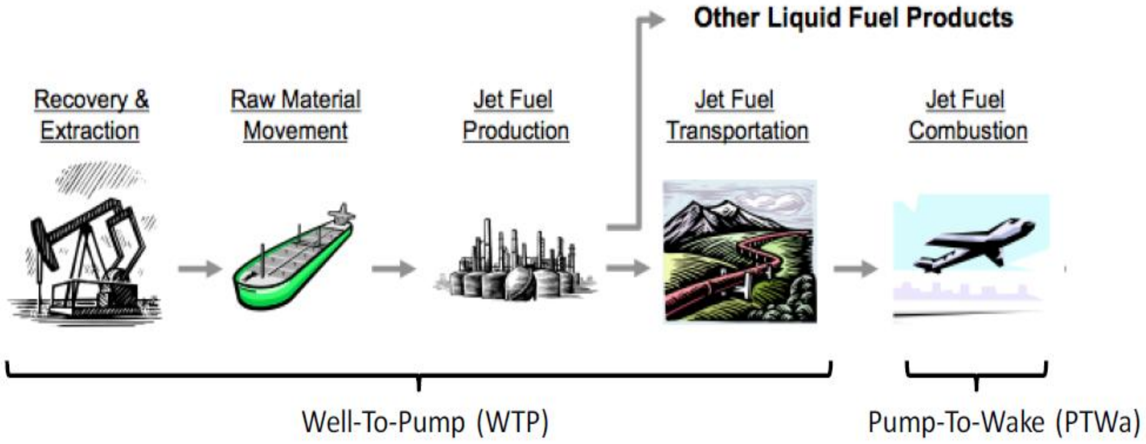


**Fig. 1.** WTWa Pathway for Conventional Jet Fuel [3]

With the alternative fuels refer in Fig 2. we present as example the „Well to Wake" model of ethanol-to-jet fuel.

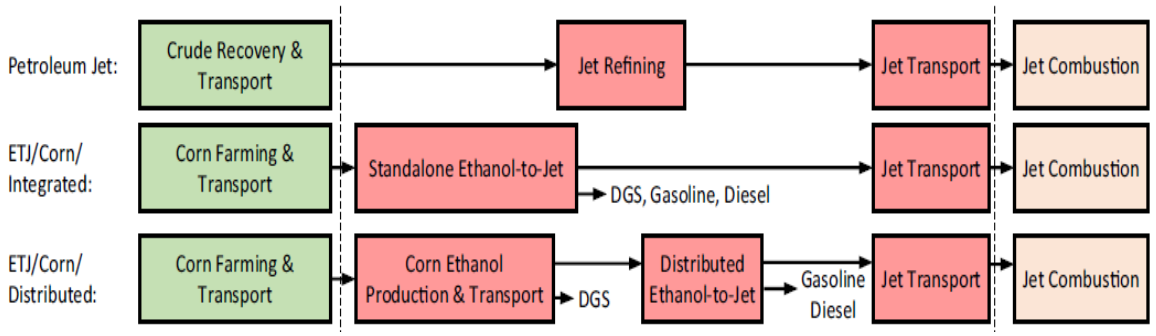


**Fig. 2** WTWa analysis system boundary (*ETJ* ethanol-to-jet) [4]

Among alternative fuels one solution can be the use of biofuels, which can be produced from various kinds of biomass, like photosynthetic microorganisms, that is, algae. Oil produced by them may be the appropriate source material for producing biodiesel, moreover, for this process the carbon dioxide from the atmosphere is used. [4] Nowdays the biodiesel is keeping his spread within limits more factor, featuredly high cost of his production. It can be told , that more and more research are in this topic on large part of the world , and increases the number of the companies, what consider with fuel analysis, development of the biodiesel, or with its establishment [5].

## 3.SOCIAL DISCOUNT RATE

The discount rate is considered as a critical element in cost-benefit analysis when the costs and the benefits differ in their distribution over time, this usually occurs when the project that is being studied is over a long period of time.

Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of a projected investment or project.

The following is the formula for calculating NPV:

$$\mathrm{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 \qquad (1)$$

where
$C_t$ – net cash inflow during the period *t*,
$C_0$ – total initial investment costs,
r – discount rate, and
t – number of time periods.

Internal Rate of Return (IRR) is a profitability measure, expressed as a percentage, that is analogous to an average rate of return from an investment. IRR is the discount rate that will yield a net present value of zero for a given stream of cash flows. This method allows a comparison between the IRR of a project and a company's self-determined discount rate.

To calculate IRR using the formula, one would set NPV equal to zero and solve for the discount rate r, which is here the IRR. Because of the nature of the formula, however, IRR cannot be calculated analytically, and must instead be calculated either through trial-and-error or using software programmed to calculate IRR.

In case of public projects the largest difficulty means the determination of discount rate, because the CAPM (the Capital Asset Pricing Modell) is inapplicable. As solution of this problem in our time the experts are applying the Social Discount Rate (SDR)

Social discount rate is the discount rate used in computing the value of funds spent on social projects. Determining this rate is not always easy and can be the subject of discrepancies in the true net benefit to certain projects, plans and policies.

The generally accepted method of calculating is the so-called Ramsey formula which represents constant discount rate application and is derived from the growth model [2,3].

The Ramsey formula:

$$S=\rho + \mu g \qquad (2)$$

Where:
*S* – social discount rate,
$\rho$ – pure rate of time preference; the rate at which the individual discounts future utility/welfare,
$\mu$ – the elasticity of the marginal utility of consumption (the indicator of the change of utility in light of income/consumption),
*g* – the expected rate of growth of per capita income/consumption

Calculating the true social marginal cost can be a lot easier than measuring the social marginal benefit. Because of the uncertainty involved with calculating benefits, problems may arise e.g., should a dollar amount be put on time based on average wages, contingent valuations or revealed preferences? One of the big problems today is putting a value on a life. While some might say that a life is priceless, economists usually state the value to be somewhere between three and ten million dollars. Another problem is that because the current generation will often be paying for most of the costs while future generations will be reaping most of the benefit, whether current and future benefits ought to be weighed differently.

The parameters for the approach, releasing the closed frameworks of utility models, now only connect to the theory as theoretical starting points and for the most part do not form a consistent system. Research concerning the social discount rate has today been given new meaning by environmental protection and energy-saving considerations, which at the same time have raised new questions [2].

The proper discount rate should represent the opportunity cost of what else the firm could accomplish with those same funds.

If that means that the money could be instead used to invest in the private sector that would yield 5% and that is the next best alternative for using that money then 5 and 5.5 percent would be the social discount rate when projects realized through EU tenders. The government uses a variety of discount rates but something around seven percent is what the US Office of Management and Budget (OMB) recommends for a pretax rate of return on private investments [2].

## CONCLUSIONS

Establishment of a holistic view embracing model , which affords a valid base in decisions with application of the alternative fuels , encountering into serious difficulties. One of this, that the generation of the model always contains as conditions implying, validity of the model, what are querying the strength and reliability. At the same an important question is the punctuality and measurability of facts and figures used in modell. Particularly relevant question in case of consideration of externalities , which appears at economic analisys of the “Well to Wake” processes of different alternative jet fuels.

At modelling of the cost benefit analisys on beyond the estimation of the individual cashflows serious difficulty appers the setting of the social discount rate.

By our guess , solution would be also the adoption of a GREET modell (The Greenhouse Gases, Regulated Emissions, and Energy use in Transportation Model) [6], and it also defining our prospective investigational tasks.

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