Manual
for evaluating the additionality of Joint Implementation projects and for calculating the baseline emissions of electric power projects

I. ADDITIONALITY

Additionality: A criterion set against project-based activities, that ensures that the project results in GHG emission savings that are additional to any that would otherwise, without the implementation of the project, occur.

In a more strict sense any investment that aims at reducing the GHG emissions can only be considered additional, if the investment produces an attractive economic performance only because of the emission reduction achieved. If the investment can be economically implemented without any revenues from GHG reduction, then the project cannot be considered additional, unless the project is prevented from the implementation by some other obstacles of non economic nature. **If the project cannot be considered additional, then it does not meet the primary criterion of being qualified as Joint Implementation Project, therefore such projects are not supported.**

The following methods can be used for identifying the additionality of projects:

- **Analysis of alternatives:** the various alternatives of the project shall be collected, and it must be presented that the very project that reduces the GHG emissions have the worst economic performance.
- **Analysis of references:** The economic performance of the GHG emission project shall be compared to a reference value. In this case, if the selected economic indicator of the actual project is lower than the reference value than the project can be considered additional.
- **Analysis of barriers:** The barriers of the project must be identified and it must be shown, how the sales of GHG emission reduction can be instrumental in removing these barriers. (This method can only be used if the project seems economically attractive, but due to the presented and analysed barriers it cannot be otherwise implemented, therefore it can still be considered additional.)

Based on the analysis of the methods used in the PDDs of the some 20 Hungarian GHG emission reduction projects, the analysis of references appears to be the most applicable under Hungarian conditions. It is the internal rate of return (IRR) that is proposed as the economic indicator to serve as criterion. It is expedient to use the “real value” of the IRR , i.e. that contains no effects of the inflation.

Evaluating additionality of projects that generate no revenues.

In case of projects that result **in GHG emission reduction but generate no revenues**, such as combustion of landfill gas or coal mine gas or the conversion of GHG by-products of chemical processes, **can be all considered additional, unless the are not forced by legislation** because they generate no income for the project owner.

Evaluating additionality of projects that generate revenues.

If the project generates revenues then evaluating its additionality requires the following steps.

a. First the internal rate of return (IRR) must be identified. This can be done with the following formula.

$$\sum_{i=0}^{n}\frac{(-B_i + Á_i - K_i + M_i}{(1+IRR)^i} = 0$$, where

n = m + z; m being the length of the project implementation (construction) (years), z being the total project lifetime.
B_i is the investment cost in year i.
$Á_i$ is the revenues in year i.
K_i is the total O&M costs in year i.
M_i is the remaining value of the equipment in year i. The remaining value of the equipment in the last year of the economic lifetime of the project shall reflect the actual market value, in other years M_i=0!

All components of the formula must be calculated without any allowances for inflation. Revenues must not include the revenues from the GHG reduction sales. Cost shall not include the deprecation and the costs of financing, i.e. the calculation must be performed as if the project 2were finance totally by equity.

b. **The project cab be considered additional if the IRR as described above is lower than …..%**.

The concrete value of the criterion is a subject to decision that considers several other aspects. However the realistic extreme values of the criterion are given below:

IRR < 0% - strict additionality criterion
IRR < 8% - mild additionality criterion

Barrier analysis

If the project is not additional according to the analysis above, and its implementation is hindered by some non economic barriers, then these barriers shall be presented and analysed in detail. It must also be shown how the sales of GHG emission reduction can help remove these barriers.

Barriers can be, for example:

1. *investment barriers:* Real and/or perceived risk associated with the technology or process is too high to attract investment; funding is not available for these kinds of projects.
2. *technology barriers:* The project represents one of the first applications of the *technology* in the country, leading to technological concerns even when the

technology is proven in other countries; skilled and/or properly trained labour to operate and maintain the technology is not available, leading to equipment disrepair and malfunctioning.

3. *barriers to prevailing practices*: Corporate culture prohibits these kinds of projects, because of lack of will or perceived risk.
4. *other barriers* the local community may fail to see the environmental benefits of the project and may oppose the project; regulations prevent these kinds of projects to happen.

If one of the above three analyses show that the project can be considered additional then it can be supported as Joint Implementation Project.

II. CALCULATING THE BASELINE EMISSIONS OF ELECTRIC POWER PROJECTS

There are several methods for the calculation of reference emission factors for the baseline calculation of JI projects that affect either the generation or the consumption of electric power. The methods and values used for this purpose in Hungary so far, were either based on the own calculations of project developers or on some internationally accepted baseline figures (such as the ERUPT method).**The emissions without the project can be calculated by multiplying the expected power generation (or consumption) of the project by the baseline reference emission factor expressed in gCO_2/kWh. For supply side projects the figures in table 1, for demand side projects those in table 2. are applicable.**

1. Supply side projects

In order to calculate the emission reduction achieved by constructing power generating capacities with zero net CO2 emission (such as biomass, wind or solar based capacities) first it must be identified which other existing capacities would be replaced by them. The concept of the method is that a new capacity, or reduction of demand is most likely to replace those capacities, that have the highest share in the load control of the power system. Consequently, those capacities that have no or little role in the load control, such as nuclear plants, power plants that generate power that is obligatory to buy, other “must-run” capacities) are excluded from the calculation. Then the CO_2 emission normalized to the output electric power for each remaining power plant must be calculated.

The fuel use is split between heat and power generation for each power plant with the following formula:

$$B_E[TJ] = B_{tot}[TJ] \times \frac{E_{out}[GWh] \times 3{,}6}{E_{out}[GWh] \times 3{,}6 + Q_{out}[TJ]}$$

where

- B_E - Input (fuel) energy corresponding to electricity generation
- B_{tot} - Total input (fuel) energy
- E_{out} - Output electric power
- Q_{out} - Output heat

The specific CO_2 emission normalized to the output electric power hence is:

$$X_i[g/kWh] = \frac{B_E[TJ]}{B_{tot}[TJ]} \times \frac{\sum_j (B_j[TJ] \times x_j[t/TJ])}{E_{out}[GWh]}$$

where

- X_i - is the specific CO_2 emission of power plant “i”
- B_j - is the fuel input of power plant “i” of fuel “j”
- x_j - is the specific CO_2 emission of fuel “j” calculated according Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories

The reference emission value is calculated as the weighted average of the power plant specific emissions, where the weighing is based on a factor that expresses to what extent the individual plant take part in the system load control. These factors are based on the utilization factor of the power plants. The utilization factor (K_T) for a given timeframe (T) is defined as

$$K_T[\%] = \frac{Peak\ utilization[hours]}{T[hours] \times availability} \times 100$$

where

$$Peak\ utilization[hours] = \frac{Total\ \ power\ generated\ during\ T[MWh]}{Peak\ capacity\ utilised[MW]}$$

The plant's share in load control (SC) then can be approached as

$$SC\ [\%] = 100 - K_T\ [\%].$$

The results, of course shall be corrected for the distorting effects of heat supply, for example.

With all these in mind, the reference emission value is calculated by weighing with plants' share in load control (SC_i) using the formula

$$X_y = \frac{\sum_{i=1}^{n} SC_i \times X_i}{\sum_{i=1}^{n} SC_i}$$

where

- X_y - is the reference CO_2 emission value in year "y" [g/kWh]
- SC_i - is the factor that characterises the share of plant "i" in the load control [%]
- X_i - is the specific CO_2 emission [g/kWh] of plant "i" in the given year (the total power-generation related emitted CO_2 divided by the electric power output)

For calculating the concrete reference values the forecast energy balances for 2005, 2010 and 2015 from MAVIR's[1] 2003 capacity planning document were used. Having performed the calculations the following results were obtained for the accounting period of JI projects (2008-12):

Year	**Reference amission(X_y) g/kWh**
2008	**707,5**
2009	**710,6**
2010	**713,8**
2011	**703,9**
2012	**694,0**
Average	**706,0**

The CO_2 emission reduction achieved in any of these years can thus be calculated as:

$$CO_2\ \text{emission reduction [tons]}_y = X_y\ \text{[g/kWh]} \times E_{ki0;y}\text{[GWh]}$$

where

[1] MAVIR – Hungarian Power System Operator Company

$E_{ki0;y}$ - is the electric power generated by the JI project from zero net emission sources[2].

Naturally, the total emission reduction between 2008-12 is calculated by adding the up the values of the individual years. However, if the $E_{ki0;y}$ is the same in each year, then the simple formula

CO_2 emission reduction $[tons]_{2008\text{-}12}$= 5 x E_{ki0} [GWh] x $X_{average}$ [g/kWh]
can be also used, where $X_{average}$=706 g/kWh.

Demand side JI projects

In case of demand side projects, the emission related to the distribution losses of the network shall also be taken in the account, as any reduction of demand that appears at the end-user not only replaces equal amount of power generation at he supply side, but also the power production that covers the transmission losses.This can be accounted for by using a modified reference emission factor ($X_{f;y}$), corrected with the distribution efficiency of the system instead of the supply side reference (X_y) factor discussed above, i.e.

$$X_{f;y} = \frac{X_y}{\eta_{distribution}}.$$

Based on statistical data, the average distribution loss of the Hungarian power system is 11.5%, thus

$$X_{f;y} = \frac{X_y}{0,885}.$$

Hence the following reference factors are to be calculated with in case of demand side JI projects:

Year	**Reference amission($X_{f;y}$) g/kWh**
2008	**799,9**
2009	**803,4**
2010	**807,0**
2011	**795,8**
2012	**784,6**
Average	**798,1**

The method of calculating the total emission reduction for a year or for the entire 2008-12 period is analogous to that of the supply side projects but the above reference values are to be used.

[2] Any fossil based power shall be deducted from the total output of the plant, e.g. in case of a biomass plant, the power related to the operation of fossil fired auxiliary burners.