

Energy-efficiency investment of tram companies can be profitable

Concretization of energy-efficiency analysis.

Fixed charge for tram company services, contract terms and public good character of the tram service utility justifying subsidies

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Abstract

Nowadays many tram operators are modernizing their rolling stock, investing significant sums of money into modern trams, which are capable of energy-efficient recuperative braking. Factors influencing profitability of these investments have been specified. Presented factors enable to plan energy-efficient public transport.

High capital costs are presently the norm for many energy efficiency technologies and serve as a deterrent to their widespread implementation. However, only trams are the sole city transport facility, which enables profit from recuperative braking. Therefore it is worth to invest more at the beginning. Later, it is expected that economies of scale will result in lower costs. Currently the investment can be facilitated by the financial instruments designed to mobilize private capital. Public funding (loan or subsidy) has the catalytic effect stimulating economic development while improving efficiency of energy consumption.

Only description of the tram as an ecological, energy-efficient transport, separated from street traffic, a public good, which cannot be replaced by buses does create the premises for additional funding.

PROFITABILITY OF ENERGY-EFFICIENCY INVESTMENT. INSUFFICIENCY OF COMMERCIAL LOAN USE FOR THE PUBLIC GOOD PROVIDER

High cost of emerging energy efficiency technologies

Tram companies in Poland face shortage of financial resources. Modernization improving energy-efficiency of supply system should be profitable. Modernization based on new, emerging technology (energy accumulator) is costly. This product needs to cover initial R&D investment costs of a producer. Future cost reduction needs large scale production. At the beginning financial support may come from older, existing, well selling products or public funds (e.g. supporting R&D ecological investments).

High capital costs are presently the norm for modern energy efficiency technologies and serve as a deterrent to their widespread implementation in tram companies. However, only trams are the sole city transport facility, which enables profit from recuperative braking. Modern tram can be energy-efficient due to recuperative braking. A moving tram has kinetic energy, which can be transformed into electric energy during recuperative braking. It can be fed back into contact system free of charge. Therefore decrease in energy consumption is possible.

So it is worth to invest more at the beginning. Later, as production level and sales increase, it is expected that economies of scale will result in lower costs.

Long term profits and social costs investment results beyond the scope of free market. The need for public legal reassessment

Calculating the efficiency in order to facilitate decision-making requires quantification of outlays and effects and expressing them in terms of financial equivalent.

The basic principle remains unchanged. From the company's point of view, an investment should be undertaken if it results in increasing the company's market value. A business person runs an enterprise in order to earn money. In accordance with Article 2.1 of the Business Activity¹ Act dated 19th Nov., 1999: a "business activity" is defined as any profit-making productive, commercial, construction, service activity [...] conducted on a continuous and organized basis". Underlining the profit-making character is related to the fact, that business is targeted at providing profit to the enterprise².

Environmental protection is of non-productive character. Calculation of such investment efficiency is based on presumptions differing from productive investment calculation done by means of NPV (discounted cash flows) instruments.

Some outputs of public transport company (lower air pollution, reductions in accidents, and mobility for less wealthy citizens) are not "traded in the market place".

A public good is not suitable for simple 'commercial' financing

Ecological effects of energy-efficient investments are a public good. A public good possesses two characteristics; once provided to one person it cannot be excluded from consuming and consumption of the good by one person does not reduce the amount of the good available to others. Since no one can be excluded from consuming the pure air (ecological effect), there is no incentive to pay to acquire it; each person can get it free of charge.

A public good is not suitable for simple 'commercial' financing. A public good has to be bought by the community in large. From a commercial company's point of view the ecological results of investments are not evaluated.

The companies constituting the free market are not interested in environmental protection and they do not run any assessments of these results. Regardless of differences in individual expenses, the ecological advantages are common to all inhabitants in a given area. The enterprises existing in the market are too small to cover the whole area and to individually be sensible of greater advantages arising from their environmental protection outlay. Environmental protection yields effects not easy to express in a quantitative form, by the market in particular. It does not evaluate the decrease in carbon dioxide emission or the decrease in number of waste dumps filled with ash, which is indispensable to produce required amount of energy.

Ecological investment would not be provided in free market economy where production is motivated by profit. It should be provided as long as social profits outweigh social costs.

¹ Polish name: *Prawo działalności gospodarczej* dated 17 Dec. 1999; (Journal of Laws 1999 with later amendments)

² cf. BIENIEK-KORONKIEWICZ E., SIENICZYŁO-CHLABICZ J.: *Działalność gospodarcza i przedsiębiorca na gruncie ustawy prawo działalności gospodarczej*, publication in PPH 2000/4/13, (*Economic activity and businessman basing on Economic Activity Act*. In Polish),

Society's welfare would be raised if the good were provided, but it will not be provided in a free market economy. The public good needs then to be provided by public sector.

The non-commercial institutions having impact on all members of society assess environmental protection indirectly. Companies in the market receive this institutional assessment of individual protection investments. They fulfill appropriate legal regulations and technical standards. These standards are obligatory for electric power plants. For example, the emission limits are defined and exceeding these limits means that penalties must be paid, or operating licenses might be withdrawn. However, there are no standards for plants consuming the electric power, which could help to assess the investment value.

PROFITABILITY ANALYSIS AFTER AGREEMENTS FOR SUBSIDIES AND CHEAPER LOANS

Applying properly adjusted NPV investment analysis inside the tram company -thanks to previously organized outside financing

A commercial enterprise may obtain cheaper loan from public funds, governed by an appropriate agencies. In order to obtain these funds, a company proves public benefits arising from investment. It is essential to present fully - environmental and other non-financial effects.

Modern investment (for example in energy accumulator) can result in predicted electrical energy efficient consumption, decrease in company's operating costs and increase in quality of the service, i.e. reliability of the runs due to elimination of excess voltage drops causing transport stoppages.

Today only cost seems to be the major consideration in investment analysis, preceding the purchase of new modern equipment. Incentives in the form of public subsidies can significantly alter the economics of an energy efficiency investment by lowering the capital costs and accelerating the payback period. The environmental protection is taken into account solely by regarding the possible **decrease in capital costs** (in analyses - actual rate of discount) due to loans and subsidies obtained from pro-ecological funds (Fund for Environmental Protection).

Thus adjusted NPV analysis can assess profitability of investment, taking into consideration changed financial cost of operation.

Subsidies

The subsidy stands for money paid by the government to producers of certain goods to help them provide low prices without loss to themselves.

Possible subsidizing entities

Acquisition of government funds (general subsidies, appropriated allocations) by public investment profits analysis

The Government should see the introduction of new technology as vital. The investment can be facilitated by the development of financial instruments designed to mobilize private

capital. Public funding has the catalytic effect stimulating economic development while improving the environment.

Giving such support “external” institutions (i.e. in relation to commercial enterprise) are obliged to make the detailed analysis to indicate the scale of benefits resulting from their capital outlays for particular projects. The application for a loan or subsidy must have positive opinions concerning the usefulness or technical and economic effectiveness of the funded project.

Some examples of these institutions are the government or specialized agencies e.g. The National Fund for Environmental Protection and Water Management³ hereinafter referred to as the “NFEPWM”. Their goal is to quantify, evaluate⁴ the effects and help realize the best projects of environmental protection. These “external” institutions have to work out their own methods of assessing advantages to the society. The proecological investments’ criteria are: adherence to environmental pollution standards and limiting economic and social losses, which arise as a result of dust and gas emission, industrial waste dumping or individual car transport emission.

Resolution⁵ of the NFEPWM Supervisory Board no. 52/2002 of 22nd April 2002 determines rules for granting and remitting loans, granting subventions and subsidies for interest costs of preferential credits and loans from the resources of the national fund for environmental protection and water management.

Loans, subventions and subsidies for interest costs of preferential credits, granted from the financial resources of the National Fund are allocated for the purposes specified in the Act on Environmental Protection, in accordance with the priorities of the NFEPWM, defined pursuant to the “National Environmental Policy”, the list of priority projects of voivodship (regional) environmental protection and water management funds.

Loans granted for projects leading to: changes from technologies posing a threat to the environment to less harmful solutions, rationalization of the use of energy, limiting the emission of air pollutants bear an annual interest rate amounting to 0.6 of the bill of exchange rediscount rate, announced by the National Bank of Poland⁶.

³ It funds projects which serve the protection of the environment. Their implementation is supervised by the Minister of Environmental Protection, Natural Resources and Forestry. Loans, subventions and subsidies for interest costs of preferential credits, granted from the financial resources of the National Fund are allocated for the purposes specified in the *Act on Environmental Protection* of 27 April 2001 (Journal of Laws 2001 no. 62, item. 627 with later amendments), hereinafter referred to as the “Act”, in accordance with the priorities of the National Fund, defined pursuant to the *National Environmental Policy*, the list of priority projects of voivodship (regional) environmental protection and water management funds, as well as in accordance with the operating plan and criteria for choosing projects referred to in art. 414 par. 1 pt. 1 and par. 2 pt. 3 of the Act. Projects, whose execution results from Poland’s obligations to the European Union related to Poland’s membership in the European Union, are treated as priorities. cf. *Rules for granting and remitting loans* http://www.nfosigw.gov.pl/site/main_en/pomoc_zasady_dofinansowania.php

⁴ These effects may be evaluated relatively, i.e. analysis might be formalised, for example by using outlay per unit indicator, which is defined by quotient of outlay and effect (expressed in quantitative or value)

⁵ http://www.nfosigw.gov.pl/site/main_en/dzialalnosc_zasady_zakres.php

⁶ §7. 1. Co-funding granted in the form of loans or loans and subsidies may not exceed 70% of the costs of the project.

Subsidies may be granted, in particular for: pilot projects related to the implementation of high risk or experimental technical advancements and new technologies, comprehensive research, development. Air protection directions of NFEPWM include: conserving energy and limiting the emission of air pollutants (reducing sulphur dioxide emissions), improving the quality of fuels and engine technologies used in transport.

Environmental investments for improving quality of life in cities require full analysis of benefits

If discounted cash flow shows the environmental project to be not worth investing in it could be falsely assessed due to harmfulness of unconsciousness of public money allocation rules and imposed legal boundaries.

An overview of Cost Benefit Analysis (CBA)

Cost Benefit Analysis is a systematic quantitative method of assessing the desirability of government projects or policies when it is important to take a long view of future effects and a broad view of possible side-effects. CBA estimates and totals up the financial equivalent value of the benefits and cost to the community of projects to establish whether they are worthwhile.

There might be a benefit that is not directly expressed in money, but there is the amount the recipients of the benefit would consider just as good as the project's benefit.

However some environmental measures of benefits require the valuation of human life

Sometimes in CBA it is necessary to evaluate the benefit of human life prolongation in less polluted cities⁷. If a project is to save some human lives, people are willing to take higher risks on a return on investment.

Efficiency concretized to technical efficiency

Factors limiting ability to recognize full spectrum of investment benefits and free market behavior

Side effects of various forms of state ownership (state owned enterprises, sole-shareholder companies of the State Treasury, companies with major State Treasury participation)

Public transport state-owned companies and companies with major state treasury participation are believed to fulfil not only economic goals, but also political and social ones.

The political goal is to keep the continuity of public transport services, ensuring political stability. The gasoline and Diesel oil price rise has been a reminder of political significance of continuous and stable tram transport services.

The social functions of public transport are expressed by opinion that low fare must be kept, so that poor people could be able to commute.

2. In granting loans, the National Fund applies a maximum grace period of 12 months from the day of the physical completion of the project, specified in the agreement on the day of its signing.

3. The maximum loan period applied by the National Fund is 15 years.

⁷ Proecological aspects of this investment could include reduction of CO₂ emission.

The other goal of transport policy⁸ is to limit the environmental degradation. Electric tram transport is more environment-friendly, but it may cost more than cars driving in the cities. After signing the *Kyoto Protocol to the UN Framework Convention on Climate Change*, the participating countries are legally obliged to reduce the emission of six principal greenhouse gases, carbon dioxide (CO₂) in particular. Therefore, when defining transport policies, the governments must take into account the international obligations on environmental protection.

The economic, political, environmental and social objectives may comply with one another. For example, cheap and effective transport can best fulfill the social expectancy of low prices, service regularity and quality; these are elements of equal political and economic importance.

However, environmental protection may cause rise in ticket prices and this discrepancy requires the adoption of appropriate decisions.

TECHNICAL efficiency is determined by fixed charge for tram company services

This paragraph appoints **actual tram operator customer** identity and its consequences.
KZKGOP – the sole customer of the tram operator

Who are actual CUSTOMERS of tram operator in Katowice? Not passengers but – established by local government (municipalities), a single agent.

The act dated on **8th March 1990** about local self-governments (*Journal of Laws 1990 No 16, item 95* with later amendments) states that the organization of urban transport belongs to the duties of municipalities. The act also anticipates the possibility of setting up (e.g. within urban agglomeration) inter-municipal unions. In Poland local self-governments set up unions in order to conduct the public tasks jointly. Their tasks exceed the abilities of one municipality⁹. Municipalities of the Katowice agglomeration set up Municipal Transport Union of the Upper Silesian Industrial District (in Polish: **Komunikacyjny Związek Komunalny Górnośląskiego Okręgu Przemysłowego**, hereinafter called: “**KZKGOP**”). This union performs the function of **organizer of urban transport**.

Integration on the level of management of local transport allows setting up a single system of tariff and a **single system of financing local transport** within the area of many municipalities.

The statutory task of KZK GOP is to satisfy the needs of member municipalities regarding local mass transport. Detailed tasks of the Union include:

- 1) execution of municipalities' suggestions concerning the range of transport services that should be provided,
- 2) arrangement of schedules guaranteeing adjustment of the transport offer to the demands reported by passengers and municipalities,
- 3) concluding contracts with operators for competitive transport services,
- 4) promotion of urban transport,
- 5) shaping tariffs in urban transport, conducting the production, sale and control of tickets,
- 6) financing the transport.

Reasons for fixed charge for tram company services

Analysis adheres strictly to the contract conditions of tram operator. The KZKGOP has signed contracts with tram operator, on the basis of which full payment for conducted services is

⁸ which has less influence on decision adopted within the enterprise

⁹ cf. <http://www.kzkgop.com.pl/english/origin>

made. The payment is based on previously negotiated rates for elementary (tram) vehicle kilometer¹⁰. The size of a rate is gradually valorized. Passengers flow is less relevant. Why is that pre-arranged price accepted (for every km covered by tram accordingly to fixed schedule)?

Fixed charge for tram company services:

- 1) makes low profitability of certain lines irrelevant and enables to keep whole existing net,
- 2) enables the company to provide trams where there are not enough passengers to cover costs,
- 3) guarantees permanent coverage of network related to huge fixed costs of the whole network,
- 4) provides finance for public utility company. Community transit needs are recognized as elementary needs which must be provided at any cost, which is a public domain. Public transport is regarded as the right of every community and every citizen (the fear of vacuum in transport). Whole existing net makes public transport accessible to everyone,
- 5) simplify method of accounting.

I am not always in favor of fixed charge for tram company services. It is not proportional to a number of passengers carried by trams. That prevents additional social profits and reduces tram company's investment return.

The increase in passengers' flow and ticket sale due to investment promotion does not yield additional profits to investor. Implementation of investments by tram operating company does not necessarily result in the increase in its sales revenue, even if the trams carry more passengers. The increase in number of passengers interested in city transport (trams) will not yield the direct profit to tram operating company.

Potential mistakes in ticket sales profits assignment

Potential mistakes in ticket sales profits assignment result from faulty tram operator customer recognition. Passengers are customers of KZKGOP – local public transport organizer.

It is not yet possible to define precisely the company's profits due to lack of tram operator **profits from increased number of runs** caused by investment promotion.

Ecological investment. Advertisement free of charge

Environmental protection yields social advantages, which are shown in descriptive part of efficiency assessment. This description will be used by company's managers and PROs¹¹ to project a positive image of the enterprise in media. The free of charge TV-time will be received by invited journalists interested in these proecological activities. Hence, the investment effects here might be defined as the price of TV-time.

However, due to terms of contract, nowadays profits arising from investment aiming at promoting and adapting the production are not evaluated (**allocation efficiency**).

¹⁰ The rate that is paid depending on the type of transport line, operated by a company (in such a case the parameter in form of exploitation speed is used, the length and time of work and the type of exploited rolling-stock).

¹¹ Public Relations Officers

Technical efficiency as an investment analysis method. Terms of a contract limiting analysis scope

The public transport organizer has fixed the charge for tram company services and services level.

Increase in ticket sales by KZKGOP is not recognizable by tram operator due to its terms of contract¹². Nowadays, efficiency of tram company is limited to technical efficiency. **Technical efficiency** is reached by production of given, predetermined amount of product using minimum resources, i.e. energy cost.

Full environmental impact analysis should change current limitations¹³ imposed on Tram Companies. Allowing increasing market share of Tram Company, city managers can change the scope of the profitability assessment of energy-efficient investments.

This would **require drawing up new contracts** (between the tickets selling agent and tram operating company). New terms should guarantee immediate increase in tram operator's income proportional to growth in the number of passengers. In the future this kind of deal would make specification of additional profits possible, beyond increased cost-effectiveness of proposed investment. Before drawing up a new contract there is no need to show these financial results.

Today it is possible to analyze only the lower limit of tram operator investment profits. The minimum direct financial gains will be described.

Ways of municipal financing of investment project realized by public transport company

Reasons for subsidy by municipality – Method for providing funds for infrastructure improvements, including public transport facilities

Tramwaje Śląskie S.A. does not have enough resources to finance modern investments. Ecological effect as well as fewer traffic jams in the city is a public good of the local community. That's why the external forms of financial support seem to be necessary. Tram investments in urban transport often require large public expenditure.

Additional finance and subsidies for tram investment are not easy when there is a strong pressure to reduce budgets and public expenses. Public transport organizer (KZKGOP) can transfer transport tasks between different modes of transport and place additional orders not with trams but with bus company. Service integration between operators exists. This is helped by providing convenient intermodal interchanges and through "interoperability", for example by allowing light rail to be replaced by buses for passengers' convenience. A ticket system allows users to travel by different modes of public transport (tram, bus) with a single ticket. Possible replacement of trams in urban areas by cars and buses means that car transport is considered to be a **substitute** for tram transport. If tram can be replaced by car transport (with combustion engine), then the unique, ecological character of tram transport is no longer noticed. In this case, in many cities the local authorities responsible for transport (collective

¹² fixing charge for tram company services

¹³ contract boundaries - articles fixing output and limiting benefits

customer with a decisive vote) will start to limit the expenses for tram transport development. Public transport seems to play a strictly subsidiary role.

Unfortunately in larger cities the road network cannot be expanded to satisfy the full potential for travel by car or bus. Combustion engine transport can be too harmful due to traffic jams, air pollution and its real costs¹⁴ – of what many seem to be unaware.

Only description of the PRODUCT offered by Tramwaje Śląskie S.A., as a **fast, electric, energy-efficient, ecological transport, separated from street traffic**, which cannot be replaced by buses¹⁵ does create the premises for additional funding.

In that situation a wide range of financing sources can be adopted. Imaginative finance should help local authorities to make the best use of existing city infrastructure¹⁶ and improve it by taking advantage of the latest progress in finance techniques for the benefit of all citizens (both car users and walkers). The use of valuable city space by the car should be charged for.

One possibility is the use of parking charges, designed to manage car traffic levels, to provide funding for infrastructure improvements, including public transport facilities.

The tools¹⁷ that can be used for increasing tram demand and profits include: giving a priority to trams at traffic lights (helping to speed public transport), limitation of the number of parking places, introduction of bans on car traffic in town center areas. The city can be covered with areas with a 3 hour parking limit except for disabled or residents in their own area, which effectively discourages commuting by car and encourages switching to trams. Under these circumstances trams offer a viable alternative worth investing in improvement of energy efficiency. Introduction of traffic restraints is a way to finance public transport improvement, enabling acquisition of necessary investment subsidies¹⁸.

Improving energy efficiency and proposed tram company investment comply with the KZKGOP plans for applying modern transport technologies, creating the fast tram network.

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¹⁴ petrol excise and other taxes needed for subventions for road modernization

¹⁵ and accounting for the scale advantages (cost decrease) arising from using more catenary lines and tracks by a single tram operating company,

¹⁶ investment in energy accumulator and catenary is the necessary complement to full use of recuperative braking new tram purchase

¹⁷ cf. LACONTE P.: *Planning, Design and Management for Sustainable Urban Growth: Aspects Related to Land-Use and Transportation*, Internet Conference on Ecocity Development, (Feb-June 2003), <http://www.ias.unu.edu/proceedings/icibs/ecocity03/index.html>

¹⁸ other schemas can be developed

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