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CDM Validation Report

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Audit/Assessment:

CDM Validation

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15/11/2011-12/11/2012

Project name:

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Large Scale

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1 Introduction

1.1 Objective

Grütter Consulting has retained SQS to validate the Daegu Metro 3th Urban Railroad (the project). The objective of the validation is an independent assessment by a Designated Operational Entity (DOE) of a proposed project activity against the defined set of criteria for registration under the Clean Development Mechanism (CDM). Validation is part of the CDM project cycle and will finally result in a conclusion by the DOE whether a project activity should be submitted for registration to the CDM Executive Board (CDM EB). The ultimate decision on the registration of a proposed project activity rests with the CDM EB.

1.2 Scope

The scope of the validation is an independent and objective review of the project design document (PDD) and the DOE uses a risk-based approach focusing on the identification of significant risks for project implementation and the generation of Certified Emission Reductions (CERs) against the criteria stated in

- The Kyoto Protocol, in particular § 12 and Modalities and Procedures for the Clean Development Mechanism
- Decision 2/CMP.1 and Decision 3/CMP.1 (Marrakech Accords)
- Modalities and Procedures for a Clean Development Mechanism
- Clean Development Mechanism Validation and Verification Manual (VVM ver. 01.2)
- GLOSSARY OF CDM TERMS, v.06
- ACM0016 "Baseline Methodology for Mass Rapid Transit Projects", v.2.0
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, v.01
- Tool for the demonstration and assessment of additionality v.05.2.1
- GUIDELINES ON THE DEMONSTRATION AND ASSESSMENT OF PRIOR CONSIDERATION OF THE CDM, v.04
- GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS, v.05
- Decisions and specific guidance by the EB published under <http://cdm.unfccc.int>

A comprehensive list of the normative references given in the validation protocol (Appendix F).

1.3 Project description

The objective of the project is the establishment and operation of an efficient, safe, rapid, convenient, comfortable and effective modern mass transit system with high ridership capacity linking Chilgok to Beommul in Daegu, Korea. The Mass Rapid Transit System (MRTS) proposed is a fully elevated monorail with a length of 24 km and 30 stations expecting to transport in the first operational year around 84 million passengers. The MRTS line will be extended by a total of 4 km until the year 2031. Construction of this metro started 30/06/2009 and the operational start is expected for the year 2015. The project is the third MRTS line in Daegu. Lines 1 and 2 both started construction prior to the year 2000 and are both operational. Line 3 is a critical element as it runs N-S and therefore increases considerably the city coverage as lines 1 and 2 both run E-W, thus making the entire MRTS system more attractive to inhabitants while reducing the necessity of building new roads .

The owner of the system is the Daegu Metropolitan City. The MRTS is constructed by the Daegu Urban Railroad Construction Headquarters which is specialized in the construction of railsystems in Daegu in accordance with the Urban Railway Act. The Daegu Urban Railroad Construction Headquarters is an entity of Daegu Metropolitan City. The Daegu Metropolitan City Urban Railroad Construction HQ has been designated by the Daegu Metropolitan City as the Project Participant. Daegu Metropolitan Transit Corporation is the MRTS operator. Daegu Metropolitan Transit Corporation is a Public Corporation established by Daegu Metropolitan City.

The geographical boundary of the project is the Metropolitan area of Daegu (about 2.5 million inhabitants in 2010) in the region of Yeongnam. The spatial area includes the trip origins and destinations of passengers using the MRTS project line. The geographical coordinates of Daegu are Latitude 35.85 and Longitude 128.60.

The baseline situation is that passengers would use conventional modes of transport including buses, taxis, cars, motorcycles, bicycles, existing metro line and non-motorized transport thus causing baseline trip emissions in absence of the project. Project emissions are based on the estimated electricity consumption of the new Metro Line 3 plus emissions caused by passenger trips to and from the Metro Line 3. Leakage emissions are caused by changes of congestion and speed resulting potentially in a rebound and a speed effect plus potential change of load factors of remaining buses and taxis in part of the city. Emission reductions are the result of reduced greenhouse gas emissions per passenger trip comparing with the baseline emissions.

Baseline and project emissions calculation as well as leakage and monitoring are based on the approved CDM methodology ACM0016, version 02 "Baseline Methodology for Mass Rapid Transit Projects", which is valid until 25/07/2012. The total emission reduction over the first crediting period - which lasts from 01/01/2015 until 31/12/2021 - is estimated to be 422 451 t CO_{2eq}, being 60 350 t CO_{2eq} as an average per year. The gases accounted for are CO₂ and CH₄.

The starting date of the first crediting period is ambiguous; the financial calculation uses October 2014, whereas the PDD under 1.3. gives 01/01/2015. Therefore CL30 had to be raised. The answer by the PP is satisfying, thus CL30 could be closed.

Has been raised:

No.:	CL 30	Reference: PDD C.2.1.1
Validator request:	The starting date of the first crediting period is ambiguous. The financial calculation file uses October 2014, whereas the PDD gives January 2015	
Project owner response:	This is correct. However the financial calculation is based on information of early 2009. The starting date of 01/2015 is an estimation as of today based on possible delays as well as trial operations prior full operation. Therefore the PP has put as starting date of the 1 st crediting period 01/2015. This date may still change based on actual construction time required and can, based on UNFCCC regulations, also be changed ex-post registration by the PP.	
Validator conclusion:	Explanation is satisfying. CL 30 closed	Date: 29/03/2012

1.4 Validation methodology

The DOE applies standard auditing techniques to assess the correctness of the information provided by the project participants, including, where appropriate, but not limited to:

- Document review, involving: review of data and information to verify the correctness, credibility and interpretation of presented information and cross-checks between information provided in the PDD and information from sources other than that used, if available, and if necessary independent background investigations.
- Follow-up actions (on-site visit, telephone, email interviews), including: interviews with relevant stakeholders in the host country, personnel with knowledge of the project design and implementation and cross checks between information provided by interviewed personnel to ensure that no relevant information has been omitted from the validation.
- Reference to available information relating to projects or technologies similar to the proposed CDM project activity under validation.
- Review, based on the approved methodology being applied, of the appropriateness of formulae and correctness of calculations.

If, during the validation of a project activity, the DOE identifies issues that need to be further elaborated upon,

researched or added to in order to confirm that the project activity meets the CDM requirements and can achieve credible emission reductions, the DOE shall ensure that these issues are correctly identified, discussed and concluded in the validation report.

The DOE shall raise a corrective action request (CAR) if one of the following occurs:

- a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- b) The CDM requirements have not been met;
- c) There is a risk that emission reductions cannot be monitored or calculated.

The DOE shall raise a clarification request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

The DOE shall raise a forward action request (FAR) during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

The project participant shall respond to all requests with sufficient evidence.

The DOE shall resolve or “close out” CARs and CLs only if the project participants modify the project design, rectify the PDD or provide adequate additional explanations or evidence that satisfy the DOE’s concerns. If this is not done, the DOE shall not recommend the project activity for registration to the CDM Executive Board.

In order to ensure transparency, a validation protocol was customized for the project. The protocol shows, in a transparent manner, criteria (requirements), means of validation and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organizes, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process in which the DOE will document how a particular requirement has been validated and the result of the validation;
- The validation protocol consists of several chapters, as described below.

The completed validation protocol is enclosed in Appendix F to this report.

CDM Validation Protocol, Chapters 1 - 3: Requirements	
<i>Requirement</i>	The requirements the project must meet.
<i>Ref.</i>	Reference to the PDD or documents.
<i>MoV (Means of Validation)</i>	Explains how conformance with the requirements is investigated. DR = Document Review, I = Interview, N/A = Not Applicable
<i>Comment</i>	The section is used to elaborate and discuss the conformance to the requirement.
<i>Draft Concl. / Final Concl. (Draft and/or Final Conclusion)</i>	OK = Conform, CAR = Corrective Action Request, CL = Clarification Request, FAR = Forward Action Request

CDM Validation Protocol Chapter 4: Summary of Requests	
<i>No.</i>	The requests (CAR, CL, FAR) are numbered and listed in this section.
<i>Ref.</i>	Reference to the requirement number in Protocol 1 - 3 where the request is explained.
<i>DOE request</i>	The section is used to elaborate and discuss the request. The DOE may give reference to the PDD or documents.
<i>Project participant response</i>	The responses given by the project participants during the communications with the DOE is summarised in this section.
<i>DOE conclusion</i>	This section should summarise the DOE’s responses and final conclusions. The conclusions should also be included in Protocol 1 - 3, under “Final Conclusion”.
<i>Date</i>	Date when request was closed.

2 Validation Opinion

2.1 Summary of the validation conclusions

SQS has performed a validation of the project's approach as outlined in the PDD being part of the CDM validation process. This validation was performed on the basis of appropriate criteria. SQS used the approved CDM methodology ACM0016 version 2 including the therein referenced tools as the project-criteria for the validation.

SQS, by the chosen validation method, can provide a reasonable level of assurance. The term reasonable is to be understood according to the definition in ISO14064-3, A.2.3 and guarantees that the greenhouse gas assertion is materially correct.

The review of the PDD, the additional information gathered during the subsequent on-site inspection and the satisfaction of corrective actions and clarification requests has provided SQS with sufficient evidence in order to be able to determine the fulfilment of stated criteria. In our opinion, the project, as outlined in the PDD vs 1.3 of 21/06/2012 [76], is consistent with the methodology mentioned. The project correctly applies the approved CDM methodology and therein baseline, additionality and monitoring principles.

The project activity results in reduction of greenhouse gas emissions that are real, measurable, and give long-term benefits to the mitigation of climate change. Information and data supporting the GHG ascertain are mostly historical in nature. They are based on official data, surveys and projections.

An analysis of the additionality test demonstrates that the proposed project activity is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project.

The total emission reductions due to the project activity are estimated to be 422 451 metric tons CO₂e over the entire crediting period of 7 years. The estimated emission reduction was checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

Adequate training and monitoring procedures have been implemented and will be supervised by the involved project entities.

In summary, it is SQS's opinion that the project „Daegu Metro 3th Urban Railroad“, as described in the PDD vs 1.3 of 21/06/2012 [76], meets all relevant requirements and criteria listed in Appendix F and correctly applies the CDM methodology ACM0016 version 2.0. Therefore, SQS requests the registration of the given CDM project.

2.2 Summary of the validation methodology and process used and the validation criteria applied

The validation process was carried out according to the methodology described in 1.4. This included a comprehensive desk-review by 2 auditors, an on-site visit of 1.5 days by the same 2 auditors on 03/02/2012 and 04/02/2012, as well as a thorough analysis of the raised CL/CAR. 35 CL have been raised, all of them are closed. 2 CAR have been raised, both of them are closed. 1 FAR has been raised and has already been closed after reviewing the PP's answer to the request. See the details in Appendix F, Chapter 4.

2.3 Description of project components or issues not covered by the validation process

All project components have been covered by the validation process.

2.4 Statement on the validation of the expected emission reductions

The expected emission reduction of 60 350 tCO₂ per year and 422 451 tCO₂ for the whole crediting period

was found to be correct according to the validated assumptions. It is based on a preliminary survey at a different metro line; the definitive survey could therefore lead to another result. For the moment however it is the best available estimation according to the opinion of SQS.

2.5 Statement whether the proposed CDM project activity meets the stated criteria

It is SQS' opinion that the project „Daegu Metro 3th Urban Railroad “, as described in the PDD vs. 1.3 of 21/06/2012 [76], meets all relevant requirements and correctly applies the CDM methodology ACM0016 version 2.0; it is accurate, conservative, relevant, credible and reliable.

3 Validation Findings

3.1 Approval

A letter of approval by the host country Republic of Korea was requested (CL1) and issued on 19/07/2012 [81]. The Letter of Approval (LoA) from the DNA of Republic of Korea consequently confirms in accordance with VVM Version 01.2 paragraph 45:

- Republic of Korea is a Party to the Kyoto Protocol (point 1 of LoA issued)
- The participation is voluntary (point 2 of LoA issued)
- The project contributes to sustainable development in the Republic of Korea (point 3 of LoA issued)
- The LoA refers exactly to the project title „Daegu Metro 3th Urban Railroad“

SQS confirms that the letters refer precisely to the proposed CDM project activity title in line with the title in the PDD „Daegu Metro 3th Urban Railroad“. In addition, the LoA statements are clear and unambiguous with respect to all required content such as Kyoto Protocol ratification status and voluntary participation. The LoA of the Republic of Korea also confirms that the proposed CDM project activity contributes to the sustainable development of the country.

Switzerland, as the second party involved, has also issued a letter of approval, dated 30/05/2012 [80]. The Letter of Approval (LoA) from the DNA of Switzerland confirms in accordance with VVM version 01.2 paragraph 45:

- Switzerland is a Party to the Kyoto Protocol (point 1 of LoA issued)
- The participation is voluntary (point 2 of LoA issued)
- Authorization of Grütter Consulting AG to participate as project proponent to the mentioned CDM project activity (point 3 of LoA issued)
- The Swiss National Account Identifier for this company is CH-100-80-0 (point 4 of LoA issued)
- The LoA refers exactly to the project title „Daegu Metro 3th Urban Railroad“

Both are considered as authentic without doubts and are unconditional. SQS received these letters from the project participant directly. The SQS validation team was able to confirm the authenticity of the LoA issued by the DNA of South Korea by a telephone call from the local expert to Mr. Jang, jaewoo, the secretariat of the Ministry of Land, Transport and Maritime Affairs on 20 July 2012. The SQS validation team was able to confirm the authenticity of the LoA issued by DNA of Switzerland by conducting a phone interview with the secretariat of Mr. Yvan Keckeis (senior policy officer responsible for CDM related issues within the DNA of Switzerland and issuer of the received LoA) on 16/07/2012.

SQS confirms that the approval of participation is valid for the proposed project participants – see [80] and [81]. SQS confirms that the Letters of Approval are in accordance with paragraphs 45 – 48 of the VVM version 1.2 (EB 55, Annex 1, paragraph 49).

Has been raised:

No.:	CL 1	Reference:	VVM 44: Letter of Approval
Validator request:	Letters of Approval have not yet been submitted		
Project owner response:	For both LOAs the draft validation report is required		
Validator conclusion:	LoA from Switzerland received 30/05/2012, LoA from Republic of Korea received 19/07/2012, CL 1 closed.	Date:	20/07/2012

3.2 Participation

The names of the project participants:

- "Daegu Metropolitan City Urban Railroad Construction HQ" (public entity) (Republic of Korea)
- "South Pacific Inc." (private entity) (Republic of Korea) and
- "Grütter Consulting AG" (private entity) (Switzerland)

are listed in the PDD in tabular form in Section A.3. This information is consistent with the contact information details of the project participants as provided in Annex I of the latest version of the PDD [76]. No entities other than those approved as project participants are included in these sections of the PDD.

The participation of "Daegu Metropolitan City Urban Railroad Construction HQ" as well as the participation of "South Pacific Inc." is approved by means of the Letter of Approval of the host party. The participation of "Grütter Consulting AG" is approved by means of the Letter of Approval of Switzerland. [80].

By reviewing the latest version of the completed Modalities of Communication Form (F-CDM-MOC) [71] for the project activity signed by all project participants, the validation team was able to confirm that this form is correctly completed. The names and authorized signatories of the project participants indicated in the MoC [71] are consistent with the ones in the PDD.

Has been raised:

No.:	CL 2	Reference:	MoC
Validator request:	The MoC document of the project has not yet been submitted		
Project owner response:	Attached		
Validator conclusion:	The MoC document has been submitted (File 71), [71]. CL 2 is closed.	Date:	15/03/2012

3.3 Project design document

The official form "PROJECT DESIGN DOCUMENT FORM (CDM-PDD) version 03 - in effect as of: 28 July 2006" without any alteration was used for submitting the project. The "GUIDELINES FOR COMPLETING THE PROJECT DESIGN DOCUMENT (CDM-PDD) AND THE PROPOSED NEW BASELINE AND MONITORING METHODOLOGIES (CDM-NM) (Version 07)" were followed for completing the PDD, no confidential information is contained in the PDD.

The PDD is very comprehensive and contains with over 70 additional files an exceptional high level of proofs for all relevant statements.

Some minor corrections had to be made in the PDD following the raised Clarification Requests (CL 3, CL 5, CL 6, CL 11, CL 34):

No.:	CL 3	Reference:	PDD A.4.1.4
Validator request:	The geographical coordinates are not written in the correct format (x,yyyy °)		
Project owner response:	Has been updated.		
Validator conclusion:	DOE agrees. CL 3 is closed	Date:	15/03/2012

No.:	CL 5	Reference:	PDD A.4.3 (Figure 1)
Validator request:	It is not clear why there is only data up to 2006		
Project owner response:	The last year i.e. 2006 is based on the Daegu Action Plan published 04/2010. No newer data source is available.		
Validator conclusion:	DOE agrees. CL 5 is closed	Date:	15/03/2012

No.:	CL 6	Reference:	PDD A.4.3 (pre-project situation)
Validator request:	It is not clear in which dimension the modal split rates are measured (passenger-rides, passenger*km, other?)		
Project owner response:	It refers, as is common, to passenger trips. The information has been added in the figure.		
Validator conclusion:	DOE agrees. CL 6 is closed	Date:	15/03/2012

No.:	CL 11	Reference:	PDD B.1 step 2 alternative 2
Validator request:	There are ambiguities in the understanding of the term "other rail based systems" in the text of the PDD.		
Project owner response:	Reference to types of other rail system has been added and the title has been adjusted		
Validator conclusion:	DOE agrees. CL 11 is closed	Date:	15/03/2012

No.:	CL 34	Reference:	PDD and monitoring manual
Validator request:	The project title is not identical throughout all documents, there seems to be a printing error in the title, " Daegu Metro 3 th Urban Railroad" should read "Daegu Metro 3 rd Urban Railroad"		
Project owner response:	Daegu Metro 3 th Urban Railroad is the title used in the prior consideration form and must thus be used in the PDD. We have not found inconsistencies in this title in the PDD		
Validator conclusion:	DOE agrees. CL 34 is closed	Date:	29/03/2012

3.4 Project description

The project description (see 1.3 above) in the PDD is understandable and gives a good overall picture of the activities. The on-site visit on February 3, 2011 and the interviews (see on-site visit program and interviews in Appendix A) have confirmed this description. No contradictory information or findings have been unveiled. The DOE confirms that the project description is accurate and complete.

Some minor corrections had to be made in the project description following the raised Clarification Requests (CL 4, CL 8, CL 9):

No.:	CL 4	Reference:	PDD A.4.3 (pre project situation)
Validator request:	There are no motorized rickshaws		
Project owner response:	Has been corrected		
Validator conclusion:	DOE agrees. CL 4 is closed	Date:	15/03/2012

No.:	CL 8	Reference:	PDD B.2 Table 2
Validator request:	There is insufficient information about how the bus system is planned to be re-structurized.		
Project owner response:	Some further information has been added how the process actually is made.		
Validator conclusion:	DOE agrees. CL 8 is closed	Date:	15/03/2012

No.:	CL 9	Reference:	PDD B.2 Table 2
Validator request:	There is insufficient information about the possible actual and future use of bio-fuels for buses. Specifically, it is not clear:		

	<ul style="list-style-type: none"> - whether there is actually no use of bio-fuels for buses - what will happen to the project if in future the use of some bio-fuel would become mandatory for some motorized vehicles procedures 	
Project owner response:	<ul style="list-style-type: none"> - No bio-fuel is used. See confirmation letter of public transportation system File 65 - If in the future bio-fuel is used this is monitored and the BEF is adjusted (see p. 10 of the methodology and p. 29 of the methodology). For clarification this has been added also to Section B.7.1. Parameter EF_{CO2} 	
Validator conclusion:	The confirmation letter has been received. By adding the monitoring of the use of biofuel to the monitoring plan a correct treatment and calculation are assured. DOE agrees. CL 9 is closed.	Date: 15/03/2012

3.5 Baseline and monitoring methodology

3.5.1 General requirement

The following methodology and adequate tools were applied:

- ACM0016, Baseline Methodology for Mass Rapid Transit Projects, version 2.0
- Tool for the demonstration and assessment of additionality, version 05.2.1
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 01

The applied methodology was the newest available one when the project was started, it is valid until 25/07/2012, thus it is justified to still use it for this project although there is now a newer version available.

3.5.2 Applicability of the selected methodology to the project activity

The following table shows the applicability conditions of the proposed project:

Applicability condition	Project situation	Means of Validation
The project constructs a new rail-based infrastructure or segregated bus lanes. In the case of rail systems the project needs to provide new infrastructure (new rail lines). The segregated bus lanes or the rail-based MRTS replace existing bus routes operating under mixed traffic conditions.	The MRTS is new rail-based mass transit system. The rail infrastructure is new. The bus system is re-structured once the metro is operational. Re-structuring during construction and years prior operation makes no sense as bus routes change over time. This approach was followed by metro Line 2 (operational start 10.2005). Daegu Metropolitan City removed in the year 2006 bus routes overlapping with the metro line 2. Initially overlapping lines were identified with an overlapping rate. This included in total 15 lines. The 5 lines which overlapped Metro Line 2 by around 50% or more where thereafter eliminated i.e. they no longer operate. The same approach is proposed to be used once the metro line 3 is near to entering operations	The site visit showed that the new rail infrastructure is under construction. CL8 and CL9 were issued asking for more information about the replacing of the existing bus routes. Additional information was given. OK
The methodology is not applicable for operational improvements (e.g. new or larger buses) of an already existing and operating bus lane or rail-based MRTS.	The MRTS is a new metro with new infrastructure.	Site visit, the MRTS is a new metro line. The infrastructure was under construction. OK
The methodology is not applicable for bus lanes replacing an existing rail-based system.	The MRTS is rail-based and not a bus lane.	Site visit, the MRTS is rail based (monorail). OK

The methodology is applicable for passenger transport only.	The MRTS is a passenger transport system	Site visit, the MRTS is planned as a passenger transport system. OK
Any fuels including electricity, (liquefied) natural gas and biofuel blends can be used in the baseline or project case. <ul style="list-style-type: none"> In case of natural gas, the methodology is applicable if equal or more natural gas is used in the baseline than in the project case. The methodology is not applicable in its current form if more natural gas is used in the project compared to the baseline case. In the case of bio-fuels, project buses must use the same bio-fuel blend (same percentage of bio-fuel) as commonly used by conventional comparable urban buses in the country. 	Baseline transport fuels are diesel, gasoline and gaseous fuels. No bio-fuels are used in the baseline or project case. The project uses electricity. Thus more natural gas is used in the baseline than in the project case as passengers switch partially from buses and taxis which use partially gaseous fuels to metro.	There was insufficient information about the possible actual and future use of bio-fuels for buses, therefore CL9 was raised. No bio-fuel is used, as can be seen in the confirmation letter in File [65]. If in the future bio-fuel will be used this will be monitored and the emission factors will be adjusted as mentioned in the methodology. OK
The methodology is not applicable for the implementation of air and water-based transport systems.	No air or water-based transport system is implemented. The MRTS is rail based.	Site visit: The MRTS is lead mainly above ground by monorail tracks which follow mostly the existing roads. OK
The project system partially replaces a traditional public transport system in a given city. The methodology cannot be used in areas where currently no public transport is available.	The MRTS replaces partially traditional bus trips. Public transport is currently available in the project area. Bus routes are existent in the area where the metro line will be established (see map below). Their replacement is discussed in point 1 of the applicability conditions.	Site visit: Daegu has already a large public transport system with metro and bus lines. OK
The methodology is applicable for urban or suburban trips. It is not applicable for inter-urban transport.	The MRTS is for urban or suburban trips.	Site visit: The MRTS is a real metro, no interurban transport is planned. OK
The methodology is only applicable if the application of the procedure to identify the baseline scenario results in that a continuation of the current public transport system is the most plausible baseline scenario.	The identified baseline is a continuation of the current urban transit system (see Section B.4).	No other baseline scenario than continuation of the current public transport system makes really sense. See Section B4. OK

The methodology includes the direct and indirect project GHG emissions as well as leakage. No further GHG emissions are to be expected within the project boundary as a result of the project activity. SQS states that the applied methodology is justified and all applicability conditions are met.

No.:	CL 8	Reference: PDD B.2 Table 2
Validator request:	There is insufficient information about how the bus system is planned to be re-structurized.	
Project owner response:	Some further information has been added how the process actually is made.	
Validator conclusion:	DOE agrees. CL 8 is closed	Date: 15/03/2012

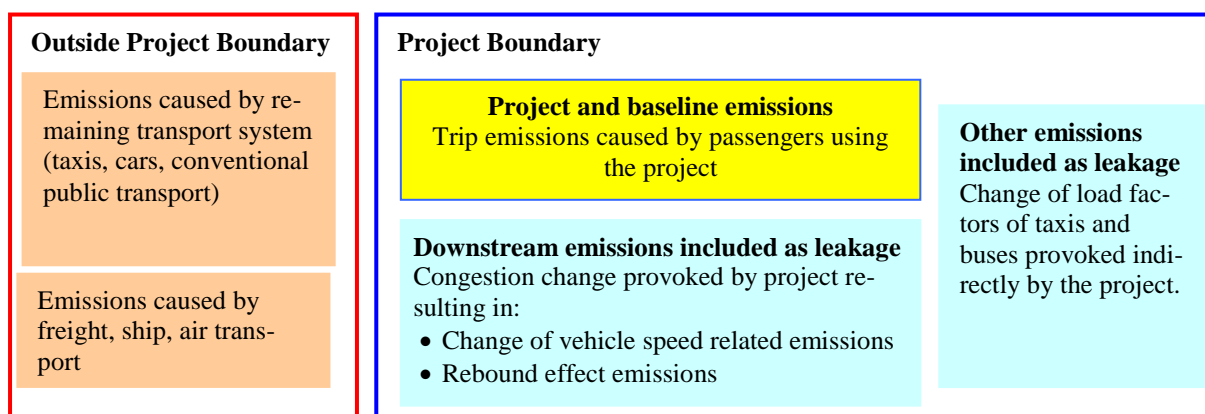
No.:	CL 9	Reference: PDD B.2 Table 2
Validator request:	There is insufficient information about the possible actual and future use of bio-fuels for buses. Specifically, it is not clear: <ul style="list-style-type: none"> - whether there is actually no use of bio-fuels for buses - what will happen to the project if in future the use of some bio-fuel would become mandatory for some motorized vehicles procedures 	
Project owner response:	-No bio-fuel is used. See confirmation letter of public transportation system File 65	

-If in the future bio-fuel is used this is monitored and the BEF is adjusted (see p. 10 of the methodology and p. 29 of the methodology). For clarification this has been added also section B.7.1. Parameter EF_{CO_2}		
Validator conclusion:	The confirmation letter has been received. By adding the monitoring of the use of bio-fuel to the monitoring plan a correct treatment and calculation are assured. DOE agrees. CL 9 is closed.	Date: 15/03/2012

3.5.3 Project boundary

The spatial and conceptual project boundary is defined in the PDD Chapter B.3. The project boundary is shown in Figure 2 and in the “Project Layout” in Chapter A.4.1. The spatial extent of the project according to the PDD is the Capital Metropolitan Area of Daegu which corresponds to the methodology where the “LUZ larger urban zone” is mentioned. According to the methodology version 2 a “larger urban zone (LUZ)” of a city covers the whole functional zone around the city (including the core city) i.e. it corresponds to the commuting field around the city.

The conceptual project boundaries are given in Figure 3 of the PDD:



The greenhouse gas emissions include CO_2 and CH_4 . N_2O and tailpipe CH_4 emissions are excluded since they contribute less than 2% to the total CO_{2eq} emissions; they would be reduced by the project as well, thus their omission is conservative. This corresponds to the methodology.

The identified boundary and emission sources that will be affected by the project activity are justified. The national grid has correctly been taken into the project boundary. The boundary was verified during the on-site visit.

The choice of boundary, sources and gases corresponds to the methodology and is deemed correct by SQS.

3.5.4 Baseline identification

The baseline identification was done according to the methodology.

Step 1: Identification of alternative scenarios to the proposed CDM project activity that are consistent with current laws and regulations

All options are identified that meet the same requirement as the proposed project activity. Alternatives assessed are public transport systems which are complemented with other modes of transport such as passenger cars, taxis, motorcycles, baseline metro and non-motorized transport:

1. The establishment of a BRT (Bus Rapid Transit);
2. The establishment of a different rail-based MRTS;
3. The continuation of the current public and individual transport systems, including (future) investments in road based infrastructure if applicable;
4. The proposed project activity being implemented at a later date in the future, without being registered as a CDM project activity;
5. The project proposal not implemented as a CDM project activity.

All 5 alternatives are legally compliant and meet the same requirements as the proposed project activity; a clear affirmation of the legal compliance was lacking in the PDD (v.1.0.) [74], see CL31. This was added in the new PDD [75] so CL31 could be closed, since no evidence for a non-compliance could be detected during the site visit and the appropriate interviews.

The validation by desk-review, on-site visit and interviews has not come up with another alternative than those identified in the report.

Step 2: Assessment of Options

The analysis of options identified in Step 1 is based on the "Tool for the demonstration and assessment of additionality", version 05.2.

Alternative 1, establishment of a BRT: The arguments against a BRT have been questioned in CL10, which has been persuadingly answered: Due to limited passenger carrying capacity compared to the project requirement this option does not seem to be feasible.

The following table (Table 4 in the PDD [76]) was cross-checked by SQS with the mentioned references ([61], [62], [63], <http://www.chinabrt.org/>).

BRT Project	Phd
Ahmedabad, India	1,000
Amsterdam, Netherlands	1,000
Bangkok, Thailand	1,000
Beijing, China	4,000
Bogota, Colombia	42,000
Brisbane, Australia	7,000
Bucaramanga, Colombia	10,000
Cali, Colombia	12,000
Cartagena, Colombia	14,000
Changzhou, China	7,000
Dalian, China	6,000
Guadalajara, Mexico	9,000
Guatemala City, Guatemala	12,000
Guangzhou, China	27,000
Hangzhou, China	7,000
Hefei, China	3,000

Jakarta, Indonesia	4,000
Jinan, China	3,000
Kunming, China	4,000
Medellin, Colombia	7,000
Mexico City, Mexico	6,000-15,000 (according to line)
Nagoya, Japan	1,000
Nantes, France	1,000
Pereira, Colombia	7,000
Quito, Ecuador	6,000
Seoul, Korea	7,000
Xiamen, China	8,000
Zaozhuang, China	1,000
Zhengzhou, China	6,000
Median	7,000
Range	1,000 – 42,000

The median of the 29 cities lies at around 7 000 passengers per hour and direction, which is far too low compared to the required 16 000. Then, Daegu already has two metro lines. Another metro line makes the connectivity easier than with a completely new BRT system. Furthermore, it requires additional space to put a new BRT system to the ground; space which is not available and which the monorail tracks of the project do not need. The alternative of a BRT is therefore not considered a feasible alternative basically due to additional space requirements to achieve the desired capacity. SQS therefore agrees with the PP that Alternative 1 is not feasible.

Alternative 2, establishment of an other (than project) rail-based MRTS: Various rail-based systems including LRT, monorail etc. were studied. The different rail systems can all comply with the expected passenger demand. In terms of projected construction investment the Monorail system is by far less expensive than all other rail alternatives studied with 22-31% lower construction investment required. CL11 has been raised because the description of Alternative 2 was ambiguous. It was answered satisfactorily. SQS agrees with the PP that Alternative 2 is not feasible.

Alternative 3, continuation of the current system incl. future investments: This alternative requires

- No large-scale public investment requiring additional income/tax sources, and is of
- Lowest technical and financial risk of all options.

It respects all applicable legal and regulatory requirements, as could be shown by spot checks during the site visit and through discussions with the local expert. CL12 considering unclear investment figures could be answered satisfactorily. Heavy investment in road infrastructure until the year 2020 is planned in Daegu Metropolitan City totalling 344 km of new or expanded roads with an investment of 8,270,000 million Won (in comparison the metro line is 24 km with a projected investment of 858,800 million Wong) [20]. This shows clearly that investment in road-based transit is still far higher than for rail and that the road system is being expanded rapidly, thus allowing for traffic accommodation also in absence of any new MRTS without major difficulties. Therefore, SQS states that continuation of the current system is the most plausible alternative to the project and can thus be considered as the baseline scenario.

Alternative 4, the project being realized in a later date without CDM: The obstacles for realizing a new metro line are mainly of financial nature, which would be worse without CDM (see also 3.6.3). Waiting with the realization of the project would also mean that inhabitants of Daegu would continue investing in private means of transport like in the past. The trend in cities, including Daegu, has been towards decreasing shares of public transit, thus making new MRTS not easier but more complex due to lack of passenger demand. SQS agrees with PP's argumentation that Alternative 4 is not feasible.

Alternative 5, the project without CDM: The arguments for the non-feasibility of this alternative are given mainly in Chapter B5 of the PDD and are of financial nature. SQS agrees, the financial proof is discussed in 3.6.3.

Step 3: If Step 2 results in more than one possible alternative baseline scenario, the most likely baseline scenario is the scenario with the lowest baseline emissions

Alternatives 1 (Establishment of a BRT), 2 (Establishment of a LRT), 4 (Proposed project activity being implemented at a later date in the future, without being registered as a CDM project activity) and 5 (Project proposal not implemented as a CDM project activity) are not feasible. The most probable alternative in the future in absence of the project is therefore a continuation of the current transport system (Alternative 3). This is thus the baseline for this project.

Baseline Scenario

Baseline emissions include the emissions that would have happened due to the transportation of the passengers who use the project activity, had the project activity not been implemented. This is differentiated according to the modes of transport (relevant vehicle categories) that the passengers would have used in the absence of the project. The baseline is a continuation of the current transport system consisting of various transport modes between which the population chooses:

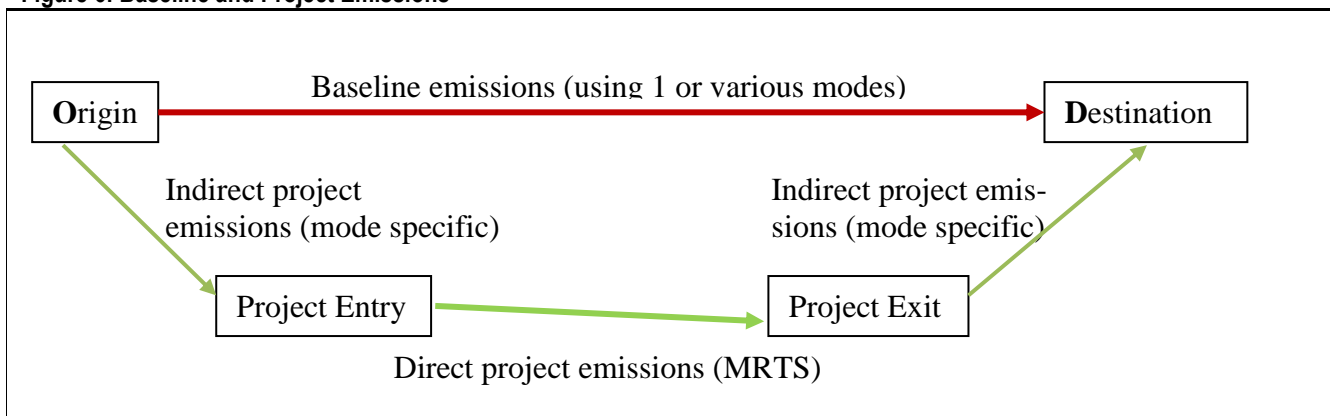
- NMT (Non-Motorized Traffic) with bikes and per foot;
- Private passenger car;
- Taxis;
- Motorcycles (two-wheelers);
- Buses;
- Existing metro network

For all above-listed transport modes the emissions per passenger kilometre (PKM) are calculated. To adjust for emission improvement under BAU, a technology improvement factor is applied to all road-based modes.

Baseline emissions are calculated per passenger surveyed. For each passenger surveyed the individual baseline emissions are calculated and multiplied with the individual expansion factor, thus getting the baseline emissions of all passengers of the specific week surveyed.

Figure 6 gives an overview of baseline and project emissions, the latter being differentiated in indirect and direct project emissions.

Figure 6: Baseline and Project Emissions



Have been raised:

No.:	CL 10	Reference: PDD B.4 step 2 Alternative 1
Validator request:	There is too little evidence that the establishment of a BRT as an alternative to the project can be excluded.	
Project owner response:	More information has been added especially concerning the BRT capacity versus rail capacity.	
Validator conclusion:	DOE agrees. CL 10 is closed	Date: 15/03/2012

No.:	CL 11	Reference: PDD B.4 step 2 Alternative 2
Validator request:	There are ambiguities in the understanding of the term "other rail-based systems" in the text of the PDD.	
Project owner response:	Reference to types of other rail system has been added and the title has been adjusted	
Validator conclusion:	DOE agrees. CL 11 is closed	Date: 15/03/2012

No.:	CL 12	Reference: PDD B.4 step 2 Alternative 3
Validator request:	There are ambiguities in the understanding of the investment figures. The numbers given in the PDD text seem to be in contradiction with the investment figures given in Table 6 and in the financial spreadsheet (File 41)	
Project owner response:	Table 6 coincides fully with File 41 sheet "assumptions" Table 6 is in 100 million WON as explained in the title of Table 6. The text on p.23 "investment cost" is however in millions i.e. 1,097,900 which is equivalent to 10,979 x 100 million	
Validator conclusion:	DOE agrees. CL 12 is closed	Date: 15/03/2012

3.5.5 Algorithms and/or formulae used to determine emission reductions

Step 1 of the methodology requires that the PP defines alternatives to the project activity. This was done in chapter B4; of the 5 alternatives just 2 were credible, realistic and comparable:

1. Continuation of the current situation
2. Project without CDM

As outlined in 3.5.4, SQS agrees with this classification and proceeds to the investment analysis (3.6.3.) and to common practice analysis (3.6.4.).

Baseline emissions were calculated according to the methodology in B.6.1 as follows.

BASELINE EMISSIONS

$$BE_y = \frac{P_y}{P_{SPER\ p}} \sum (BE_{p,y} \cdot FEX_{p,y})$$

Where:

BE_y	Baseline emissions in the year y (g CO ₂)
$BE_{p,y}$	Baseline emissions per surveyed passenger p in the year y (g CO ₂)
$FEX_{p,y}$	Expansion factor for each surveyed passenger p surveyed in the year y (each surveyed passenger has a different expansion factor)
P_y	Total number of passengers in the year y
P_{SPER}	Number of passengers in the time period of the survey (1 week)
p	Surveyed passenger
y	Year of the crediting period

$$BE_{p,y} = \sum_i BTD_{p,i,y} \cdot EF_{PKM,i,y}$$

Where:

$BE_{p,y}$	Baseline emissions per surveyed passenger p in the year y (g CO ₂)
$BTD_{p,i,y}$	Baseline trip distance p per surveyed passenger using mode i in the year y (PKM)
$EF_{PKM,i,y}$	Emission factor per passenger-kilometre of mode i in the year y (g CO ₂ /PKM)
i	Relevant vehicle category
p	Surveyed passenger
y	Year of the crediting period

$$EF_{PKM,i,y} = \frac{TE_{EL,i,y}}{P_{EL,i,y} \cdot TD_{EL,i}}$$

Where:

$EF_{PKM,i,y}$	Emission factor per passenger-kilometre of suburban rail/metro for year y (gCO ₂ /PKM)
$TE_{EL,i,y}$	Total emissions from suburban rail / metro for year y (tCO ₂)
$P_{EL,i,y}$	Total passengers transported per year by suburban rail / metro for year y (passengers)
$TD_{EL,i}$	Average trip distance of passengers using suburban rail/metro prior to project start (km)
i	Suburban rail / metro
y	Year of the crediting period

$$TE_{EL,i,y} = EC_{BL,i,y} \times EF_{grid,CM} \times (1 + TDL) \times 10^{-6}$$

Where:

$TE_{EL,i,y}$	Total emissions from suburban rail / metro for year y (tCO ₂)
$EC_{BL,i,y}$	Quantity of electricity consumed by suburban rail / metro in the year y (MWh)
$EF_{grid,CM}$	Emission factor for electricity generation in the grid based on combined margin (gCO ₂ /kWh)
TDL	Average technical transmission and distribution losses for providing electricity

$$EF_{PKM,i,y} = \frac{EF_{KM,i,y}}{OC_i}$$

Where:

$EF_{PKM,i}$	Emission factor per passenger-kilometre of vehicle category i in the year y (g CO ₂ /PKM)
$EF_{KM,i}$	Emission factor per kilometre of vehicle category i in the year y (g CO ₂ /km)
OC_i	Average occupation rate of vehicle category i prior project start (passengers)
i	Relevant vehicle category
y	Year of the crediting period

$$OC_B = \frac{PBL_B \times TDBL_{P,B}}{DD_B}$$

Where:

OC_B	Average occupation rate of buses prior project start (passengers)
PBL_B	Passengers transported by baseline buses prior project (passengers)
$TDBL_{P,B}$	Average trip distance of passengers using baseline bus (kilometre)
DD_B	Distance driven by all baseline buses (kilometre)

$$EF_{KM,i,y} = \frac{\sum_x (SFC_{i,x,y} \cdot NCV_{x,y} \cdot EF_{CO2,x,y} \cdot N_{x,i})}{N_i}$$

Where:

$EF_{KM,i,y}$	Emission factor per kilometre of vehicle category i in the year y (g CO ₂ /km)
$SFC_{x,i}$	Specific fuel consumption of vehicle category i using fuel type x prior project start (g/km)
$NCV_{x,y}$	Net calorific value of fuel x in the year y (J/g)
$EF_{CO2,x,y}$	Carbon emission factor for fuel type x in the year y (g CO ₂ /J)
$N_{x,i}$	Number of vehicles of category i using fuel type x prior to project start (units)
$N_{x,i}$	Number of vehicles of category i prior to project start (units)
i	Relevant vehicle category
x	Fuel type
y	Year of the crediting period

$$EF_{K,My} = (IR_i^{t+y} \cdot \frac{\sum_x (SFC_{x,i} \cdot NCV_{x,y} \cdot EF_{CO2,x,y} \cdot N_{x,i})}{N_i})$$

Where:

$EF_{KM,i,y}$	Emission factor per kilometre of vehicle category i in the year y (g CO ₂ /km)
$SFC_{x,i}$	Specific fuel consumption of vehicle category i using fuel type x prior project start (g/km)
$NCV_{x,y}$	Net calorific value of fuel x in the year y (J/g)
$EF_{CO2,x,y}$	Carbon emission factor for fuel type x in the year y (g CO ₂ /J)
$N_{x,i}$	Number of vehicles of category i using fuel type x prior to project start (units)
$N_{x,i}$	Number of vehicles of category i prior to project start (units)
IR_i^{t+y}	Technology improvement factor for the vehicle of category i per year $t+y$ (ratio)
i	Relevant vehicle category
x	Fuel type
t	Years of annual improvement (dependent on age of data per vehicle category)
y	Year of the crediting period

The following parameters were used for the calculations and were validated by checking thoroughly the mentioned sources and by comparing the different parameters with at least two other CDM-metro-projects (Incheon Metro Line 2, Busan Metro Line 1 Dadae) and where appropriate also with Seoul Metro Line 9 (results see table below). The main differences were discussed during the site visit and could be explained by the PP and other interview partners.

Data / Parameter:	SFC _C , G/D/LPG	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of passenger cars using gasoline, diesel or LPG	
Source of data used:	Korea Energy Management Corporation. 2010, p.50 (File 1)	[1]
Value applied:	Cars gasoline: 58.46 Cars diesel: 62.60 Cars LPG: 55.91	Checked with [1] Gasoline: 12.67 km/l OK Diesel: 13.48 km/l OK LPG: 9.34 km/l OK
Justification of the choice of data or description of measurement methods and procedures actually applied:	Based on national literature. To check plausibility the value is compared with: <ul style="list-style-type: none"> IPCC 1996 (last available source for fuel consumption data vehicles): gasoline cars as lowest US values 11.8 l/100km (table 1-27) and as lowest European value 8.1 l/100km (Table 1-36). Both values are higher than the one used by the project (7.9 l/100km) IPCC 1996 reports for diesel cars as lowest US values 10.0 l/100km (Table 1-30) and as lowest European value 7.3 l/100km (Table 1-37). The Korean value is close to the lowest European one (7.4 l/100km) Gasoline cars represent 71% of vehicles and diesel cars 16% thus being the 2 dominant and most important categories.	Plausibility with IPCC shows that the applied values are conservative.
Any comment:	To transform from litres to grams the specific weight of gasoline, diesel and LPG was taken based on IEA, 2005, Table A.3.8 Calculation: Gasoline: 7.9 (l/100km) / 100 * 0.741 (kg/l) * 1,000 = 58.46 g/km Diesel: 7.4 (l/100km) / 100 * 0.844 (kg/l) * 1,000 = 62.60 g/km LPG: 10.7 (l/100km) / 100 * 0.522 (kg/l) * 1,000 = 55.91 g/km	Correct, data crosschecked with specific weights from literature.

Data / Parameter:	N _{C,G/D/LPG}	Means of Validation
Data unit:	Vehicles	
Description:	Number of passenger cars using fuel type: gasoline, diesel or LPG	
Source of data used:	Korea Transportation Safety Authority, Table 4-24, p. 133, 2009 (File 4)	According to methodology, [4], OK
Value applied:	Gasoline: 461 761 (71%) Diesel: 105 295 (16%) LPG: 84 668 (13%)	Checked with [4] OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official registration statistics	Total of 651 897 passenger cars, OK
Any comment:	This data is monitored annually. Percentages and not absolute figures are required for calculations.	

Data / Parameter:	SFC _{T,LPG}	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of LPG taxis	
Source of data used:	Daegu Metropolitan City Public Transportation Division, 2011 (File 5)	According to methodology, [5]
Value applied:	94.26	Checked with [5] OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic	
Any comment:	To transform from litres to grams the specific weight of LPG was taken based on IEA 2005, Table A.3.8 4 Calculation: LPG: 18.1 (l/100km) / 100 * 0.522 (kg/l) * 1 000 = 94.26 g/km	Correct, data cross-checked with specific weights from literature. OK

Data / Parameter:	N _{T,LPG}	Means of Validation
Data unit:	Vehicles	
<input type="checkbox"/> Description:	Number of taxis using LPG	
Source of data used:	Daegu Metropolitan City Public Transportation Division, 2011 (File 5)	According to methodology [5] OK
Value applied:	17,079 (100%)	Checked with [5] corporate and private taxis, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official registration statistics (licensed number including corporation and private units)	
Any comment:	This data is monitored annually. Percentages and not absolute figures are required for calculations.	

Data / Parameter:	SFC _{B,D}	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of diesel buses	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.4, 2010 (File 6)	[6] data is not older than 3 years
Value applied:	334.48	Checked with [6], 39.6 l/100km
Justification of the choice of data or de-	Based on records of total fuel consumed and total distance driven; As total fuel consumed and total distance driven is recorded no separation	

scription of measurement methods and procedures actually applied :	in bus size is required (latter is required if only SFC data is available to weight SFC per bus size)	
Any comment:	To transform from litres to grams the specific weight of diesel was taken based on IEA2005, Table A.3.8 Calculation: $9\,717\,259 \text{ litres} / 24\,516\,273 \text{ km} * 0.844 \text{ kg/l} * 1,000 = 334.48$	Correct, data cross-checked with specific weights from literature. Fuel consumption and distances from [6]

Data / Parameter:	SFC _{B,CNG}	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of CNG buses	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.4, 2010 (File 6)	[6] data is not older than 3 years, OK
Value applied:	336.75	Checked with [6], 47.2 m ³ /100km, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on records of total fuel consumed and total distance driven; As total fuel consumed and total distance driven is recorded no separation in bus size is required (latter is required if only SFC data is available to weight SFC per bus size)	
Any comment:	To transform from m ³ to grams the specific weight of CNG was taken based on molar mass (CH ₄ has a molar mass of 16g per mol. 16g/mol * 1000 l/m ³ / 22.4 l/mol = 714g/m ³ Calculation: $62\,050,306 \text{ m}^3 / 131\,564,657 \text{ km} * 0.714 \text{ kg/m}^3 * 1\,000 = 334.48$	Correct, data cross-checked with specific weights from literature. Fuel consumption and distances from [6]

Data / Parameter:	N _{B,D/CNG}	Means of Validation
Data unit:	Vehicles	
Description:	Number of diesel and CNG buses	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.2, 2010 (File 6)	[6]
Value applied:	Diesel: 198 CNG: 1 460	Checked with [6] operational vehicles, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on operational units	
Any comment:		

Data / Parameter:	EF _{Grid}	Means of Validation
Data unit:	kgCO ₂ /kWh	
Description:	Emission factor for the grid	
Source of data used:	KEPCO, 2010 (File 3a/b)	[3] File 3b EF grid 2007-2009
Value applied:	0.67379	Checked with [3], see text below, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official data; follow procedures as in "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"	According to methodology, OK
Any comment:		

Data / Parameter:	TDL	Means of Validation
Data unit:	---	
Description:	Average technical transmission and distribution losses for providing electricity	
Source of data used:	KEPCO, p. 116 data year 2009 (File 12)	File 12, [12]
Value applied:	1.67%	CL19 closed; checked with [12], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official value	
Any comment:		

Data / Parameter:	OC _c	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of passenger cars	Occupation rates are different for each city. National values should not be used
Source of data used:	Korea Transport Institute, 2010, p.9 (File 2)	[2]
Value applied:	1.21	[2] average of rush hour and normal for Daegu, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Survey of independent organization	
Any comment:		

Data / Parameter:	OC _T	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of taxis	
Source of data used:	Daegu Metropolitan City Public Transportation Division, 2011 (File 5)	According to methodology [5]
Value applied:	0.55	Checked with [5], calculated with PKM and number of taxis*daily km, private and corporate taxis. OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Survey of independent organization	
Any comment:	Excluding driver Is monitored also for determination of leakage occupation rate.	

Data / Parameter:	OC _B	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of buses	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.4, 2010 (File 6)	According to methodology [6]
Value applied:	13 (26%)	See below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculation based on PKM divided by total distance buses	

ment methods and procedures actually applied :		
Any comment:	<p>Is monitored also for determination of leakage occupation rate. Calculation: Passengers: 285 306 462 (File 6, Daegu Metropolitan City Public Transportation Division, p.2, 2010) Average trip distance: 7.3 km (File 8, Korea Transportation Safety Authority, p.273, 2011 (average trip time of 24.9 minutes) and Daegu Metropolitan City, 2010, p.80 (average speed of 17.7km/h) Distance driven buses: see parameter SFC above</p> <p>Occupation = PKM / DD = 285 306 462 passengers * 7.3 km / (24 516 273km + 131 564 657km) = 13.4 passengers</p> <p>Occupation percentage = passengers / bus capacity = 13.4 / 52 = 26%</p> <p>Bus capacity: 52 (File 15, Daegu Metropolitan City Public Transportation Division, 2010)</p>	<p>Passengers checked with [6] OK Trip distance and time (translation error not boarding time but transfer time) checked with [8] OK Total bus distance checked with [6] OK → 13.4 passengers OK Bus capacity checked with [15] OK</p>

Data / Parameter:	PBL _B	Means of Validation
Data unit:	Passengers	
Description:	5 Passengers transported by baseline buses per year	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.2, 2010 (File 6)	According to methodology [6]
Value applied:	285,306,462	Checked with [6], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official records	
Any comment:		

Data / Parameter:	TDBL _{P,B}	Means of Validation
Data unit:	Kilometre	
Description:	Average trip distance of passengers using buses prior project start	
Source of data used:	Korea Transportation Safety Authority, p.273, 2011 and Daegu Metropolitan City, 2010, p.80 (File 8)	According to methodology [8]
Value applied:	7.3	Checked with [8], see above
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on average trip time of 24.9 minutes and average speed of bus of 17.7km/h	
Any comment:		
Any comment:		

Data / Parameter:	DD _B	Means of Validation
Data unit:	Km	
Description:	Total distance driven by baseline buses per year	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.4, 2010 (File 6)	[6]
Value applied:	156 080 930	Checked with [6], OK
Justification of the choice of data or de-	Based on CNG distance drive and diesel distance driven (see parameter SFC above)	

scription of measurement methods and procedures actually applied :		
Any comment:		

Data / Parameter:	AD _B	Means of Validation
Data unit:	Km	
Description:	5.1 Average annual distance driven of buses	
Source of data used:	Daegu Metropolitan City Public Transportation Division, p.4, 2010 (File 6)	[6]
Value applied:	94,138	Checked with [6], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on annual distance driven of all buses of (D _B see above) and the average operational fleet (see above)	156 080 930/1658= 94 138
Any comment:	Used for leakage load factor change buses if calculation is required. Data is updated if leakage occurs in occupation rate buses with the same source.	

Data / Parameter:	TD _{EL,R}	Means of Validation
Data unit:	Km	
Description:	Average trip distance of baseline metro passengers prior project start	
Source of data used:	Daegu Metropolitan Transit Corporation, 2010, p.91 (File 1)	According to methodology [1]
Value applied:	8.1	Checked with [1] OK
Justification of the choice of data or description of measurement methods and procedures actually applied :		
Any comment:		

Data / Parameter:	AD _T	Means of Validation
Data unit:	Km	
Description:	Average annual distance driven of taxis	
Source of data used:	Daegu Metropolitan City Public Transportation Division, 2011 (File 5)	[5]
Value applied:	67,346	Checked with [5] average between private and corporate taxis OK
Justification of the choice of data or description of measurement methods and procedures actually applied :		
Any comment:	Used for leakage load factor change taxis if calculation is required	

Data / Parameter:	NIZ _{C,T,BL}	Means of Validation
Data unit:	Vehicles	
Description:	Number of cars/taxis on roads affected per annum in the baseline	
Source of data used:	South Pacific, 2011 (File 59)	According to methodology, [59]
Value applied:		Checked with File 59b [59] Average of the two point count-

	Table 15: Number of Vehicles Baseline on Affected Roads (per annum)			ings. Multiplication by 360 seems reasonable but should be applied at annual re-measurements as well. OK
	5.1.	Affected Road	Number of cars	Number of taxis
	1	Palldalro Road	8,550,180	6,401,880
	2	Myeongdeongro	7,232,220	5,767,200
	3	Dong-daegugroYongji		
			8,967,600	6,645,600
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement on affected roads from 06.00 to 20.00. Multiplication without expansion factor by 360 for year. 2 points per affected road. Same procedure will be applied during monitoring to ensure consistency.			
Any comment:	The same measurements will be realized annually to determine the leakage congestion and speed.			

Data / Parameter:	V_B	Means of Validation												
Data unit:	Km/h													
Description:	Vehicle baseline speed on affected roads.													
Source of data used:	Daegu Metropolitan City, 2010 (File 59a)	According to methodology, [59]												
Value applied:	Table 16: Baseline Moving Speed on Affected Roads <table> <tr> <th>ID</th><th>Affected Road</th><th>Average moving speed</th></tr> <tr> <td>1</td><td>Palldalro Road</td><td>41</td></tr> <tr> <td>2</td><td>Myeongdeongro</td><td>38</td></tr> <tr> <td>3</td><td>DongdaegugroYongji</td><td>42</td></tr> </table>	ID	Affected Road	Average moving speed	1	Palldalro Road	41	2	Myeongdeongro	38	3	DongdaegugroYongji	42	Checked with File 59a [59] moving speed, OK
ID	Affected Road	Average moving speed												
1	Palldalro Road	41												
2	Myeongdeongro	38												
3	DongdaegugroYongji	42												
Justification of the choice of data or description of measurement methods and procedures actually applied :	Regular measurements made city-wide													
Any comment:	The average moving speed is measured as this is required for vehicle speed change.													

The further data was checked as follows:

Parameter	Description	Value	Unit	Source	Validation
NCV _G	Net calorific value gasoline	42.5	MJ/kg	IPCC 2006, Table 1.2	Data were checked with appropriate tables in IPCC 2006, OK
NCV _D	Net calorific value diesel	41.4	MJ/kg	IPCC 2006, Table 1.2	
NCV _{CNG}	Net calorific value CNG	46.5	MJ/m ³	IPCC 2006, Table 1.2	
NCV _{LPG}	Net calorific value LPG	44.8	MJ/kg	IPCC 2006, Table 1.2	
EF _{CO₂,G}	CO ₂ emission factor gasoline	67.5	gCO ₂ /MJ	IPCC 2006, Table 1.4	
EF _{CO₂,D}	CO ₂ emission factor diesel	72.6	gCO ₂ /MJ	IPCC 2006, Table 1.4	
EF _{CO₂,CNG}	CO ₂ emission factor CNG	54.3	gCO ₂ /MJ	IPCC 2006, Table 1.4	
EF _{CO₂,LPG}	CO ₂ emission factor LPG	61.6	gCO ₂ /MJ	IPCC 2006, Table 1.4	
EF _{CH₄,CNG}	CH ₄ emission factor of CNG buses	162.0	gCO ₂ /km	IPCC 2006, Table 3.2.4	

EF _{CH4,LPG}	CH ₄ emission factor of LPG light vehicles	0.5	gCO ₂ /km	IPCC 2006, Table 3.2.4	
	Specific weight gasoline	0.741	kg/l	IEA, 2005, Table A.3.8	Data were checked with literature, OK
	Specific weight diesel	0.844	kg/l	IEA, 2005, Table A.3.8	
	Specific weight CNG	0.714	kg/m ³	Based on molar mass	
	Specific weight LPG	0.522	kg/l	IEA, 2005, Table A.3.8	
IR	Technology improvement factor	0.99	no unit	ACM0016	According to methodology

EF_{Grid} was calculated in the PDD according to the “Tool to calculate the emission factor for an electricity system , v1”, which is still valid for this validation [82]; it is described in detail in Annex A7 “Determination of the combined margin”. Step 1 asks for the identification of the relevant electricity system, where the national grid of the Republic of Korea was chosen. In step 2 only grid power plants were included. In step 3 the simple OM (operating margin) was chosen, since less than 50% of the total grid are low-cost / must run resources. In step 4 the OM was calculated with option A, because the data on fuel consumption and electricity generation is available by power unit in Korea; a value of 0.7366 tCO₂/MWh came out. In step 5 the build margin emission factor was calculated with Option 1 (*ex-ante*); a value of 0.6610 tCO₂/MWh resulted. And finally in step 6 the combined margin emission factor was calculated with the default weight factor of 0.5, resulting in 0.6738 tCO₂/MWh.

All sources were carefully checked by SQS [3] and the results were compared with the data in 20120601_iges_er_sheet_gridref_EN.xls [83]; the result of 0.6738 tCO₂/MWh was thus calculated according to the appropriate tools and is deemed reasonable.

The validation team checked the calculations in the Excel file “CER sheet Daegu vs. 1.0.xls” [84] table baseline emissions with above assumptions and states that the calculations were done according the methodology and that the results for baseline emissions are reliable.

Has been raised:

No.:	CL 19	Reference: PDD B.6.2 page 44
Validator request:	It is not clear, why the value for the TDL (1.67%) was chosen just only from 1 year (and not 3 years as the grid emission factor).	
Project owner response:	The grid emission factor is based on how to calculate the CM which is based on a 3-year average of the OM (not the BM). This is irrelevant for TDL. TDL is based on the most recent available year. This is in accordance with the EB Tool to calculate baseline, project and/or leakage emissions from electricity consumption section “Data and Parameters Monitored” which also states annual data (annual monitoring)	
Validator conclusion:	DOE agrees. CL 19 is closed	Date: 15/03/2012

Project emissions were calculated according to the following formulae

PROJECT EMISSIONS

$$PE_y = DPE_y + IPE_y$$

Where:

PE_y, Project emissions in the year y(tCO₂)
DPE_y Direct project emissions in the year y(tCO₂)

IPE_y Indirect project emissions in the year y (tCO₂)
 y Year of the crediting period

$$DPE_y = EC_{PJ,y} \times EF_{grid,CM} \times (1 + TDL) \times 10^{-6}$$

Where:

DPE_y Direct project emissions in the year y (tCO₂)
 $EC_{PJ,y}$ Quantity of electricity consumed by project metro for traction in the year y (MWh)
 $EF_{grid,CM}$ Emission factor for electricity generation in the grid based on combined margin (gCO₂/kWh)
 TDL Average technical transmission and distribution losses for providing electricity

$$IPE_y = \frac{P_y}{P_{SPER}} \sum_p (IPE_{p,y} \cdot FEX_{p,y})$$

Where:

IPE_y Indirect project emissions in the year y (g CO₂)
 $IPE_{p,y}$ Indirect project emissions per surveyed passenger p in the year y (g CO₂)
 $FEX_{p,y}$ Expansion factor for each surveyed passenger p surveyed in the year y (each surveyed passenger has a different expansion factor)
 P_y Total number of passengers in the year y
 P_{SPER} Number of passengers in the time period of the survey (1 week)
 p Surveyed passenger
 y Year of the crediting period

$$IPE_{p,y} = \sum_i IPTD_{p,i,y} \times EF_{PKM,i,y}$$

Where:

$IPE_{p,y}$ Indirect project emissions per surveyed passenger p in the year y (g CO₂)
 $BTD_{p,i,y}$ Indirect project trip distance p per surveyed passenger using mode i in the year y (PKM)
 $EF_{PKM,i,y}$ Emission factor per passenger-kilometre of mode i in the year y (g CO₂/PKM)
 i Relevant vehicle category
 p Surveyed passenger
 y Year of the crediting period

The following data was used:

Data / Parameter:	EC_{PJ}	Means of Validation
Data unit:	MWh	
Description:	Electricity consumed by project metro	
Source of data to be used:	Daegu Metropolitan Transit Corporation	According to methodology
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20,342 For projections based on File 13, Daegu Metropolitan Transit Corporation, 2010, p.5	CL 28, data checked with [13] OK
Description of measurement methods and pro-	Traction energy only Monitoring frequency: Continuously, aggregated at least annually	See monitoring

cedures to be applied:	There are two substation converters for the station which include the shops and station office electricity (AC), and traction electricity (DC). The transformer converts 22.9 kV to 1500 DC for traction energy. The measurement of DC1500V for the train is checked in the rectifier, which includes the watt-hour meter of Daegu Metropolitan Transit Corporation. Total electricity consumed is registered by KEPCO which owns and calibrates the meters. Traction energy is only recorded by Daegu Metropolitan Transit Corporation. The DTRO equipment is not calibrated since it is attached in the rectifier (see for details File 68 and see Figure 7 Section B.7.2.). The traction energy as recorded by Daegu Metropolitan Transit Corporation is taken as data.	
QA/QC procedures to be applied:	Control with electricity invoices. The electricity meters are calibrated by the local electricity board. The electricity meters are not owned or managed by Incheon Metro but by KEPCO. Latter is also responsible for their periodic calibration. Electricity meters are calibrated, depending on the electricity meter type, every 7 to 15 years based on regulations of the Ministry of Knowledge Economy (File 66).	See monitoring
Any comment:	Used to calculate together with the emission factor grid the DPE as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".	

And further:

Parameter	Description	Value	Unit	Source	Validation
EF _{grid,CM}	Emission factor of grid	0.67379	tCO ₂ /MWh	File 3	OK
TDL	Average technical transmission and distribution losses for providing electricity	1.67%	percentage	File 12	CL 19, answer = average over 1 year [12], OK
EC _{M,y}	Quantity of electricity consumed by the metro (trains only)	20,342	MWh	File 13	CL 21, 27, 28: OK
EF _{PKM,i}	Emission factor per passenger-kilometer of mode "i"	See Table A4	gCO ₂ /PKM	File 55	See baseline calculation above, OK
IPTD _{PS,i}	Indirect project trip distance of the surveyed passenger using mode "i"	Value per passenger surveyed	km	File 55	Checked with survey [55], OK
P	Passengers transported by the project	See Table A5	passengers	File 14	Checked with [14], OK

Table A5. Baseline Emissions

Parameter	unit	2015	2016	2017	2018	2019	2020	2021
Number of passengers	passengers	84 146 005	86 670 385	89 270 497	91 948 612	94 707 070	97 571 435	100 498 578

Has been raised:

No.:	CL 21	Reference:	PDD B.6.3 and File 13a
Validator request:	It is not clear, how the electricity consumption of the project was <i>ex-ante</i> estimated.		
Project owner response:	Electricity consumption is based on running distance of train per day (train-car-km) and the electricity consumption per car-km. For details see File 13c, Rows 194-248		
Validator conclusion:	DOE agrees. CL 21 is closed	Date:	15/03/2012

For the estimation of emission reductions *ex ante* a survey had to be taken from another metro line, since the new line is not yet operational. It was taken from Daegu Metro Lines 1 and 2 in a preliminary survey of 800 passengers (see File [55]). This survey has been executed during one week in July 2011. CL22 and CL23 were raised because there was not enough evidence given to recalculate the results from the survey data and because the survey had to be validated by checking the original data. Both requests could be answered persuasively and by supplying the requested data.

The passenger survey was validated by verifying a random sample of 30 original documents of the survey, which gave a good conformity. It was done by the local expert using the website “naver.com”.

All calculations were controlled and could be reproduced. The requirements by the methodology like the adaptation of the technology improvement factor or the 95% confidence level were checked.

Have been raised:

No.:	CL 22	Reference: PDD B.6.3 and File 55
Validator request:	There are uncertainties about the calculation and the results coming from the survey (file 55). Apparently, there are people walking more than 100km to the metro. Please send the following samples out of the survey with a respective translation pattern to the DOE: 19, 48, 104, 120, 125, 148, 205, 207, 209, 221, 249, 306, 322, 350, 385, 407, 423, 451, 467, 492, 508, 510, 524, 552, 552, 609, 653, 653, 710, 754	
Project owner response:	The CER sheet only includes plausible surveys (see sheet survey). The required IDs have been sent to the DOE. See files “survey corean and english” and “survey ID” plus “survey ID 653”	
Validator conclusion:	DOE agrees. CL 22 is closed	Date: 15/03/2012

No.:	CL 23	Reference: PDD B.6.3 and File 55
Validator request:	It is not clear how the results of the survey were calculated from the data obtained in the interviews. There is no algorithm / TOR given and there are no samples to reproduce partially the results.	
Project owner response:	This is in the CER sheet “survey”. The calculations are based on following steps: 1. Determine for each passenger surveyed the baseline and the project emissions based on mode used, the distance driven on this mode and the EF of this mode for the initial year. This corresponds to the equation 2 baseline and the equation 11 for project emissions. 2. The average of the baseline and the project emission factor is taken. The average is based on the simple average of the interviews assuming an uniform expansion factor of 1 for all passengers. 3. The average value is then multiplied with the number of projected passengers of the metro. This simplified approach (not using FEX respectively assuming unifmr FEX of 1) is justified based on the fact that this is only a survey for projection purposes which is made on another metro line of Daegu due to the fact that the project line is not yet operational. The survey is thus also executed at a much smaller number (800 units) than the actual monitoring survey of around 8 000 units. The survey is a gross projection based on extrapolating the survey results of metro line 2 to metro line 3. Actual results will vary as users of the project metro line will have different origins and destinations and might also use other modes. However it is the best possible approximation for projection purposesgiven the fact that the project metro line is not yet operational.	
Validator conclusion:	The calculation can be reproduced now. DOE agrees. CL 23 is closed	Date: 15/03/2012

The validation team checked the calculations in the Excel file “CER sheet Daegu vs 1.0.xls” [84] project emissions with above assumptions and states that the calculations were done according the methodology and that the results for project emissions are reliable.

The leakage emissions were calculated according to the following formulae:

LEAKAGE EMISSIONS

$$LE_y = LE_{LFB,y} + LE_{LFT,y} + LE_{CON,y}$$

Where:

LE_y	Leakage emissions in the year y (tCO ₂)
$LE_{LFB,y}$	Leakage emissions due to change of load factor buses in the year y (tCO ₂)
$LE_{LFT,y}$	Leakage emissions due to change of load factor taxis in the year y (tCO ₂)
$LE_{CON,y}$	Leakage emissions due to reduced congestion in the year y (tCO ₂)
y	Year of the crediting period

If $LE_y < 0$, then leakage is not included

If $LE_y > 0$, then leakage is included

$$LE_{LFB,y} = \frac{1}{10^6} \cdot N_{B,y} \cdot AD_B \cdot EF_{KM,B,y} \cdot \left(1 - \frac{OC_{B,y}}{OC_B} \right)$$

Where:

$LE_{LFB,y}$	Leakage emissions due to change of load factor of buses in the year y (tCO ₂)
$N_{B,y}$	Number of baseline buses in the year y (buses)
AD_B	Average annual distance driven by baseline buses (km/bus)
$EF_{KM,B,y}$	Emission factor per kilometre of baseline buses in the year y (g CO ₂ /km)
$OC_{B,y}$	Average occupancy rate of baseline buses in the year y (passengers)
OC_B	Average occupancy rate of baseline buses prior project start (passengers)
y	Year of the crediting period

$$LE_{LFT,y} = N_{T,y} \cdot AD_T \cdot EF_{KM,T,y} \cdot \left(1 - \frac{OC_{T,y}}{OC_T} \right) \cdot \frac{1}{10^6}$$

Where:

$LE_{LFT,y}$	Leakage emissions due to change of load factor of taxis in the year y (tCO ₂)
$N_{T,y}$	Number of taxis in the year y (taxis)
AD_T	Average annual distance driven per taxi (km/taxi)
$EF_{KM,T,y}$	Emission factor per kilometre of taxis in the year y (g CO ₂ /km)
$OC_{T,y}$	Average occupancy rate of taxis in the year y (passengers)
OC_T	Average baseline occupancy rate of taxis prior project start (passengers)
y	Year of the crediting period

$$LE_{CON,y} = LE_{REB,y} + LE_{SP,y}$$

Where:

$LE_{CON,y}$	Leakage emissions due to reduced congestion in the year y (tCO ₂)
$LE_{REB,y}$	Leakage emissions due to induced traffic / rebound effect in the year y (tCO ₂)

LE_{SP,y} Leakage emissions due to changing vehicle speed in the year y (tCO₂)

$$LE_{REB,y} = \frac{1}{10^6} \cdot \sum_i (NIZ_{i,y} \cdot EF_{KM,i,y} \cdot (NIZ_{i,y} - NIZ_{i,BL} + NIZ_{i,MS,y}))$$

Where:

LE_{REB,y} Leakage emissions due to rebound effect in the year y (tCO₂)
 NIZ_{i,y} Number of cars/taxis per annum using the affected roads in the year y (cars, taxis)
 NIZ_{i,BL} Number of cars/taxis per annum using the affected roads in the baseline (cars, taxis)
 NIZ_{i,MS,y} Number of cars/taxis per annum not used anymore due to mode shift to the MRTS in the year y (cars, taxis)
 TDIZ_i Average trip distance made by cars/taxis on the affected roads in the year y (km)
 EF_{KM,i,y} Emission factor per kilometre of cars and taxis in the year y (g CO₂/km)
 i Cars, taxis
 y Year of the crediting period

$$NIZ_{i,MS,y} = \frac{MS_{i,s} \cdot P_y}{OC_i}$$

Where:

NIZ_{i,MS,y} Number of cars/taxis per annum not used anymore due to mode shift to the metro in the year y (cars, taxis)
 MS_{i,y} Net share of passengers using the metro which would have used mode i in the year y (%)
 P_y Passengers transported by the project in the year y (passengers)
 OC_i Average occupation rate of vehicle category i prior project start (passengers)
 i Cars, taxis
 y Year of the crediting period

$$LE_{S,y} = \frac{1}{10^6} \cdot \sum_i (NIZ_{i,y} \cdot TDIZ_{i,y} \cdot (EF_{KM,VP,i,y} - EF_{KM,VB,i}))$$

Where:

LE_{SP,y} Leakage emissions due to changes in vehicle speed of cars and taxis in year y (tCO₂)
 NIZ_{i,y} Number of cars/taxis using the affected roads in the year y (cars, taxis)
 TDIZ_{i,y} Average trip distance made by cars/taxis on the affected roads in the year y (km)
 EF_{KM,VP,i,y} Emission factor per kilometre of cars/taxis at project speed in the year y (g CO₂/km)
 EF_{KM,VB,i} Emission factor per kilometre of cars/taxis at baseline speed (g CO₂/km)
 i Cars, taxis
 y Year of the crediting period

The following data was used:

Parameter	Description	Value	Unit	Source	Validation
AD _B	Average distance driven by buses per annum	94 138	kilometre	File 6	Checked with [6], see baseline calc., OK
OC _B	Occupation rate buses baseline	26%	%	File 6, 8, 15	Checked with [6], [8], [15], see baseline calc., OK
AD _T	Average distance driven by taxis per annum	67 346	kilometre	File 5	Checked with [5], see baseline calc., OK

NIZ _{BL}	Number of cars/taxis using affected roads in the baseline	Table A10 see below	vehicles	File 59	Checked with [59], see baseline calc., OK
V _{BL}	Baseline speed of vehicles on affected roads (moving speed)	Table A10 see below	km/h	File 59	Checked with [59], see baseline calc., OK

Affected Road	Number of cars	Number of taxis	Average moving speed	Average total speed	Validation
Paldalro Road	8 550 180	6 401 880	41	28	Checked with [59], see baseline calc., and site visit, OK
Myeongdeongro	7 232 220	5 767 200	38	25	
Dongdaegugro Yongji	8 967 600	6 645 600	42	24	

All affected roads were visited during the site visit where also several construction sites could be visited. Mr. KIM Kyu Gon and Mr. PARK Hai Sik on behalf of the Daegu Urban Railroad Construction HQ explained the construction works. Mr. LEE Jong Whan and Mr. LEE Jong Min explained the measurements on affected roads. The validator could see that considering the state of the construction sites an end of construction by end of 2014 seems plausible.

For the leakage calculation the procedures in the methodology were followed and the appropriate parameters were measured and defined (see also 3.7 Monitoring Plan). For the *ex-ante* calculation no leakage was adopted.

The validation team checked the formulas in the Excel file "CER sheet Daegu vs 1.0.xls" [84] table leakage emissions with above assumptions and states that the formulae for the leakage calculations are according to the methodology and can thus be used for the verification.

Has been raised:

No.:	CL 20	Reference:	PDD B.6.2 page 44
Validator request:	There is insufficient information about the <i>ex-ante</i> measured values of V _B . There is no document referenced.		
Project owner response:	Table 14 has the baseline speed. This corresponds to File 59a which has the average speed and the average moving speed at road intersections. V _B is also listed as parameter under B.6.2. The file source has been added there		
Validator conclusion:	DOE agrees. CL 20 is closed	Date:	15/03/2012

The calculation of the emission reductions was done according to the formula

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER _y	Emission reductions in year "y" (t CO ₂ e/yr)
BE _y	Baseline emissions in year "y" (t CO ₂ e/yr)
PE _y	Project emissions in year "y" (t CO ₂ /yr)
LE _y	Leakage emissions in year "y" (t CO ₂ /yr)

A sensitivity analysis as been performed (see PDD Annex 3, A.5 Table A11). It shows that the only sensitive parameter is the number of project passengers:

Parameter	% Change required for 5% less ERs	Sensitive or Not	Comment
Project passengers	4% less	Sensitive	Data is monitored continuously and checked with ticket-sales. Core data for project owner and thus also adequate monitoring of latter. Fare dodgers are not counted, thus understating also poten-

			tially passenger numbers.
Metro electricity consumption	>10% increase	Not sensitive	
Specific fuel consumption gasoline cars	>10% lower	Not sensitive	
Specific fuel consumption diesel cars	> 10% lower	Not sensitive	
Specific fuel consumption LPG cars	> 10% lower	Not sensitive	
Specific fuel consumption taxis	>10% lower	Not sensitive	
Specific fuel consumption diesel buses	> 10% lower	Not sensitive	
Specific fuel consumption CNG buses	> 10% lower	Not sensitive	
Passengers existing metro	> 10% more	Not sensitive	
Electricity consumption existing metro	> 10% less	Not sensitive	
Average trip distance existing metro	> 10% longer	Not sensitive	
Occupation rate passenger cars	10% higher	Not sensitive	
Occupation rate taxis	>10% higher	Not sensitive	

The project owner has detailed the results of the sensitivity analysis in Annex 3 Section A5 of the PDD. The sensitivity results are obtained by changing one specific parameter. This is technically done by using the CER spread-sheet [84]. Changing one specific parameter of this spread-sheet e.g. numbers of project passengers by x will result automatically in a change of the ER result. The PP has thereby calculated for each parameter the reduction percentage required to change the total ERs over the crediting period by 5% (ACM0016 states "The sensitivity analysis is based on calculating the change of the data parameter that would be required to reduce emission reductions by 5%"). Based on ACM0016: "Assess the result in light of possible data uncertainty. As sensitive parameter/data are considered those where a change of less than 10% leads to a reduction of ERs of more than 5%."

The validation team has checked for various random parameters including all critical parameters the calculations were made with the same spreadsheet [84] inserting the percentage change as indicated in the PDD and revising the ER outcome. The results of the sensitivity analysis could be reproduced.

Therefore, SQS concludes that the sensitivity analysis was done according to the methodology and that Table A11 sensitivity analysis is correct.

As a summary, the validation team concludes that the Excel file "CER sheet Daegu vs 1.0.xls" [84] was checked extensively for correct input values, formulae, and cross-checked for consistency with the referenced documents. No errors were found. SQS concludes that the parameters and the mathematical operations used for the *ex-ante* estimation of the project's emission reductions are correct, reasonable and conservative. All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD. Of course the *ex-ante* calculations are an estimate, which could lead to differences when the metro is operating and the real survey will be done.

3.6 Additionality of project activity

The additionality of the project was determined using the "Tool for the demonstration and assessment of additionality, v 05.2.1". This tool is still valid and is appropriate to demonstrate additionality.

3.6.1 Prior consideration of the clean development mechanism

The project starting date is the signature of the first construction contract being 29/06/2009. The appropriate document is scanned and translated in File 32 [32], which could be verified on-site by the local expert. Since according to EB62 Annex 13 "Guidelines on the demonstration and assessment of prior consideration of CDM (version 4)" this is a new project activity (project starting date after 02/08/2008) the DNA and the UNFCCC must be informed within 6 months of project starting date. The UNFCCC was informed on 04/12/2009. The notification for UNFCCC could be checked on the appropriate internet site (http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html, date received = 04/12/2009). The Korean DNA was informed on 06/12/2009 by the standardized form F-CDM-Prior Consideration [34]. Thus the DNA and UNFCCC have been informed within less than 6 months after the project starting date. CL 13 was raised because there was no acknowledgement document from the DNA found. The acknowledgement was actually

given in File [33]. CL 13 could be closed.

All requirements of the appropriate guidelines are met. The official stamps on the mentioned letters give, according to the local expert, proof that the documents were issued by the mentioned official site.

Has been raised:

No.:	CL 13	Reference:	PDD B.5 prior consideration
Validator request:	It is not clear whether the prior consideration form was acknowledged by the Korean DNA. There is no response document.		
Project owner response:	File 33 is the confirmation letter. The DOE can at any time get in contact through a phone interview with the DNA of Korea and get a confirmation of the authenticity of this letter.		
Validator conclusion:	DOE agrees. CL 13 is closed	Date:	15/03/2012

3.6.2 Identification of alternatives

The list of alternatives is discussed in Chapters B4 and B5 of the PDD. SQS' opinion on Chapter B4 of the PDD is given in clause 3.5.4 of this validation report.

In Chapter B5 of the PDD the following alternatives are listed:

1. The establishment of a BRT (Bus Rapid Transit);
2. The establishment of another rail-based MRTS;
3. The continuation of the current public and individual transport systems, including (future) investments in road based infrastructure if applicable;
4. The proposed project activity being implemented at a later date in the future, without being registered as a CDM project activity;
5. The project proposal not implemented as a CDM project activity.

Alternatives 1 and 2 are assessed in Chapter B.4. of the PDD and have been discarded:

Alternative 1 as BRTs due to their limited phd capacity are also basically used for secondary lines in large metropolitan cities in which a rail-based MRTS have already been established. Also with Incheon already having a metro line the connectivity is easier if the same system can be used and buses are thereafter used for secondary routes. For the area in which the metro is planned a BRT system is also considered as non-optimal basically due to the required passenger per hour capacity. BRT or bus lane systems have typical carrying capacities of less than 10,000 passengers per hour per direction (phd) (proven in Table 4 of the PDD). The median value for all included BRTs is 7,000 phd, which gives an indication that BRT are basically used for secondary lines in large metropolitan cities and as main lines in smaller and medium sized cities. Also the only operational Korean BRT in Seoul has a capacity of 7,000 passengers per hour and direction only. The capacity of the proposed metro line is 30,000 passengers per hour per direction¹.

Alternative 2 Light rail transit (LRT) includes also trams and monorails. This alternative faces similar if not more severe constraints than a BRT. LRTs typically have a capacity of 10-20,000 phd. Also they reach only about half the average speed of metro (this is also true of normal BRT systems) thus not offering the same level of convenience as metro. Based on above consideration a LRT is not considered as a technically viable solution due to the passenger demand on the corridors on which the metro is built.

Alternative 3 is the baseline situation.

Alternative 4 has been discarded in Chapter B4 respectively is identical with the alternative 5.

Following alternatives are thus credible, realistic and comparable:

- Continuation of the current situation
- Project without CDM

The options BRT, other rail-systems and the option project in the future without CDM are not considered credible, realistic or comparable alternatives as outlined in Chapter B.4. of the PDD. They are thus eliminated in Step 1 and not further considered. Step 2 conducts an investment comparison analysis for all alternatives that are remaining after Step 1 in accordance with page 6 of ACM0016:

"Apply Step 2 of the latest approved version of the "Tool for the demonstration and assessment of additionality". Conduct an investment comparison analysis for all alternatives that are remaining after Step 1. Use the NPV as indicator."

Step 1 is performed in B.4. of the PDD and Chapter B.5. then resumes the result of Chapter B.4. As only 1 alternative to the baseline remains after step 1 only for this alternative the financial analysis is performed.

SQS agrees that identified Alternative 3 "Continuation of the current system incl. future investments" is correctly determined as the baseline scenario and that Alternative 5 "The project without CDM" is technically feasible. The DOE considers this list of alternatives as complete.

¹ File 14 [21]

3.6.3 Investment analysis

The investment analysis is required by the methodology ACM0016: "Conduct an investment comparison analysis for all alternatives that are remaining after Step 1. Use the NPV as indicator." The two remaining alternatives after step 1 are (see 3.5.4)

1. Continuation of the current situation
2. Project without CDM

The guidelines for the investment analysis version 5 EB62 Annex 5 were followed. The following table shows the principles, the adoption for the project and the means of validation.

EB Guideline	Project	Means of validation
Points 1 and 2: General introduction of Guidance		
Point 3: Period of assessment	The period of assessment taken is 30 years of operation plus the construction period in line with the assessment made by the Ministry of Land, Transport and Maritime Affairs, 2008, chapter 4, assumptions (File 24b). This is a longer period than the maximum period suggested in the guidelines and thus conservative.	The guidelines suggest a maximum period of 20 years, SQS agrees that 30 years is more conservative. OK
Point 4: Salvage value	No salvage value is included as this is considered the technical life span of the rolling stock as well as communication and energy system in line with other metros. Construction and stations can have a longer time period but also need repairs and overhauls. The investment contains no land which could be resold after the metro's operating time.	Checked with financial spreadsheet (File [41]), OK.
Point 5: Depreciation and other non-cash items	The NPV is based on cash flow and does not include depreciation or other non-cash items.	Checked with financial spreadsheet (File [41]), OK.
Point 6: Time of assessment	All calculations are based on a report realized by the Ministry of Land, Transport and Maritime Affairs in May 2008 (File 43 and full in File 24) prior to the investment decision 22/05/2009 (File 42) which again is prior to the project starting date of 29/06/2009 (File 32)	Checked with the mentioned files. OK
Point 7: Cessation of implementation	Not relevant for project	OK
Point 8: Provision of spreadsheet	Spreadsheet is provided (File [41]). An error was corrected according to CAR 1.	[41] adapted, OK
Point 9: Finance expenditures	Financing expenditures are not included when calculating the NPV.	OK
Point 10: Equity IRR	Not used by project as ACM0016 requires the usage of NPV.	According to methodology OK
Point 11: Pre-tax benchmark	The project uses NPV with a benchmark for the discount rate of 5.5% based on the Ministry of Land, Transport and Maritime Affairs, 2008, Chapter 4, assumptions (File 24b). The benchmark is not based on the published value for return on equity for transport projects in Korea which would be 11.7% but on the 10-year government bond rate which was 5.57% at the time of the decision making.	Benchmark has been questioned with CL 7 and CL 17. Based on the additional information given with the responses to these CL's, DOE concludes that the choice of the benchmark is correct. OK
Point 12-18: Selection of benchmark	The discount rate is from Ministry of Land, Transport and Maritime Affairs, 2008, Chapter 4, assumptions (File 24b) In accordance with ACM0016 which states that when applying the investment comparison analysis, cost overruns of former investments in MRTS or reduced revenues of former MRTS investments compared to original projections, which make new investments less viable and riskier, can be considered in the investment analysis.	Checked with File [24b]. OK
Point 19: Benchmark analysis	Analysis is made based on NPV as required by ACM0016	According to methodology OK

Points 20 and 21: Sensitivity analysis	<p>Sensitivity analysis is made assuming following changes:</p> <ul style="list-style-type: none"> • 10% lower investment costs • 10% lower staff cost • 10% lower energy cost • 10% lower maintenance cost • 10% lower administration cost • 10% increase in revenues • Break-even point (0 NPV) with changing risk parameter <p>These are all important cost/revenue variables and all variables which constitute more than 20% of cost respectively revenue.</p>	The sensitivity analysis shows for the chosen risk factor always a negative NPV. Remarks to the risk factor see below. OK
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The following major parameters for the financial assessment have been applied and have been validated as follows:

Parameter	Unit	Value	Means of validation
Total investment	100 million WON	10,979	Checked with File [43] (financial details and File [41] (financial spreadsheet. Additional information was requested by CL 14 and CL 15. Satisfactory response was given. OK
Investment by Central Government (subsidy)	100 million WON	6,587	
Investment by Municipality	100 million WON	4,392	
Staff cost (annual average) ²	100 million WON	109	
Energy cost (annual average)	100 million WON	66	
Maintenance cost (annual average)	100 million WON	84	
Administrative cost (annual average)	100 million WON	21	
Revenue (annual average)	100 million WON	903	The fixed ticket-price was questioned by CL 16. There was a satisfactory answer. Revenue was recalculated from primary data. OK
Price of CERs	(tsd WON / tCER)	27	CER price based on Pointcarbon average 1 year prior 05/2009 (File 44) and exchange rate 05/2009 based on http://www.oanda.com/currency/converter OK
Discount rate		5.5%	See table above, point 11 OK.
Risk rates (rate actual to expected passengers)		30%	The NPV is quite sensitive to this risk factor: At about 60% actual to projected passengers NPV would become positive. The choice of 30%, however, is conservative. See table below. OK

The document used for the entire financial analysis is the economic and financial analysis realized by the Ministry of Land, Transport and Maritime Affairs, 2008. In Chapter 4, assumptions, the financial discount rate is included as standard. The discount rate used is 5.5% and not 5.57% as cited by the EB. This is conservative. EB 62 Annex 5 has in its Appendix as default return on equity for transport projects in Korea 11.8%. Long-term (10-year) government bond rates also had in the year 2008 (year prior investment decision and year in which financial analysis was made) an average interest rate of 5.57% whilst the project used the rate of 5.50%. The date of investment decision is 05/2009. All the input values used in the investment analysis were clearly applicable at the time of investment decision.

The plausibility of the investment and operational cost are compared to other installations worldwide in a document "Bus-systems for the future" [46]:

The investment cost per km are listed in there with 30-75 US\$ per km for the year 2002, which is equivalent to 35-89 million USD as of 05/2009, the 36 US\$ per km for the new line in Daegu is therefore at the lower end of this margin and not exaggerated.

² Average of all operational years

The investment cost is based on the Ministry of Land, Transport and Maritime Affairs, a 3rd party. To assess the plausibility of the value independent and well known international sources are taken being the IEA and a published report by B Flyvberg, Comparison of Capital Costs per Route-Kilometre in Urban Rail, EJTIR, 8, no. 1 (2008) which show that the investment cost of the project with 36 million USD/km (elevated metro) is at the lower end of international estimates. The Article of Flyvberg includes thereby also the investment cost of Seoul metro network (117km) which is stated to be 65.8 million USD/km in 2002 (File 47 [47], Table 3, p.23). The IEA comparison is for elevated metros. Not all elevated metros are monorails but most monorails, including the project one, are elevated. Thus elevated metros (including monorails and others) are the most comparable rail-based MRTS. GTZ on p.14 states also: "... monorail and maglev train technologies could be considered a form of elevated rail transit...". In fact Korea has at the moment only 2 monorail systems operating (in theme-parks Lotte World and on the site of Taejon expo 1993) and thus this system could be determined "first of its kind" as a MRTS. However, albeit having some unique technological features, basically its an elevated MRTS and therefore compared to the latter.

Park and Han (2003) estimate the cost of building metros in Korea by 80-100 million USD/km (see cited in J. Pucher et.al., Public Transport Reforms in Seoul, p.56; The study for the state of construction and improvement policy of advanced transit system of Korea, 2003) (See Journal of Public Transportation, Vol. 8, No. 5, 2005 [85])

The cost of other fully elevated MRTs under construction is shown in the table below:

Daegu	Gurgaon, India	Metro Mumbai 1	Metro Mumbai 2
36 million USD/km	46 million USD/km	46 million USD/km	72 million USD/km

Data based on finance documents as included in the respective PDD published on the UNFCCC website.

See also about the difficulty of comparing investments in metro: <http://www.railway-technical.com/finance.shtml>.

The project is at the lower end of cost estimates compared to other projects. In terms of projected construction investment the Monorail system is less expensive than other rail alternatives studied with 22-31% lower construction investment required as determined in the FSR³. Taking the investment of the other systems and reducing it by 20-30% we can see that the Daegu project is in the range of other projects and thus the investment cost is plausible.

Above figures including other elevated metros, Seoul metro data, IEA and Flyvberg all show that the investment for an elevated metro as planned in Daegu are plausible. The dataset is deemed as comparable as based on elevated MRTS.

The operational cost is based on the Ministry of Land, Transport and Maritime Affairs, a 3rd party. As Korea and especially Daegu already have operating metros the operational cost can be estimated fairly well depending on train frequency and demand projections. Whilst operational cost might be lower if passenger numbers are lower than projected this has been included in the finance model as the operational costs have been reduced proportionally to the reduction in passenger numbers which is very conservative as this assumes that all operational costs are variable whilst in practice some are fixed costs (e.g. station maintenance; also electricity consumption is not strictly proportional to passenger numbers).

The metro lines are compared to recently established metro lines or such under construction. The data from the Busan PDD has not been included as latter is a short line extension and not a full line thus not making costs comparable. The table below shows the operational costs of all elevated metros for which data was available on a comparable base i.e. FSR were available for a same year to make cost data per passenger comparable:

Metro Dae-gu	Metro Mumbai 1	Metro Mumbai 2	Metro Seoul Line 9	Metro Gur-gaon	Metro Mexico	Metro Delhi Phase II
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³ File 20 [20] chapter 1.3., table 1.3.7.

					Line 12	
0.22	0.13	0.12	0.19	0.11	0.29	0.23 ⁴

Metro Incheon is underground and has thus significantly higher cost and has therefore not been included.

Metro Buenos Aires is to a large part underground and has thus not been included.

Metro Seoul Line 9 is double tracked which means much more passengers but using the same stations and thus reducing the cost per passenger transported. Metro Mumbai 1 and 2 and Metro Gurgaon have passenger numbers which are 2-4x higher than

DMRC and Metro Mexico are partially elevated, partially underground and partially at level.

In terms of operational cost the Monorail is more expensive than other metro systems basically due to higher electricity and maintenance cost. Operational costs are between 4 and 25% higher than for other rail-based systems – see FSR⁵. Taking this data the Metro Daegu operational cost is idem to Metro Seoul which is the most comparable for operational costs due to being in the same country with similar staff and electricity costs.

The number of employees, their salaries, the electricity cost and the maintenance cost (divided in station-, train- and system-maintenance cost) have been taken from the 'Master plan of Daegu Metro 3th Urban Railroad' edited by Saman Engineering, an independent 3rd Party ([69]), which was sent to SQS in responding to CL14. The figures were crosschecked by the local expert who made the following statement: The local expert (Mr. KO from KFQ) hereby confirms that the back data of operation cost for Daegu Metro is duly reasonable and correct (see "file Daegu Line 3 Operational Cost Evaluation (09 Nov 12).xls" SQS ref. [87]).

These figures were discussed in detail and crosschecked during the on-site visit by the SQS' validation team and the local expert Mr Ko (KFQ). Furthermore the performed assessment is confirmed in writing on 09/11/2012 by the Korean Foundation for Quality (KFQ), regarding the assessment on operational costs analysis for Daegu Metro, in which Mr Ko confirms that the background data for operational costs for Daegu Metro is duly reasonable and correct (see Annex 2: File Daegu Operational Cost Evaluation (09. Nov. 12)_1.xls).

SQS checked the sources of the different metro lines and agrees with the conclusions.

SQS confirms that the assumptions are therefore correct and plausible.

Two issues have been treated with special care because the setting of these parameters is crucial to the outcome of the financial analysis:

- The choice of a benchmark IRR of 5.5% was questioned concerning the choice of the value as well as concerning the question whether a benchmark should be applied at all since the financing is public. It could be clarified that even if the financing is public, a loan rate is justified because the government itself is financing governmental tasks by bonds. The corresponding benchmark rate was correctly applied.
- A risk factor (actual to expected passenger numbers) was established with data from the Korean metros, according to the following table and based on File [37]:

City/Line		Expected	Actual	%
Seoul	Line 5	2,410(2001)	827(2001)	34.3
	Line 6	1,319(2001)	284(2001)	21.5
	Line 7	2,363(2001)	703(2001)	29.8
	Line 8	557(2001)	222(2001)	39.9
	Total	6,649	2,036	

⁴ File finance 1.1 [78] operational cost (9,645 million INR) exchange rate 44 INR/USD (<http://www.oanda.com/currency/converter/> for 1.9.2005); pax number File 2 DMRC [79] project with growth rate 5.8% per annum (960 million); all 2020; all files attached

⁵ File 20 [20] chapter 1.3., section 2 p.23

Busan	Line 1	1,932(2001)	544(2001)	28.2
	Line 2	1,782(2006)	230(2006)	12.9
	Line 3	276(2006)	65(2006)	23.6
	Total	3,990	839	
Daegu	Line 1	347 (2001)	138 (2001)	39.8
	Line 2	912 (2006)	125 (2006)	13.7
	Total	1,259	263	
Incheon		1,441(2003)	204(2003)	14.2
Gwangju		187(2004)	305(2004)	16.3
Daegjeon		91(2006)	42(2006)	46.2
Average relation actual to projected passenger numbers				27 %
Median relation actual to projected passenger numbers				26 %

Source: All cities/lines except Daegu Line 2 based on Inha University, 2006, Table 17 (File 37 [37]); Daegu Line 2 for expected passenger number based on Daegu Metropolitan City Railroad Construction Headquarters and Daegu Metropolitan Transit Corporation for actual passenger numbers ([40]); median and average of all lines calculated by Grütter Consulting
Also if the average of the 2 Daegu lines would be taken the risk rate would be lower than 30%.

All lines in the host country were considered, in accordance with the methodology p.6: "...project participants should evaluate the cost overruns or reduced revenues of former MRTS that were implemented in the same host country in the last 20 years at the time of project start. Information on originally projected and actually observed costs/revenues should be based on official and public data..."

Based on the approved methodology this element may be taken into consideration when applying the investment analysis, because the methodology states: "In applying the investment comparison analysis, cost overruns of former investments in MRTS or reduced revenues of former MRTS investments compared to original projections, which make new investments less viable and riskier are considered in the investment analysis".

Given the results of the table above the choice of a risk factor of 30% is justified and conservative.

Considering the ticket price (CL 16) the answer of the PP says that the 1100 Won used correspond to the full rate charged 2009, and no inflation – for revenues nor for investment nor for operational costs – is included. Since public transport ticket prices are rather politically determined and difficult to be raised, the assumption of constant ticket prices is plausible.

The "other revenues" were assumed to be 10% of the fare-box revenues, which is plausible. As could be seen at the site visit a considerable part of these revenues are coming from lending surfaces of infrastructure bodies for commercial advertising.

An error in the financial spreadsheet (3 months too much in the assessment period) was detected during validation and corrected, following CAR 1.

A CAR 2 had to be raised since it seemed that the CER income was taken from 100% passengers, whereas cost and revenues were based on 30% passengers. The answer by the PP made the difference between ER-calculation and additionality, for the latter a risk adjustment factor is foreseen in the methodology, but not for ER-calculations, where the passenger projection from the feasibility study was taken. The explanation is correct and CAR 2 could be closed.

Passenger projections and revenue projections were performed by Saman Engineering, an independent 3rd Party [66]. The fare-box revenues are calculated based on passenger projections (based again on demand forecast models) multiplied with the average actual fare paid.

The average fare is based on the population shares and the fare rates respectively discounts per passenger group as summarized below:

Table 6-6 of Saman Eng. report Population ratio for Daegu metropolitan city (30th June 2007)						
	infant	Child	Student	Adult	Senior (65 or Older)	Total
Population	132,572	238,838	224,197	1,686,483	214,183	2,496,273
Population Ratio	5.31%	9.57%	8.98%	67.56%	8.58%	100%
Table 6-7 of Saman Eng. report Discount rates and free of charge						
	Child	Student	Adult (Card etc)	Adult (General)	Senior and infant	
Discount Rate	55%	39.10%	13.60%	-	100%	

The average resultant fare rate is 800 Won based on a standard tariff of Won 1,100 applicable as of time of FSR (calculated as 1,100-discount rate per category x population ratio per category summarized over all categories)

The discount rates for metro line 1 and 2 have considered to be setting the discount rates for line 3 and it has been assumed that the 50% of adult passengers would get fare discount by using traffic card or commuter pass.

Revenue is based on fare box and non-fare box revenue.

Non-fare box revenue is estimated as 10% of fare-box revenue based on experience in Daegu. This rate is comparable to other metros. Metro Seoul Line 9 has e.g. 8%⁶. The non-fare box revenue is subject to the risk rate. This is justified as the FSR assumes that the non-fare box revenue is correlated to the passenger number. Based on the FSR with lower passenger number the non-fare box revenue also drops (this is also quite logical as a core non-fare box revenue is publicity and rates of the latter are dependent on the number of persons which can be reached). Also non-fare box revenue only accounts for 10% and with a risk rate of 70% the non-fare-box is reduced by 7 percentage points. The sensitivity analysis shows however, that the total revenues would need to increase by 62% to achieve the benchmark. Therefore even if no risk rate would be applied to the non-fare box revenue the result of the financial exercise of a negative NPV would not be affected.

Trial-run expenses are put as expenses and not as investment. Therefore the risk rate of minus 70% is also applied to this expenditure. The NPV with the expense trial-run (base case with risk factor) is – 176,000 million Won and without the trial-run cost this number would change to 172,700 million Won i.e. a change of 1.9%. This means that this expense is completely irrelevant in financial terms to determine the NPV. This is logical as the expense is only incurred once. Total expenses over the observation period are 856,400 million Won whilst trial-run expenses are 15,600 million Won i.e. 1.8% of total expenses. As the incidence of this expense is marginal and completely insignificant an in-depth review, (as was made for other relevant operational expenses such as staff, maintenance or power consumption, which have 10-30x higher expenditures) is not required.

In conclusion, SQS confirms that the investment analysis has been performed according to the rules and that the assumptions and the financial calculations corresponding to the guidelines and to the common practice, are accurate and conservative.

Have been raised:

No.:	CL 7	Reference: PDD A.4.5 and B.5 Table 6
Validator request:	There is insufficient information about the nature of the financing by the city government. Is it a private or a government financing? Does it justify a loan interest-rate?	

⁶ File Seoul (93,650 million Won / 288.1 million passengers; exchange rate 0.00059), [86]

Project owner response:	<p>A.4.5. refers to public funding through ODA of an Annex I country. This is not the case as funds are from Korea. The 1st sentence in A.4.5. has been deleted as wrong.</p> <p>Daegu Metropolitan City i.e. a public body is the owner of the metro. Also cities have to pay for their money just like private entities. The usage of a loan interest rate is thus not subject to being a private or public entity. The grant of the central government worth 60% of the investment has – in accordance with the methodology – been deducted from the total investment i.e. the interest rate is only accounted for 40% of the total investment. The discount rate of 5.5% is from the Ministry of Land, Transport and Maritime Affairs. Long-term (10-year) government bond rates also had in the year 2008 (year prior investment decision and year in which financial analysis was made) an average interest rate of 5.57% This is the rate which the government has to pay to finance itself – the rate is far lower than the rate of 11.8% as included in EB 62 Annex 5 in its appendix as default return on equity for transport projects in Korea.</p> <p>Thus it is justified to use an interest rate even if publicly financed as the government also needs to pay for its loans. The rate taken is in accordance with the long-term bond rate of the Korean government and thus also justified.</p>	
Validator conclusion:	DOE agrees. CL 7 is closed	Date: 15/03/2012

No.:	CL 17	Reference: PDD B.5 Table 6
Validator request:	There is insufficient information about the choice of the discount rate (5.5%). The referred OECD website shows only figures down to the year 2009 (5.17%).	
Project owner response:	<p>As Table 6 points out the discount rate is based on the Ministry of Land, Transport and Maritime Affairs, 2008, Chapter 4, assumptions (File 24b). Long-term (10-year) government bond rates also had in the year 2008 (year prior investment decision and year in which financial analysis was made) an average interest rate of 5.57%. This data is based on OECD.</p> <p>The date of investment decision is 22/05/2009 (File 42) All the input values used in the investment analysis need to be applicable at the time of investment decision (see EB GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS, point 6). Therefore the OECD rate used to ascertain and make plausible the benchmark rate MUST be prior 22.5.2009. Therefore the annual rate of 2008 was taken which is 5.57% (File 51). This is slightly higher than the benchmark rate of 5.5% which shows its plausibility and conservativeness. To take the value of 2009, 2010 or 2011 would not be correct as these rates are AFTER decision taking (File 51 for information purpose by the way show the rate until Q2 2011, see Row 25)</p>	
Validator conclusion:	DOE agrees. CL 17 is closed	Date: 15/03/2012

No.:	CL 14	Reference: PDD B.5 Table 6 and finance details, File 43
Validator request:	There is intransparent information about the calculation of the operational cost (staff, energy, maintenance and administrative cost). The figures can not be reproduced from primary data.	
Project owner response:	See details File 69	
Validator conclusion:	The calculation has become transparent. DOE agrees. CL 14 is closed	Date: 15/03/2012

No.:	CL 15	Reference: PDD B.5 Table 6 and finance de-
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		tails, File 43
Validator request:	There is intransparent information about the calculation of the revenues (fare box, other income). The figures can not be reproduced from primary data.	
Project owner response:	<p>Revenue is based on fare box and non-fare-box revenue.</p> <p>Non-fare box revenue is estimated as 10% of fare-box revenue.</p> <p>Fare box revenue is based on passenger numbers * average fare. The passenger numbers are based on demand projections based on traffic studies. The average fare is calculated based on the population share per group of passengers (infants, children, students, adults, seniors) which all have their discount rates on the full fare. This results in average fare of 800 Wons per passenger.</p> <p>See for details File 66 plus amendments in the PDD.</p>	
Validator conclusion:	The calculation has become transparent. DOE agrees. CL 15 is closed	Date: 15/03/2012

No.:	CL 16	Reference: PDD B.5 Table 6 and finance details, File 43
Validator request:	There is insufficient information about the choice of the ticket prices. It is specifically not clear why the price should remain constant over the entire period.	
Project owner response:	<p>The NPV is calculated based on constant Wons. Therefore inflation is not included in any revenue, investment or cost estimate.</p> <p>The full fare rate of 1100 Won used corresponds to the metro Daegu fare charged 2009 (idem to the current fare rate if not paying cash (cash it is 1,200 Won))</p>	
Validator conclusion:	<p>Concerning inflation the question is answered correctly. Still one could - regardless of inflation - ask whether it would be possible to rise the ticket prices if the metro is not profitable. However, rising prices of public transport is politically difficult and the price elasticity would partially destroy the effect of higher revenues.</p> <p>Information is sufficient now. DOE agrees. CL 16 is closed.</p>	Date: 15/03/2012

No.:	CAR 1	Reference: PDD B.5 Table 8 and financial spreadsheet, File 41
Validator request:	The financial calculation shall be corrected in order to really show 30 years. Actually it shows 30 years plus some additional months because the year 2044 is fully accounted for.	
Project owner response:	Has been corrected to include only 9 months of 2044. The numbers in the PDD and the spreadsheet have been adjusted	
Validator conclusion:	DOE agrees. CAR 1 is closed	Date: 29/03/2012

No.:	CAR 2	Reference: PDD B.5 Table 8 and financial spreadsheet, File 41
Validator request:	The financial calculation shall be corrected in order to have consistency between	

	the number of passengers chosen and the calculation of the NPW including CER income. Actually, CER income is taken from 100% passengers whereas cost and revenues are based on 30% passengers.	
Project owner response:	<p><i>Ex-ante</i> emission reductions have been calculated based on the passenger projections made in the FSR. For ER calculation the methodology does not preview a risk adjustment factor and it would not be correct to adjust them as no such provision is made in the chapters of baseline as well as project emission calculations. The risk provision made is not only on passenger numbers but also on revenues and costs i.e. financial figures.</p> <p>ERs are however, not linked directly with financial figures as ERs are due to electricity usage in the project case plus indirect project emissions. No direct relationship between electricity usage and passenger numbers could be made and the methodology has no provision for that.</p> <p>ACM0016 has for the additionality part the provision to allow for a risk calculation based on previous experience related to finance. This provision is however, not part of ER calculations of the methodology. The CER numbers calculated in the ER however, need to be consistent with the ones used in the potential impact of CDM. If we take other numbers this would be arbitrary and not supported by the ER calculations following the approved methodology. Therefore the finance calculation is based on the CER numbers as presented in the PDD without adjustment.</p>	
Validator conclusion:	Explanation is satisfying, CAR 2 closed	Date: 29/03/2012

3.6.4 Barrier analysis

According to the methodology ACM0016 additionality must be proven by investment analysis. The participants have followed the methodology. No further barriers were identified.

3.6.5 Common practice analysis

Common practice analysis is defined in ACM0016 v2.1 as follows:

"The investment analysis shall be complemented with an analysis of the extent to which the proposed project type has already diffused in the host country. This test is a credibility check to complement the investment analysis. For the purpose of the common practice analysis, a set of cities for comparison with the city of the project activity is defined as follows:

- If the larger urban zone (LUZ) of the city of the project activity contains more than one million inhabitants, then the set of cities for comparison includes all cities (including the city of the project activity) in the host country with a LUZ that contains more than 1 million inhabitants;*
- If the LUZ of the city of the project activity contains less than 1 million inhabitants...*

Collect information on which cities in the considered set of cities for comparison have already implemented a MRTS. The proposed project activity is regarded as common practice if MRTS have already been implemented in 50% of the cities in the set of cities for comparison as defined above without using the CDM."

In Table 11 of the PDD Metropolitan Areas in South Korea with over 1 million inhabitants are listed together with the status concerning MRTS. The table cross-checked with statistical data available and checked by the local expert, who agreed with the answers of the validation.

Metropolitan Area	MRTS	Validation, answer by local expert
Seoul Metropolitan City	Metro, BRT	10'464'051 (2009), OK
Busan	Metro	3'570'000 (2011), OK
Daegu	Metro	2'509'187 (2009), OK
Gwangju	Metro	1'445'828 (2009), OK
Daejeon	Metro	1'518'540 (2010), OK
Changwon	No MRTS	1'082'100 (2010), OK

Ulsan	No MRTS	1'129'827 (2009), OK
Suwon	No MRTS	1'098'000 (2010), OK
Seongnam	No MRTS	981'390 (2011), OK *
Goyang	No MRTS	937'752 (2009), OK *
Yongin	No MRTS	909'425 (2010), OK *

* : The number of inhabitants for Seongnam, Goyang and Yongin as cities lie a little below 1 million inhabitants; if one looks at the "larger urban zone" as stated by the methodology, then they are above 1 million as was acknowledged by the local expert.

It was cleared by CL 18 that none of the Metropolitan Areas having a Metro have constructed their Metro including CDM.

Since it was still not clear how the interpretation of the LUZ was done and how it correlates for example to the definition in Eurostat, the European Union's statistical agency, where the expression "LUZ" is coming from, CL35 was raised.

The answer by the project owner was an attempt to "translate" the expression "larger urban zone LUZ" into the situation of the Republic of Korea. File 70a [77] consists of a short description how LUZ is used in Europe and by Eurostat, and then of an attempt to translate it into the Republic of Korea.

The methodology states that the LUZ needs to be taken (which is often bigger than the official number of city inhabitants).

A. Eurostat, the European Union's statistical agency, has created the concept of Larger Urban Zone (LUZ) in an effort to harmonise definitions of urbanisation in the European Union and in countries outside the European Union. These definitions were agreed upon between Eurostat and the National Statistics Offices of the different countries of the European Union at the European Commission's Urban Audit of 2004. Eurostat's objective was to have an area where a significant share of the residents commute into the city, a concept known as the "functional urban region." To ensure a good data availability, Eurostat adjusts the LUZ boundaries to administrative boundaries which approximate the functional urban region.

B. The concept of LUZ needs to be transformed to the traditional concept of city inhabitants. The functional area is therefore taken for the cities for which no metropolitan area statistics are available. The result we see below:

Metropolitan Population (year 2009) of Korean Cities

Urban Area based on functional area idem to LUZ	Population in millions
SNCA	24.38
Busan Metropolitan City	3.54
Daegu Metropolitan City	2.49
Daejeon Metropolitan City	1.48
Gwangju Metropolitan City	1.43
Ulsan Metropolitan City	1.11
Changwon (only city, 2010)	1.09
Cheongju	1.15
Jeonju	1.39
Cheonan	1.25
Pohang	1.30

File 70b [77]⁷

Therefore we have 11 cities with > 1 million of which 5 have a MRTS (highlighted in yellow) i.e. less than 50%.

⁷ File 70b was erroneously mentioned as file 26b in the former validation report, this is corrected in the new VR

In detail for the below cities which as metropolitan or functional area have > 1 million but less than 1 million when taking only the city population data which is however NOT in line with LUZ as used by the methodology:

			Total population in the metropolitan area
Cheongju (LUZ)	Cheongju city	643,161	1,153,443
	Cheongwon	149,783	
	Boeun	34,845	
	Okcheon	54,117	
	Yeongdong	50,426	
	Jeungpyeong	33,164	
	Jincheon	61,456	
	Goesan	36,775	
	Eumseong	89,716	
Jeonju (LUZ)	Jeonju city	635,007	1,387,253
	Iksan	306,669	
	Gimje	94,770	
	Gunsan	266,922	
	Wanju	83,885	
Cheonan (LUZ)	Cheonan city	540,832	1,245,560
	Gongju	124,172	
	Boryeong	106,754	
	Nonsan	127,097	
	Gyeryong	42,760	
	Geumsan	56,220	
	Yeongi	79,482	
	Buyeo	75,564	
	Seocheon	60,066	
	Cheongyang	32,613	
Pohang (LUZ)	Pohang city	509,475	1,300,503
	Geongju	267,466	
	Youngcheon	103,115	
	Cheongsong	26,917	
	Yeongyang	18,553	
	Yeongdeok	41,710	
	Uljin	52,529	
	Geongsan	236,459	
	Cheongdo	44,279	

C. To assess the plausibility a check was performed with the EU LUZ empirical calculations. The plausibility is done by comparing LUZ calculations done in the EU with official city population data and thereby determining an expansion factor to determine LUZ based on city inhabitant data. All cities of the Eurostat database are taken for this purpose. The figures in the Eurostat database are an attempt at a compromise between harmonised data for all of the European Union, and with availability of statistical data, making comparisons more ac-

curate. The data used is from the 2006 Urban Audit III, which uses information collected for 2004⁸. The database was made for all cities with > 500,000 inhabitants for which data was available. Eurostat published thereby data for 128 cities. The population of each city is based on national statistics (city population data). The expansion factor is defined as LUZ population/city population. The average expansion factor taking the lower 95% confidence interval for the entire database was 2.1 i.e. to determine the LUZ population the city population number must be multiplied with the factor 2.1. This is based on the empirical relationship of all Eurostat cities between LUZ and city population taking the lower 95% confidence level (File 70b SQS ref. [77]⁹).

D. The metropolitan data calculated in the first table is thereafter compared with the LUZ population based on the LUZ expansion factor as determined in point 3. The table below shows for the relevant cities the population data based on Metropolitan population and a calculated LUZ based on empirical EU data for cities where no metropolitan area information is directly available by the National Statistical Authority and where the core city population is less than 1 million.

Population (year 2009) of Korean Cities

Urban Area	Population in millions metropolitan area	Population in millions LUZ
SNCA	24.38	Not determined
Busan Metropolitan City	3.54	Not determined
Daegu Metropolitan City	2.49	Not determined
Daejeon Metropolitan City	1.48	Not determined
Gwangju Metropolitan City	1.43	Not determined
Ulsan Metropolitan City	1.11	Not determined
Changwon (only city, 2010)	1.09	Not determined
Cheongju	1.15	1.38
Jeonju	1.39	1.35
Cheonan	1.25	1.20
Pohang	1.30	1.08

File 70b 5.57[77]¹⁰

As can be seen with both approaches all included urban areas have a population of > 1 million. Therefore using 2 different approaches both coincide that the cities listed in the PDD have a population of > 1million in the larger urban area. Thus 11 cities in Korea have a LUZ of > 1 million of which 5 have a MRTS i.e. less than 50% thus proving that the project is not common practice in accordance with the methodology.

SQS concludes that the given common practice analysis is correct because it is based on the population of the LUZ at the time of the investment decision.

SQS agrees with this procedure, since it represents a more systematic attempt to clarify the LUZ in the methodology for this specific project. It is further conservative since the lower 95% confidence level was used and even with an expansion factor of 1.75 (17% lower than applied) common practice according to the methodology would have been given.

The new table together with the procedure of the calculation was also checked by the local expert who had no objection against the new approach and who agrees with SQS's conclusion.

Based on this evidence SQS concludes that the common practice analysis was done according to the methodology and that the proposed project activity is not to be regarded as common practice.

Has been raised:

No.:	CL 18	Reference: PDD B.5 Table 10
Validator request:	It is not clear whether some of the Metropolitan Areas having a Metro have constructed their Metro(s) including the CDM.	

⁸ See file 70b [77]

⁹ See footnote 6

¹⁰ See footnote 6

Project owner response:	No, only VCS has been used to the moment. The information has been added to the PDD.	
Validator conclusion:	DOE agrees. CL 18 is closed	Date: 15/03/2012

No.:	CL 35	Reference: PDD A 4.1.4
Validator request:	The common practice analysis is not yet clear since the expression LUZ (larger urban zone) according to the methodology exists only in Europe. It should therefore be defined or transferred to the situation in the Republic of Korea.	
Project owner response:	Common practice analysis has been made clearer by assessing relation LUZ to common city population definition based on European cities and transferring that relation to Korean cities.	
Validator conclusion:	According to the local expert the name of Jeonbuk (name of province) should be changed in Jeonju (name of city)	Date: 20/06/2012
Project owner response:	Jeonju has been taken. The PDD has been adapted. See Files 70a and 70b for more details.	
Validator conclusion:	PDD was adapted, OK. CL 35 closed.	Date: 26/06/2012

3.7 Monitoring plan

The monitoring plan is described in the PDD under B7. The following data and parameters will be monitored as follows:

Data / Parameter:	NCV _{G/D,LPG,CNG}	Means of Validation
Data unit:	MJ/kg	
Description:	Net calorific value of gasoline and diesel	
Source of data to be used:	IPCC 2006, table 1.2	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Gasoline: 42.5 Diesel: 41.4 LPG: 44.8 CNG: 46.5	Has been checked against the official IPCC source and found correct, OK
Description of measurement methods and procedures to be applied:	Monitoring frequency: annual Any future revision of the IPCC Guidelines is taken into account.	According to methodology OK
QA/QC procedures to be applied:	lower 95% confidence interval	According to methodology OK
Any comment:		

Data / Parameter:	EF _{CO₂G/D/CNG/LPG}	Means of Validation
Data unit:	gCO ₂ /MJ	
Description:	CO ₂ emission factor for gasoline, diesel, CNG and LPG	
Source of data to be used:	IPCC 2006, Table 1.4, lower 95% confidence interval	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Gasoline: 67.5 Diesel: 72.6 CNG: 54.3 LPG: 61.6	Has been checked against the official IPCC source and found correct OK
Description of measurement methods and procedures to be applied:	No national value; IPCC default value lower 95% confidence interval Monitoring frequency: annual Any future revision of the IPCC Guidelines is taken into account.	According to methodology OK
QA/QC procedures to be applied:		Bio Fuel
Any comment:	In case bio-fuel blends are used in liquid fuels the bio-fuel share of the blend is accounted for with zero emission factor. The usage of bio-fuel is monitored annually for diesel and gasoline. The EF is thereafter adjusted based on the bio-fuel contents e.g. if the bio-fuel contents is 10% then the IPCC EF is multiplied with (100%-10%) to get the EF used. The baseline emission factors must be adjusted if the biofuel contents changes	According to methodology OK

Data / Parameter:	EF _{KM,B,CH₄}	Means of Validation
Data unit:	gCO _{2eq} /km	
Description:	CH ₄ emission factor of CNG buses per kilometre in CO _{2eq}	
Source of data to be used:	IPCC 2006, Table 3.2.4.	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	162.0	Has been checked against the official IPCC source and found correct OK
Description of measurement methods and procedures to be applied:	IPCC value as no national measurements exist Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:		
Any comment:	Any future revision of the IPCC Guidelines is taken into account. The methodology requires that CH ₄ emissions of vehicles using gaseous fuels are included.	Has been checked against the official IPCC source and found cor-

	Value of 7,715 mg CH ₄ of IPCC is multiplied with the GWP of 21 for CH ₄ to calculate CO _{2eq}	rect. OK
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Data / Parameter:	EF _{KM,LPG,C/T,CH4}	Means of Validation
Data unit:	gCO _{2eq} /km	
Description:	CH ₄ emission factor of LPG cars and taxis per kilometre in CO _{2eq}	
Source of data to be used:	IPCC 2006, Table 3.2.4.	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.5	Has been checked against the official IPCC source and found correct. OK
Description of measurement methods and procedures to be applied:	IPCC value as no national measurements exist Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:		
Any comment:	Any future revision of the IPCC Guidelines is taken into account. The methodology requires that CH ₄ emissions of vehicles using gaseous fuels are included. 24 mg CH ₄ of IPCC is multiplied with the GWP of 21 for CH ₄ to calculate CO _{2eq}	Has been checked against the official IPCC source and found correct OK

Data / Parameter:	N _{x,C/T}	Means of Validation
Data unit:	Vehicles	
Description:	Number of passenger cars (C) and taxis (T) using fuel type x	The description was clarified by CL26. OK
Source of data to be used:	Korea Transportation Safety Authority	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change projected	Estimation of expected emission reduction, OK
Description of measurement methods and procedures to be applied:	Registration statistics Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:	latest available data not elder than 3 years	According to methodology OK
Any comment:	Required to check if passenger cars or taxis use different fuels than those used for calculating the baseline parameter.	

Data / Parameter:	P	Means of Validation																					
Data unit:	Passengers																						
Description:	Total passengers transported by the project																						
Source of data to be used:	Daegu Metropolitan Transit Corporation	According to methodology OK																					
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><th colspan="7">Table 19: Million Passengers per Year</th></tr><tr><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th><th>2021</th></tr><tr><td>84</td><td>87</td><td>89</td><td>92</td><td>95</td><td>98</td><td>100</td></tr></table> For projections based on File 14, Daegu Metropolitan City, 2006	Table 19: Million Passengers per Year							2015	2016	2017	2018	2019	2020	2021	84	87	89	92	95	98	100	Data checked with [14] OK
Table 19: Million Passengers per Year																							
2015	2016	2017	2018	2019	2020	2021																	
84	87	89	92	95	98	100																	
Description of measurement methods and procedures to be applied:	Turnpike controls at stations and electronic smart cards. Passengers are included which enter stations of the project metro (Get On) and transfer passengers. Monitoring frequency: Continuously, aggregated at least annually	According to methodology OK																					
QA/QC procedures to be applied:	Checked with ticket sales (average fare and income from ticket).																						
Any comment:																							

Data / Parameter:	EC _{PJ}	Means of Validation
Data unit:	MWh	

Description:	Electricity consumed by project metro	
Source of data to be used:	Daegu Metropolitan Transit Corporation	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20,342 For projections based on File 13, Daegu Metropolitan Transit Corporation, 2010, p.5	Checked with [13] see above OK
Description of measurement methods and procedures to be applied:	Traction energy only Monitoring frequency: Continuously, aggregated at least annually There are two substation converters for the station which include the shops and station office electricity (AC), and traction electricity (DC). The transformer converts 22.9 kV to 1500 DC for traction energy. The measurement of DC1500V for the train is checked in the rectifier which includes the watt-hour meter of Daegu Metropolitan Transit Corporation. Total electricity consumed is registered by KEPCO which owns and calibrates the meters. Traction energy is only recorded by Daegu Metropolitan Transit Corporation. The DTRO equipment is not calibrated since it is attached in the rectifier (see for details File 68 and see Figure 7 Section B.7.2.).	The situation was clarified by CL 27 and CL 28.
QA/QC procedures to be applied:	Control with electricity invoices. The electricity meters are calibrated by the local electricity board. The electricity meters are not owned or managed by Daegu Metropolitan Transit Corporation but by KEPCO. Latter is also responsible for their periodic calibration. Electricity meters are calibrated, depending on the electricity meter type, every 7 to 15 years based on regulations of the Ministry of Knowledge Economy (File 67).	
Any comment:	Used to calculate together with the emission factor grid the DPE as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".	OK

Data / Parameter:	MS _i	Means of Validation
Data unit:	Percentage	
Description:	Net share of passengers using the metro which would have used baseline mode <i>i</i> (%)	
Source of data to be used:	Survey realized by external survey company	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For projections a survey on the existing metro lines of Daegu: Passenger car: 24% Taxi: 8% Motorcycle: 0% Bus: 69% NMT and induced traffic: 01% The total is more than 100% as passengers can use various modes in the baseline from their trip origin to their trip destination.	Survey [84] table survey OK
Description of measurement methods and procedures to be applied:	Survey. Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:	See Annex 3 for the survey design	According to methodology OK
Any comment:	Only used for leakage calculation of rebound effect.	

Data / Parameter:	N _B	Means of Validation
Data unit:	Buses	
Description:	Number of buses circulating in the city	
Source of data to be used:	Daegu Metropolitan City Public Transportation Division	According to methodology Meth. asks for "Municipal transit authorities"

		based on vehicle registration statistics from the respective city or data from vehicle control stations" OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	None as no change in occupation rate of buses is previewed	Estimation of expected emission reduction. OK
Description of measurement methods and procedures to be applied:	Monitoring frequency: years 1, 4 and 7	According to methodology OK
QA/QC procedures to be applied:		
Any comment:	Monitoring is only if required i.e. if a change of occupation rate is registered	According to methodology OK

Data / Parameter:	OC _{B,T}	Means of Validation
Data unit:	Passengers	
Description:	Average occupancy rate of buses and taxis	
Source of data to be used:	Survey realized by project proponent or 3 rd party report (e.g. made by Daegu Metropolitan City Public Transportation Division)	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No change of occupation rate previewed to baseline. Practical experience of a comparable MRTS (TransMilenio Bogota, which has a comparable outreach) has shown no negative change (reduced occupation rate) of occupation rates of baseline vehicles. See verification report TransMilenio 2009 (project 0672) (published on www.unfccc.int).	Estimation of expected emission reduction. OK
Description of measurement methods and procedures to be applied:	Independent published data or in accordance with TORs of methodology Monitoring frequency: Years 1,4, and 7	According to methodology, OK
QA/QC procedures to be applied:		
Any comment:		

Data / Parameter:	NIZ _{C,T}	Means of Validation
Data unit:	Vehicles	
Description:	Number of cars/taxis using affected roads	
Source of data to be used:	Survey realized by project proponent or 3 rd party report	According to methodology, OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No projections as no speed change is expected, thus not requiring this parameter.	Estimation of expected emission reduction. OK
Description of measurement methods and procedures to be applied:	Visual counting. Monitoring frequency: annual	According to methodology, OK
QA/QC procedures to be applied:	Same roads, same data points, same hours and same number of days are monitored as in the baseline study (File 59b and c).	In [59] the roads, points and days/ hours are listed OK
Any comment:		

Data / Parameter:	TDIZ _{C,T}	Means of Validation
Data unit:	Kilometres	
Description:	Distance driven by taxis and passenger cars on affected roads	
Source of data to be used:	Survey realized by project proponent or 3 rd party	According to methodology OK
Value of data applied for the purpose of calculating ex-	No projections as no speed change is expected, thus not requiring this parameter.	Estimation of expected emission reduction. OK

pected emission reductions in section B.5		
Description of measurement methods and procedures to be applied:	Visual tracking of samples of vehicles entering/exiting the affected roads registering the entry and the exit point and measuring the distance by GPS or other means Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:		
Any comment:		

Data / Parameter:	V _P	Means of Validation
Data unit:	Km/h	
Description:	Vehicle project speed on affected roads; Average moving speed is recorded.	
Source of data to be used:	Survey realized by project proponent or 3 rd party	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Same speed as under baseline is expected	Estimation of expected emission reduction. OK
Description of measurement methods and procedures to be applied:	On-board measurements determining the average moving speed (when circulating) on the affected road based e.g. on GPS measuring or measurement of speed and distances / time through electronic surveillance. Monitoring frequency: annual	In [59] the roads, points and days/ hours are listed OK
QA/QC procedures to be applied:	Same roads, same data points, same hours and same number of days are monitored as in the baseline study (file 59a).	In [59] the roads, points and days/ hours are listed OK
Any comment:	Only passenger cars and taxis	OK

Data / Parameter:	EC _{EL,R}	Means of Validation
Data unit:	MWh	
Description:	Quantity of electricity consumed by the baseline metro line per annum	
Source of data to be used:	Daegu Metropolitan Transit Corporation	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	68,142 (File 9, Daegu Metropolitan Transit Corporation, 2010 traction energy only, p-4)	Checked with [9], both metro lines OK
Description of measurement methods and procedures to be applied:	Monitoring frequency: annual	According to methodology OK
QA/QC procedures to be applied:		
Any comment:	Required to establish the emission factor per PKM for existing metro	According to methodology OK

Data / Parameter:	P _{EL,R}	Means of Validation
Data unit:	Passengers	
Description:	Total passengers transported by baseline metro lines per year	
Source of data to be used:	Daegu Metropolitan Transit Corporation	According to methodology OK
Value of data applied for the purpose of calculating expected emission reductions in section B.5	111,780,000 (File 10, Daegu Metropolitan Transit Corporation, 2010, p.81)	Checked with [10] line 1+2 for 2009, OK
Description of measurement methods and procedures to be applied:	Monitoring frequency: annual	According to methodology OK

applied:		
QA/QC procedures to be applied:		
Any comment:	Required to establish the emission factor per PKM for suburban rail	According to methodology OK

The monitoring manual for Daegu Metro 3th Urban Railroad was received during the on-site visit as “CDM Monitoring Manual Metro Daegu Line 3, version 1.0” [70]. The requirements of the methodology are respected. Three clarification requests had to be raised, CL 26 states that the parameter $N_{x,CT}$ is inconsistent with the monitoring manual, which was amended in version 1.1 of the manual; CL 29 asks for clarifications in the organization of the monitoring and led to an amendment in the new monitoring manual as well [70]. CL 33 asking for more details concerning the consistency checks of the survey could be answered satisfactorily.

A FAR1 was raised claiming that before the start of the metro the parameters $OC_{B,T}$, $NIZ_{C,T}$ and V_P have to be measured with a survey performed in accordance with the TOR in order to have their reliable values for the comparison with the later surveys. The FAR was not accepted by the PP because the mentioned parameters are available prior to validation and therefore listed in Chapter B.7.1 and will not be measured a second time. The explanation is correct and FAR 1 was closed.

SQS states that the monitoring plan is compliant with all requirements of the approved methodology and that the monitoring arrangements are feasible within the project design. It is SQS' opinion, that based on the monitoring manual, version 1.1. of 03/03/2012 [70], the PP is able to implement the monitoring according to the monitoring plan.

Have been raised:

No.:	CL 24	Reference: PDD B.7.1 page 53
Validator request:	It is not clear, how it will be assured that the measurements of NIZ , V_B and OC will always be done in the same way. DOE did not get any TOR's.	
Project owner response:	V_B is based on moving and average speed. File 59a contains the points of measurement. Therefore the method of measuring is irrelevant. If a 3 rd party source such as in the baseline continues to publish speed data, latter will be used. OC : The methodology has in its annexes TORs. This is referenced in B.7.1. where we have $OC_{B,T}$. NIZ needs no TORs but requires to fix locations. This is done. The baseline study which has now been referenced clearly in this parameter in B.7.1. has the sites and locations and times when the vehicle counting is done (File 59b and c)	
Validator conclusion:	DOE agrees. CL 24 is closed	Date: 15/03/2012

No.:	CL 25	Reference: PDD B.7.1 several parameters
Validator request:	The source of data / responsibility is not always clear. There are inconsistencies between the PDD and the monitoring manual and there are inexistent names of organizations.	
Project owner response:	Inconsistencies have been eliminated. See changes PDD B.7.1. and MM vs 1.1.	
Validator conclusion:	DOE agrees. CL 25 is closed	Date: 15/03/2012

No.:	CL 26	Reference: PDD B.7.1 page 50
Validator request:	The description of the parameter $N_{x,CT}$ is inconsistent with the monitoring manual (number of cars or % of types?).	
Project owner response:	MM has been updated	
Validator conclusion:	DOE agrees. CL 26 is closed	Date: 15/03/2012

No.:	CL 27	Reference: PDD B.7.1 page 51
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Validator request:	It is not clear whether the electricity meters will be calibrated by an officially accredited organization.		
Project owner response:	According to government regulations the electricity meters (depending on the type) are calibrated every 7-10 years. This is for total electricity consumption. The electricity meters are from KEPCO and managed by KEPCO and not the metro. Therefore the metro i.e. the PP does not calibrate the meters because it does not have the competence to do this. The PDD has been amended. See also File 67 and 68.		
Validator conclusion:	DOE agrees. CL 27 is closed	Date:	29/03/2012

No.:	CL 28	Reference:	PDD B.7.1 page 51
Validator request:	It is not clear how the electricity consumed will really be measured. There are measurements at the substations (22.9 kV) which can be checked with the bills. The electricity consumption of the traction, however, is measured at 1500 V DC. In between there are other consumptions and losses.		
Project owner response:	See details in File 68. The PDD has been amended in Section B.7.2.		
Validator conclusion:	The electricity is measured by the in-built Watt-Hour-Meter in the rectifier at the level of 1500 V DC. This is correct according to the approved methodology which states that only traction energy should be taken. However, PDD B.7.1. and the Monitoring Manual say that the electricity measurement is controlled with the electricity invoices from KEPCO. This is misleading since the electricity invoices are based on measurements of an other electricity meter which operates at the level of 22.9 kV AC. It is not yet clear (in the PDD and in the Monitoring manual) that the figure for the electricity consumption will really be taken from the 1500 V DC measurement and that the invoice will only serve as a plausibility check.		
		Date:	28/04/2012
Project owner response:	The monitoring data used is the traction energy electricity meter. The invoice from KEPCO will only be used for plausibility and will show higher readings than the value used. Differences of readings however must be in an explicable range. The PDD and the MM have been amended.		
		Date:	01/05/2012
	Explanation is satisfactory, CL 28 closed	Date:	05/05/2012

No.:	CL 29	Reference:	PDD B.7.2 and monitoring manual
Validator request:	The responsibilities for the monitoring given in the monitoring manual are not clear. Daegu Urban Railroad Construction HQ and Daegu Metropolitan Transit Corporation are not clearly addressed / mixed up in the organigram.		
Project owner response:	The MM has been adapted and is now consistent with the PDD Annex 4. The PP is Daegu Metropolitan City Urban Railroad Construction HQ. Therefore even if the metro is operated and therefore also various data parameters such as passenger and electricity consumption are delivered by Daegu Metropolitan Transit Corporation latter is not included in the MM or the PDD except as data source because it has no direct contractual CDM responsibilities.		
Validator conclusion:	DOE agrees. CL 17 is closed	Date:	29/03/2012

No.:	CL 33	Reference:	PDD B.7.1 and Annex 4 and monitoring manual
Validator request:	It is not clear how the check of internal consistency of the survey (using Cronbachs Alpha) will be performed. Specifically it is not clear which items will be cho-		

	sen for the calculation of the sub-variances.	
Project owner response:	Cronbach is used to test the consistency of results between the 2 measurements in different times as proxy regarding the internal consistency of the survey. The consistency is checked within the same unit of analysis which corresponds to the metro station. The average emissions per metro station are checked between the 2 surveys. If the emission levels of the same station between the two measurements are highly correlated this implies the correlation and consistency of the main items of the survey with latter being modes of transit and distance per mode.	
Validator conclusion:	Explanation satisfactory. DOE agrees. CL 33 is closed	Date: 29/03/2012

No.:	FAR 1	Reference: PDD B.6.2 / B.7.1 and monitoring plan
Validator request:	Before the start of the metro the parameters $OC_{B,T}$, $NIZ_{C,T}$ and V_P have to be measured with a survey performed in accordance with the TOR in order to have their reliable values for the comparison with the later surveys.	
Project owner response:	No. OC, NIZ and VB are, in accordance with the methodology, parameters available prior validation and therefore in B.6.2. They are thereafter monitored to determine leakage once the project is operational as listed in B.7.1. Baseline factors will however NOT be determined a 2 nd time prior project start.	
Validator conclusion:	There was a misunderstanding concerning the role of these 3 parameters. DOE agrees. FAR 1 is closed	Date: 29/03/2012

3.8 Sustainable development

The letter of approval from the host party was not available, therefore CL1 was raised. . It was received on 19/07/2012 and confirmed that the project contributes to sustainable development in the Republic of Korea (point 3 of LoA issued).

Has been raised:

No.:	CL 1	Reference: VVM 44: Letter of Approval
Validator request:	Letters of Approval have not yet been submitted	
Project owner response:	For both LOAs the draft validation report is required	
Validator conclusion:	LoA from Switzerland received 30/05/2012, LoA from Republic of Korea received 19/07/2012, CL 1 closed	Date: 20/07/2012

3.9 Local stakeholder consultation

The local stakeholder consultation is described in Section E1 of the PDD.

The following stakeholder meetings have been realized:

- 16/01/2006 meeting to discuss the line plan
- 03/06/2007 consultation meeting
- 30/05/2007 stakeholder meeting
- 17/08/2007 presentation at the Construction Forum at the Munhwa International Conference Meeting

Room

- 16/01/2008 Stakeholder Meeting for Environmental Impact Explanation at the Hall of Daegu People

The stakeholder meeting held 30/05/2007 was announced through the press on 14/05/2007 and was public. It was held at the Daegu Art Center National Room. A report on this stakeholder meeting was realized (File [58]). The project was presented and thereafter discussed. Following major elements were highlighted:

- Usage of the most advanced technology to avoid noise and vibrations and to protect the townscape.
- With a monorail the smaller pillar size allows to maintain the road.
- Partially the metro would need to be made underground if based on a LRT due to road space availability.
- The monorail appears as the most feasible option under financial considerations.

The comments raised during the stakeholder meeting were responded. The final design approved is based on the monorail proposal without underground section.

The recognition and follow up of local stakeholders comments was questioned by CL 32. CL 32 was answered and is closed.

SQS states that the stakeholder consultation was done in a correct way, the few comments were all answered.

Has been raised:

No.:	CL 32	Reference:	PDD E.2 and E.3
Validator request:	There is insufficient information about what were stakeholders comments / questions / proposals and what was the corresponding action taken by the project management.		
Project owner response:	All questions raised by the stakeholders are included in the report see File 58 sheet "meeting result". See also the original report attached as File 58b. The issues raised have been summarized in the PDD. We cannot invent additional requests and questions if the stakeholder did not make more questions.		
Validator conclusion:	DOE agrees. CL 32 is closed	Date:	29/03/2012

3.10 Global stakeholder consultation

The PDD v1.0 of 20/10/2011 was published for comments from 17/11/2011 until 16/12/2011 on the UNFCCC website; no comments were received.

3.11 Environmental impacts

An EIA study has been realized by Hankook Environment & Consultation Co.Ltd. The conclusion of the EIA is that the metro construction will have an overall positive impact community-wide, due to promoting regional development and mitigation of traffic problems downtown. Impacts on users identified and included that the metro meets the demand of passengers in terms of convenience, punctuality and reliability. Social benefits are expected due to traffic improvement. The educed utilization of transit means, such as cars also reduce the amount and cost of road traffic accidents and reduces the maintenance cost and expenses for roads. The reduction of baseline traffic means also results in less air pollution.

By reviewing the translated EIA study (File [56]) and by performing the site visits the validators were able to check the plausibility of these conclusions. The conclusions are plausible.

CL31 had to be raised, since it was not clear even after the site visit, whether the project respects all the legal requirements. A new document was added (Summary of Approvals, File [64]) and the PDD was amended accordingly.

In accordance with the "Metro Act" Art. 4, clause 3 the Daegu metro complies with the environmental impact,

transportation impact assessment and disaster impact assessment. The Ministry of Land, Transportation and Maritime Affairs has approved the Traffic Impact Assessment for Daegu Metro 3th Urban Railroad as of 19/12/2008. The same Ministry also confirms on the 27/10/2008 that the environmental impact assessment of Daegu Metro 3th Urban Railroad has been realized in accordance with the "Environment, Traffic and Disaster Assessment Act, Art. 20." The construction permit has been issued on the 22/05/2009.

The relevant documents have been checked by SQS and are in accordance with the declarations in the PDD. Therefore the legal compliance of the project is given.

Has been raised:

No.:	CL 31	Reference:	PDD D.2
Validator request:	It is not clear whether the project complies with all legal requirements. There is insufficient information about the requirements stated and about official approval that these requirements are met.		
Project owner response:	See all approvals in File 64. The PDD has been amended in section D2		
Validator conclusion:	DOE agrees. CL 31 is closed	Date:	29/03/2012

3.12 Validation protocol

In order to ensure transparency and organize the corrective or additional information and measures a validation protocol was established for the project (see Appendix F). The protocol shows in transparent manner the criteria (requirements), the means of validation and the results from validating the identified criteria including any resulting CAR, FAR and CL.

4 List of Interviewees and Documents Reviewed

The on-site audit and interviews were done according to the on-site visit programme (see Appendix A).

The following stakeholders were interviewed during the validation (see Appendix B).

The following documents were assessed during the validation (see Appendix C).

5 Validation Team and Reviewer

The following matrix shows the names and roles of the members of the validation team and the technical reviewer. The reviewer is not a member of the validation team. Certificates of Competence for each validation team member and of the reviewer are included in Appendix D to this report. Local expertise/support was provided by Mr Byungho KO, South Korea.

Name	Role (1)	Country	Duties				
			Desk review	On-site audit	Resolution of CAR & CL	Report	Technical review
Hanspeter Graf	LA	Switzerland	X	X	X	X	
Jürg Liechti	TM	Switzerland	X	X			
Oliver Stankiewicz	TR	Switzerland					X

(1) LA = Lead auditor/assessor; TM = Team member; TE = Technical expert (if any); TR = Technical reviewer

6 Quality Control

Cross-checks and/or other plausibility checks undertaken during validation are mentioned in the report or in the protocol. The draft validation report, including the initial validation findings, is checked by an internal reviewer (a member of the validation team) before being sent to the project participants. The final validation report undergoes a technical review before requesting registration of the project activity. The technical reviewer (not a member of the validation team) is qualified in accordance with SQS' qualification scheme for CDM validation and verification.

7 Appendix A: On-Site Visit Programme

03/02/2012

From	To	Subject	Where	Who
15.00	17.00	Visit Metro Daegu: Construction sites, survey points, affected roads.	On Sites	Liechti Jürg Graf Hanspeter Ko Byungho Rohini Balasubramanian Lee Jong Whan Lee Jong Min Kim Kyu Gon Park Hai Sik Lee Jong Geun Ahm Yong Mo
17.00	18.00	Reception by the city mayor. Talk about the project	Town Hall	The abovementioned plus: Kim Bumil, City Mayor

04/02/2012

From	To	Subject	Where	Who
08.30	10.30	Discussion of the project documents: <ul style="list-style-type: none"> • General description • Planning, prior consideration • Baseline, project and emission reduction 	DURC HQ Office	Liechti Jürg Graf Hanspeter Ko Byungho Rohini Balasubramanian Lee Jong Whan Lee Jong Min Kim Kyu Gon
10.45	13.00	Discussion of the project documents (cont.): <ul style="list-style-type: none"> • Investment analysis • Sensitivity • Common practice 	DURC HQ Office	The abovementioned
13.00	14.30	Lunch break		
14.30	16.30	Discussion of the project documents (cont.): <ul style="list-style-type: none"> • Monitoring Plan • Monitoring of passengers frequencies • Monitoring of electricity consumption 	DURC HQ Office and Control Room	The abovementioned plus: Cho Sung Mun Kim Seung Jin
16.30	18.00	Discussion of the project documents (cont.): <ul style="list-style-type: none"> • Environmental impact • Stakeholders' comment 	DURC HQ Office	As 08.30 – 10.30
18.00	18.30	Final discussion Metro Daegu	DURC HQ Office	As 08.30 – 10.30

8 Appendix B: List of Interviewees

Date: 3 February, 2012		
Name	Position	Issue
Rohini BALASUBRAMANIAN	Grütter Consulting Country Manager	PDD, general questions
LEE Jong Min	South Pacific Consulting	PDD, general questions
LEE Jong Whan	South Pacific Consulting	PDD, general questions
KIM Kyu Gon	Daegu Urban Railroad Construction HQ Staff	Financial aspects. General project questions
PARK Hai Sik	Daegu Urban Railroad Construction HQ Manager	Construction site. General project questions
AHM Yong Mo	Daegu Urban Railroad Construction HQ Chief	Construction site. General project questions
LEE Jong Geun	Daegu Urban Railroad Construction HQ General Director	Construction site. General project questions
KO Byungho	KFQ, local expert, translator	Specific questions

Date: 4 February, 2012		
Name	Position	Issue
Rohini BALASUBRAMANIAN	Grütter Consulting Country Manager	PDD, general questions
LEE Jong Min	South Pacific Consulting	PDD, general questions
LEE Jong Whan	South Pacific Consulting	PDD, general questions
KIM Kyu Gon	Daegu Urban Railroad Construction HQ Staff	Financial aspects. General project questions
CHO Sung Mun	Daegu Metropolitan Transit Corporation Staff	Monitoring aspects, electricity
KIM Seung Jin	Daegu Metropolitan Transit Corporation Staff	Monitoring aspects, passenger counting
KO Byungho	KFQ, local expert, translator	Specific questions

16/07/2012, Telephone		
Name	Position	Issue
Secretariat of Mr. Keckeis,	DNA Switzerland	Authenticity of LoA Switzerland

9 Appendix C: Documents Reviewed

No.	Title
1	File 1a/b, Korea Energy Management Corporation, 2009 Vehicle average fuel consumption research, 2010
2	File 2, The Korea Transport Institute, KOTI brief, 2010
3	File 3a/b, KEPCO, Combined Margin, 2010
4	File 4a/b, Korea Transportation Safety Authority, 2008 Vehicle Driven Distance research, 2009
5	File 5a/b, Daegu Metropolitan City Public Transportation Division, official letter taxis, 2011
6	File 6a/b, Daegu Metropolitan City Public Transportation Division, official letter buses, 2011
7	File 7, Ministry of Knowledge Economy, Korea Energy Management Corporation, 2008 Vehicle average fuel consumption research, 2009
8	File 8a/b/c, Korea Transportation Safety Authority, Research on Present Situation of Public Transportation 2010, 2011
9	File 9a/b, Daegu Metropolitan Transit Corporation, letter electricity consumption existing metro, 2010
10	File 10a/b, Daegu Metropolitan Transit Corporation, Material of business present condition 2010, 2010
11	File 11a/b, Daegu Metropolitan Transit Corporation, Material of business present condition 2010, 2010
12	File 12, KEMCO, statistics of electric power in Korea, 2010
13	File 13a/b/c, Daegu Metropolitan Transit Corporation, letter electricity consumption metro line 3, 2010
14	File 14a/b, Daegu Metropolitan city, Summary of Construction and Operation Master Plan for Daegu Metro 3th Urban Railroad, 2010
15	File 15a/b, Daegu Metropolitan City Public Transportation Division, official letter buses, 2011
16	File 16, Korean Statistical Information Service official website, Population by city, 2011
17	File 17, Daegu Metropolitan City Railroad Construction Headquarters, metro information, 2011
18	File 18, Daegu Metropolitan City, vehicle statistics, 2011
19	File 19, Daegu Metropolitan Transit Corporation (DTRO), maps, 2011
20	File 20a/b/c, Daegu Metropolitan Urban Railroad Construction HQ, Preliminary Design Report of Daegu Metro 3th Urban Railroad, 2008
21	File 21, Korea Ministry of Government Legislation, Urban Railway Act, 2009
22	File 22, Daegu Metropolitan City, Basic study on transportation 2009
23	File 23, Daegu Metropolitan City, action plan for public transportation 2010 and KOTI, Daegu Metro Basic Plan Feasibility Study, 1990
24	File 24a/b/c, Ministry of Land, Transport and Maritime Affairs, Alteration to Master plan of Daegu Metro 3th Urban Railroad, 2008
25	File 25, Daegu Metropolitan City, Public transportation System reformation, 2006
26	File 26a/b/c/d/e/f/g/h/i/j, various, city population, 2011
27	File 27, Ministry Official Notice No. 2010-230, 24/12/2010, and some revisions
28	File 28, Act on the Promotion of the Development, Use, and Diffusion of New and Renewable Energy [Enforcement Date 12. Apr, 2010] [Act No.10253, 12. Apr, 2010, Partial Amendment]
29	File 29, The Legislation Office, Oil and Substitute Energy for Petroleum regulation, Vehicle Management Regulation, 2011
30	File 30, Daegu-Gyeongbuk Development Institute, The study of feasibility review for the Daegu Metropolitan Bus Rapid Transit introduction, 2007
31	File 31, GTZ, Mass Transit Options, 2005
32	File 32, Public Procurement Service, construction contract 29/06/2009
33	File 33, Prime Ministers office, Confirmation Document from DNA prior consideration, 2011
34	File 34, UNFCCC, prior consideration form, 2010
35	File 35, The Minister of Land, Transportation and Maritime Affairs, Regulation No.131, 2009
36	File 36, Daegu City Railroad - Line 3, Section 4 zone Construction official Site(Hyundai Engineering

	And Construction Company), project total cost, 2011
37	File 37, Inha University, A Comparison of feasibility studies, construction and operation on Infrastructure: Focused on Urban Subways, 2006
38	File 38, GTZ, Training Course Mass Transit, 2004
39	File 39, B Flyvbjerg, Cost Overruns and Demand Shortfalls in Urban Rail and Other Infrastructure, Transportation Planning and Technology, February 2007 Vol. 30, No. 1, pp. 9-30
40	File 40, Daegu Metropolitan Transit Corporation, comparison projected and actual passengers line 1 and 2, 2011
41	File 41, Grütter Consulting, CDM finance file Daegu Line 2, 2011
42	File 42, The Ministry of Land, Transportation and Maritime Affairs, Notification of Approval for the Daegu Metro Line 3 Construction Project, 22/05/2009
43	File 43, Ministry of Land, Transport and Maritime Affairs, Alteration to Master Plan of Daegu Metro 3th Urban Railroad, 2008
44	File 44, Pointcarbon, CER price, 2008/2009
45	File 45, Rites Ltd, Detailed Project Report for Phase II Corridors of Delhi Metro, 2005
46	File 46, IEA, Bus Systems for the Future, 2002
47	File 47, B Flyvbjerg, Comparison of Capital Costs per Route-Kilometre in Urban Rail, EJTI, 8, no. 1 (2008), pp. 17-30
48	File 48, Grütter Consulting, Finance File MM1, 2011
49	File 49, SML9, finance file, 2011
50	File 50, Grütter Consulting, Finance File Metro Mexico Line 12, 2011
51	File 51, OECD, Interest Rate Bonds, 2011
52	File 52a, Ministry of Environment, Korea Vehicle Emission Standards, 2011; File 52b, Walsh, Global Motor Vehicle Emissions Regulations
53	File 53, CORINAIR, Emission Inventory Guidebook, 23/08/2007
54	File 54, US-Korea FTA, vehicle engine size, 2011
55	File 55, South Pacific Inc, metro Daegu survey, 2010
56	File 56a/b, Hankook Environment & Consultant Co.LTD, Daegu Line 3 Construction Project Environmental Impact Assessment final Report, 2010
57	File 57, Daegu Metropolitan City, Daegu Metropolitan Railway Line No.3 Construction and operating business, 2008
58	File 58a/b, Daegu Metropolitan City, stakeholder report, 2007
59	File 59a/b/c, Daegu Metropolitan City, A Basic study on transportation 2009, 2010 and Daegu Metropolitan Urban railroad Construction Headquarter, summary of Executive Design Report, 2008 and South Pacific, Measurement vehicles affected roads, 2011
60	File 60, Daegu Metropolitan Urban Railroad Construction Headquarter, Daegu Metro Line 3 construction Executive Design Summary report, 12/2008
61	File 61, DNP, En que inviarta el Gobierno Colombiano?, 2009
62	File 62, Macrobus, BRT Guadalajara data, 2010
63	File 63, Municipalidad de Guatemala, BRT data, 2010
64	File 64, Ministry of Land, Transportation and Maritime Affairs, approvals Metro Line 3 Daegu, 2008/2009
65	File 65, Public Transportation Department, confirmation letter of non-usage of biofuels, 02/03/2012
66	File 66, Saman Engineering, Alteration to Master plan of daegu Metro 3th Urban Railroad-Additional internal data, 2008
67	File 67, The Ministry of Knowledge Economy, Enforcement Ordinance of Measurement Annex 13 - Verification expiration period of measuring equipment, 06/04/2011
68	File 68, Daegu Metropolitan Transit Corporation, Electricity Measurement, 2012
69	File 69, Saman Engineering, Alteration to Master plan of daegu Metro 3th Urban Railroad - Details of

	operational costs, 2008
70	Monitoring Manuals: Version 1.0 only discussed during site visit, Version 1.1 of 3.3.2012 delivered as a Word file.
71	MoC form of Daegu project, march 2012
72	CDM executive board, EB 62, Annex 5: GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS (Version 05), 2008
73	File 73 a,b,c; Survey 2010 performed at Daegu Metro lines 1 and 2
74	PDD Version 1.0, of 20/10/2011
75	PDD Version 1.1, of 02/03/2012
76	PDD Version 1.3 of 21.06.2012
77	File 70a City population and LUZ new.pdf, File 70b Population data korea and LUZ.xlsx
78	File 47finance version 1.1 DMRC.xlsx
79	File 2 Passengers and OP cost DMRC.xls
80	LoA Switzerland, 30.05.2012
81	LoA Republic of Korea of 19/07/2012 No. 2012-17
82	Tool to calculate the emission factor for an electricity system, v1
83	20120601_iges_er_sheet_gridef_EN.xls
84	CER sheet Daegu vs 1.0.xls, 1.10.2011
85	Public Transport Reforms in Seoul: Innovations Motivated by Funding Crisis. Journal of Public Transportation, Vol. 8, No. 5, 2005
86	File Seoul, (93,650 million Won / 288.1 million passengers; exchange rate 0.00059
87	File Daegu Line 3 Operational Cost Evaluation (09 Nov 12).xls

10 Appendix D: Certificates of Competence

Name: Mr Hanspeter Graf

Scopes of expertise:		
1	Energy industries (renewable/non-renewable sources) TA 1.1: Thermal energy generation from fossil fuels as well as thermal energy from solar TA 1.2: Energy generation from renewable energy sources	X X <input type="checkbox"/>
2	Energy distribution TA 2.1: Electricity distribution TA 2.2: Heat distribution	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3	Energy demand TA 3.1 Energy demand	<input type="checkbox"/> <input type="checkbox"/>
4	Manufacturing industries TA 4.1: Cement sector TA 4.2: Aluminium TA 4.3: Iron and steel TA 4.4: Refinery	X <input type="checkbox"/> <input type="checkbox"/> X <input type="checkbox"/>
5	Chemical industry TA 5.1: Chemical process industries	<input type="checkbox"/> <input type="checkbox"/>
6	Construction TA 6.1: Construction	<input type="checkbox"/> <input type="checkbox"/>
7	Transport TA 7.1: Transport	X X
8	Mining/mineral production TA 8.1: Mining and mineral processes, excluding those included in TA 8.2 below TA 8.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
9	Metal production TA 9.1: Metal production	X X
10	Fugitive emissions from fuels TA 10.1: Mining and mineral processes, excluding those included in TA 10.2 below TA 10.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride TA 11.1: Chemical process industries TA 11.2: GHG capture and destruction	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
12	Solvents use TA 12.1: Chemical process industries	<input type="checkbox"/> <input type="checkbox"/>
13	Waste handling and disposal TA 13.1: Waste handling and disposal TA 13.2: Animal waste management	X X <input type="checkbox"/>
14	Afforestation and reforestation TA 14.1: Forestry	<input type="checkbox"/> <input type="checkbox"/>
15	Agriculture TA 15.1: Agriculture TA 15.2: Animal waste management	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Name: Mr Jürg Liechti, PhD

Scopes of expertise:

1	Energy industries (renewable/non-renewable sources)	X
	TA 1.1: Thermal energy generation from fossil fuels as well as thermal energy from solar	<input type="checkbox"/>
	TA 1.2: Energy generation from renewable energy sources	X
2	Energy distribution	<input type="checkbox"/>
	TA 2.1: Electricity distribution	<input type="checkbox"/>
	TA 2.2: Heat distribution	<input type="checkbox"/>
3	Energy demand	<input type="checkbox"/>
	TA 3.1 Energy demand	<input type="checkbox"/>
4	Manufacturing industries	X
	TA 4.1: Cement sector	X
	TA 4.2: Aluminium	<input type="checkbox"/>
	TA 4.3: Iron and steel	X
	TA 4.4: Refinery	<input type="checkbox"/>
5	Chemical industry	<input type="checkbox"/>
	TA 5.1: Chemical process industries	<input type="checkbox"/>
6	Construction	<input type="checkbox"/>
	TA 6.1: Construction	<input type="checkbox"/>
7	Transport	X
	TA 7.1: Transport	X
8	Mining/mineral production	<input type="checkbox"/>
	TA 8.1: Mining and mineral processes, excluding those included in TA 8.2 below	<input type="checkbox"/>
	TA 8.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/>
9	Metal production	<input type="checkbox"/>
	TA 9.1: Metal production	<input type="checkbox"/>
10	Fugitive emissions from fuels	<input type="checkbox"/>
	TA 10.1: Mining and mineral processes, excluding those included in TA 10.2 below	<input type="checkbox"/>
	TA 10.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/>
11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	<input type="checkbox"/>
	TA 11.1: Chemical process industries	<input type="checkbox"/>
	TA 11.2: GHG capture and destruction	<input type="checkbox"/>
12	Solvents use	<input type="checkbox"/>
	TA 12.1: Chemical process industries	<input type="checkbox"/>
13	Waste handling and disposal	X
	TA 13.1: Waste handling and disposal	X
	TA 13.2: Animal waste management	<input type="checkbox"/>
14	Afforestation and reforestation	<input type="checkbox"/>
	TA 14.1: Forestry	<input type="checkbox"/>
15	Agriculture	<input type="checkbox"/>
	TA 15.1: Agriculture	<input type="checkbox"/>
	TA 15.2: Animal waste management	<input type="checkbox"/>

Name: Mr Oliver Stankiewicz

Scopes of expertise:

1	Energy industries (renewable/non-renewable sources)	X
	TA 1.1: Thermal energy generation from fossil fuels as well as thermal energy from solar	<input type="checkbox"/>
	TA 1.2: Energy generation from renewable energy sources	X
2	Energy distribution	<input type="checkbox"/>
	TA 2.1: Electricity distribution	<input type="checkbox"/>
	TA 2.2: Heat distribution	<input type="checkbox"/>
3	Energy demand	<input type="checkbox"/>
	TA 3.1 Energy demand	<input type="checkbox"/>
4	Manufacturing industries	<input type="checkbox"/>
	TA 4.1: Cement sector	<input type="checkbox"/>
	TA 4.2: Aluminium	<input type="checkbox"/>
	TA 4.3: Iron and steel	<input type="checkbox"/>
	TA 4.4: Refinery	<input type="checkbox"/>
5	Chemical industry	<input type="checkbox"/>
	TA 5.1: Chemical process industries	<input type="checkbox"/>
6	Construction	X
	TA 6.1: Construction	X
7	Transport	X
	TA 7.1: Transport	X
8	Mining/mineral production	<input type="checkbox"/>
	TA 8.1: Mining and mineral processes, excluding those included in TA 8.2 below	<input type="checkbox"/>
	TA 8.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/>
9	Metal production	<input type="checkbox"/>
	TA 9.1: Metal production	<input type="checkbox"/>
10	Fugitive emissions from fuels	<input type="checkbox"/>
	TA 10.1: Mining and mineral processes, excluding those included in TA 10.2 below	<input type="checkbox"/>
	TA 10.2: Oil and gas industry, coal mine methane recovery and use	<input type="checkbox"/>
11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	<input type="checkbox"/>
	TA 11.1: Chemical process industries	<input type="checkbox"/>
	TA 11.2: GHG capture and destruction	<input type="checkbox"/>
12	Solvents use	<input type="checkbox"/>
	TA 12.1: Chemical process industries	<input type="checkbox"/>
13	Waste handling and disposal	X
	TA 13.1: Waste handling and disposal	X
	TA 13.2: Animal waste management	X
14	Afforestation and reforestation	X
	TA 14.1: Forestry	X
15	Agriculture	X
	TA 15.1: Agriculture	X
	TA 15.2: Animal waste management	X

12 Appendix E: Abbreviations

BRT	Bus Rapid Transit
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH ₄	Methane
CL	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IEE	Initial Environmental Examination
IPCC	Intergovernmental Panel on Climate Change
LFG	Landfill Gas
MP	Monitoring Plan
MRTS	Mass Rapid Transit System
MSW	Municipal Solid Waste
MVP	Monitoring and Verification Plan
N ₂ O	Nitrous oxide
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
SQS	Swiss Association for Quality and Management Systems
UNFCCC	United Nations Framework Convention on Climate Change

**Swiss Association for Quality and
Management Systems (SQS)**

B e r n s t r a s s e 1 0 3
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C H - 3 0 5 2 Z o l l i k o f e n
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F a x . + 4 1 3 1 9 1 0 3 5 4 5
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w w w . s q s . c h

CDM Validation Protocol

Enterprise

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Service

Audit/Assessment:

CDM Validation

Audit/Assessment beginning/end:

15/11/2011 – 12/11/2012

Project name:

Daegu Metro 3th Urban Railroad

GBZ/Report-No.:

324172 / P32042.33

UNFCCC Scope(s)/Technical area(s):

7 Transport

UNFCCC Methodology:

ACM0016, version 2.0

UNFCCC Scale:

Large Scale

Team of auditors/assessors:

Mr Hanspeter Graf

Mr Jürg Liechti

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Introduction

[VVM] 26: The purpose of validation is to ensure a thorough, independent assessment of proposed CDM project activities submitted for registration as a proposed CDM project activity against the applicable CDM requirements.

[VVM] 35: The DOE shall raise a corrective action request (CAR) if one of the following occurs:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- The CDM requirements have not been met;
- There is a risk that emission reductions cannot be monitored or calculated.

[VVM] 36: The DOE shall raise a clarification request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

[VVM] 37: The DOE shall raise a forward action request (FAR) during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

Normative References/Documents

No.	Title	Version
[1]	CLEAN DEVELOPMENT MECHANISM VALIDATION AND VERIFICATION MANUAL	01.2
[2]	GUIDANCE ON THE ASSESSMENT OF INVESTMENT ANALYSIS	05
[3]	GLOSSARY OF CDM TERMS	06
[4]	MODALITIES AND PROCEDURES FOR A CLEAN DEVELOPMENT MECHANISM	unedited
[5]	ACM0016 "Baseline Methodology for Mass Rapid Transit Projects"	2.0
[6]	Tool to calculate baseline, project and/or leakage emissions from electricity consumption	01
[7]	Tool for the demonstration and assessment of additionality	05.2.1
[8]	GUIDELINES ON THE DEMONSTRATION AND ASSESSMENT OF PRIOR CONSIDERATION OF THE CDM	04
[9]	GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS	05
[10]	GUIDELINES FOR COMPLETING THE PDD	07
[11]	TEMPLATE FOR CDM-PDD	03

Protocol 1: General CDM Requirements

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
1	Validation requirements based on paragraph 37 of the CDM modalities and procedures				
1.1	APPROVAL				
[1] 44	All Parties involved have approved the project activity.		DR	CL1 OK	OK
	Comment: CL1: Letter of approval not yet received LoA received on 19/07/2012				
1.1.1 [1] 45	The DOE shall determine whether the DNA of each Party indicated as being involved in the proposed CDM project activity in section A.3 of the PDD has provided a written letter of approval. The DOE shall determine whether each letter confirms that: (a) The Party is a Party to the Kyoto Protocol; (b) Participation is voluntary; (c) In the case of the host Party, the proposed CDM project activity contributes to the sustainable development of the country; (d) It refers to the precise proposed CDM project activity title in the PDD being submitted for registration.		DR	CL1 OK	OK
	Comment: CL1: Letter of approval not yet received LoA of Korea received on 19/07/2012, a) OK, b) OK c) OK d) it refers exactly to Daegu Metro 3th Urban Railroad LoA of Switzerland received on 30/05/2012, it confirms • Switzerland is a Party to the Kyoto Protocol (point 1 of LoA issued) • The participation is voluntary (point 2 of LoA issued) • Authorization of Grütter Consulting AG to participate as project proponent to the mentioned CDM project activity (point 3 of LoA issued) CL1 closed				
1.1.2 [1] 46	The DOE shall determine whether the letter(s) of approval is unconditional with respect to (a) to (d) above.		DR	CL1 OK	OK
	Comment: CL1: Letter of approval not yet received LoA is unconditional, CL1 closed				
1.1.3 [1] 47	The DOE shall confirm that the letter(s) of approval was issued by the respective Party's designated national authority (DNA) and is valid for the proposed CDM project activity under validation. A list of DNAs is available on the UNFCCC CDM website.		DR	CL1 OK	OK
	Comment: CL1: Letter of approval not yet received LoA was checked by a telephone call from the local expert to Mr. Jang, jaewoo, the secretariat of the Ministry of Land, Transport and Maritime Affairs on 20 July 2012				
1.1.4 [1] 48	If the DOE doubts the authenticity of the letter of approval, the DOE shall verify with the DNA that the letter of approval is authentic.		DR	CL1 OK	OK
	Comment: CL1: Letter of approval not yet received See above				
1.2	PARTICIPATION				
[1] 51	All project participants have been listed in a consistent manner in the project documentation. Also, their participation in the project activity was approved by a Party to the Kyoto Protocol.		DR	OK	OK
	Comment: Switzerland is party to the Kyoto Protocol				

MoV = Means of Validation, DR = Document Review, I = Interview, N/A = Not Applicable

CAR = Corrective Action Request, CL = Clarification Request, FAR = Forward Action Request

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
1.2.1 [1] 52	The DOE shall confirm that the project participants are listed in tabular form in section A.3 of the PDD and that this information is consistent with the contact details provided in annex 1 of the PDD. The DOE shall determine whether the participation of each project participant has been approved by at least one Party involved, either in a letter of approval or in a separate letter specifically to approve participation. The DOE shall confirm that no entities other than those approved as project participants are included in these sections of the PDD.		DR	CL1 OK	OK
	Comment: Participants are listed in tabular form in the PDD. CL1: Letter of approval not yet received. LoA of Switzerland received on 30/05/2012, it confirms <ul style="list-style-type: none"> Switzerland is a Party to the Kyoto Protocol (point 1 of LoA issued) The participation is voluntary (point 2 of LoA issued) Authorization of Grütter Consulting AG to participate as project proponent to the mentioned CDM project activity (point 3 of LoA issued) CL1 closed No other entities are included				
1.2.2 [1] 53	The DOE shall ensure that the approval of participation was issued from the relevant DNA and if in doubt shall verify with the DNA that the approval of participation is valid for the proposed CDM project participant.		DR	CL1 CL2 OK	OK
	Comment: CL1: Letter of approval not yet received. See above CL2: MoC not yet received. → MoC has been submitted in Form F-CDM-MOC → CL2 closed				
1.3	PROJECT DESIGN DOCUMENT				
[1] 55	The PDD used as a basis for validation shall be prepared in accordance with the latest template and guidance from the CDM Executive Board available on the UNFCCC CDM website.		DR	OK	OK
	Comment: The latest template was used: CDM-PDDversion 03 in effect as of 28.07.2006				
1.3.1 [1] 56	The DOE shall determine whether the PDD is in accordance with the applicable CDM requirements for completing PDDs.		DR	OK	OK
	Comment: Guidelines for completing the PDD and the proposed new baseline and monitoring methodologies version 07				
1.4	PROJECT DESCRIPTION				
[1] 58	The PDD shall contain a clear description of the project activity that provides the reader with a clear understanding of the precise nature of the project activity and the technical aspects of its implementation.		DR	CL3 CL4 CL5 CL6 CL8 CL9 CL11 CL34 OK	OK
	Comment: PDD is clear and understandable. Some clarification requests had to be raised: CL3: Geographical coordinates CL4: There are no motorized rickshaws CL5: Data source for Figure 1 in A4.3 is rather old CL6: Inconsistency in the modal split of A4.3 CL8: Restructurizing of bus-system after project start CL9: Insufficient information about bio-diesel CL11: Ambiguities in the term "other rail-based systems" CL34: Project title should be consistent All CL's are closed.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
1.4.1 [1] 59	The DOE shall confirm that the description of the proposed CDM project activity as contained in the PDD sufficiently covers all relevant elements, is accurate and that it provides the reader with a clear understanding of the nature of the proposed CDM project activity.		DR	OK	OK
	Comment: The description of the project is accurate and gives a good picture of what will be realized. It covers all relevant elements.				
1.4.2 [1] 60	For proposed CDM project activities in existing facilities or utilizing existing equipments, the DOE shall conduct a physical site inspection to confirm that the description in the PDD reflects the proposed CDM project activity for the following types of CDM project activities unless other means are specified in the methodology: (a) Large scale projects;		I	OK	OK
	Comment: The site visit on 3 February, 2012 at construction sites gave a good accordance with the description in the PDD				
1.4.3 [1] 61	For other individual proposed small scale CDM project activities with emission reductions not exceeding 15,000 tonnes per year, the DOE may conduct a physical site visit as appropriate.		NA		
	Comment:				
1.4.4 [1] 62	For all other proposed CDM project activities not referred to in paragraphs 59-61, the DOE shall undertake the validation by reviewing available designs and feasibility studies and may conduct comparison analysis to equivalent projects, as appropriate. The DOE may conduct physical site visit to assess the plan. For proposed CDM project activities for which the DOE does not undertake a physical site inspection, this shall be appropriately justified.		NA		
	Comment:				
1.4.5 [1] 63	If the proposed CDM project activity involves the alteration of an existing installation or process, the DOE shall ensure that the project description clearly states the differences resulting from the project activity compared to the pre-project situation.		DR	OK	OK
	Comment: Pre-project situation described in the PDD, Metro line 1 and 2 are already existing, the new line is an independent monorail system and leads in other directions.				
1.5	BASELINE AND MONITORING METHODOLOGY				
1.5.1	General requirement				
1.5.1.1 [1] 65	The DOE shall ensure that the baseline and monitoring methodologies selected by the project participants comply with the methodologies previously approved by the CDM Executive Board.		DR	OK	OK
	Comment: ACM0016 v2 is valid until 25 July, 2012				
1.5.1.2 [1] 66	To ensure that the project activity meets this general requirement, the DOE shall determine whether: (a) The selected methodology is applicable to the project activity; (b) The PP has correctly applied the selected methodology.		DR	CL9 OK	OK
	Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL9 → closed				
1.5.1.3 [1] 67	The DOE shall ensure that the selected methodology applies to the project activity and has correctly been applied with respect to the following: (a) Project boundary; (b) Baseline identification; (c) Algorithms and/or formulae used to determine emission reductions;		DR	CL9 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	(d) Additionality; (e) Monitoring methodology.				
	Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL9 → closed				
1.5.2	Applicability of the selected methodology to the project activity				
1.5.2.1 [1] 68	The DOE shall validate that the selected baseline and monitoring methodology previously approved by the CDM Executive Board is applicable to the project activity, including that the used version is valid.		DR	OK	OK
	Comment: ACM0016 v2 is valid until 25/07/2012				
1.5.2.2 [1] 69	The DOE shall apply specific guidance provided by the CDM Executive Board in respect to any approved methodology.		DR	OK	OK
	Comment: 2 Guidances valid: Guidance related to use of additionality tool and Guidance on IPCC default values				
1.5.2.3 [1] 70	The DOE shall determine whether the methodology is correctly quoted and applied by comparing it with the actual text of the applicable version of the methodology available on the UNFCCC CDM website.		DR	OK	OK
	Comment: Correctly quoted				
1.5.2.4 [1] 71	A selected approved methodology applies to the project activity if the applicability conditions of the methodology are met and the project activity is not expected to result in emissions other than those allowed by the methodology. The DOE shall determine whether the choice of methodology is justified, and the project participants have shown that the project activity meets each of the applicability conditions of the approved methodology or any tool or other methodology component referred to therein. This shall be done by validating the documentation referred to in the PDD and by verifying that its content is correctly quoted and interpreted in the PDD. If the DOE, based on local and sectoral knowledge, is aware that comparable information is available from sources other than the one used in the PDD, then the DOE shall cross check the PDD against the other sources to confirm that the project activity meets the applicability conditions of the methodology.		DR	CL9 OK	OK
	Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL9 → closed				
1.5.2.5 [1] 72	If the DOE cannot make a determination regarding the applicability of the selected methodology to the proposed CDM project activity, the DOE shall request clarification of the methodology in accordance with the guidance provided by the CDM Executive Board.		DR	OK	OK
	Comment: No clarification needs				
1.5.2.6 [1] 73	If the DOE determines that the proposed CDM project activity does not comply with the applicability conditions of the methodology, the DOE may proceed by means of requesting revision to or deviation from the methodology in accordance with the guidance provided by the CDM Executive Board.		NA	NA	
	Comment:				
1.5.2.7 [1] 74	If the DOE has requested clarification of revision to or deviation from a methodology, the DOE shall not submit a request for registration until the CDM Executive Board has approved the proposed deviation or revision.		NA	NA	
	Comment:				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
1.5.2.8 [1] 75	Under no circumstance shall the DOE consider the submission of a request for registration as a means of seeking clarification from the CDM Executive Board on the applicability of a methodology. Comment:		NA	NA	
1.5.3	Project boundary				
[1] 78	The PDD shall correctly describe the project boundary, including the physical delineation of the proposed CDM project activity included within the project boundary for the purpose of calculating project and baseline emissions for the proposed CDM project activity. Comment: Figure 2, Conceptual Project Boundary, PDD v1		DR	OK	OK
1.5.3.1 [1] 79	Based on documented evidence and corroborated by a site visit where required by paragraphs 59-62 above, the DOE shall determine whether the delineation in the PDD of the project boundary is correct and meets the requirements of the selected baseline methodology. The DOE also shall confirm that all sources and GHGs required by the methodology have been included within the project boundary. If the methodology allows project participants to choose whether a source or gas is to be included within the project boundary, the DOE shall determine whether the project participants have justified that choice. The DOE shall confirm that the justification provided is reasonable, based on assessment of supporting documented evidence provided by the project participants and corroborated by observations if required. Comment: Site visit of 03/02/2012. For including or excluding gases the conservative way was used.		I	OK	OK
1.5.4	Baseline identification				
[1] 81	The PDD shall identify the baseline for the proposed CDM project activity, defined as the scenario that reasonably represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed CDM project activity. Comment: Baseline identification was exactly done according to the methodology		DR	OK	OK
[1] 82	The DOE shall confirm that any procedure contained in the methodology to identify the most reasonable baseline scenario has correctly been applied. If the selected methodology requires use of tools (such as the "Tool for the demonstration and assessment of additionality" and the "Combined tool to identify the baseline scenario and demonstrate additionality") to establish the baseline scenario, the DOE shall consult the methodology on the application of these tools. In such cases, the guidance in the methodology shall supersede the tool. The DOE shall check each step in the procedure described in the PDD against the requirements of the methodology. Comment: Baseline identification was exactly done according to the methodology		DR	OK	OK
1.5.4.1 [1] 83	If the methodology requires several alternative scenarios to be considered in the identification of the most reasonable baseline scenario, the DOE shall, based on financial expertise and local and sectoral knowledge, determine whether all scenarios that are considered by the project participants and are supplementary to those required by the methodology, are reasonable in the context of the proposed CDM project activity and that no reasonable alternative scenario was excluded. Comment: All the assumptions and data used by the project participants are listed in the PDD, including their references and sources.		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	All documentation used is relevant for establishing the baseline scenario and correctly quoted and interpreted in the PDD.				
1.5.4.2 [1] 84	The DOE shall determine whether the baseline scenario identified is reasonable by validating the assumptions, calculations and rationales used as described in the PDD. It shall ensure that documents and sources referred to in the PDD are correctly quoted and interpreted. The DOE shall cross check the information provided in the PDD with other verifiable and credible sources, such as local expert opinion, if available.		DR	OK	OK
	Comment: Assumptions and data used in the identification of the baseline scenario are justified appropriately, supported by evidence and can be deemed reasonable.				
1.5.4.3 [1] 85	The DOE shall determine whether all applicable CDM requirements have been taken into account in the identification of the baseline scenario for the proposed CDM project activity, including "relevant national and/or sectoral policies and circumstances." Drawing on its knowledge of the sector and/or advice from local experts, the DOE shall confirm that all relevant policies and circumstances have been identified and correctly considered in the PDD, in accordance with the guidance by the CDM Executive Board.		DR	OK	OK
	Comment: Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD.				
1.5.4.4 [1] 86	The DOE shall determine whether the PDD provides a verifiable description of the identified baseline scenario, including a description of the technology that would be employed and/or the activities that would take place in the absence of the proposed CDM project activity.		DR	OK	OK
	Comment: The approved baseline methodology has been correctly applied to identify the most reasonable baseline scenario and the identified baseline scenario reasonably represents what would occur in the absence of the proposed CDM project activity.				
1.5.5	Algorithms and/or formulae used to determine emission reductions (see also protocol 3)				
[1] 89	The steps taken and equations applied to calculate project emissions, baseline emissions, leakage and emission reductions shall comply with the requirements of the selected baseline and monitoring methodology.		DR	OK	OK
	Comment: In accordance with the methodology				
1.5.5.1 [1] 90	The DOE shall determine whether the equations and parameters in the PDD were correctly applied by comparing them to those in the selected approved methodology. If the methodology provides for selection between different options for equations or parameters, the DOE shall confirm that adequate justification was provided (based on the choice of the baseline scenario, context of the proposed CDM project activity and other evidence provided) and that the correct equations and parameters were used, in accordance with the methodology selected.		DR	OK	OK
	Comment: All assumptions and data used by the project participants are listed in the PDD, including their references and sources. All documentation used by project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD.				
1.5.5.2 [1] 91	The DOE shall verify the justification given in the PDD for the choice of data and parameters used in the equations. If data and parameters will not be monitored throughout the crediting period of the proposed CDM project activity but have already been determined and will remain fixed throughout the crediting period, the DOE shall assess that all data sources and assumptions are appropriate and that calculations are correct, applicable to the proposed CDM project activity and will result in a conservative estimate of the emission reductions. If data and parameters will be monitored on implementation and hence become available only after validation of the project activity, the DOE shall confirm that the estimates provided in the PDD for these data and parameters are reasonable.		DR	CL30 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>Comment: CL30: The starting date of the first crediting period is ambiguous. The financial calculation file uses October 2014 whereas the PDD gives 01/2015. → The financial calculation is based on information of early 2009, the starting date of 01/2015 is an estimation as of today based on possible delays. This date may still change based on actual construction time and can, based on UNFCCC regulations, also be changed ex-post registration by the PP. → Explanation is reasonable CL30 closed.</p> <p>All values used in the PDD are considered reasonable in the context of the proposed CDM project activity. The baseline methodology was applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions.</p> <p>All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.</p>				
1.6	ADDITIONALITY OF A PROJECT ACTIVITY				
[1] 94	The PDD shall describe how a proposed CDM project activity is additional.		DR	OK	OK
	Comment: According to Tool for the demonstration and assessment of additionality				
1.6.1 [1] 95	The DOE shall assess and verify the reliability and credibility of all data, rationales, assumptions, justifications and documentation provided by project participants to support the demonstration of additionality. This requires the DOE to critically assess the presented evidence, using local knowledge and sectoral and financial expertise.		DR	OK	OK
	Comment: Local knowledge by Mr. KO from KFQ, see also part 3				
1.6.2 [1] 96	The DOE shall consider tools and documents provided by the CDM Executive Board to demonstrate the additionality of proposed CDM project activities as well as specific complementary or alternative requirements included in approved CDM methodology.		DR	OK	OK
	Comment: The appropriate tools were used				
1.6.1	Prior consideration of the clean development mechanism				
[1] 98	If the project activity start date is prior to the date of publication of the PDD for stakeholder comments, it shall be demonstrated that the CDM benefits were considered necessary in the decision to undertake the project as a proposed CDM project activity.		DR	OK	OK
	Comment: The appropriate guidelines were used				
1.6.1.1 [1] 99	The DOE shall confirm that the start date of the project activity, reported in the PDD, is in accordance with the "Glossary of CDM terms". If the reported date is not in accordance with the glossary, the DOE shall raise a CAR to ensure that the start date is correctly reported in a revised PDD. In particular, for project activities that require construction, retrofit or other modifications, the date of commissioning cannot be considered the project activity start date.		DR	OK	OK
	Comment: Starting date is 29/06/2009 which is after 02/08/2008. The starting date was verified by looking into the contract by the local expert (File 32)				
1.6.1.2 [1] 100	The DOE, in accordance with the guidance from the CDM Executive Board, shall determine whether it is a new project activity (a project activity with a start date on or after 2 August 2008) or an existing project activity (a project activity with a start date before 2 August 2008).		DR	OK	OK
	Comment: Start date after 2 August, 2008 → new project activity				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
1.6.1.3 [1] 101	For a new project activity, for which the PDD has not been published for global stakeholder consultation or a new methodology proposed to the CDM Executive Board before the project activity start date, the DOE shall ensure by means of confirmation from the UNFCCC secretariat that PPs had informed the host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. If such a notification has not been provided by the project participants within six months of the project activity start date, the DOE shall determine that the CDM was not seriously considered in the decision to implement the project activity.		DR	CL13 OK	
	Comment: Information letters were sent and acknowledged, CL13 closed				
1.6.1.4 [1] 102	For an existing project activity, for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, the DOE shall assess the project participant's prior consideration of the CDM through document reviews and shall satisfy following requirements: (a) Evidence which must indicate that the awareness of the CDM prior to the project activity start date, and that the benefits of the CDM, were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a proposed CDM project activity. (b) Reliable evidence from project participants which must indicate that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. Evidence to support this should include, inter alia, contracts with consultants for CDM/PDD/methodology services, Emission Reduction Purchase Agreements or other documentation related to the sale of the potential CERs (including correspondence with multilateral financial institutions or carbon funds), evidence of agreements or negotiations with a DOE for validation services, submission of a new methodology to the CDM Executive Board, publication in newspaper, interviews with DNA, earlier correspondence on the project with the DNA or the UNFCCC secretariat.		NA		
	Comment:				
1.6.1.5 [1] 103	If evidence to support the serious prior consideration of the CDM as indicated above is not available, the DOE shall determine that the CDM was not considered in the decision to implement the project activity.		NA		
	Comment:				
1.6.2	Identification of alternatives				
[1] 105	The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.		DR	OK	OK
	Comment: Alternatives according to the methodology				
1.6.2.1 [1] 106	The DOE shall assess the list of alternatives given in the PDD and ensure that: (a) The list of alternatives includes as one of the options that the project activity is undertaken without being registered as a proposed CDM project activity; (b) The list contains all plausible alternatives that the DOE, on the basis of its local and sectoral knowledge, considers to be viable means of supplying the outputs or services that are to be supplied by the proposed CDM project activity; (c) The alternatives comply with all applicable and enforced legislation.		DR	CL10 CL11 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>Comment: CL10 had to be raised since there is too little evidence that the establishment of a BRT as an alternative to the project can be excluded. → More information has been added especially concerning the BRT capacity versus rail capacity. CL10 closed.</p> <p>CL11: There are ambiguities in the understanding of the term "other rail based systems" in the text of the PDD. → Reference to types of other rail system has been added and the title has been adjusted. CL11 closed</p>				
1.6.3	Investment analysis (see protocol 3)				
[1] 108	<p>If the investment analysis has been used to demonstrate the additionality of the proposed CDM project activity, the PDD shall provide evidence that the proposed CDM project activity would not be:</p> <p>(a) The most economically or financially attractive alternative; or</p> <p>(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).</p>		DR	OK	OK
	<p>Comment: NPV is negative, see VR 3.6.3.</p>				
[1] 109	<p>Project participants can show this through one of the following approaches, by demonstrating that:</p> <p>(a) The proposed CDM project activity would produce no financial or economic benefits other than CDM-related income. Document the costs associated with the proposed CDM project activity and the alternatives identified, and demonstrate that there is at least one alternative which is less costly than the proposed CDM project activity;</p> <p>(b) The proposed CDM project activity is less economically or financially attractive than at least one other credible and realistic alternative;</p> <p>(c) The financial returns of the proposed CDM project activity would be insufficient to justify the required investment.</p>		DR	OK	OK
	<p>Comment: Negative NPV, see VR 3.6.3.</p>				
[1] 110	<p>The DOE shall comply with the latest version of the "Guidance on the Assessment of Investment Analysis" as provided by the CDM Executive Board and with other relevant guidance, including the latest guidelines on plant load factors "guidelines for the reporting and validation of plant load factors".</p>		DR	OK	OK
	<p>Comment: Guidance v.05 was used (GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS, v5)</p>				
1.6.3.1 [1] 111	<p>To verify the accuracy of financial calculations carried out for any investment analysis, the DOE shall:</p> <p>(a) Conduct a thorough assessment of all parameters and assumptions used in calculating the relevant financial indicator, and determine the accuracy and suitability of these parameters using the available evidence and expertise in relevant accounting practices;</p> <p>(b) Cross-check the parameters against third-party or publicly available sources, such as invoices or price indices;</p> <p>(c) Review feasibility reports, public announcements and annual financial reports related to the proposed CDM project activity and the project participants;</p> <p>(d) Assess the correctness of computations carried out and documented by the project participants;</p> <p>(e) Assess the sensitivity analysis by the project participants to determine under what conditions variations in the result would occur and the likelihood of these conditions.</p>		DR	CL12 OK	OK
	<p>Comment: CAR1: The financial calculation shall be corrected in order to show really 30 years. Actually it shows 30 years plus some months because the year 2044 is fully accounted. → Has been corrected to include only 9 months 2044. The numbers in the PDD and the spreadsheet have been adjusted. → CAR1 closed.</p> <p>CL7: There is insufficient information about the nature of the financing by the city government. Is it a private or a government financing? Does it justify a loan interest rate? → see answer and amendments by</p>				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>PP → CL7 closed.</p> <p>CL17: There is insufficient information about the choice of the discount rate (5.5%). The referred OECD website shows only figures down to the year 2009 (5.17%). → see answer by PP → CL17 closed.</p> <p>CL14: There is intransparent information about the calculation of the operational cost (staff, energy, maintenance and administrative cost). The figures can not be reproduced from primary data. → details are given in file 69 [69]. → CL14 closed</p> <p>CL15: There is intransparent information about the calculation of the revenues (fare box, other income). The figures can not be reproduced from primary data. → see explanation by PP → CL15 closed</p> <p>CL16: There is insufficient information about the choice of the ticket prices. It is specifically not clear why the price should remain constant over the entire period. → see answer by PP → Concerning inflation the question is answered correctly. Still one could - regardless of inflation – ask whether it would be possible to rise the ticket prices if the metro is not profitable. However, rising prices of public transport is politically difficult and the price elasticity would partially destroy the effect of higher revenues. → Information is sufficient now. CL 16 is closed.</p> <p>CL12: There are ambiguities in the understanding of the investment figures. The numbers given in the PDD text seem to be in contradiction with the investment figures given in table 6 and in the financial spreadsheet (file 41) → Table 6 coincides fully with File 41 sheet “assumptions”</p> <p>Table 6 is in 100 million WON as explained in the title of Table 6. The text on p.23 “investment cost” is however in millions i.e. 1,097,900 which is equivalent to 10,979 x 100 million. CL12 closed.</p>				
1.6.3.2 [1] 112	<p>To confirm the suitability of any benchmark applied in the investment analysis, the DOE shall:</p> <p>(a) Determine whether the type of benchmark applied is suitable for the type of financial indicator presented;</p> <p>(b) Ensure that any risk premiums applied in determining the benchmark reflect the risks associated with the project type or activity;</p> <p>(c) Determine whether it is reasonable to assume that no investment would be made at a rate of return lower than the benchmark by, for example, assessing previous investment decisions by the project participants involved, and determining whether the same benchmark has been applied or if there are verifiable circumstances that have led to a change in the benchmark.</p> <p>Comment: Analysis is made based on NPV as required by ACM0016</p>		DR	OK	OK
1.6.3.3 [1] 113	<p>The CDM Executive Board clarified that in cases where project participants rely on values from Feasibility Study Reports (FSR) that are approved by national authorities for proposed CDM project activities, DOEs are required to ensure that:</p> <p>(a) The FSR has been the basis of the decision to proceed with the investment in the project, i.e. that the period of time between the finalization of the FSR and the investment decision is sufficiently short for the DOE to confirm that it is unlikely in the context of the underlying project activity that the input values would have materially changed;</p> <p>(b) The values used in the PDD and associated annexes are fully consistent with the FSR, and where inconsistencies occur, the DOE should validate the appropriateness of the values;</p> <p>(c) On the basis of its specific local and sectoral expertise, confirmation is provided, by cross-checking or other appropriate manner, that the input values from the FSR are valid and applicable at the time of the investment decision.</p> <p>Comment: FSR was base for the whole planning, they are accepted by national authorities. Site visit with local expert showed that the input values are unlikely to have materially changed, the values in the PDD are consistent with the FSR</p>		DR	OK	OK
1.6.4	Barrier analysis (see Protocol 3)				
[1] 115	If barrier analysis was used to demonstrate the additionality of the proposed CDM project activity, the PDD shall demonstrate that the proposed CDM project activity faces barriers that:		NA		

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	(a) Prevent the implementation of this type of proposed CDM project activity; (b) Do not prevent the implementation of at least one of the alternatives. Comment: No barrier analysis				
1.6.4.1 [1] 116	Issues that have a clear direct impact on the financial returns of the project activity cannot be considered barriers and shall be assessed by investment analysis. This does not refer to either: (a) Risk related barriers, for example risk of technical failure, that could have negative effects on financial performance, or (b) Barriers related to the unavailability of sources of finance for the project activity. Comment:		NA		
1.6.4.2 [1] 117	The DOE shall apply a two-step process to assessing the barrier analysis performed as follows: (a) <i>Determine whether the barriers are real.</i> The DOE shall assess the available evidence and/or undertake interviews with relevant individuals (including members of industry associations, government officials or local experts if necessary) to determine whether the barriers listed in the PDD exist. The DOE shall ensure that existence of barriers is substantiated by independent sources of data such as relevant national legislation, surveys of local conditions and national or international statistics. If existence of a barrier is substantiated only by the opinions of the project participants, the DOE shall not consider this barrier to be adequately substantiated. If the DOE considers, on the basis of its sectoral or local expertise, that a barrier is not real or is not supported by sufficient evidence, it shall raise a CAR to have reference to this barrier removed from the project documentation; (b) <i>Determine whether the barriers prevent the implementation of the project activity but not the implementation of at least one of the possible alternatives.</i> Since not all barriers present an insurmountable hurdle to a project activity being implemented, the DOE shall apply its local and sectoral expertise to judge whether a barrier or set of barriers would prevent the implementation of the proposed CDM project activity and would not equally prevent implementation of <i>at least one of the possible alternatives</i> , in particular the identified baseline scenario. Comment:		NA		
1.6.5	Common practice analysis				
[1] 119	For proposed large-scale CDM project activities, unless the proposed project type is first-of-its kind, common practice analysis shall be carried out as a credibility check of the other available evidence used by the project participants to demonstrate additionality. This is a test to complement the investment analysis (Step 2 of the additionality tool) or barrier analysis (Step 3 of the additionality tool) to confirm that the project activity is not widely observed and commonly carried out in the region. Comment:				
1.6.5.1 [1] 120	The DOE shall use its local and sectoral expertise to: (a) Assess whether the geographical scope (e.g. the defined region) of the common practice analysis is appropriate for the assessment of common practice related to the project activity's technology or industry type. For certain technologies, the relevant region for assessment will be local. For others, it may be transnational/global. If a region other than the entire host country is chosen, the DOE shall assess the explanation why this region is more appropriate;		DR	CL18 CL35 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>(b) Using official sources as well as local and industry expertise, determine to what extent similar and operational projects (e.g., using similar technology or practice), other than CDM project activities, were undertaken in the defined region;</p> <p>(c) If similar and operational projects, other than CDM project activities, are already "widely observed and commonly carried out" in the defined region, assess whether there are essential distinctions between the proposed CDM project activity and the other similar activities.</p>				
	<p>Comment: Exactly according to the methodology. CL18: It is not clear whether some of the Metropolitan Areas having a Metro have constructed their Metro(s) including the CDM. → No, only VCS has been used to the moment. The information has been added to the PDD. → CL18 could be closed</p> <p>CL35: The common practice analysis is not yet clear since the expression LUZ (larger urban zone) according to the methodology exists only in Europe. It should therefore be defined or transferred to the situation in the Republic of Korea. → Common practice analysis has been made clearer by assessing relation LUZ to common city population definition based on European cities and transferring that relation to Korean cities. → after correction of Jeonbuk into Jeonju CL35 closed.</p>				
1.7	MONITORING PLAN (see Protocol 3)				
[1] 122	The PDD shall include a monitoring plan. This monitoring plan shall be based on the approved monitoring methodology applied to the proposed CDM project activity.		DR	OK	OK
	<p>Comment: Monitoring Manuals: Version 1.0 only discussed during site visit, Version 1.1 of 3.3.2012 delivered as a Word file</p>				
1.7.1 [1] 123	<p>The DOE shall apply a two-step process to assessing compliance with this requirement as follows:</p> <p>(a) <i>Compliance of the monitoring plan with the approved methodology.</i> The DOE shall:</p> <p>(i) By means of document review, identify the list of parameters required by the selected approved methodology;</p> <p>(ii) Confirm that the monitoring plan contains all necessary parameters, that they are clearly described and that the means of monitoring described in the plan complies with the requirements of the methodology;</p> <p>(b) <i>Implementation of the plan.</i> The DOE shall, by means of review of the documented procedures, interviews with relevant personnel, project plans and any physical inspection of the proposed CDM project activity site in accordance with paragraphs 59-62, assess whether:</p> <p>(i) The monitoring arrangements described in the monitoring plan are feasible within the project design;</p> <p>(ii) The means of implementation of the monitoring plan, including the data management and quality assurance and quality control procedures, are sufficient to ensure that the emission reductions achieved by/resulting from the proposed CDM project activity can be reported ex post and verified.</p>				OK
	<p>Comment: See under 3.2.2..</p>				
1.8	SUSTAINABLE DEVELOPMENT				
[1] 125	CDM project activities shall assist Parties not included in Annex I to the Convention in achieving sustainable development.				OK
	<p>Comment:</p>				
1.8.1 [1] 126	The DOE shall determine whether the letter of approval by the DNA of the host Party confirms the contribution of the proposed CDM project activity to the sustainable development of the host Party.		DR	CL1 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: The LoA is not yet available. See above, LoA received and sustainable development confirmed				
1.9	LOCAL STAKEHOLDER CONSULTATION				
[1] 128	Local stakeholders shall be invited by the PPs to comment on the proposed CDM project activity prior to the publication of the PDD on the UNFCCC website.		DR	OK	OK
	Comment: Described completely in the PDD Section E.1				
1.9.1 [1] 129	The DOE shall, by means of document review and interviews with local stakeholders as appropriate, determine whether: (a) Comments by local stakeholders that can reasonably be considered relevant for the proposed CDM project activity, have been invited; (b) The summary of the comments received as provided in the PDD is complete; (c) The project participants have taken due account of any comments received and have described this process in the PDD.		DR I	OK	OK
	Comment: Described completely in the PDD section E.1 List of all comments could be seen, some propositions could not be realized because of financial aspects.				
1.10	ENVIRONMENTAL IMPACTS				
[1] 131	Project participants shall submit documentation to the DOE on the analysis of the environmental impacts of the project activity in accordance with paragraph 37(c) of the CDM modalities and procedures.		DR	OK	OK
	Comment: EIA could be seen together with local expert				
1.10.1 [1] 132	The DOE shall confirm, by means of a document review and/or using local official sources and expertise, whether the project participants have undertaken an analysis of environmental impacts and, if required by the host Party, an environmental impact assessment.				OK
	Comment: CL32 had to be raised since it was not clear, how all the legal requirements will be respected. The answer contained some official documents, CL32 could be closed.				

Protocol 2: Specific validation activities

2.1	BACKGROUND				
[1] 134	Project participants may contract a DOE to undertake certain specific validation activities. For such validation activities, the DOE shall apply the general means of validation and reporting requirements described above as well as those described below.				
2.2	PROJECT DESIGN OF SMALL-SCALE CLEAN DEVELOPMENT MECHANISM PROJECT ACTIVITIES				
[1] 135	The DOE shall determine whether a proposed small-scale CDM project activity meets the requirements of the simplified modalities and procedures for small-scale CDM project activities.			NA	
	Comment:				
2.2.1 [1] 136	During its validation of a small-scale project activity, the DOE shall confirm that: (a) The project activity qualifies within the thresholds of the three possible types of small-scale project activities. It may include more than one component; for example, a type III methane recovery component activity and a type I electricity component activity; (b) The project activity conforms to one of the approved small-scale categories and applies the relevant tool or methodology. The DOE shall confirm that the small-scale methodologies are applied in conjunction with the general guidelines to SSC CDM methodologies, which provides guidelines on equipment capacity, equipment performance/lifetime, baseline identification for type-II/III Greenfield project activities, sampling and other monitoring-related issues; (c) The project activity is not a debundled component of a large-scale project, in accordance with the rules defined in appendix C of the simplified modalities and procedures for small-scale CDM project activities; (d) Whether an assessment of the environmental impacts of the proposed CDM project activity is required by the host Party.			NA	
	Comment: In assessing the additionality of small scale CDM project activities, the DOE shall refer to the specific requirements on demonstration of additionality for small scale project activities, together with the guidance in Chapter V, section E, subsection 6 and the "Non-binding best practice examples to demonstrate additionality for SSC project activities".				
2.5	PROGRAMME OF ACTIVITIES				
[1] 165	The CDM Executive Board has provided guidance and procedures for registering a programme of activities (PoA) as a single CDM project activity. In validating a PoA and any CDM programme activities (CPAs) proposed to be included in the PoA, the DOE shall, in general, apply the means of validation and reporting requirements described in this Manual. However, there are a number of requirements unique to PoAs for which additional instructions are provided below. The precise extent of validation required in each of these areas will need to be determined by the DOE, based on the type or PoA being validated.			NA	
	Comment:				
2.5.1	Operational and management arrangements for the PoA				
[1] 166	The DOE shall assess the operational and management arrangements which have been established by the coordinating/managing entity in order to determine whether these arrangements are suitable for the PoA being validated. The arrangements shall be sufficient to ensure that the coordinating/managing entity will have control of all records and information related to the implementation of individual CPAs and will be in a position to ensure that each CPA is being operated in accordance with the specific requirements of the programme. Where the DOE considers the arrangements to be unsatisfactory or insufficient, a CAR shall be raised. A request for registration shall not be submitted until the CAR has			NA	

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	been resolved to the satisfaction of the DOE.				
	Comment:				
2.5.2	Eligibility criteria for CPAs				
[1] 167	The DOE shall assess the specified eligibility criteria in the POA-DD in order to determine whether or not these criteria are sufficient to ensure that all CPAs would comply with the CDM requirements applicable to the PoA. These requirements will include, inter alia, the means of demonstrating the additionality of the CPA and the applicability of the applied methodology. The eligibility criteria represent an essential element of ensuring the smooth functioning or programmatic CDM. Therefore, the DOE may raise CARs which ensure the ease of application of the eligibility criteria.			NA	
	Comment:				
2.5.3	Validation of CPAs				
[1] 168	The DOE shall assess any proposed CPA, which a coordinating/managing entity wishes to include in the PoA, to determine whether or not it complies with the eligibility criteria specified in the POA-DD. The means of validation to determine compliance with this requirement will be specific to the PoA. The DOE may consider a desk review of the documentation sufficient to determine compliance in certain instances. It may also consider follow-up interviews and/or site visits necessary for other types of PoA.			NA	
	Comment:				
2.6	RENEWAL OF CREDITING PERIOD				
[1] 169	When contracted to validate a proposed CDM project activity for a second or further crediting period, the DOE shall undertake a thorough reassessment of the validity of the original baseline or any updates thereto proposed by the project participants, and the corresponding estimation of emission reductions for the applicable crediting period, based on the latest version of the procedures for renewing the crediting period, the latest applicable version of approved methodology and the means of validation described in this Manual.			NA	
	Comment:				
2.7	CHANGES TO THE START DATE OF THE CREDITING PERIOD				
[1] 170	The CDM Executive Board has revised procedures for requesting post registration changes to the start date of the crediting period. The requirement for the Host Country to re-confirm that the delay in the start date of crediting period will not affect project's contribution to sustainable development was removed, and that these revised procedures also contain provisions for project activities hosted in Least Developed Countries (LDCs). If project participants wish to delay the start date of the crediting period by more than one year but less than two years, and if project participants of projects hosted by a LDC wish to delay the start date of the crediting period by more than two year but less than four years, the DOE shall validate the baseline scenario in accordance with chapter V, section E, subsection 5(d) above.			NA	
	Comment: The validation report shall contain a description of the progress made in project implementation. Further, the DOE shall validate that the project participants have obtained written confirmation from the host Party that the delay will not alter the project's contribution to sustainable development.				

Protocol 3: Methodological Requirements

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3	Methodology ACM0016: Baseline methodology for mass rapid transit projects - Version 2.0				
3.1	APPLICATION OF METHODOLOGY				
3.1.1	Title and reference of methodology				
3.1.1.1	Are reference number, version number, and title of the baseline and monitoring methodology clearly indicated?		DR	OK	OK
	Comment: ACM0016 v2 → B1				
3.1.2	Applicability of methodology				
3.1.2.1	Is the applied version the most recent one and/or is this version still applicable?		DR	OK	OK
	Comment: Valid until 25 July, 2012				
3.1.2.2	Is the applied methodology considered the most appropriate one?		DR	OK	OK
	Comment: Yes Mass Rapid Transit includes Metros				
3.1.2.3	<p>Applicability Criterion 1: The project constructs a new rail-based infrastructure or segregated bus lanes. The segregated bus lanes or the rail-based MRTS replace existing bus routes (e.g. through scrapping units or through closing or re-scheduling existing bus routes) operating under mixed traffic conditions.</p> <p>Comment: New rail infrastructure. Bus routes will be re-designed after start of Metro Line 3 (ML3) CL8: There is insufficient information about how the bus system is planned to be restructurized. → Explanation was added to the PDD showing how the re-designing process will take part → CL8 closed CL9: There is insufficient information about the possible actual and future use of biofuels for buses. Specifically, it is not clear: - whether there is actually no use of biofuels for buses - what will happen to the project if in future the use of some biofuel would become mandatory for some motorized vehicles procedures. → answer by PP see CL9: No biofuel is used, if biofuel will be used it will be monitored → CL9 closed.</p>		DR	CL8 CL9 OK	OK
3.1.2.4	<p>Applicability Criterion 2: The methodology is not applicable for operational improvements (e.g. new or larger buses) of an already existing and operating bus lane or rail-based MRTS.</p> <p>Comment: New rail infrastructure for ML3 → rail based</p>		DR	OK	OK
3.1.2.5	<p>Applicability Criterion 3: The methodology is not applicable for bus lanes replacing an existing rail-based system i.e. the existing urban or suburban rail infrastructure must remain fully (in its full length) operational.</p> <p>Comment: MRTS is rail based, no reduction of the existing rail infrastructure is planned</p>		DR	OK	OK
3.1.2.6	<p>Applicability Criterion 4: The methodology is applicable for passenger transport only.</p> <p>Comment: OK</p>		DR	OK	OK

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	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.1.2.7	<p>Applicability Criterion 5: Any fuels including (liquefied) gaseous fuels or biofuel blends, as well as electricity can be used in the baseline or project case. The following conditions apply:</p> <ul style="list-style-type: none"> In the case of gaseous fossil fuels, the methodology is applicable if equal or more gaseous fossil fuels are used in the baseline scenario than in the project activity. The methodology is not applicable in its current form if more gaseous fossil fuel is used in the project activity compared to the baseline scenario; In the case of biofuels, project buses must use the same biofuel blend (same percentage of biofuel) as commonly used by conventional comparable urban buses in the country i.e. the methodology is not applicable if project buses use higher or lower blends of biofuels than those used by conventional buses. In addition, the project buses shall not use a significantly higher biofuel blend than cars and taxis. 		DR I	CL9 OK	OK
	Comment: CL9: Bio-fuel, see above				
3.1.2.8	<p>Applicability Criterion 6: The methodology is not applicable for the implementation of air and water-based transport systems.</p>		DR I	OK	OK
	Comment: No water or air-based transport OK				
3.1.2.9	<p>Applicability Criterion 7: The project system partially replaces a traditional public transport system in a given city. The methodology cannot be used in areas where currently no public transport is available.</p>		DR I	OK	OK
	Comment: Bus system existing Metro Lines 1 and 2 existing				
3.1.2.10	<p>Applicability Criterion 8: The methodology is applicable for urban or suburban trips. It is not applicable for inter-urban transport.</p>		DR I	OK	OK
	Comment: ML3 is for urban and suburban trips				
3.1.2.11	<p>Applicability Criterion 9: The methodology is only applicable if the application of the procedure to identify the baseline scenario results in that a continuation of the current public transport system is the most plausible baseline scenario.</p>		DR I	OK	OK
	Comment: OK				
3.1.3	GHG sources, sinks and reservoirs (project boundaries)				
3.1.3.1	<p>Spatial extent is the Metropolitan City of Daegu (LUZ).</p>		DR	CL35 OK	OK
	Comment: See CL35: LUZ is not a term commonly used in Korea. For other cities than Seoul the metropolitan area of the city has been taken if data was available. The table 11 shows metropolitan areas in cities with LUZ population in Korea with more than 1 million inhabitants and MRTS systems implemented by these cities.				
3.1.3.2	<p>The project only includes emission reductions from the MRTS lanes as outlined in the PDD. If any MRTS lane would in a later stage be extended (prolonged) beyond the originally planned route detailed in the PDD then emission reductions can only be claimed for the original lane included in the PDD.</p>		DR	OK	OK
	Comment: It is planned to extend the line in parts of 1 km with a total extension of 4 km reaching a total line length of 28 km by the year 2031				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.											
3.1.3.3	In case of using electricity from an interconnected grid or captive power plant for the propulsion of the transport system, the project boundary also includes the power plants connected physically to the electricity system that supply power to the project, and/or the captive power plant.		DR	OK	OK											
	Comment: OK Figure 3															
	Are the following (3.1.3.4. – 3.1.3.7.) GHG included or excluded from the project boundaries according to the methodology?															
3.1.3.4	Type: Baseline Emissions Source: Mobile source emissions of different modes of transport due to the trips made by the passengers using the MRTS Gas(es): CO ₂ , CH ₄ , N ₂ O			OK	OK											
	<table><tr><th>Boundary checklist</th><th>Yes / No</th></tr><tr><td>Source and gas(es) discussed in the PDD?</td><td>Yes</td></tr><tr><td>Inclusion / exclusion justified?</td><td>CO₂, CH₄ included, N₂O, CH₄ tailpipe excl.</td></tr><tr><td>Explanation / Justification sufficient?</td><td>Sufficient</td></tr><tr><td>Consistency with monitoring plan?</td><td>Yes</td></tr></table>	Boundary checklist	Yes / No			Source and gas(es) discussed in the PDD?	Yes	Inclusion / exclusion justified?	CO ₂ , CH ₄ included, N ₂ O, CH ₄ tailpipe excl.	Explanation / Justification sufficient?	Sufficient	Consistency with monitoring plan?	Yes			
	Boundary checklist	Yes / No														
	Source and gas(es) discussed in the PDD?	Yes														
	Inclusion / exclusion justified?	CO ₂ , CH ₄ included, N ₂ O, CH ₄ tailpipe excl.														
	Explanation / Justification sufficient?	Sufficient														
	Consistency with monitoring plan?	Yes														
Comment: See also 3.2.1.																
3.1.3.5	Type: Project Activity Emissions Source: Mobile source emissions of the project transport system (MRTS) due to the trips made by the passengers using it Gas(es): CO ₂ , CH ₄ , N ₂ O		DR, I	CL24 OK	OK											
	<table><tr><th>Boundary checklist</th><th>Yes / No</th></tr><tr><td>Source and gas(es) discussed in the PDD?</td><td>Yes table 3</td></tr><tr><td>Inclusion / exclusion justified?</td><td>Yes</td></tr><tr><td>Explanation / Justification sufficient?</td><td>Yes</td></tr><tr><td>Consistency with monitoring plan?</td><td>Yes</td></tr></table>	Boundary checklist				Yes / No	Source and gas(es) discussed in the PDD?	Yes table 3	Inclusion / exclusion justified?	Yes	Explanation / Justification sufficient?	Yes	Consistency with monitoring plan?	Yes		
	Boundary checklist	Yes / No														
	Source and gas(es) discussed in the PDD?	Yes table 3														
	Inclusion / exclusion justified?	Yes														
	Explanation / Justification sufficient?	Yes														
	Consistency with monitoring plan?	Yes														
Comment: See also 3.2.1.																
3.1.3.6	Type: Project Activity Emissions Source: Mobile source emissions of different modes of transport due to the trips made by the passengers using the MRTS, from their trip origin to the MRTS and from the MRTS to their trip destination Gas(es): CO ₂ , CH ₄ , N ₂ O		DR	OK	OK											
	<table><tr><th>Boundary checklist</th><th>Yes / No</th></tr><tr><td>Source and gas(es) discussed in the PDD?</td><td>Yes</td></tr><tr><td>Inclusion / exclusion justified?</td><td>Yes</td></tr><tr><td>Explanation / Justification sufficient?</td><td>Yes</td></tr><tr><td>Consistency with monitoring plan?</td><td>Yes</td></tr></table>	Boundary checklist				Yes / No	Source and gas(es) discussed in the PDD?	Yes	Inclusion / exclusion justified?	Yes	Explanation / Justification sufficient?	Yes	Consistency with monitoring plan?	Yes		
	Boundary checklist	Yes / No														
	Source and gas(es) discussed in the PDD?	Yes														
	Inclusion / exclusion justified?	Yes														
	Explanation / Justification sufficient?	Yes														
	Consistency with monitoring plan?	Yes														
Comment: See also 3.2.1.																
3.1.3.7	Type: Leakage Source: Emissions due to changes of the load factors of taxis and conventional buses; and due to congestion change (incl. change of vehicle speed and induced traffic (rebound effect)) Gas(es): CO ₂ , CH ₄ , N ₂ O		DR	OK	OK											
	<table><tr><th>Boundary checklist</th><th>Yes / No</th></tr></table>	Boundary checklist	Yes / No													
Boundary checklist	Yes / No															

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	Requirement	Ref.	MoV	Draft Concl.	Final Concl.	
	Source and gas(es) discussed in the PDD?	Yes				
	Inclusion / exclusion justified?	Yes				
	Explanation / Justification sufficient?	Yes				
	Consistency with monitoring plan?	CL31, Yes				
	Comment: See also 3.2.1.					
3.1.4	Baseline					
3.1.4.1	Is the latest approved version of the “Tool for the demonstration and assessment of additionality” used?			DR	OK	OK
	Comment: Yes, version 05.2.1 was used, which is the latest one					
3.1.4.2	Are all variables with >20% analyzed for their material impact? Is it necessary to analyze a variable <20%? (→ CAR)			DR	OK	OK
	Comment: A sensitivity analysis was performed with lower investment costs, lower operational costs and higher fare box revenues. These are the main variables for NPV, it is not necessary to analyze other variables.					
3.1.4.3	Have all feasible baseline scenario alternatives to the project scenario been identified and discussed in the PDD. The following alternative scenarios should, inter alia, be considered: <ul style="list-style-type: none">• The proposed project activity not being registered as a CDM project activity;• The proposed project activity being implemented at a later date in the future, without being registered as a CDM project activity;• The continuation of the current public and individual transport systems, including (future) investments in road based infrastructure if applicable. Transport systems which are different to the proposed project activity, e.g. if a bus lane is the project activity then alternatives might be a metro and reverse.			DR	OK	OK
	Comment: 5 alternatives were discussed including the above mentioned ones CL15: The proof for increasing traffic with private cars (file 20) is rather old; are there no newer data available? → Explanation by PP is plausible and no other data available → CL15 closed					
3.1.4.4	Are the alternatives assessed in a dynamic framework for the entire crediting period, taking into account the evolutions foreseen during this period?			DR	OK	OK
	Comment: Yes					
3.1.5	Demonstration and assessment of additionality					
3.1.5.1	Have applicable regulatory or legal requirements been identified? Does the project activity identify correctly and exclude those options not in line with regulatory or legal requirements?			DR	OK	OK
	Comment: CL31:					
3.1.5.2	Is the appropriate analysis method determined in the PDD (simple cost, investment comparison or benchmark analysis)?			DR	OK	OK
	Comment: Investment Comparison Method					
3.1.5.3	Simple cost analysis: At least one alternative is less costly than the project activity?				NA	
	Comment:					
3.1.5.4	Has an investment comparison analysis using NPV, IRR, as indicators for all alternatives that are remaining after step 1 been conducted?			DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: Investment comparison analysis with NPV				
3.1.5.5	Was the latest guideline used for the investment analysis?		DR	OK	OK
	Comment: Yes "GUIDANCE ON THE ASSESSMENT OF INVESTMENT ANALYSIS, v2.1" was used . [9]				
3.1.5.6	Is the investment analysis based on the parameters that are standard in the market?		DR	CL19 OK	OK
	Comment: CL19: There is not enough information about operational costs like # employees, details of energy, maintenance and administrative cost, and others. → New file 57b gives enough information for the judgment of the financial analysis → CL19 closed The parameters are normal to public companies and more conservative than with private parties.				
3.1.5.7	Are all relevant costs and revenues (subsidies/fiscal incentives, ODA's, etc.) included?		DR	OK	OK
	Comment: Yes, no ODA's				
3.1.5.8	Is the investment analysis presented in a transparent manner? Does the PP want to black-out certain elements for the publicly available version? [8]		DR	CL21 OK	OK
	Comment: Financial File 41, had to be adapted for closing of CL21				
3.1.5.9	Is the period of assessment appropriate in the context of the underlying project?		DR	OK	OK
	Comment: 30 years, more than required by the guidance, which is conservative				
3.1.5.10	How is depreciation handled?		DR	OK	OK
	Comment: The NPV is based on cash flow and does not include depreciation or other non-cash items.				
3.1.5.11	Are the input values of the investment analysis valid and applicable at the time of the investment decision?		DR	CL20 OK	OK
	Comment: Yes, investment decision was on 05/2009 CL20: There is not enough information about the choice of the ticket prices. It is especially not clear why the price should be constant over the entire period of 30 years. → Explanation by PP is OK → CL20 closed				
3.1.5.12	Are the listed input values consistent in all calculations?		DR	OK	OK
	Comment: Yes				
3.1.5.13	For post-tax benchmarks is the actual interest payable taken into account for income tax calculation?		NA		
	Comment: Analysis is made based on NPV as required by ACM0016				
3.1.5.14	If benchmarks are used are they applicable to the project activity and the type of IRR calculation?		NA		
	Comment: Analysis is made based on NPV as required by ACM0016				
3.1.5.15	If internal benchmarks are used are they compatible with the financial behaviour of at least the last 3 years?		NA		

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: Analysis is made based on NPV as required by ACM0016				
3.1.5.16	How do the benchmarks used correspond to the default ones in Appendix A of the Guidance?		NA		
	Comment: Analysis is made based on NPV as required by ACM0016				
3.1.5.18	Is the sensitivity analysis correctly applied and is the interpretation of the results in line with the methodology?		DR	OK	OK
	Comment: Table A11 in the PDD, only one parameter (passenger numbers) is sensitive.				
3.1.5.19	Are all variables with >20% analysed for their material impact? Is it necessary to analyse a variable <20%?		DR	OK	OK
	Comment: See 3.1.4.2				
3.1.5.20	Is the range of variations reasonable in the project context?		DR	OK	OK
	Comment: The range for the sensitivity analysis is 10%, which seems reasonable. However it was extended until a NPV of zero, which in fact represents an enlargement of the range by 16% (for higher fare box revenue until 28% for lower investment cost.				
3.1.5.21	In case of applying step 3 (barrier analysis) of the additionality tool: Is a complete list of barriers developed that prevent the different alternatives to occur?		NA		
	Comment: No barrier analysis had to be applied				
3.1.5.22	In case of applying step 3 (barrier analysis): Is transparent and documented evidence provided on the existence and significance of these barriers?		NA		
	Comment: No barrier analysis had to be applied				
3.1.5.23	In case of applying step 3 (barrier analysis): Is it transparently shown that the execution of at least one of the alternatives is not prevented by the identified barriers?		NA		
	Comment: No barrier analysis had to be applied				
3.1.5.24	Common practice analysis: Are all larger urban zones (LUZ) in the host country with more than 1 million inhabitants, which have already implemented a MRTS, considered for common practice analysis? (official data?)		DR	OK	OK
	Comment: The number of inhabitants for Seongnam, Goyang and Yongin as cities lie a little below 1 million inhabitants; if one looks at the "larger urban zone" as stated by the methodology, then they are above 1 million as was acknowledged by the local expert. CL18: In table 11 of the PDD Incheon as a city with more than 1 million inhabitants is missing. We understand that Seoul was chosen as the LUZ including Incheon. But then there is not enough evidence why Yongin and to a lesser degree Goyang are listed as separate cities, since according to Wikipedia "... Yongin is a major city in the Seoul National Capital Area, located in Gyeonggi Province" and Goyang is linked over metro line 3 with Seoul. The answer of the PP is according to the local expert correct, therefore CL18 could be closed.				
3.1.5.25	Common practice analysis: Are at least 3 cities with inhabitants between 0.5 and 1 million people considered for the common practice analysis?		NA		
	Comment: The LUZ of the city of the project has more than 1 million inhabitants.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.1.5.26	Common practice analysis: Are in less than 50% of the considered cities MRTS implemented without CDM?		DR I	OK	OK
	Comment: Yes, confirmation by local expert				
3.2	DESCRIPTION OF ALL DATA AND PARAMETERS AVAILABLE AT VALIDATION, MONITORING PLAN				
3.2.1	Data available at validation				
3.2.1.1	SFC _{C,G/D,LPG} Specific fuel consumption for passenger cars using G,D,LPG		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Correct value provided?	Yes			
	Has this value been verified?	Yes			
	Choice of data or measurement methods correctly justified?	Yes			
	Comment: See Table A1 Baseline Parameters and VR 3.5.4.				
3.2.1.2	SFC _{T,LPG} Specific fuel consumption for taxis using LPG		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Correct value provided?	Yes			
	Has this value been verified?	Yes			
	Choice of data or measurement methods correctly justified?	Yes			
	Comment: See Table A1 Baseline Parameters and VR 3.5.4.				
3.2.1.3	SFC _{M,G} Specific fuel consumption for motor cycles using gasoline		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Correct value provided?	Yes			
	Has this value been verified?	Yes			
	Choice of data or measurement methods correctly justified?	Yes			
	Comment: See Table A1 Baseline Parameters and VR 3.5.4.				
3.2.1.4	SFC _{D,CNG} Specific consumption of buses using diesel or CNG		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.																
	<table><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes														
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: See Table A1 Baseline Parameters and VR 3.5.4.																				
3.2.1.5	<i>N_{I,x}</i> Numbers of vehicles per category I using fuel type x <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes, diff.values</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes, diff.values	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes, diff.values																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: See VR 3.5.4																				
3.2.1.6	<i>OC_C</i> Average occupation rate for passenger cars <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: See Table A1 Baseline Parameters and VR 3.5.4																				
3.2.1.7	<i>OC_T</i> Average occupation rate for taxis <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: See table A1 baseline parameters and VR 3.5.4																				
3.2.1.8	<i>OC_M</i> Average occupation rate for motor cycles <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td></td></tr><tr><td>Data unit correctly expressed?</td><td></td></tr><tr><td>Appropriate description of parameter?</td><td></td></tr><tr><td>Source clearly referenced?</td><td></td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?		Data unit correctly expressed?		Appropriate description of parameter?		Source clearly referenced?			DR I	OK	OK						
Data Checklist	Yes/No/NA																				
Title in line with methodology?																					
Data unit correctly expressed?																					
Appropriate description of parameter?																					
Source clearly referenced?																					

	Requirement		Ref.	MoV	Draft Concl.	Final Concl.
	Correct value provided?					
	Has this value been verified?					
	Choice of data or measurement methods correctly justified?					
	Comment: There are no motorcycles					
3.2.1.9	<i>OC_B Average occupation rate for buses</i>			DR I	OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	Yes				
	Appropriate description of parameter?	Yes				
	Source clearly referenced?	Yes				
	Correct value provided?	Yes				
	Has this value been verified?	Yes				
	Choice of data or measurement methods correctly justified?	Yes				
	Comment: See VR 3.5.4					
3.2.1.10	<i>PBL_B Passengers transported by baseline buses per annum</i>			DR I	OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	Yes				
	Appropriate description of parameter?	Yes				
	Source clearly referenced?	Yes				
	Correct value provided?	Yes				
	Has this value been verified?	Yes				
	Choice of data or measurement methods correctly justified?	Yes				
	Comment: See Table A1 Baseline Parameters					
3.2.1.11	<i>TDBL_{P,B} Average trip distance of passengers using buses</i>			DR I	OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	Yes				
	Appropriate description of parameter?	Yes				
	Source clearly referenced?	Yes				
	Correct value provided?	Yes				
	Has this value been verified?	Yes				
	Choice of data or measurement methods correctly justified?	Yes				
	Comment: See Table A1 Baseline Parameters and VR 3.5.4					
3.2.1.12	<i>DD_B Total distance driven by baseline buses per annum</i>			DR I	OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	Yes				
	Appropriate description of parameter?	Yes				
	Source clearly referenced?	Yes				
	Correct value provided?	Yes				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.																
	<table><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes																
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: See Table A1 Baseline Parameters and VR 3.5.4																				
3.2.1.13	<div><i>AD_B Average annual distance driven by buses</i></div> <table><tr><th>Data Checklist</th><th>Yes/No/NA</th></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: File 6 [6] and VR 3.5.4																				
3.2.1.14	<div><i>AD_T Average annual distance driven by taxis</i></div> <table><tr><th>Data Checklist</th><th>Yes/No/NA</th></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: File 5 [5] and VR 3.5.4																				
3.2.1.15	<div><i>N_{I,Z,C,T,BL} Number of cars, taxis on affected roads per annum in the baseline</i></div> <table><tr><th>Data Checklist</th><th>Yes/No/NA</th></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				
	Comment: File 59 [59] and VR 3.5.4																				
3.2.1.16	<div><i>V_B Vehicle baseline speed on affected roads</i></div> <table><tr><th>Data Checklist</th><th>Yes/No/NA</th></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Correct value provided?</td><td>Yes</td></tr><tr><td>Has this value been verified?</td><td>Yes</td></tr><tr><td>Choice of data or measurement methods correctly justified?</td><td>Yes</td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
Data Checklist	Yes/No/NA																				
Title in line with methodology?	Yes																				
Data unit correctly expressed?	Yes																				
Appropriate description of parameter?	Yes																				
Source clearly referenced?	Yes																				
Correct value provided?	Yes																				
Has this value been verified?	Yes																				
Choice of data or measurement methods correctly justified?	Yes																				

MoV = Means of Validation, DR = Document Review, I = Interview, N/A = Not Applicable

CAR = Corrective Action Request, CL = Clarification Request, FAR = Forward Action Request

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: File 59 [59] and VR 3.5.4				
3.2.1.17	Is the data set complete or are there data missing?		DR	OK	OK
	Comment: Complete according to ACM0016				
3.2.2	Data and parameters monitored				
3.2.2.1	<i>1.1.1 P_{EL,R} Total passengers transported by metro per year</i>				
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
	Comment: File 10 [10] and VR 3.7				
3.2.2.2	<i>EC_{EL,R} Quantity of electricity consumed by the baseline metro per year</i>				
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
	Comment: File 9 [9] and VR 3.7				
3.2.2.3	<i>NCV_{GD/CNG/LPG} Net calorific value of gasoline, diesel, CNG and LPG</i>				
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
	Comment: See VR 3.7 and 3.5.5.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.2.2.4	<i>EF_{CO2,G/D/CNG/LPG} CO₂-emission factor for gasoline, diesel, CNG and LPG</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
Are QA/QC procedures defined and applied?					
Comment: IPCC 2006, Table 1.4, lower 95% confidence interval, See VR 3.7 and 3.5.5.					
3.2.2.5	<i>EF_{KM,B,CH4} CH₄-emission factor of CNG buses in CO_{2eq}</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
Are QA/QC procedures defined and applied?					
Comment: IPCC 2006, Table 3.2.4, lower 95% confidence interval, See VR 3.7 and 3.5.5.					
3.2.2.6	<i>EF_{KM,LPG,C/T,LPG} CH₄-emission factor of LPG cars and taxis in CO_{2eq}</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
Are QA/QC procedures defined and applied?					
Comment: IPCC 2006, Table 3.2.4, lower 95% confidence interval					
3.2.2.7	<i>N_{x,C/T} Number of passenger cars and taxis using fuel type x</i>		DR I	CL26 OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	CL26			
Frequency of monitoring/recording	Yes				

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CAR = Corrective Action Request, CL = Clarification Request, FAR = Forward Action Request

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.						
	Is value applied verified and correct?	Yes									
	Is monitoring equipment calibrated?										
	Are QA/QC procedures defined and applied?										
	Comment: CL26: The description of the parameter Nx,CT is inconsistent with the monitoring manual (number of cars or % of types?). MM was changed → CL26 closed. See VR 3.7										
3.2.2.8	<i>P Total passengers transported by the project</i>			DR I	OK	OK					
	Data Checklist	Yes/No/NA									
	Title in line with methodology?	Yes									
	Data unit correctly expressed?	Yes									
	Appropriate description of parameter?	Yes									
	Source clearly referenced?	Yes									
	Description of measurement methods and procedures?	Yes									
	Frequency of monitoring/recording	Yes									
	Is value applied verified and correct?	Yes									
	Is monitoring equipment calibrated?										
	Are QA/QC procedures defined and applied?										
	Comment: File 14 [14], See VR 3.7 and 3.5.5.										
	3.2.2.9	<i>EC_{PJ} Electricity consumed by MRTS (trains)</i>						DR I	CL27, CL28 OK	OK	
		Data Checklist									Yes/No/NA
Title in line with methodology?		Yes									
Data unit correctly expressed?		Yes									
Appropriate description of parameter?		Yes									
Source clearly referenced?		Yes									
Description of measurement methods and procedures?		CL28									
Frequency of monitoring/recording		Yes									
Is value applied verified and correct?		Yes									
Is monitoring equipment calibrated?		CL27									
Are QA/QC procedures defined and applied?											
Comment: File 13 [13] See VR 3.7 CL27: It is not clear whether the electricity meters will be calibrated by an officially accredited organization. Answer by PP is clear → CL27 closed CL28: It is not clear how the electricity consumed will really be measured. There are measurements at the substations (22.9 kV) which can be checked with the bills. The electricity consumption of the traction, however, is measured at 1500 V DC. In between there are other consumptions and losses. → Answers by PP finally satisfying → CL28 closed											
3.2.2.10		<i>N_{B,T} Number of buses and taxis circulating in the city</i>			DR I	OK					OK
		Data Checklist	Yes/No/NA								
	Title in line with methodology?	Yes									
	Data unit correctly expressed?	Yes									
	Appropriate description of parameter?	Yes									
	Source clearly referenced?	Yes									
	Description of measurement methods and procedures?	Yes									
	Frequency of monitoring/recording	Yes									
	Is value applied verified and correct?	Yes									
	Is monitoring equipment calibrated?										
	Are QA/QC procedures defined and applied?										

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment:				
3.2.2.11	<i>OC_T Average occupancy rate of taxis</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
Comment: See VR 3.7					
3.2.2.12	<i>OC_B Average occupancy rate of buses</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
Comment: According to methodology, See VR 3.7					
3.2.2.13	<i>NIZ_{C,T} Number of cars, taxis using affected roads</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			
	Source clearly referenced?	Yes			
	Description of measurement methods and procedures?	Yes			
	Frequency of monitoring/recording	Yes			
	Is value applied verified and correct?	Yes			
	Is monitoring equipment calibrated?				
	Are QA/QC procedures defined and applied?				
Comment: See VR 3.7					
3.2.2.14	<i>TDIZ_{C,T} Distance driven by taxis and passenger cars on affected roads</i>		DR I	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	Yes			

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.																				
	<table><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Description of measurement methods and procedures?</td><td>Yes</td></tr><tr><td>Frequency of monitoring/recording</td><td>Yes</td></tr><tr><td>Is value applied verified and correct?</td><td>Yes</td></tr><tr><td>Is monitoring equipment calibrated?</td><td></td></tr><tr><td>Are QA/QC procedures defined and applied?</td><td></td></tr></table>	Source clearly referenced?	Yes	Description of measurement methods and procedures?	Yes	Frequency of monitoring/recording	Yes	Is value applied verified and correct?	Yes	Is monitoring equipment calibrated?		Are QA/QC procedures defined and applied?													
Source clearly referenced?	Yes																								
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Frequency of monitoring/recording	Yes																								
Is value applied verified and correct?	Yes																								
Is monitoring equipment calibrated?																									
Are QA/QC procedures defined and applied?																									
	Comment: See VR baseline parameters and 3.7																								
3.2.2.15	<p><i>V_P Vehicle project speed on affected roads</i></p> <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Description of measurement methods and procedures?</td><td>Yes</td></tr><tr><td>Frequency of monitoring/recording</td><td>Yes</td></tr><tr><td>Is value applied verified and correct?</td><td>Yes</td></tr><tr><td>Is monitoring equipment calibrated?</td><td></td></tr><tr><td>Are QA/QC procedures defined and applied?</td><td></td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Description of measurement methods and procedures?	Yes	Frequency of monitoring/recording	Yes	Is value applied verified and correct?	Yes	Is monitoring equipment calibrated?		Are QA/QC procedures defined and applied?					
Data Checklist	Yes/No/NA																								
Title in line with methodology?	Yes																								
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Frequency of monitoring/recording	Yes																								
Is value applied verified and correct?	Yes																								
Is monitoring equipment calibrated?																									
Are QA/QC procedures defined and applied?																									
	Comment: See VR baseline parameters and 3.7.																								
3.2.2.16	<p><i>BTD_{p,i} Baseline trip distance of the cluster p of surveyed passengers using mode i</i></p> <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Description of measurement methods and procedures?</td><td>Yes</td></tr><tr><td>Frequency of monitoring/recording</td><td>Yes</td></tr><tr><td>Is value applied verified and correct?</td><td>Yes</td></tr><tr><td>Is monitoring equipment calibrated?</td><td></td></tr><tr><td>Are QA/QC procedures defined and applied?</td><td></td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Description of measurement methods and procedures?	Yes	Frequency of monitoring/recording	Yes	Is value applied verified and correct?	Yes	Is monitoring equipment calibrated?		Are QA/QC procedures defined and applied?			DR I	OK	
Data Checklist	Yes/No/NA																								
Title in line with methodology?	Yes																								
Data unit correctly expressed?	Yes																								
Appropriate description of parameter?	Yes																								
Source clearly referenced?	Yes																								
Description of measurement methods and procedures?	Yes																								
Frequency of monitoring/recording	Yes																								
Is value applied verified and correct?	Yes																								
Is monitoring equipment calibrated?																									
Are QA/QC procedures defined and applied?																									
	Comment: See VR 3.5.5. and Survey																								
3.2.2.17	<p><i>IPD_{p,i} Indirect project trip distance of the cluster p of the surveyed passengers using mode i</i></p> <table><tr><td>Data Checklist</td><td>Yes/No/NA</td></tr><tr><td>Title in line with methodology?</td><td>Yes</td></tr><tr><td>Data unit correctly expressed?</td><td>Yes</td></tr><tr><td>Appropriate description of parameter?</td><td>Yes</td></tr><tr><td>Source clearly referenced?</td><td>Yes</td></tr><tr><td>Description of measurement methods and procedures?</td><td>Yes</td></tr><tr><td>Frequency of monitoring/recording</td><td>Yes</td></tr><tr><td>Is value applied verified and correct?</td><td>Yes</td></tr><tr><td>Is monitoring equipment calibrated?</td><td></td></tr><tr><td>Are QA/QC procedures defined and applied?</td><td></td></tr></table>	Data Checklist	Yes/No/NA	Title in line with methodology?	Yes	Data unit correctly expressed?	Yes	Appropriate description of parameter?	Yes	Source clearly referenced?	Yes	Description of measurement methods and procedures?	Yes	Frequency of monitoring/recording	Yes	Is value applied verified and correct?	Yes	Is monitoring equipment calibrated?		Are QA/QC procedures defined and applied?			DR I	OK	OK
Data Checklist	Yes/No/NA																								
Title in line with methodology?	Yes																								
Data unit correctly expressed?	Yes																								
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Frequency of monitoring/recording	Yes																								
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Is monitoring equipment calibrated?																									
Are QA/QC procedures defined and applied?																									

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: See VR 3.5.5. and Survey				
3.2.2.18	Is the set of monitored data and parameters complete?				OK
	Comment: Yes, complete according to ACM 0016				
3.2.3	Monitoring plan				
3.2.3.1	<i>Are the collected data archived electronically and kept for at least 2 years after the end of the last crediting period?</i>		NA		
	Comment:				
3.2.3.2					
	Comment:				
3.3	CALCULATION OF BASELINE EMISSIONS, PROJECT EMISSIONS, LEAKAGE EMISSIONS AND NET GHG EMISSION REDUCTIONS AND REMOVALS				
3.3.1	Baseline emissions				
	Is the survey conducted according to annex 4 of the methodology?		DR	CL22 OK	OK
3.3.1.1	Comment: No, because the project is not yet operational. The survey was conducted on another metroline and with only around 700 samples. CL22: There are uncertainties about the calculation and the results coming from the survey (file 55). Apparently, there are people walking more than 100km to the metro. → The CER sheet only includes plausible surveys (see sheet survey). → CL22 closed CL33: It is not clear how the check of internal consistency of the survey (using Cronbachs Alpha) will be performed. Specifically it is not clear which items will be chosen for the calculation of the sub-variances. → Explanation by PP is satisfactory, CL33 closed.				
3.3.1.2	Are the procedures to derive a sample size adequate to get the required level of precision (Annex 4)?		NA		
	Comment: Not applicable, since the new metro line is not yet operational.				
3.3.1.3	Was the baseline emission per surveyed passenger correctly calculated according to the equations in the methodology?		DR	OK	OK
	Comment: Simplified expansion factor since the number of surveyed passengers was too small.				
3.3.1.4	Were the total baseline emissions correctly calculated according to the equations in the methodology?		DR	OK	OK
	Comment: Yes				
3.3.1.5	Was the lower limit of the 95% confidence interval used to calculate the final total baseline emissions?		DR	OK	OK
	Comment: Yes				
3.3.1.6	Were the different equations of the methodology applied correctly to calculate the intermediate parameters for the final calculation of baseline emissions?		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: Yes				
3.3.1.7	Are the relevant vehicle categories chosen according to the methodology?				OK
	Comment: Yes				
3.3.1.8	Is a technology improvement factor used to take care of continuous improvement?		DR	OK	OK
	Comment: 0.99 according to ACM0016				
3.3.1.9	Are the final total baseline emissions covering the entire emissions which would have been caused by the project passengers in absence of the project from his trip origin to his trip destination?		DR	OK	OK
	Comment: Yes				
3.3.1.10	How are the different distances calculated and is the procedure reliable?		DR	OK	OK
	Comment: Survey of Metro Line 9 Seoul				
3.3.2	Project emissions				
3.3.2.1	Are the direct project emissions calculated according to the methodology?		DR	OK	OK
	Comment: Yes, but see CL28				
3.3.2.2	In case of electricity use in rail based MRTS is only the propulsion energy included in the consumption?		DR	OK	OK
	Comment: Yes for the estimation of ex-ante emissions. But see CL28				
3.3.2.3	Was the survey for determining indirect project emissions conducted according to annex 4 of the methodology?		DR	OK	OK
	Comment: Yes with a much lower sample size				
3.3.2.4	Are the procedures to derive a sample size adequate to get the required level of precision (annex 4)?		NA		
	Comment: Not yet the real survey				
3.3.2.5	Are the indirect project emissions per passenger calculated according to the methodology?		DR	OK	OK
	Comment: Yes, for the survey at existing Metro Lines in Daegu				
3.3.2.6	Were the total indirect project emissions calculated according to the methodology?		DR	OK	OK
	Comment: Yes				
3.3.2.7	Was the upper limit of the 95% confidence interval used to calculate the final total indirect project emissions?		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: Yes				
3.3.2.8	Are the final total project emissions plausible and conservative?		DR	OK	OK
	Comment: Yes for the ex-ante estimation of project emissions				
3.3.3	Leakage emissions				
3.3.3.1	Are the sources of leakage emissions complete according to the methodology?		DR	OK	OK
	Comment: Yes, but no leakage applied for <i>ex-ante</i> emission estimation				
3.3.3.2	Are leakage emissions due to change of load factors of buses and taxis calculated according to the methodology?		DR	OK	OK
	Comment: Yes				
3.3.3.3	Are load factors of buses and taxis monitored in the years 1, 4, 7 (and 10) and according to the methodology (Annex 1, 2, 3)?		DR	OK	OK
	Comment: Foreseen in monitoring manual				
3.3.3.4	Are leakage emissions due to reduced congestion and rebound effects calculated according to the methodology?		DR	OK	OK
	Comment: Yes				
3.3.3.5	Are the affected roads identified according to the methodology and clearly listed in the PDD?		DR	OK	OK
	Comment: Yes PDD table 13				
3.3.3.6	Are the vehicle speeds on the affected roads monitored annually?		DR	OK	OK
	Comment: Yes PDD B.7.1				
3.3.3.7	Are the leakage emissions due to changes in vehicle speed calculated according to the methodology?		DR	OK	OK
	Comment: Yes				
3.3.3.8	Do the visible speeds on some affected roads correspond to those encountered during the site visit?		I	OK	OK
	Comment: Paldalro Road, Myeongdeongro, DongdaegugroYongji were visited, the moving speeds of between 38 and 42 km/h seem plausible.				
3.3.4	Emission reductions				
3.3.4.1	Are emission reductions calculated according to the methodology?		DR	OK	OK
	Comment: Yes ACM 0016				
3.3.4.2	Is leakage with values < 0 excluded from the calculation of emission reductions?		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: No leakage was applied for ex-ante estimation				
3.3.4.3	Was a sensitivity analysis carried out according to the methodology (5% emission reduction)?		DR	OK	OK
	Comment: Table A11 PDD, only passenger numbers are sensitive				
3.3.4.4	Are the sensitive parameters discussed in the PDD and is it ensured that the appropriate value is correct and conservative?		DR	OK	OK
	Comment: Yes				
3.3.4.5	Are net GHG emission reductions plausible?		DR	CL5 OK	OK
	Comment: Yes, after correction of CL's.				

Protocol 4: Summary of Requests

No.:	CL 1	Reference: VVM 44: Letter of Approval
Validator request:	Letters of Approval have not yet been submitted	
Project owner response:	For both LOAs the draft validation report is required	
Validator conclusion:	LoA from Switzerland received 30/05/2012, LoA from Republic of Korea received 19/07/2012, CL 1 closed.	Date: 20/07/2012

No.:	CL 2	Reference: MoC
Validator request:	The MoC document of the project has not yet been submitted	
Project owner response:	Attached	
Validator conclusion:	The MoC document has been submitted (file 71), [71]. CL 2 is closed.	Date: 15/03/2012

No.:	CL 3	Reference: PDD A.4.1.4
Validator request:	The geographical coordinates are not written in the correct format (x,yyyy °)	
Project owner response:	Has been updated.	
Validator conclusion:	DOE agrees. CL 3 is closed	Date: 15/03/2012

No.:	CL 4	Reference: PDD A.4.3 (pre project situation)
Validator request:	There are no motorized rickshaws	
Project owner response:	Has been corrected	
Validator conclusion:	DOE agrees. CL 4 is closed	Date: 15/03/2012

No.:	CL 5	Reference: PDD A.4.3 (Figure 1)
Validator request:	It is not clear why there is only data up to 2006	
Project owner response:	The last year i.e. 2006 is based on the Daegu Action Plan published 04/2010. No newer data source is available.	
Validator conclusion:	DOE agrees. CL 5 is closed	Date: 15/03/2012

No.:	CL 6	Reference: PDD A.4.3 (pre project situation)
Validator request:	It is not clear in which dimension the modal split rates are measured (passenger-rides, passenger*km, other?)	
Project owner response:	It refers, as is common, to passenger trips. The information has been added in the figure.	
Validator conclusion:	DOE agrees. CL 6 is closed	Date: 15/03/2012

No.:	CL 7	Reference: PDD A.4.5 and B.5 Table 6
Validator request:	There is insufficient information about the nature of the financing by the city government. Is it a private or a government financing? Does it justify an loan interest rate?	
Project owner response:	<p>A.4.5. refers to public funding through ODA of an Annex I country. This is not the case as funds are from Korea. The 1st sentence in A.4.5. has been deleted as wrong.</p> <p>Daegu Metropolitan City i.e. a public body is the owner of the metro. Also cities have to pay for their money just like private entities. The usage of a loan interest rate is thus not subject to being a private or public entity. The grant of the central government worth 60% of the investment has – in accordance with the methodology – been deducted from the total investment i.e. the interest rate is only accounted for 40% of the total investment. The discount rate of 5.5% is from the Ministry of Land, Transport and Maritime Affairs. Long-term (10-year) government bond rates also had in the year 2008 (year prior investment decision and year in which financial analysis was made) an average interest rate of 5.57% This is the rate which the government has to pay to finance itself – the rate is far lower than the rate of 11.8% as included in EB 62 Annex 5 in its Appendix as default return on equity for transport projects in Korea.</p> <p>Thus it is justified to use an interest rate even if publicly financed as the government also needs to pay for its loans. The rate taken is in accordance with the long-term bond rate of the Korean government and thus also justified.</p>	
Validator conclusion:	DOE agrees. CL 7 is closed	Date: 15/03/2012

No.:	CL 8	Reference: PDD B.2 Table 2
Validator request:	There is insufficient information about how the bus system is planned to be restructured.	
Project owner response:	Some further information has been added how the process actually is made.	
Validator conclusion:	DOE agrees. CL 8 is closed	Date: 15/03/2012

No.:	CL 9	Reference: PDD B.2 Table 2
Validator request:	<p>There is insufficient information about the possible actual and future use of biofuels for buses. Specifically, it is not clear:</p> <ul style="list-style-type: none"> - whether there is actually no use of biofuels for buses - what will happen to the project if in future the use of some biofuel would become mandatory for some motorized vehicles procedures 	
Project owner response:	<p>-No biofuel is used. See confirmation letter of public transportation system File 65</p> <p>-If in the future biofuel is used this is monitored and the BEF is adjusted (see p. 10 of the methodology and p. 29 of the methodology). For clarification this has been added also section B.7.1. Parameter EF_{CO2}</p>	
Validator conclusion:	The confirmation letter has been received. By adding the monitoring of the use of biofuel to the monitoring plan a correct treatment and calculation are	Date: 15/03/2012

assured. DOE agrees. CL 9 is closed.

No.:	CL 10	Reference: PDD B.4 step 2 Alternative 1
Validator request:	There is too little evidence that the establishment of a BRT as an alternative to the project can be excluded.	
Project owner response:	More information has been added especially concerning the BRT capacity versus rail capacity.	
Validator conclusion:	DOE agrees. CL 10 is closed	Date: 15/03/2012

No.:	CL 11	Reference: PDD B.1 step 2 Alternative 2
Validator request:	There are ambiguities in the understanding of the term "other rail based systems" in the text of the PDD.	
Project owner response:	Reference to types of other rail system has been added and the title has been adjusted	
Validator conclusion:	DOE agrees. CL 11 is closed	Date: 15/03/2012

No.:	CL 12	Reference: PDD B.4 step 2 Alternative 3
Validator request:	There are ambiguities in the understanding of the investment figures. The numbers given in the PDD text seem to be in contradiction with the investment figures given in table 6 and in the financial spreadsheet (file 41)	
Project owner response:	Table 6 coincides fully with File 41 sheet "assumptions" Table 6 is in 100 million WON as explained in the title of Table 6. The text on p.23 "investment cost" is however in millions i.e. 1,097,900 which is equivalent to 10,979 x 100 million	
Validator conclusion:	DOE agrees. CL 12 is closed	Date: 15/03/2012

No.:	CL 13	Reference: PDD B.5 prior consideration
Validator request:	It is not clear whether the prior consideration form was acknowledged by the Korean DNA. There is no response document.	
Project owner response:	File 33 is the confirmation letter. The DOE can at any time get through a phone interview with the DNA of Corea get a confirmation of the authenticity of this letter.	
Validator conclusion:	DOE agrees. CL 13 is closed	Date: 15/03/2012

No.:	CL 14	Reference: PDD B.5 Table 6 and finance details, File 43
Validator request:	There is intransparent information about the calculation of the operational cost (staff, energy, maintenance and administrative cost). The figures can not be reproduced from primary data.	
Project owner response:	See details File 69	
Validator conclusion:	The calculation has become transparent. DOE agrees. CL14 is closed	Date: 15/03/2012

No.:	CL 15	Reference: PDD B.5 Table 6 and finance details, File 43
Validator request:	There is intransparent information about the calculation of the revenues (fare box, other income). The figures can not be reproduced from primary data.	
Project owner response:	<p>Revenue is based on fare box and non-fare-box revenue.</p> <p>Non-fare box revenue is estimated as 10% of fare-box revenue.</p> <p>Fare box revenue is based on passenger numbers * average fare. The passenger numbers are based on demand projections based on traffic studies. The average fare is calculated based on the population share per group of passengers (infants, children, students, adults, seniors) which all have their discount rates on the full fare. This results in average fare of 800 Won per passenger.</p> <p>See for details file 66 plus amendments in the PDD.</p>	
Validator conclusion:	The calculation has become transparent. DOE agrees. CL15 is closed	Date: 15/03/2012

No.:	CL 16	Reference: PDD B.5 Table 6 and finance details, File 43
Validator request:	There is insufficient information about the choice of the ticket prices. It is specifically not clear why the price should remain constant over the entire period.	
Project owner response:	<p>The NPV is calculated based on constant WONs. Therefore inflation is not included in any revenue, investment or cost estimate.</p> <p>The full fare rate of 1100 Won used corresponds to the metro Daegu fare charged 2009 (idem to the current fare rate if not paying cash (cash is 1,200 Won))</p>	
Validator conclusion:	<p>Concerning inflation the question is answered correctly. Still one could - regardless of inflation - ask whether it would be possible to rise the ticket prices if the metro is not profitable. However, rising prices of public transport is politically difficult and the price elasticity would partially destroy the effect of higher revenues.</p> <p>Information is sufficient now. DOE agrees. CL 16 is closed.</p>	Date: 15/03/2012

No.:	CL 17	Reference: PDD B.5 Table 6
Validator request:	There is insufficient information about the choice of the discount rate (5.5%). The referred OECD website shows only figures down to the year 2009 (5.17%).	
Project owner response:	As table 6 points out the discount rate is based on the Ministry of Land, Transport and Maritime Affairs, 2008, Chapter 4, assumptions (File 24b). Long-term (10-year) government bond rates also had in the year 2008 (year prior investment decision	

and year in which financial analysis was made) an average interest rate of 5.57%. This data is based on OECD.

The date of investment decision is 22/05/2009 (File 42) All the input values used in the investment analysis need to be applicable at the time of investment decision (see EB GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS, point 6). Therefore the OECD rate used to ascertain and make plausible the benchmark rate MUST be prior 22.5.2009. Therefore the annual rate of 2008 was taken which is 5.57% (File 51). This is slightly higher than the benchmark rate of 5.5% which shows its plausibility and conservativeness. To take the value of 2009, 2010 or 2011 would not be correct as these rates are AFTER decision taking (File 51 for information purpose by the way show the rate until Q2 2011, see Row 25)

Validator conclusion:	DOE agrees. CL 17 is closed	Date:	15/03/2012
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No.:	CL 18	Reference:	PDD B.5 Table 10
Validator request:	It is not clear whether some of the Metropolitan Areas having a Metro have constructed their Metro(s) including the CDM.		
Project owner response:	No, only VCS has been used to the moment. The information has been added to the PDD.		
Validator conclusion:	DOE agrees. CL 18 is closed	Date:	15/03/2012

No.:	CL 19	Reference:	PDD B.6.2 page 44
Validator request:	It is not clear, why the value for the TDL (1.67%) was chosen just only from 1 year (and not 3 years as the grid emission factor).		
Project owner response:	The grid emission factor is based on how to calculate the CM which is based on a 3-year average of the OM (not the BM). This is irrelevant for TDL. TDL is based on the most recent available year. This is in accordance with the EB Tool to calculate baseline, project and/or leakage emissions from electricity consumption section "Data and Parameters Monitored" which also states annual data (annual monitoring)		
Validator conclusion:	DOE agrees. CL 19 is closed	Date:	15/03/2012

No.:	CL 20	Reference:	PDD B.6.2 page 44
Validator request:	There is insufficient information about the ex-ante measured values of V_B . There is no document referenced.		
Project owner response:	Table 14 has the baseline speed. This corresponds to File 59a which has the average speed and the average moving speed at road intersections. V_B is also listed as parameter under B.6.2. The file source has been added there		
Validator conclusion:	DOE agrees. CL 20 is closed	Date:	15/03/2012

No.:	CL 21	Reference:	PDD B.6.3 and File 13a
Validator request:	It is not clear, how the electricity consumption of the project was ex-ante estimated.		
Project owner response:	Electricity consumption is based on running distance of train per day (train-car-km) and the electricity consumption per car-km. For details see File 13 c Row 194-248		
Validator conclusion:	DOE agrees. CL 21 is closed	Date:	15/03/2012

No.:	CL 22	Reference: PDD B.6.3 and File 55
Validator request:	<p>There are uncertainties about the calculation and the results coming from the survey (File 55). Apparently, there are people walking more than 100km to the metro. Please send the following samples out of the survey with a respective translation pattern to the DOE:</p> <p>19, 48, 104, 120, 125, 148, 205, 207, 209, 221, 249, 306, 322, 350, 385, 407, 423, 451, 467, 492, 508, 510, 524, 552, 552, 609, 653, 653, 710, 754</p>	
Project owner response:	<p>The CER sheet only includes plausible surveys (see sheet survey). The required IDs have been sent to the DOE.</p> <p>See files "survey corean and english" and "survey ID" plus "survey ID 653"</p>	
Validator conclusion:	DOE agrees. CL 22 is closed	Date: 15/03/2012

No.:	CL 23	Reference: PDD B.6.3 and File 55
Validator request:	<p>It is not clear how the results of the survey were calculated from the data obtained in the interviews. There is no algorithm / TOR given and there are no samples to reproduce partially the results.</p>	
Project owner response:	<p>This is in the CER sheet "survey". The calculations are based on following steps:</p> <ol style="list-style-type: none"> 1. Determine for each passenger surveyed the baseline and the project emissions based on mode used, the distance driven on this mode and the EF of this mode for the initial year. This corresponds to the equation 2 baseline and the equation 11 for project emissions. 2. The average of the baseline and the project emission factor is taken. The average is based on the simple average of the interviews assuming an uniform expansion factor of 1 for all passengers. 3. The average value is then multiplied with the number of projected passengers of the metro. <p>This simplified approach (not using FEX respectively assuming unifmr FEX of 1) is justified based on the fact that this is only a survey for projection purposes which is made on another metro line of Daegu due to the fact that the project line is not yet operational. The survey is thus also executed at a much smaller number (800 units) than the actual monitoring survey of around 8,000 units. The survey is a gross projection based on extrapolating the survey results of metro line 2 to metro line 3. Actual results will vary as users of the project metro line will have different origins and destinations and might also use other modes. However it is the best possible approximation for projection purposes given the fact that the project metro line is not yet operational.</p>	
Validator conclusion:	The calculation can be reproduced now. DOE agrees. CL 23 is closed	Date: 15/03/2012

No.:	CL 24	Reference: PDD B.7.1 page 53
Validator request:	<p>It is not clear, how it will be assured that the measurements of NIZ, V_B and OC will always be done in the same way. DOE did not get any TOR's.</p>	
Project owner re-	V _B is based on moving and average speed. File 59a contains the points of measure-	

sponse:	<p>ment. Therefore the method of measuring is irrelevant. If an 3rd party source such as in the baseline continues to publish speed data latter will be used.</p> <p>OC: The methodology has in its annexes TORs. This is referenced in B.7.1. where we have OC_{B,T}.</p> <p>NIZ needs no TORs but requires to fix locations. This is done. The baseline study which has now been referenced clearly in this parameter in B.7.1. has the sites and locations and times when the vehicle counting is done (File 59b and c)</p>	
Validator conclusion:	DOE agrees. CL 24 is closed	Date: 15/03/2012

No.:	CL 25	Reference: PDD B.7.1 several parameters
Validator request:	The source of data / responsibility is not always clear. There are inconsistencies between the PDD and the monitoring manual and there are inexistent names of organizations.	
Project owner response:	Inconsistencies have been eliminated. See changes PDD B.7.1. and MM vs 1.1.	
Validator conclusion:	DOE agrees. CL 25 is closed	Date: 15/03/2012

No.:	CL 26	Reference: PDD B.7.1 page 50
Validator request:	The description of the parameter Nx,CT is inconsistent with the monitoring manual (number of cars or % of types?).	
Project owner response:	MM has been updated	
Validator conclusion:	DOE agrees. CL 26 is closed	Date: 15/03/2012

No.:	CL 27	Reference: PDD B.7.1 page 51
Validator request:	It is not clear whether the electricity meters will be calibrated by an officially accredited organization.	
Project owner response:	According to government regulations the electricity meters (depending on the type) are calibrated every 7-10 years. This is for total electricity consumption. The electricity meters are from KEPCO and managed by KEPCO and not the metro. Therefore the metro i.e. the PP does not calibrate the meters because it does not have the competence to do this. The PDD has been amended. See also File 67 and 68.	
Validator conclusion:	DOE agrees. CL 27 is closed	Date: 29/03/2012

No.:	CL 28	Reference: PDD B.7.1 page 51
Validator request:	It is not clear how the electricity consumed will really be measured. There are measurements at the substations (22.9 kV) which can be checked with the bills. The electricity consumption of the traction, however, is measured at 1500 V DC. In between there are other consumptions and losses.	
Project owner response:	See details in File 68. The PDD has been amended in Section B.7.2.	
Validator conclusion:	<p>The electricity is measured by the inbuilt Watt-Hour-Meter in the rectifier at the level of 1500 V DC. This is correct according to the approved methodology which states that only traction energy should be taken.</p> <p>However, PDD B.7.1. and the Monitoring Manual say that the electricity measurement is controlled with the electricity invoices from KEPCO. This is misleading since the</p>	

	electricity invoices are based on measurements of an other electricity meter which operates at the level of 22.9 kV AC. It is not yet clear (in the PDD and in the Monitoring manual) that the figure for the electricity consumption will really be taken from the 1500 V DC measurement and that the invoice will only serve as a plausibility check.	Date:	28/04/2012
Project owner response:	The monitoring data used is the traction energy electricity meter. The invoice from KEPCO will only be used for plausibility and will show higher readings than the value used. Differences of readings however must be in an explicable range. The PDD and the MM have been amended.	Date:	01/05/2012
	Explanation is satisfactory, CL 28 closed	Date:	05/05/2012

No.:	CL 29	Reference:	PDD B.7.2 and monitoring manual
Validator request:	The responsibilities for the monitoring given in the monitoring manual are not clear. Daegu Urban Railroad Construction HQ and Daegu Metropolitan Transit Corporation are not clearly addressed / mixed up in the organigram.		
Project owner response:	The MM has been adapted and is now consistent with the PDD Annex 4. The PP is Daegu Metropolitan City Urban Railroad Construction HQ. Therefore even if the metro is operated and therefore also various data parameters such as passenger and electricity consumption are delivered by Daegu Metropolitan Transit Corporation latter is not included in the MM or the PDD except as data source because it has no direct contractual CDM responsibilities.		
Validator conclusion:	DOE agrees. CL 17 is closed	Date:	29/03/2012

No.:	CL 30	Reference:	PDD C.2.1.1
Validator request:	The starting date of the first crediting period is ambiguous. The financial calculation file uses october 2014 whereas the PDD gives january 2015		
Project owner response:	This is correct. However the financial calculation is based on information of early 2009. The starting date of 01/2015 is an estimation as of today based on possible delays as well as trial operations prior full operation. Therefore the PP has put as starting date of the 1 st crediting period 01/2015. This date may still change based on actual construction time required and can, based on UNFCCC regulations, also be changed ex-post registration by the PP.		
Validator conclusion:	Explanation is satisfying. CL 30 closed	Date:	29/03/2012

No.:	CL 31	Reference:	PDD D.2
Validator request:	It is not clear whether the project complies with all legal requirements. There is insufficient information about the requirements stated and about official approval that these requirements are met.		
Project owner response:	See all approvals in File 64. The PDD has been amended in Section D2		
Validator conclusion:	DOE agrees. CL 31 is closed	Date:	29/03/2012

No.:	CL 32	Reference: PDD E.2 and E.3
Validator request:	There is insufficient information about what were stakeholders comments / questions / proposals and what was the corresponding action taken by the project management.	
Project owner response:	All questions raised by the stakeholders are included in the report see file 58 sheet "meeting result". See also the original report attached as File 58b. The issues raised have been summarized in the PDD. We cannot invent additional requests and questions if the stakeholder did not make more questions.	
Validator conclusion:	DOE agrees. CL 32 is closed	Date: 29/03/2012

No.:	CL 33	Reference: PDD B.7.1 and Annex 4 and monitoring manual
Validator request:	It is not clear how the check of internal consistency of the survey (using Cronbachs Alpha) will be performed. Specifically it is not clear which items will be chosen for the calculation of the sub-variances.	
Project owner response:	Cronbach is used to test the consistency of results between the 2 measurements in different times as proxy regarding the internal consistency of the survey. The consistency is checked within the same unit of analysis which corresponds to the metro station. The average emissions per metro station are checked between the 2 surveys. If the emission levels of the same station between the two measurements are highly correlated this implies the correlation and consistency of the main items of the survey with latter being modes of transit and distance per mode.	
Validator conclusion:	Explanation satisfactory. DOE agrees. CL 33 is closed	Date: 29/03/2012

No.:	CL 34	Reference: PDD and monitoring manual
Validator request:	The project title is not identical throughout all documents, there seems to be a printing error in the title, " Daegu Metro 3 th Urban Railroad" should read "Daegu Metro 3 rd Urban Railroad"	
Project owner response:	Daegu Metro 3 th Urban Railroad is the title used in the prior consideration form and must thus be used in the PDD. We have not found inconsistencies in this title in the PDD	
Validator conclusion:	DOE agrees. CL 34 is closed	Date: 29/03/2012

No.:	CL 35	Reference: PDD A 4.1.4
Validator request:	The common practice analysis is not yet clear since the expression LUZ (larger urban zone) according to the methodology exists only in Europe. It should therefore be defined or transferred to the situation in the Republic of Korea.	
Project owner response:	Common practice analysis has been made clearer by assessing relation LUZ to common city population definition based on European cities and transferring that relation to Korean cities.	
Validator conclusion:	According to the local expert the name of Jeonbuk (name of province) should be changed in Jeonju (name of city)	Date: 20/06/2012
Project owner response:	Jeonju is been taken. The PDD has been adapted. See Files 26a and 26b for more details.	
Validator conclusion:	PDD was adapted, OK	Date: 26/06/2012

No.:	CAR 1	Reference:	PDD B.5 Table 8 and financial spreadsheet, File 41
Validator request:	The financial calculation shall be corrected in order to show really 30 years. Actually it shows 30 years plus some months because the year 2044 is fully accounted.		
Project owner response:	Has been corrected to include only 9 months 2044. The numbers in the PDD and the spreadsheet have been adjusted		
Validator conclusion:	DOE agrees. CAR 1 is closed	Date:	29/03/2012

No.:	CAR 2	Reference:	PDD B.5 Table 8 and financial spreadsheet, File 41
Validator request:	The financial calculation shall be corrected in order to have consistency between the number of passengers chosen and the calculation of the NPW including CER income. Actually, CER income is taken from 100% passengers whereas cost and revenues are based on 30% passengers.		
Project owner response:	<p>Ex-ante emission reductions have been calculated based on the passenger projections made in the FSR. For ER calculation the methodology does not preview a risk adjustment factor and it would not be correct to adjust them as no such provision is made in the chapters of baseline as well as project emission calculations. The risk provision made is not only on passenger numbers but also on revenues and costs i.e. financial figures.</p> <p>ERs are however not linked directly with financial figures as ERs are due to electricity usage in the project case plus indirect project emissions. No direct relationship between electricity usage and passenger numbers could be made and the methodology has no provision for that.</p> <p>ACM0016 has for the additionality part the provision to allow for a risk calculation based on previous experience related to finance. This provision is however not part of ER calculations of the methodology. The CER numbers calculated in the ER however need to be consistent with the ones used in the potential impact of CDM. If we take other numbers this would be arbitrary and not supported by the ER calculations following the approved methodology. Therefore the finance calculation is based on the CER numbers as presented in the PDD without adjustment.</p>		
Validator conclusion:	Explanation is satisfying, CAR2 closed	Date:	29/03/2012

No.:	FAR 1	Reference: PDD B.6.2 / B.7.1 and monitoring plan
Validator request:	Before the start of the metro the parameters $OC_{B,T}$, $NIZ_{C,T}$ and V_P have to be measured with a survey performed in accordance with the TOR in order to have their reliable values for the comparison with the later surveys.	
Project owner response:	No. OC, NIZ and VB are, in accordance with the methodology, parameters available prior validation and therefore in B.6.2. They are thereafter monitored to determine leakage once the project is operational as listed in B.7.1. Baseline factors will however NOT be determined a 2 nd time prior project start.	
Validator conclusion:	There was a misunderstanding concerning the role of these 3 parameters. DOE agrees. FAR 1 is closed	Date: 29/03/2012