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CDM Final Validation Report

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Audit/Assessment:

CDM Validation

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Incheon Metro Line 2

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UNFCCC Methodology:

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UNFCCC Scale:

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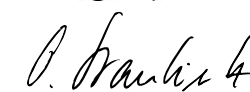
Signature



Reviewer:

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12/11/2012



Executive board:

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12/11/2012

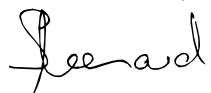


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1 Introduction

1.1 Objective

Grütter Consulting has retained SQS to validate the Incheon Metro Line 2 (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 is given in the validation protocol (Appendix F).

1.3 Project description

The objective of the project is to establish and operate an efficient, safe, rapid, convenient, comfortable and effective modern mass transit system with high ridership capacity. The 29 km east-west Line 2 will run mainly underground from Oryu-dong in Seo-gu to Incheon Grand Park in Namdong-gu, with 27 stations. Interchanges will be provided with the Arex airport express and with Seoul Metro Line 1. The Seoul National Capital Area (SNCA) is taken as project area.

The Mass Rapid Transit System (MRTS) proposed is basically a metro of medium capacity with up to around 30 000 passengers per hour and direction expecting to transport in the first operational year around 84 million passengers. The project is the 2nd MRTS line in Incheon, Line 1 started construction in July 1993 and was operational by October 1999.

The owner of the system is the Incheon Metropolitan City and will be constructed by the Incheon Urban Railroad Construction Headquarters (IURCH), which is specialized in the construction of rail systems in Incheon in accordance with the Urban Railway Act.

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 2 plus emissions caused by passenger trips to and from the metro Line 2. 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 GHG 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 estimated emission reductions of 48 064 t CO₂ per year are achieved by passengers using the metro instead of buses, cars, etc, thus reducing GHG emissions of the conventional transportation means.

The project starting date was 09/06/2009, the first seven-year-period starts 01/01/2015.

The project location is Republic of Korea, Region of Incheon, Incheon city, with geographical coordinates of Latitude 37.53 and Longitude 126.67.

The geographical boundary of the project is the Seoul National Capital Area (SNCA). The SNCA is technically distinct from the Seoul Metropolitan Area (SMA), as the former is a fixed entity, while the latter refers to places currently considered under the economic, industrial and cultural influence of Seoul. This corresponds to the Eurostat, the European Union's statistical agency, concept of Larger Urban Zone (LUZ) with a concept known as the "functional urban region." Incheon forms part of SNCA. . Gases include CO₂ and CH₄.

The Project participants (PPs) are:

- Incheon Urban Railroad Construction Headquarters (Republic of Korea);
- South Pacific Inc. (Republic of Korea);
- Grütter Consulting AG (Switzerland).

1.4 Validation methodology

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

- a) 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.
- b) 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.
- c) Reference to available information relating to projects or technologies similar to the proposed CDM project activity under validation.
- d) 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 PPs 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 PP shall respond to all requests with sufficient evidence.

The DOE shall resolve or "close out" CARs and CLs only if the PPs 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 organises, 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 tables, as described below.

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

CDM Validation Protocol 1 - 3: Requirements	
Protocol 1: General CDM Requirements	
Protocol 2: Specific validation activities	
Protocol 3: Methodological 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 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>PP response</i>	The responses given by the PPs 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.

The review of the PDD, the additional information gathered during the subsequent on-site inspection and the satisfaction of corrective actions and clarification requests have 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 Version 1.2 as of 21/06/2012 [4], 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 GHG emissions that are real, measurable, additional 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 336 450 tonnes CO₂e over the entire crediting period of 7 years or 48 064 tCO₂e per year. 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' opinion that the project „Incheon Metro Line 2“, as described in the PDD Version 1.2 of 21/06/2012 [4], meets all relevant requirements and criteria listed in Appendix F. The selected CDM methodology ACM0016 Version 2.0 is applicable for the proposed CDM project activity and is correctly applied. 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 using 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 02 – 03/02/2012, and a thorough analysis of the raised CL/CAR (35 CL), where all of them could be closed. 1 FAR was raised and has already been closed after reviewing the PP's answer to the request. See details in Appendix F.

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 48 064 tCO₂ per year and 336 450 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.

The emission reduction in the first PDD (Version 1.0 of 25/10/2011) was about 25% higher; the reduction is mainly due to a mistake in the emission factor for rail in the appropriate file (see later 3.5.5).

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

It is SQS' opinion that the project „Incheon Metro Line 2“, as described in the PDD Version 1.2 of 21/06/2012 [4], 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

Both parties, the Republic of Korea and Switzerland have ratified the Kyoto Protocol on 08/11/2002 and 09/07/2003, respectively (verified on the UNFCCC internet site).

A Letter of Approval (LoA) was requested (CL1) and issued by the host country's DNA (Republic of Korea) on 18/07/2012 [101], it has been submitted to SQS by the PP Gruetter Consulting AG. The 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 „Incheon Metro Line 2“

SQS confirms that the letter refers precisely to the proposed CDM project activity title in line with the title in the PDD „Incheon Metro Line 2“. 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 LoA, dated 30/05/2012 [100]. The 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 „Incheon Metro Line 2“

Both are considered as authentic without doubts and are unconditional. SQS received these letters from the PP 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 20/07/2012.

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 PPs – see [100] and [101]. SQS confirms that the LoAs are in accordance with paragraphs 45 – 48 of the VVM version 1.2 (EB 55, Annex 1, paragraph 49).

No.:	CL 1	Reference:	VVM 44: Letter of Approval
Validator request:	LoAs 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 16/07/2012, CL 1 closed.	Date:	18/07/2012

3.2 Participation

The names of the PPs:

- “Incheon Urban Railroad Construction Headquarters (IURCH)” (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 PPs as provided in Annex I of the latest version of the PDD [76]. No entities other than those approved as PPs are included in these sections of the PDD.

The participation of “Incheon Urban Railroad Construction Headquarters (IURCH)” as well as of “South Pacific Inc.” is approved by means of the LoA of the host party. The participation of “Grütter Consulting AG” is approved by means of the LoA of Switzerland [100].

The modalities of communication were not yet available, CL 2 was raised; the document in the right form was delivered [98] and CL 2 could be closed.

By reviewing the latest version of the completed modalities of communication form (F-CDM-MOC, v01-3) signed by all PPs, SQS was able to confirm that this form is correctly completed. The names, authorized signatories and contact details of the PPs indicated in the MoC [98] are consistent with the ones in the PDD.

The names of the representative of IURCH in the PDD (Annex 1) and in the official Certificate of Unique Registration Number are not identical (CL 23), which seems to be on purpose; CL 23 could be closed.

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 [98]. Form F-CDM-MOC was used, CL 2 is closed.	Date:	12/04/2012

No.:	CL 23	Reference:	PDD Annex 1
Validator request:	The representative of IURCH according to file 16 is Mr Jung Yeungeul, in Annex 1 of the PDD however Mr Keun Cheon Lee figures as representative.		
Project owner response:	Mr Keun Cheon has been designated by the company for the CDM project. The person listed in the Annex 1 of the PDD or the MOC need not be the legal representatives of the company. The company itself designates whom it wants to list. Annex I is also identical with the MoC signed.		
Validator conclusion:	OK, some minor amendments were added in the new PDD, CL 23 closed.	Date:	12/04/2012

3.3 Project design document

The official form “PROJECT DESIGN DOCUMENT FORM (CDM-PDD) Version 03 - in effect as of: 28/07/2006” 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 90 additional files an exceptional high level of proofs for all relevant statements.

In the PDD a 3rd metro line is mentioned; CL7 asks for more information. In a footnote this information was given, but of today no detailed planning has started. CL7 could be closed.

Some minor corrections had to be made by the PP regarding the PDD (CL3, CL6, CL8, CL10, CL17, CL37)

No.:	CL 3	Reference:	PDD A 4.1.4
Validator request:	The geographical coordinates are not written in the correct format (x,yyy °) and are not repre-		

	senting the headquarter of the metro.	
Project owner response:	Has been updated.	
Validator conclusion:	Adaption OK, CL 3 closed.	Date: 12/04/2012

No.:	CL 6	Reference: PDD A 4.3 and figure 1
Validator request:	It is not clear why there is only data up to 2006. Furthermore, figure 1 does not seem to be complete and adequately labeled.	
Project owner response:	The last year i.e. 2006 is based on the metropolitan transportation authority 12/2007. This information is only collected every 4 - 5 years and no newer data source is available. The information of the label has been added in the figure.	
Validator conclusion:	Explanation is satisfying, CL 6 closed.	Date: 12/04/2012

No.:	CL 7	Reference: PDD p. 9
Validator request:	The planned 3 rd line mentioned in the PDD lacks a little more information.	
Project owner response:	Somme additional information has been added but as of today no detailed planning has started.	
Validator conclusion:	OK, the additional information was added in the footnote 12, CL 7 closed.	Date: 12/04/2012

No.:	CL 8	Reference: PDD, p. 9, map 3
Validator request:	The source for map 3 (file 44) is not clear since it could not be found.	
Project owner response:	file 44 indicates the stations and distances which were used to construct the map 3. The source of file 44 is The Ministry of Land, Transportation and Maritime Affairs. The map without stations is based on Incheon Transport Corporation.	
Validator conclusion:	OK, some explanation was added, CL 8 closed.	Date: 12/04/2012

No.:	CL 10	Reference: PDD p. 12 A 4.4
Validator request:	The years for the first crediting period (2015 - 2021) are not consistent with the different tables in Annex 3 (but see also CL 11).	
Project owner response:	The start is 01/01/2015. PDD has been corrected.	
Validator conclusion:	OK, the appropriate tables were amended, CL 10 closed.	Date: 12/04/2012

No.:	CL 17	Reference: PDD p. 26
Validator request:	There seems to be a printing error "... IEA estimates initial capital costs for underground MRTS between 60-7180 million USD/km...", should probably read ... 60-180 million USD/km ...	
Project owner response:	Has been corrected	
Validator conclusion:	Printing error, CL 17 closed.	Date: 12/04/2012

No.:	CL 37	Reference: PDD and monitoring manual
Validator request:	The project titles are not throughout the documents identical.	
Project owner response:	Should be consistent now.	
Validator conclusion:	Is consistent, CL 37 closed.	Date: 12/04/2012

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 02 - 03/02/2012 and the interviews (see on-site visit programme and interviews in Appendix A and B) have confirmed this description.

CL 9 asks about a remark in a letter regarding the bus route re-arrangement for Incheon Metro Line 2, where of "increasing intra-bus usage" is spoken. The answer given by the PP explains this statement with "occupation rate" which should be improved while the absolute number of buses and the overlapping bus lines shall be reduced. CL 9 could be closed.

No contradictory information or findings have been unveiled.

No.:	CL 9	Reference:	PDD p. 12, file 22
Validator request:	The letter in file 22 [30] speaks of "increasing intra-bus usage", which could be misinterpreted as new bus lines through the project will be created. The site visit showed however, that there must be a translation error.		
Project owner response:	No this is correct. The usage in the sense of occupation rate shall be improved while the absolute number of buses and the overlapping bus lines shall be reduced.		
Validator conclusion:	OK, the explanation is satisfying, being consistent, CL 9 closed.	Date:	12/04/2012

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 a 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. Bus routes will be changed and re-designed and ways to improve intra-bus usage will be identified.	The site visit showed that the new rail infrastructure is under construction. CL 9 and CL 12 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. 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. 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 	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 biofuels for buses, therefore CL 13 was raised. No biofuel is used, as can be seen in the confirmation letter in file 62 [89]. If in the

gas is used in the project compared to the baseline case. • 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.		future biofuel 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 underground with the exception of 3 elevated sections. No air or water-based system is planned. 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: Incheon 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 with a contribution of more than 1% 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 9	Reference:	PDD p. 12, file 22
Validator request:	The letter in file 22 speaks of "increasing intra-bus usage", which could be misinterpreted as new bus lines through the project will be created. The site visit showed however, that there must be a translation error.		
Project owner response:	No this is correct. The usage in the sense of occupation rate shall be improved while the absolute number of buses and the overlapping bus lines shall be reduced		
Validator conclusion:	OK, the explanation is satisfying, being consistent, CL 9 closed.	Date:	12/04/2012

No.:	CL 12	Reference:	PDD table A2
Validator request:	There is not enough information about bus lines which could be affected / closed with starting of the new metro.		
Project owner response:	Some additional information about the planned study have been added. As of the current stage detailed information is however not available as this will be studied in detail once the project starts operations.		
Validator conclusion:	OK, the mentioned study is planned within 6 months after the operational start, Is consistent, CL 9 closed.	Date:	12/04/2012

No.:	CL 13	Reference:	
Validator request:	There is insufficient information about the possible actual and future use of biofuels for buses.		

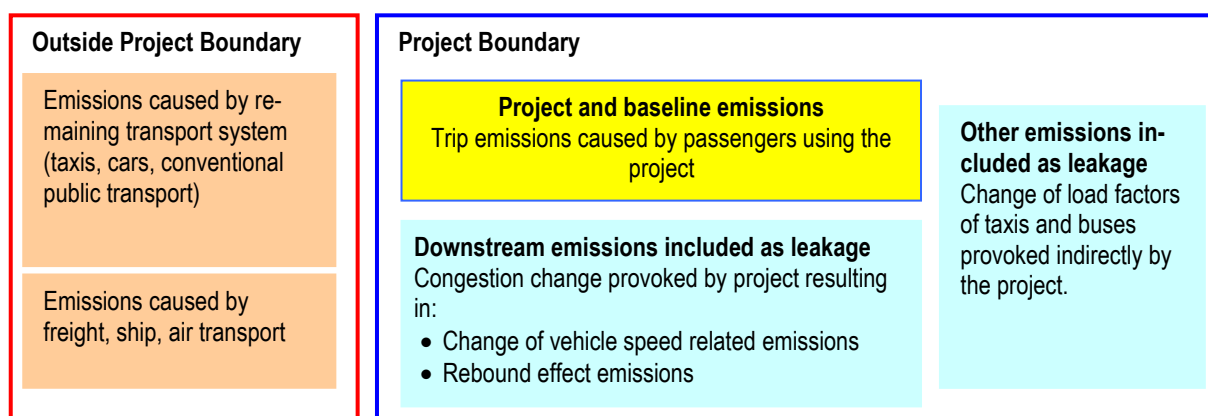
	Especially it is not clear: <ul style="list-style-type: none"> - whether there is actually no use of biofuel for buses; - what will happen to the project if in the future the use of some biofuel would become mandatory for some motorized vehicles. 	
Project owner response:	No biofuel is used. See confirmation letter of public transportation system file 62 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 in Section B.7.1. Parameter EF _{CO2} .	
Validator conclusion:	OK, clarifications have been amended and a new file 62 [89] was added, being consistent, CL 13 closed.	Date: 12/04/2012

3.5.3 Project boundary

The spatial extent of the project according to the PDD is the SNCA, which corresponds to the methodology where the "LUZ larger urban zone" is mentioned. The spatial area includes the trip origins and destinations of passengers using the MRTS project line. The origins or destinations of these trips are not only located in Incheon Metropolitan City due not least to connecting metro lines with Seoul. Therefore, the larger spatial extent of the SNCA is taken.

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"; it is thus justified to speak of a larger urban zone for the cities Seoul, Bucheon and Incheon, but it was not clear to the validators what the relationship between "larger urban zones", "Seoul Metropolitan Area SMA" and "Seoul National Capital Area SNCA" is. Therefore, CL 4 was raised. This was clarified in Chapter A4.1.4 of the PDD. The local expert agreed with the explanation, therefore CL 4 could be closed.

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



The GHG emissions include CO₂ and CH₄. N₂O and tailpipe CH₄ emissions are excluded since they contribute less than 2% to the total CO₂eq emissions; they would be reduced by the project as well, thus their omission is conservative and corresponds to the methodology.

The identified boundaries and emission sources that will be affected by the project activity are thus 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.

No.:	CL 4	Reference:	PDD A 4.1.4
Validator request:	The context between a "larger urban zone LUZ", the "capital metropolitan area" is not defined clearly enough. See also CL 18.		
Project owner response:	Has been clarified in Chapter A.4.1.4 and made consistent between chapters.		
Validator conclusion:	Adaption OK, CL 4 closed.	Date:	12/04/2012

3.5.4 Baseline identification

The baseline identification was done according to the methodology. The five following alternatives were analyzed:

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 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.

All 5 alternatives would be probably legal compliant and meet the same requirement as the proposed project activity; a clear affirmation of the legal compliance lacks in the PDD, see CL 14. This was added in the new PDD Version 1.2 [4] so CL 14 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: 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 [4]) was cross checked by SQS with the mentioned references ([47], [48], [49], <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, South 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 30 000. Furthermore, Incheon already has a metro, another metro line makes the connectivity easier than with a completely new BRT system. SQS therefore agrees with the PP that alternative 1 is not feasible.

Alternative 2, establishment of other rail-based MRTS: A light rail transit system has even lower capacities than a BRT, which is shown in "IEA Bus Systems for the Future, 2002, table 2.1" [55] and was crosschecked by SQS. Furthermore, the site visit showed that there would be probably not enough space to build a tram or monorail along the existing roads for the planned project route. 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. See however CL 14 and the explanation above.

Incheon has realised a heavy enlargement of their road infrastructure in the last few years, which could be seen from a feasibility restudy for metro Line 2 [27]. The enlargement has coped with the increase of cars and cartrips. This shows clearly that investment in road-based transit is significant thus allowing for traffic accommodation also in absence of any new MRTS without major difficulties.

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 realised in a later date without CDM: The obstacles for realising a new metro line are mainly of financial nature, which would be worse without CDM (see also 3.6.3). Waiting with the realisation of the project would also mean that inhabitants of Incheon would continue investing in private means of transport like in the past. The mentioned annual growth rate of cars in the PDD since the year 2000 of >4% could be verified ([27], 2.1 general, table 2-5), however the data are rather old; therefore CL 15 was raised. The data were available at the time of decision taking and since then no newer data are available. CL 15 could be closed.

SQS agrees with the 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 proofs are 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:

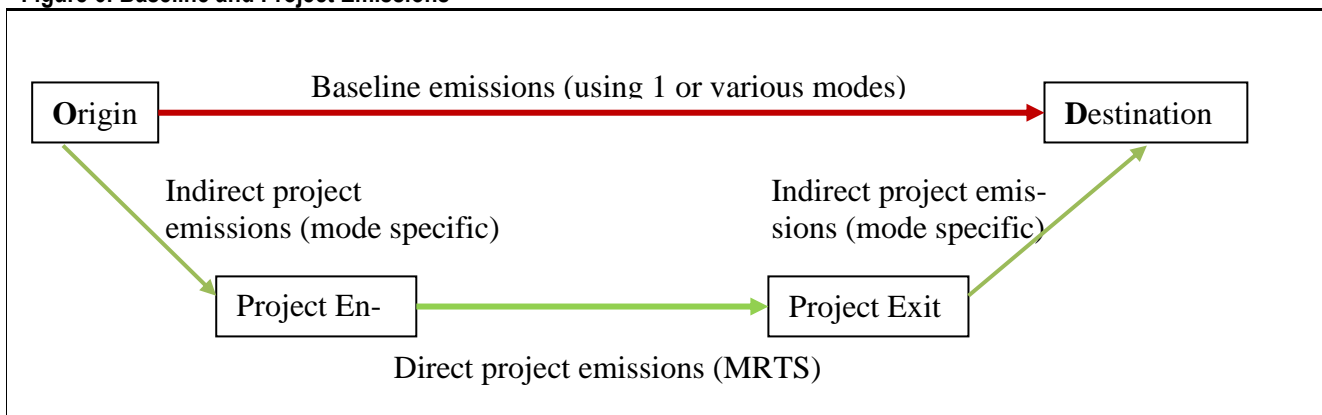
- NMT (Non-Motorized Traffic) with bikes and per foot;
- Private passenger car;
- Taxis;
- Motorcycles (two-wheelers);
- Buses;
- Existing metro network

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



CL 11 was raised, since the site visit but also documents in the PDD revealed that the end of construction will be late 2014; so the first crediting period cannot start already in the beginning of 2014. The PDD was amended and the crediting period starts now on 01/01/2015.

No.:	CL 11	Reference:	PDD Annex 3
Validator request:	The end date of construction is mentioned as 18/11/2014. Why is the first crediting period already starting at the beginning of 2014?		
Project owner response:	Crediting period start is 01/01/2015		
Validator conclusion:	Tables with starting date 01/01/2015, OK, CL 11 closed.	Date:	12/04/2012

No.:	CL 14	Reference:	PDD p. 16
Validator request:	It is not clear from the PDD if all options are consistent with laws and regulations		
Project owner response:	The PDD has been amended.		
Validator conclusion:	OK, the sentence was added on page 17 of the new version of the PDD, CL 14 closed.	Date:	12/04/2012

No.:	CL 15	Reference:	PDD p. 19 and file 20
Validator request:	The proof for increasing traffic with private cars (file 20) is rather old; are there no newer data available?		
Project owner response:	This is based on the assessment of scenarios and options in the FSR for the metro. It is thus appropriate in fact to use the data available as of time of decision taking. Comparable studies of speed and vehicle growth have not been made since 2006 (date of study mentioned). Also it is not believed that such figures will revert in short time.		
Validator conclusion:	OK, explanation is plausible and no other data available, CL 15 closed.	Date:	12/04/2012

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 PDD; 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

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

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

Where:

BE_y Baseline emissions in the year y (g CO₂)

$BE_{p,y}$ Baseline 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

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

Where:

$BE_{p,y}$ Baseline emissions per surveyed passenger p in the year y (g CO₂)
 $BTD_{p,i,y}$ 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 CO₂/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 (gCO₂/PKM)
 $TE_{EL,i,y}$ Total emissions from suburban rail / metro for year y (tCO₂)
 $P_{EL,i,y}$ 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 (tCO₂)
 $EC_{BL,i,y}$ 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 (gCO₂/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 CO₂/PKM)
 $EF_{KM,i}$ Emission factor per kilometre of vehicle category i in the year y (g CO₂/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 CO₂/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 CO₂/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

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

Where:

- EF_{KM,i,y} Emission factor per kilometre of vehicle category *i* in the year *y* (g CO₂/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 CO₂/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

SQS has re-calculated the baseline emissions from the buses and has found that the calculation performed in the PDD is mathematically identical with the calculation given in the approved methodology. This can be seen by the following considerations:

$$EF_{PKM,i,y} = \frac{EF_{KM,i,y}}{OC_i} \quad (\text{formula 4 of methodology})$$

$$OC_B = \frac{PBL_B \cdot TDBL_{P,B}}{DD_B} \quad (\text{formula 5 of methodology})$$

$$EF_{KM,i,y} = (IR_i)^{t+y} \cdot \frac{\sum_x (SFC_{i,x} \cdot NCV_{x,y} \cdot EF_{CO2,x,y} \cdot N_{x,i})}{N_i} \quad (\text{formula 7 of methodology})$$

Formula 6 is not used

In the spreadsheet the calculation for $EF_{KM,B}$ is mathematically identical to the methodology.

The calculation in the spreadsheet for EF_{KM} for buses is as follows (year 2015 taken as example) (see "Baseline Emission Factor" box B108)

$$EF_{KM,B,2015} = (FC_D \times SW_D \times NCV_D \times EF_{CO2,D} + FC_{CNG} \times SW_{CNG} \times NCV_{CNG} \times EF_{CO2,CNG} + EF_{CH4,CNG} \times DD_{B,CNG}) / (DD_{B,D} + DD_{B,CNG}) \times (IR_B)^{t+y}$$

SW is the specific weight of each fuel. This needs to be included as diesel is expressed in litres and CNG in m³ whilst the NCV in MJ/kg.

$EF_{CH4,CNG}$ multiplied with DD_{CNG} buses is required as the CH₄ emissions need to be included for CNG units based on Table 1 of the methodology. IPCC expresses CNG emissions of buses in terms of CH₄ / km and therefore this addition needs to be made to the formula.

SFC as specific consumption is idem to total fuel / total distance i.e. FC/DD. The methodology has the formulae based on SFC as in many cases total fuel and total distance are not known and therefore the SFC is determined based on samples. In the case of Incheon however, we know the total fuel consumed by the diesel and the CNG buses. The total fuel consumed by diesel buses is multiplied with NCV and EF and thus gives us the total CO₂ emissions of diesel buses. The same is valid for CNG units. Thus we have the total emissions of all buses (CBNG plus diesel) which is then divided by the total distance driven of all buses (CNG plus diesel) resulting in the EF per km of buses. See also formula (8) of the methodology which has the same procedure if various bus sizes are used. The number of vehicles per fuel type is not required as the total distance is idem to distance per unit multiplied with the number of units.

Furthermore, in the spreadsheet the calculation for $EF_{PKM,B}$ is mathematically identical with the methodology. The calculation in the spreadsheet for EF_{PKM} for buses is as follows (year 2015 taken as example) (see "Baseline Emission Factor" box B117)

$$EF_{PKM,B,2015} = \frac{(FC_D \times SW_D \times NCV_D \times EF_{CO2,D} + FC_{CNG} \times SW_{CNG} \times NCV_{CNG} \times EF_{CO2,CNG} + EF_{CH4,CNG} \times DD_{B,CNG})}{DD_B} / \frac{PBL_B \times TDBL_B}{DD_B} \times (IR_B)^{t+y}$$

The first part of the formula is again the EFKM and the second part is OCB (formula 5 of the methodology). DDB (idem to sum of distance driven diesel plus distance driven CNG buses) eliminates itself mathematically as it is in the counter and the denominator.

Therefore, both formulae are idem to the methodology.

The following parameters were used for the calculations and were validated by checking thoroughly the mentioned source and by comparing the different parameters with at least two other CDM-metro-projects (Daegu Metro 3th Urban Railroad, Busan Metro Line 1 Dadae) and where appropriate also with Seoul metro Line 9 (result 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 3)	[8]
Value applied:	Cars gasoline: 58.46	Checked with [8]

	Cars diesel: 62.60 Cars LPG: 55.91	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: 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: $7.9 \text{ (l/100km)} / 100 * 0.741 \text{ (kg/l)} * 1\,000 = 58.46 \text{ g/km}$ Diesel: $7.4 \text{ (l/100km)} / 100 * 0.844 \text{ (kg/l)} * 1\,000 = 62.60 \text{ g/km}$ LPG: $10.7 \text{ (l/100km)} / 100 * 0.522 \text{ (kg/l)} * 1\,000 = 55.91 \text{ g/km}$	Correct, data crosschecked with specific weights from literature.

Data / Parameter:	Nc,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:	Seoul Metropolitan City, Vehicle Management System, 2011 (file 4)	According to methodology, [10]
Value applied:	Gasoline: 1 668 951 (69%) Diesel: 446 438 (18%) LPG: 313 526 (13%)	Checked with [10], Registration Status by Fuel, Type and Usage, table "results" OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official registration statistics Additionally 418 CNG units (<0.1%)	[10], total of 2 433 798 vehicles 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:	Korea Energy Economic Institute, Energy Consumption Survey, Table 1-2-2, 2009 (weighted average private and corporate taxis) (file 1)	According to methodology, [6]
Value applied:	91.43	With [6] checked (see below), OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistic Private and corporate taxis exist. These are however not two different modes of transit. Data is however collected separately for the two types due to different ownership structure. The average value calculated is based on total fuel and total distance of the two types: Fuel consumed (in tsd liters): $83\,851.2 + 100\,637.7 = 184\,488.9$ Distance driven (in tsd km): $456\,076 + 597\,605 = 1\,053\,681$ I. $SFC \text{ in l/100km} = 184\,488.9 / 1\,053\,681 * 100 = 17.5 \text{ l/100km}$	[6] general taxis: 5.94 km/l and 597 605 000 km/y personal taxis: 5.44 km/l and 456 076 000 km/y → 5.72 km/l = 17.5 l/100km
Any comment:	To transform from litres to grams the specific weight of LPG was taken based on IEA 2005, table A.3.8	Correct, data crosschecked with specific weights from lit-

	Calculation: LPG: $17.5 \text{ (l/100km)} / 100 * 0.522 \text{ (kg/l)} * 1\,000 = 91.43 \text{ g/km}$	erature. OK
--	--	-------------

Data / Parameter:	N _{T,LPG}	Means of Validation
Data unit:	Vehicles	
Description:	Number of taxis using LPG	
Source of data used:	Korea Energy Economic Institute, Energy Consumption Survey, Table 1-2-2, 2009 (weighted average private and corporate taxis) (file 1)	According to methodology, [6]
Value applied:	13 782 (100%)	Checked with [6] 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)	Private and general taxis
Any comment:	This data is monitored annually. Percentages and not absolute figures are required for calculations.	

Data / Parameter:	SFC _M	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of motorcycles (gasoline)	
Source of data used:	Korea Energy Economics Institute page 407, 423, 2009 ¹ (file 61)	CL 5, PDD and CER sheet amended, according to methodology, [88]
Value applied:	37.64	Checked with [88] → 19.68 km/l
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 gasoline was taken based on IEA, 2005, table A.3.8 Calculation: $5.1 \text{ (l/100km)} / 100 * 0.741 \text{ (kg/l)} * 1\,000 = 37.64 \text{ g/km}$	Correct, data crosschecked with specific weights from literature.

Data / Parameter:	N _{M,G}	Means of Validation
Data unit:	Vehicles	
Description:	Number of motorcycles using gasoline	
Source of data used:	Incheon Metropolitan City, Edition 2010 "Incheon Statistical Yearbook", 2011 (file 17)	[24]
Value applied:	56 921 (100%)	Checked with [24], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official registration statistics file 61, Korea Energy Economics Institute page 423 shows that all are gasoline	Checked with [88], OK
Any comment:	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:	Incheon Metropolitan City, 2011 (file 6)	[12] data is not elder than 3 years

¹ There is a typing error in the PDD, it should read 2009 instead of 2000; the value and the reference in the PDD are however correct

Value applied:	327.22	Checked with [12], table 12.3 for distances and table 12.2 for fuel consumption, 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 litres to grams the specific weight of diesel was taken based on IEA 2005, table A.3.8 Calculation: $11\,537\,373 \text{ liter} / 29\,754\,636 \text{ km} * 0.844 \text{ kg/l} * 1\,000 = 327.22$	Correct, data crosschecked with specific weights from literature. Fuel consumption and distances from [12]

Data / Parameter:	SFC _{B,CNG}	Means of Validation
Data unit:	g/km	
Description:	Specific fuel consumed of CNG buses	
Source of data used:	Incheon Metropolitan City, 2011 (file 6)	[12] data is not elder than 3 years
Value applied:	338.02	Checked with [12]
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 16 g per mol. $16 \text{ g/mol} * 1\,000 \text{ l/m}^3 / 22.4 \text{ l/mol} = 714 \text{ g/m}^3$ Calculation: $100\,796\,010 \text{ m}^3 / 212\,912\,983 \text{ km} * 0.714 \text{ kg/m}^3 * 1\,000 = 338.02$	Correct, data crosschecked with specific weights from literature. Fuel consumption and distances from [12]

Data / Parameter:	N _B	Means of Validation
Data unit:	Vehicles	
Description:	Number of buses	
Source of data used:	Incheon Metropolitan City, 2011 (file 6)	[12]
Value applied:	2 484	[12] sum of licensed and reserve buses, table 12_1, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on total 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 9a/b)	[16] file 9b EF grid 2007-2009
Value applied:	0.67379	Checked with [16], 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
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 10)	file 10, [17]
Value applied:	1.67%	CL24 closed; checked with [17], 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 5)	[11]
Value applied:	1.25	[11] average of rush hour and normal for Incheon
Justification of the choice of data or description of measurement methods and procedures actually applied :	Survey of independent organisation	According to methodology
Any comment:		

Data / Parameter:	OC _T	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of taxis	
Source of data used:	Association of Incheon Metropolitan Taxi company, 2010 (file 2)	According to methodology, [7]
Value applied:	0.83	[7], calculated based on number of passengers multiplied with operating rate, OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Survey of independent organisation	According to methodology
Any comment:	Excluding driver Is monitored also for determination of leakage occupation rate.	

Data / Parameter:	OC _M	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of motorcycles	
Source of data used:	South Pacific, 2011 (file 60)	CL5, PDD and CER sheet amended; [87]
Value applied:	1.05	[87] upper confidence limit of survey 01/2011 OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on survey. Survey realised d using upper 95% confidence interval. The sample size required for a 95% confidence level and a 5% maximum error bound of a point estimation of simple random sample is 59 while the actual sample size taken was 8 864 units. Procedure followed TORs for occupation rate studies described in	Checked with [87] standard deviation is 0.2, upper 95% confidence level is conservative. OK

	methodology.	
Any comment:		

Data / Parameter:	OC _B	Means of Validation
Data unit:	Passengers	
Description:	Average occupation rate of buses	
Source of data used:	Incheon Metropolitan City, 2011 (file 6)	[12]
Value applied:	16.6 (31%)	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	According to methodology
Any comment:	<p>Is monitored also for determination of leakage occupation rate.</p> <p>Calculation:</p> <p>Passengers: 439 391 448 (Incheon Metropolitan City, 2011, file 6)</p> <p>Average trip distance: 9.2 km (Korea Transportation Safety Authority, 2011, file 7) and Incheon Metropolitan City, 2010, p.80 (average speed of 17.7km/h))</p> <p>Distance driven buses: see parameter SFC above</p> <p>Occupation = PKM / DD = 439 391 448 passengers * 9.2 km / (29 754 636 km + 212 912 983 km) = 16.6 passengers</p> <p>Occupation percentage = passengers / bus capacity = 16.6 / 54 = 26%</p> <p>Bus capacity: 54 (Incheon Metropolitan City, 2011, file 6)</p>	<p>Passengers checked with [12] OK</p> <p>Trip distance checked with [13] 9.17 OK</p> <p>Total bus distance checked with [12] OK</p> <p>→ 16.61 OK</p> <p>Bus capacity checked with [12] OK</p>

Data / Parameter:	PBL _B	Means of Validation
Data unit:	Passengers	
Description:	Passengers transported by baseline buses per year	
Source of data used:	Incheon Metropolitan City, 2011, file 6	According to methodology, [12]
Value applied:	439 391 448	Checked with [12], 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, 2011 (file 7)	According to methodology, [13]
Value applied:	9.2	Checked with [13], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on average trip time of 32 minutes and average speed of bus of 17.2 km/h	Checked with [13]
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:	Incheon Metropolitan City, 2011 (file 6)	[12]
Value applied:	242 667 619	Checked with [12], OK
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on CNG distance drive and diesel distance driven (see parameter SFC above)	Checked with [12], OK
Any comment:		

Data / Parameter:	AD _B	Means of Validation
Data unit:	Km	
Description:	Average annual distance driven of buses	
Source of data used:	Incheon Metropolitan City, 2011 (file 6)	[12]
Value applied:	97 692	Checked with [12]
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 number of units (see above)	Checked with [12] total distance DD _B and number of buses N _B : 242 667 619/2 484=97 692
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:	Incheon Metro, 2010 (file 8)	According to methodology, [14]
Value applied:	14.6	Checked with [14] table 17.3, 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:	Korea Energy Economic Institute, 1-2-2, 2009; average of private and corporate taxi (file 1)	Average of private and general taxi [6]
Value applied:	82 034	Checked with [6], 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:	Gosan Engineering Ltd., 2010 Incheon Metropolitan City Traffic Research Report, 2011 (file 42c)	[65]

Value applied:	<div>Table 15: Number of Vehicles Baseline on Affected Roads (per annum)</div> <table><tr><th>ID</th><th>Affected Road</th><th>Number of cars</th><th>Number of taxis</th></tr><tr><td>1</td><td>Seogokro (Gonchon Intersection)</td><td>18 537 120</td><td>639 000</td></tr><tr><td>2</td><td>Seodalro (Geunji Intersection)</td><td>12 265 920</td><td>2 732 400</td></tr><tr><td>3</td><td>Baekbeomrp (Sibjeong Intersection)</td><td>19 500 840</td><td>1 455 840</td></tr><tr><td>4</td><td>Guwolro (Sukchun Intersection)</td><td>18 514 440</td><td>954 000</td></tr><tr><td>5</td><td>Sooinro (Jangsoo Intersection)</td><td>44 799 840</td><td>468 000</td></tr></table>	ID	Affected Road	Number of cars	Number of taxis	1	Seogokro (Gonchon Intersection)	18 537 120	639 000	2	Seodalro (Geunji Intersection)	12 265 920	2 732 400	3	Baekbeomrp (Sibjeong Intersection)	19 500 840	1 455 840	4	Guwolro (Sukchun Intersection)	18 514 440	954 000	5	Sooinro (Jangsoo Intersection)	44 799 840	468 000	Checked with [65], OK
ID	Affected Road	Number of cars	Number of taxis																							
1	Seogokro (Gonchon Intersection)	18 537 120	639 000																							
2	Seodalro (Geunji Intersection)	12 265 920	2 732 400																							
3	Baekbeomrp (Sibjeong Intersection)	19 500 840	1 455 840																							
4	Guwolro (Sukchun Intersection)	18 514 440	954 000																							
5	Sooinro (Jangsoo Intersection)	44 799 840	468 000																							
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on full day 6AM to 22PM; for annual data multiplied with factor 360.																									
Any comment:	The same measurements will be realised d 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:	Gosan Engineering Ltd., 2010 Incheon Metropolitan City Traffic Research Report, 2011 (file 42a/b)	[63]																		
Value applied:	Table 16: Baseline Moving Speed on Affected Roads <table border="1"> <thead> <tr> <th>ID</th><th>Affected Road</th><th>Average moving speed</th></tr> </thead> <tbody> <tr> <td>1</td><td>Seogokro (Gonchon Intersection)</td><td>31 km/h</td></tr> <tr> <td>2</td><td>Seodalro (Geunji Intersection)</td><td>31 km/h</td></tr> <tr> <td>3</td><td>Baekbeomrp (Sibjeong Intersection)</td><td>35 km/h</td></tr> <tr> <td>4</td><td>Guwolro (Sukchun Intersection)</td><td>26 km/h</td></tr> <tr> <td>5</td><td>Sooiro (Jangsoo Intersection)</td><td>37 km/h</td></tr> </tbody> </table>	ID	Affected Road	Average moving speed	1	Seogokro (Gonchon Intersection)	31 km/h	2	Seodalro (Geunji Intersection)	31 km/h	3	Baekbeomrp (Sibjeong Intersection)	35 km/h	4	Guwolro (Sukchun Intersection)	26 km/h	5	Sooiro (Jangsoo Intersection)	37 km/h	Checked with [63], OK
ID	Affected Road	Average moving speed																		
1	Seogokro (Gonchon Intersection)	31 km/h																		
2	Seodalro (Geunji Intersection)	31 km/h																		
3	Baekbeomrp (Sibjeong Intersection)	35 km/h																		
4	Guwolro (Sukchun Intersection)	26 km/h																		
5	Sooiro (Jangsoo Intersection)	37 km/h																		
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on Urban Traffic Information System UTIS: The speed data collection system consists of positioning beacon, probe car, mini-base station (small size mobile base station), data collecting server and main server.																			
Any comment:	The average moving speed is measured as this is required for vehicle speed change.																			

The further data were 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 was checked with appropriate tables in IPCC 2006 and deemed 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	Data was checked with literature and deemed OK.
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	
	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	According to methodology
IR	Technology improvement factor	0.99	no unit	ACM0016	

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 [104]; 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 operating margin (OM) 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 [15], [16] and the results were compared with the data in 20120601_iges_er_sheet_gridef_EN.xls [81]; the result of 0.6738 tCO₂/MWh was thus calculated according the appropriate tools and is reasonable.

CL 5 asked about motorcycles; the answer was that there are indeed motorcycles and the appropriate parameters (emission factor for motorcycles, occupation rate for motorcycles) were added into the table. Furthermore an error in the emission factor for rails in file 11 has been detected, which lead to a correction in the CER sheet of around 25% less emission reduction. The reason was a wrong emission factor for the existing metro in the year 2015, where instead of 35 gCO₂/Pkm a value of 85 was used.

The validation team checked the calculations in the Excel file “CER sheet Incheon vs 1.1.xls” [5] 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.

PROJECT EMISSIONS

Project emissions were calculated according to the following formulas

$$PE_y = DPE_y + IPE_y$$

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

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

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 were used:

Data / Parameter:	EC _{PJ}	Means of Validation																					
Data unit:	MWh																						
Description:	Electricity consumed by project metro																						
Source of data to be used:	Incheon Metro	According to methodology																					
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	<table><tr><th colspan="7">Table 20: Traction Energy per Year in MWh</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>25 704</td><td>26 928</td><td>28 152</td><td>28 519</td><td>29 009</td><td>29 376</td><td>29 866</td></tr></table> <p>For projections based on file 13, Incheon Metro Line 2, 2010</p>	Table 20: Traction Energy per Year in MWh							2015	2016	2017	2018	2019	2020	2021	25 704	26 928	28 152	28 519	29 009	29 376	29 866	CL28, data checked with [20] OK
Table 20: Traction Energy per Year in MWh																							
2015	2016	2017	2018	2019	2020	2021																	
25 704	26 928	28 152	28 519	29 009	29 376	29 866																	
Description of measurement methods and procedures to be applied:	Traction energy only Monitoring frequency: Continuously, aggregated at least annually	See monitoring																					
QA/QC procedures to be applied:	Control with electricity invoices. The electricity metres are calibrated by the local electricity board. The electricity metres are not owned or	See monitoring																					

	managed by Incheon Metro but by KEPCO. The latter is also responsible for their periodic calibration. Electricity metres are calibrated, depending on the electricity meter type, every 7 to 15 years based on regulations of the Ministry of Knowledge Economy (file 66).	
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".	

Other parameters used for *ex-ante* calculation were checked as follows:

Parameter	Description	Value	Unit	Source	Validation
EF _{grid,CM}	Emission factor of grid	0.67379	tCO ₂ /MWh	[16]	[16] see above "Baseline emissions", OK
TDL	Average technical transmission and distribution losses for providing electricity	1.67%	percentage	[17]	CL24, answer = average over 1 year [17], see above OK
EF _{PKM,i}	Emission factor per passenger-kilometre of mode "i"	See table A4	gCO ₂ /PKM	See baseline calculation above	See baseline calculation above
IPTD _{PS,i}	Indirect project trip distance of the surveyed passenger using mode "i"	Value per passenger surveyed	km	[96]	Checked with survey [96], OK
P	Passengers transported by the project	See table A5 below	passengers	[19]	Checked with [19], get-on and transit pax., OK

Table A5. Baseline Emissions

Parameter	Unit	2015	2016	2017	2018	2019	2020	2021
Number of passengers	Passengers	84 446 765	89 694 005	94 940 515	95 449 325	95 957 770	96 466 580	96 975 025

For the estimation of emission reductions *ex-ante* the survey had to be taken from another metro line, since the new line is not yet operationable. It was taken from Seoul metro Line 9, where a VCS-project was initiated about one year ago and where a survey of around 8 000 passengers already exists. CL 22 was raised because there was not enough evidence given in the PDD why the survey for Seoul could also be used for the actual project. The answer by the PP explained, that metro Line 9 in Seoul is considered as ideal for projection purposes as in the same region, with the same type of users and therefore with similar travel patterns potentially concerning modes and trip distances. SQS agrees with this argumentation and thinks that the chosen survey gives a good approximation for the *ex-ante* calculations.

The passenger survey was validated by verifying a random sample of 93 original documents of the survey, which gave a good conformity (see CL 27). It was done by the local expert using the website "www.naver.com". The statistics as foreseen in the methodology on page 40 for the passenger survey was not done in the PDD and could therefore not be controlled. This is understandable since the survey does not correspond to the real project, which is not yet running. The survey is used just for the *ex-ante* estimation of the emission factor per passenger-kilometres and thus for the emission reductions; a detailed statistical analysis would make no sense, because the survey could not be done on the metro Line 2. Furthermore, the expansion factors were not considered as applicable since they will change with the real survey, which will be done after the start of the new metro Line 2.

It was not clear how the electricity consumption *ex-ante* of the project EC_{PJ,y} was estimated, therefore CL 28 was raised. The answer is given in the new file 65 [92,93]. It is based on an average consumption per train of 340.5 kWh; in 2014 there are 210 trains daily, 30 days per month and 12 months per year, which gives an yearly consumption of 25 704 MWh.

The average consumption per train seems reasonable, since it is based on measured values.

All calculations were controlled with the CER sheet [5], the requirements by the methodology like the adaption of the technology improvement factor or the 95% confidence level as given in the methodology were checked.

The validators controlled all formulas for baseline/project/leakage emissions and confirm that all are in accordance with the approved methodology. All data has been inserted appropriately and all calculations have been performed correctly. This was controlled by the validators through the CER spreadsheet provided by the PP which includes all parameters, all values, all formulas and performs all calculations. All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.

The sensitivity analysis is given in Annex 3, A.5 table A11: It shows that the only sensitive parameter is the number of project passengers:

Table A11: Sensitivity Analysis

Parameter	% Change required for 5% less ERs	Sensitive or Not	Comment
Project passengers	4% less passengers	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 potentially passenger numbers.
Metro electricity consumption	>10% increase	Not sensitive	
Specific fuel consumption gasoline cars	>10% lower fuel consumption	Not sensitive	
Specific fuel consumption diesel cars	> 10% lower fuel consumption	Not sensitive	
Specific fuel consumption LPG cars	> 10% lower fuel consumption	Not sensitive	
Specific fuel consumption taxis	>10% lower fuel consumption	Not sensitive	
Specific fuel consumption diesel buses	> 10% lower fuel consumption	Not sensitive	
Specific fuel consumption CNG buses	> 10% lower fuel consumption	Not sensitive	
Passengers existing metro	> 10% more passengers	Not sensitive	
Electricity consumption existing metro	> 10% less consumption	Not sensitive	
Average trip distance existing metro	> 10% longer trip	Not sensitive	
Occupation rate passenger cars	10% higher occupation rate	Not sensitive	
Occupation rate taxis	>10% higher occupation rate	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 [5] together with the survey [96]. 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 made with the same spreadsheet [5] and the survey [96] inserting the percentage change as indicated in the PDD and revising the ER outcome. Since the spreadsheet is not fully interlinked with all the mentioned parameters the survey sheet had to be modified with the appropriate changes, which led to the same results as in the PDD.

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

LEAKAGE EMISSIONS

The leakage emissions were calculated according to the following formulas:

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

Where:

- LE_y Leakage emissions in the year y (tCO₂)
- $LE_{LFB,y}$ Leakage emissions due to change of load factor buses in the year y (tCO₂)
- $LE_{LFT,y}$ Leakage emissions due to change of load factor taxis in the year y (tCO₂)
- $LE_{CON,y}$ Leakage emissions due to reduced congestion in the year y (tCO₂)
- 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 (tCO₂)
- $N_{B,y}$ 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 CO₂/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

$$LE_{LFT,y} = N_{T,y} \cdot AD_T \cdot EF_{KM,T,y} \cdot \left(1 - \frac{OC_{T,y}}{OC_T}\right) \cdot \frac{1}{1.6}$$

Where:

- $LE_{LFT,y}$ Leakage emissions due to change of load factor of taxis in the year y (tCO₂)

$N_{T,y}$ 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 CO₂/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 (tCO₂)
 $LE_{REB,y}$ Leakage emissions due to induced traffic / rebound effect in the year y (tCO₂)
 $LE_{SP,y}$ Leakage emissions due to changing vehicle speed in the year y (tCO₂)

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

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)
 $TDI_{i,y}$ 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

$$NIZ_{i,MS,y} = \frac{M_{i,y} \cdot SP_y}{OC_i}$$

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

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

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 CO ₂ /km)
i	Cars, taxis
y	Year of the crediting period

The parameters were either discussed in baseline or project emissions or will be validated in 3.7. Monitoring plan.

Affected roads are the roads influenced by the establishment of the MRTS. Affected roads are those inside a radius of minimum 1 kilometre running parallel to the MRTS line (roads on both sides of the MRTS line are included). Only roads with large traffic volumes are included. The list of affected roads is complete, as can be seen on the map in [63]; some of the affected roads were even visited during the site visit, including Seogokro, where also a construction site could be visited (sites 207 and 208, where an elevated section is under construction); Mr. Eunmong KIM on behalf of the construction company explained the construction of this site. The validator could see that at this site roughly half of the construction was finished and that the end of construction by end of 2014 seems plausible.

For the leakage calculation the procedures in the methodology are followed and the appropriate parameters are 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 Incheon vs 1.1.xls" [5] leakage emissions with above assumptions and states that the formulas for the leakage calculations are according to the methodology and can thus be used for the verification.

As a summary, the validation team concludes that the Excel file "CER sheet Incheon vs 1.1.xls" [5] was checked extensively for correct input values, formulas, and crosschecked for consistency with the referenced documents. No errors were found after the corrections had been made.

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.

No.:	CL 5	Reference:	PDD A 4.3
Validator request:	There are no motorised rickshaws and no motorcycles.		
Project owner response:	No motorised rickshaws. This has been corrected. There are motorcycles. This has been included in the CER sheet and the PDD. The file 11 has been updated and an error has been found concerning EF for rail in file 11. Therefore the CER sheet as well as the PDD have been updated.		
Validator conclusion:	The error resulted in a reduction of estimated yearly CER's of about 25%. CER-sheet and PDD adapted, CL 5 closed.	Date:	12/04/2012

No.:	CL 22	Reference:	PDD p. 52, B6.3
Validator request:	The <i>ex-ante</i> calculation of emission reductions is based on a survey which was done for metro Line 9 in Seoul. There is not enough evidence given why the survey for Seoul could also be used for the new metro line in Incheon.		
Project owner response:	Both are in the same LUZ. The geographical boundary taken is SMA. The Line 9 connects Seoul with Incheon and is a new line. A full survey of 8 000 users was made on this metro line according to ACM0016 (Line 9 is a VCS project). The project line is not yet operational and therefore to perform projections a survey must be done on another line or data must be used from other cities. Line 9 is considered as ideal as in the same region, with the same type of users and therefore with similar travel patterns potentially concerning modes and trip distances. While actual performance will vary, this will be monitored once the metro project line is operational – however for projection purposes it is considered a very good approximation.		

Validator conclusion:	OK, the above explanation is accepted. For the <i>ex-ante</i> estimation of CER's there is indeed no other choice than to take a survey in a similar surrounding. CL 22 closed.	Date:	12/04/2012
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No.:	CL 24	Reference:	PDD B6.2 p.48
Validator request:	It is not clear why the value for the TDL (1.67%) was chosen as average over just 1 year whereas the grid emission factor has to be calculated from a 3 years average.		
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:	OK, explanation accepted, CL24 closed.	Date:	12/04/2012

No.:	CL 25	Reference:	PDD table A1
Validator request:	There are several inconsistencies in table A1: DD _{B,D} is based on file 6, but the data are given for 2010 and not 2009 PBL _B again is given for 2010 and not for 2009 TDBL _P is coming from file 7; there is a printing error in the formula (Average Time from origin to destination X Busan Bus Average Speed)		
Project owner response:	Bus data is all from 2010. Has been corrected. TDBL is correctly listed as file 7. The formula in G13 of file 7 [13] is correct and the printing error Busan instead of Incheon has been corrected. See corrected file 7 [85]		
Validator conclusion:	Corrections and amendments OK, CL25 closed.	Date:	12/04/2012

No.:	CL 26	Reference:	PDD table A1
Validator request:	There seem to be two kinds of taxis in Incheon, the private and the general ones, for which consumption rates and occupation rates are different. There is insufficient information about the actual situation and the used values.		
Project owner response:	There are private and corporate taxis. These are however not 2 types of modes of transit and are therefore not separated. For calculation of fuel consumption data on each type was weighted with numbers. The PDD in Section B.6.1. has been amended to clarify.		
Validator conclusion:	OK, the amendment in Section B6.1 is clear and correct, CL 26 closed.	Date:	12/04/2012

No.:	CL 27	Reference:	Survey file 11
Validator request:	Please send the following samples out of the survey to the validator: 17, 101, 202, 303, 390, 404, 414, 505, 511, 526, 606, 707, 799, 808, 816, 909, 1010, 1111, 1181, 1201, 1302, 1303, 1401, 1501, 1601, 1701, 1801, 1901, 2001, 2102, 2203, 2304, 2305, 2406, 2452, 2507, 2608, 2709, 2800, 2863, 2895, 2901, 2925, 3001, 3102, 3203, 3304, 3405, 3506, 3607, 3708, 3809, 3987, 4001, 4006, 4112, 4178, 4198, 4203, 4203, 4207, 4270, 4304, 4338, 4405, 4414, 4506, 4507, 4508, 4601, 4701, 4801, 4819, 4901, 4924, 5001, 5102, 5103, 5204, 5305, 5406, 5507, 5560, 5608, 5709, 5801, 5802, 5903, 5920, 5990, 6001, 6102, 6200		
Project owner response:	Have been sent.		
Validator conclusion:	OK, the samples of the survey were checked by the local expert by using the database in the internet "naver.com" CL27 closed.	Date:	12/04/2012

No.:	CL 28	Reference:	PDD
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Validator request:	It is not clear how the electricity consumption <i>ex-ante</i> of the project was estimated.		
Project owner response:	See file 65		
Validator conclusion:	OK, new file 65 [92,93] was added, CL 28 closed.	Date:	12/04/2012

3.6 Additionality of project activity

The additionality of the project was determined using the “Tool for the demonstration and assessment of additionality”. 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 09/06/2009. The appropriate document is scanned and translated in file 15 [22] (ID_1.1), which could be verified on-site by SQS and the local expert; there are construction contracts with several contracting parties, the date of 09/06/2009 is the earliest one. There is some cash outflow before the starting date in the investment analysis (File 41 [62]), which could influence the prior consideration. The investment analysis however is based on a FSR developed by KDI (Korea Development Institute) published 08/2008 which again is based on the Feasibility Study 2006 and the Revised Master Plan 2007 (see File 55 [79], sheet 7.1.). The FSR starts with expenses in the year 2008. The project was however delayed and actual start was only 1 year later, in 2009. In many cases projects start late and FSR based on years might thus be outdated (some FSR therefore use the domination year 1, 2...n).

The project starting date is the date of the signature of the construction contract being 09/06/2009 (see File 15 [22]). This is in accordance with the CDM Glossary of Terms. The actual construction start is, based on the construction contract, 17/06/2009 (see File 15 [22], sheet ID 1.1.). Completion date of construction is 18/11/2014 i.e. operational start 2015 which is 1 year later than in the finance spreadsheet which again shows that the actual investment and start of the project is 1 year later than projected in the FSR for the finance.

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 02/08/2009) the DNA and the UNFCCC must be informed within 6 months of project starting date. The notification for UNFCCC could be checked on the appropriate internet site (03/12/2009), the one for the Korean DNA was written on the standardized form F-CDM-Prior Consideration and submitted on 03/12/2009, which is less than 6 months after the project start. CL16 was raised because there was no acknowledgement document from the DNA. The document was supplied, dates of 02/09/2011, comes from the office of finance and policy and is now documented and translated in file 63 [90]. CL 16 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 sites.

No.:	CL 16	Reference:	PDD B.5 prior consideration
Validator request:	The acknowledgment of the prior consideration form by the Korean DNA seems not to exist, at least it is not documented.		
Project owner response:	See file 63		
Validator conclusion:	OK, a new file 63 [90] was added, the acknowledgment dates of 02/09/2011, CL 16 closed.	Date:	12/04/2012

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 basically also used for secondary lines in large metropolitan cities in which a rail-based MRTS has 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 direction².

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 for normal BRT systems) thus not offering the same level of convenience as a 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 alternative 5.

Following alternatives are thus credible, realistic and comparable:

1. Continuation of the current situation
2. 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 additional-ity". 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.

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

² File 14 [21]

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 in the FSR by KDI, 2008 (file 56). 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 for equipment 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 full value for land cost has been included s salvage value. Also the project is only including 40% of total investment as 60% is treated as subsidy from the Central Government.	The land value will remain after the end of the life span of the metro, CL 21 was raised. Salvage was added and the investment file "finance" [99] was changed, CL 21 could be closed. 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.	Correct
Point 6: Time of assessment	All calculations are based on the FSR report realised d by Korea Development Institute, 2008 (file 20) in 8/2008 prior to the investment decision 05/2009 which again is prior to the project starting date of 09/06/2009 (file 15).	The base year of the mentioned report [27] is 2007 which is prior to the investment decision of 05/2009. OK.
Point 7: Cesation of implementation	Not relevant for project.	OK.
Point 8: Provision of spreadsheet	Spreadsheet is provided (file 41).	Spreadsheet was adapted [99] after changing the salvage value (CL 21). 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 of 0% which is lower than the benchmark used by KDI, 2008, Chapter VIII.4 table 8.3 (file 20) being 5.5% due to the fact that no profit is targeted.	Correct and conservative OK.
Point 12-18: Selection of benchmark	ACM0016 explicitly asks for a NPV. The financial/economic indicator chosen is thus the NPV in accordance with the methodology. The discount rate taken is 0% and thus very conservative.	Correct and conservative 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 operational cost • 10% increase in fare box 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 always a negative NPV. For NPV = 0 the risk factor has to be increased by around 15% above 1. SQS agrees that this is not realistic. OK.

The investment cost is based on KDI (Korea Development Institute), an independent 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 Flyvbjerg, Comparison of Capital Costs per Route-Kilometre in Urban Rail, EJTI, 8, no. 1 (2008) (File 47) which show that the investment cost of the project with 58 million USD/km (underground metro) is at the lower end of international estimates. The article of Flyvbjerg includes thereby also the investment cost of Seoul metro network (117km) which is stated to be 65.8 million USD/km in 2002 USD (File 47 [70], Table 3, p.23; this includes not only underground stretches; underground metro is more expensive than elevated or at-level, see IEA source). The most complete and comparable metro network in the same host country thus also indicates the plausibility of the used value.

Busan has with an underground metro an investment cost of 74 million USD/km (See File 36 BUSAN PDD) and is thus in the same range.

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) and in addition (See Journal of Public Transportation, Vol. 8, No. 5, 2005 [105]) See also about the difficulty of comparing investments in metro: <http://www.railway-technical.com/finance.shtml>

Two CL (CL 19, CL 20) were raised regarding the financial analysis: The first one asked for more details about the operational costs and the second one asked for more information about the ticket prices. The details of the operational costs are given in the feasibility report [81], the labor costs are based on an yearly salary of around 44 000 US\$/person, which is according to the local expert correct for this region. The electricity costs based on a rate per kWh of about 0.05 US\$. The maintenance costs are divided into station maintenance costs, those for trains and the highest portion as for system maintenance; this is less than 2% of the around 1 000 000 mio WON of investment costs (without civil engineering and land) per year, which seems reasonable.

The operational cost is based on KDI (Korea Development Institute), an independent 3rd Party. As Korea and especially Incheon already have operating metros the operational cost can be estimated fairly well depending on train frequency and demand projections. Operational cost might be lower if passenger numbers are lower than projected. This has been included in the finance model as operational costs have been reduced proportionally to the decrease in passenger numbers. This approach is very conservative as it 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 the 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 underground metros for which data was available on a comparable basis i.e. FSR was available for the same year to make cost data per passenger comparable:

Table: Comparison of Projected Operational Costs per Passenger (USD per passenger; year 2020)³

Metro Incheon Line 2	Metro Mexico Line 12	Metro Buenos Aires	Metro Seoul Line 9	Metro Delhi Phase II
0.29	0.29	0.27	0.19	0.23 ⁴

Daegu Monorail is elevated, Metro Mumbai 1 and 2 and Gurgaon metro are elevated and thus have a non-comparable operational cost (especially electricity due to ventilation and services, maintenance of stations). Metro Seoul Line 9 is double tracked which means a higher number of passengers using the same station, thus

³ Based on Feasibility reports for all i.e. projections for all cases; for all based on projection year 2020 to have a fully operational and comparable data year. Exchange rates to USD based on financial assessment report per project; all data based on published PDDs for the respective metros.

⁴ File finance 1.1 [106] 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 project [107] with growth rate 5.8% per annum (960 million); all 2020

reducing the cost per passenger transported.

DMRC is only partially underground and has thus also lower operational costs.

The number of employees, their salaries, the electricity and maintenance cost (divided by station-, train- and system-maintenance cost) have been taken from the 'Incheon Metro Line 2 feasibility report' of the Korean Development Institute (File 57b, [82]), which was sent to SQS by responding to CL 19. 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 08/11/2012 by the Korean Foundation for Quality (KFQ), regarding the assessment on operational costs analysis for Incheon Metro, in which Mr Ko confirms that the background data for operational costs for Incheon Metro is duly reasonable and correct (see "File Incheon Line 2 Operational Cost Evaluation (08 Nov 12)_1" [108]).

Based on checks and the information above, SQS considers the expected operational costs of Incheon as plausible in an international context.

Considering the ticket price (CL 20) the answer of the PP says that the 1 100 Won used correspond to the full rate charged 2009, and no inflation – for revenues nor for investment nor for operation costs – is included.

Since public transport ticket prices are rather politically determined and difficult to be risen, the assumption of constant ticket prices is plausible.

Passenger projections are based on KDI (Korea Development Institute), an independent 3rd Party. Passenger projections are based on a Master Plan (see File 55, [79] sheet 7.1) KDI (Korea Development Institute) was established 1971 as the first government-supported but autonomous social science research institute in Korea.

The other revenues were assumed to be 10% of the fare box revenues, which is plausible and similar to the ratio for metros Daegu and Busan.

The CER price was taken from the European Energy Exchange AG [84] as an average over 12 months from may 2008 until april 2009 which again is prior to the project starting date of 09/06/2009.

A risk factor (actual to expected passenger numbers) was established with data from the Korean metros (see table 6 below).

The different data were checked by SQS from the mentioned sources ([58], [61]); they show that all of the three metros have much less actual passengers than expected the highest ratio being 46%. A ratio of 90% (10% less passengers) is therefore highly probable.

Table 6: Relation Expected to Actual Passenger Numbers of Korean Metros (1 000 passenger/day)

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	
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 %

The following parameters were used for the financial assessment and validated by SQS:

Table 8: Major Parameters for Financial Assessment

Parameter	Value in 100 million WON	Validation
Total investment	21 649	From Reviewal Feasibility report [79] (Validity Reviewal Report 2008 "Construction business of Incheon Urban Rail-road Line 2") Chapter 7 finance data. Official document, with English translation. Details are given in Chapter 7.1. OK.
Investment by central government (subsidy)	12 990	60% of total investment cost, from feasibility report [79] Chapter 7. OK.
Investment by municipality	8 660	Rest of total investment = 40% [79] OK
Salvage value (land; total value)	473	CL21: Revised financial file 41 [99]. From Reviewal Feasibility report [79], Chapter 7.1. gives a value of 473, which will also be used in the financial sheet.
Operational cost (annual average)	345	CL 19 → details in [82]: Around 270 new persons with an average yearly salary of 50 million WON; electricity costs base on a rate of ~60 WON/kWh; the maintenance costs base on a study of the Korean Transportation Institute and are divided in station-, train- and system-maintenance costs; the general administrative costs were assumed to be 8% of the total costs, which comes from the same study of the Korean Transportation Institute, which gives a range of 7% to 10%.
Fare box revenue (annual average)	503	CL 20 → The NPV is calculated based on constant WONs. Therefore inflation is not included in any revenue, investment or cost estimate. Details in [83]: Average over 30 years, with a very slight increase until 509. OK.
Non-fare box revenue (annual average)	50	Details in [83]: 10% of fare box revenues. OK.
Price of CERs (tsd WON per tCER)	27	Details in [84]: Average CER prize over 1 year (may 2008-april 2009) from European Energy Exchange AG = 15.77 EUR, currency exchange 1 EUR = 1 740 WON → 27 440 WON. OK.
Discount rate	0%	OK, deemed to be conservative.

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 "Bussystems for the future" [69]:

The investment cost per km are there listed with 60 - 180 million US\$ per km (underground), the 58 million US\$ per km for the new line in Incheon is therefore below this margin and therefore not exaggerated.

The operational cost in form of cost per passenger can be compared with other metros, which is done in table 9 of the PDD:

Table 9: Comparison of Projected Operational Costs per Passenger (USD per passenger; year 2020)

Metro Incheon Line 2	Metro Seoul Line 9	Metro Mexico Line 12	Metro Daegu
0.29	0.19	0.29	0.22

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

SQS confirms that the assumptions are therefore correct and plausible.

The NPV calculations were presented in the finance file 41 [62], which had to be revised for CL 21, resulting in a new file 41 [99]. The result of the calculations is a NPV of -223 988 million WON, i.e. even without applying a risk factor for less than expected passengers the project runs a deficit.

A sensitivity analysis, which can be showed very easily in the finance file [99], where the different inputs are linked, the NPV rests negative in all cases:

Table 10: NPV Sensitivity to Parameter Changes Excluding CER Revenues (100 million WON)

Case	NPV
10% lower investment cost	-1 393
10% lower operational cost	-1 204
10% higher fare box revenue	-732

The investment cost would need to decrease by 26% to achieve a 0 NPV. This is highly improbable taking into account that the experience of metros worldwide is that construction costs are on average substantially higher than forecast. The average cost escalation of urban rail projects studied by Flyvberg was 45% i.e. costs were 45% higher than forecast. 75% of projects had a cost escalation of 33% at least [60]. Thus it is highly improbable that the project results less expensive than planned.

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

No.:	CL 19	Reference:	PDD p. 26 and finance file
Validator request:	There is not enough information about operational costs like # employees, details of energy, maintenance and administrative cost, and others.		
Project owner response:	See file 57b for details		
Validator conclusion:	OK, file 57b gives enough information for the judgment of the financial analysis, CL 19 closed.	Date:	12/04/2012

No.:	CL 20	Reference:	PDD p. 25
Validator request:	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.		
Project owner response:	The NPV is calculated based on constant WONs. Therefore, inflation is not included in any revenue, investment or cost estimate. The full fare rate of 1 100 Won used corresponds to the metro fare charged 2009 (idem to the current fare rate if not paying cash)		
Validator conclusion:	OK, explanation is accepted, CL 20 closed.	Date:	12/04/2012

No.:	CL 21	Reference:	PDD table 7
Validator request:	In table 7 there is no salvage value. However there are 2% land costs in the investment costs, which probably will be sellable after 30 years (see also PDD Busan, where the landcosts appear as salvage value).		
Project owner response:	Land has been included with 100% of value with the same distribution central government and municipality as the other investments. The PDD has been updated on the changed results. See also new file 41 finance.		
Validator conclusion:	New financial analysis and amendment of PDD: The overall conclusions did not change with	Date:	12/04/2012

	this (minor) change. But the CER's in the assumptions are still the old ones.	
Project owner response:	Financial file corrected	
Validator conclusion:	OK, has no influence on the PDD, CL21 closed.	Date: 23/04/2012

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 host country. This test is a credibility check to complement the investment analysis (Step 2). 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..." and*

"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 [4] Metropolitan Areas in the Republic of Korea with over 1 million inhabitants are listed together with the status concerning MRTS. The table does not contain Incheon as a separate city, since it belongs to the LUZ of Seoul. However it was then not clear why Yongin and to a lesser degree Goyang are listed as separate cities since they are also part of the SNCA Seoul National Capital Area. CL 18 was raised. The answer by the PP states that there is a difference between SNCA and Seoul Metropolitan Government. The answer of the PP was sent to the local expert, who agreed with it.

Metropolitan Area	MRTS	Means of 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, OK Yongin City constructed LRT (Light Rail Transit) about two years ago, however LRT has not been running at all yet because of financial problem between investor and Yongin City.

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 (EU) statistical agency, where the expression "LUZ" is coming from, CL 38 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.

The methodology states that the LUZ is required to be taken (which is often larger 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 this area. 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 in 2004. Eurostat's objective was to have an area of a significant share of residents commuting 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 that approximate the functional urban region.

B. The concept of LUZ needs to be transformed to the traditional definition of city inhabitants. The functional area is therefore taken for the cities for which no metropolitan area statistics are available. The result is depicted 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 68b [103]

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

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

			Total population of 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	
	Ulsan	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 to reach a compromise between harmonised data for all of the European Union, and with availability of statistical data, making comparisons more accurate. The data used is from the 2006 Urban Audit III, which uses information collected for 2004⁵. 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 68b [103]).

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 C. 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 metro-politan area	Population in millions LUZ
SNCA	24.38	Not determined
Busan Metropolitan City	3.54	Not determined

⁵ See file 68b [103], EU city to LUZ

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 68b [103]

Both approaches show that 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.

The local expert (Mr Ko, KFQ) checked the file 'population data korea and LUZ' [103] table 'korean cities nu 2' thoroughly ; he confirms that the population numbers mentioned are correct and agrees with his own data; therefore he concludes that table 'korean cities LUZ concept' in the same Excel file is correct. (e-mail of 16/07/2012).

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' 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 regarded as common practice.

No.:	CL 18	Reference:
Validator request:	In table 11, 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 "... <i>Yongin is a major city in the Seoul National Capital Area, located in Gyeonggi Province</i> " and Goyang is linked over metro Line 3 with Seoul.	
Project owner response:	Capital Metropolitan City is taken as area based on LUZ as indicated in the methodology. This is not equivalent to the Seoul National Capital Area (SNCA) which is much larger. Seoul Metropolitan City definition is taken as on the official website of Seoul Metropolitan Government (http://english.seoul.go.kr/gtk/main.php) SNCA is over 11 000km ² and includes the entire Province of Gyeonggi and is thus more than an urban area. This can also be seen in the urbanization of SNCA which only comprises a part of the entire area. Goyang and Yongin do not form part of Seoul Metropolitan City. Goyang is connected with Line 3. However this is the Ilsan Line which is the extension of Line 3 and which is no operated by Seoul Metro but by Korail which operates the national rail infrastructure. This is not the case with Incheon and Seoul where the metro operates the lines which run partially in seoul and partially in Incheon	
Validator conclusion:	OK, according to the local expert the explanation of the PP is correct (document of 17/03/2012), CL 18 closed.	Date: 12/04/2012

No.:	CL 38	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 was taken. The PDD has been adapted. See files 68a and 68b for more details.		
Validator conclusion:	PDD was adapted, new files included, CL 38 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}	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.
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 _{CO₂,G/D/CNG/LPG}	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 biofuel blends are used in liquid fuels, the biofuel share of the blend is accounted for with zero emission factor. The usage of biofuel is monitored annually for diesel and gasoline. The EF is thereafter adjusted based on the biofuel contents e.g. if the biofuel contents is 10% then the IPCC EF is multiplied with (100%-10%) to get the EF used. The baseline emis-	According to methodology OK.

	sion factors must be adjusted, if the biofuel contents changes over time.	
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Data / Parameter:	EF _{KM,B,CH4}	Validation
Data unit:	gCO ₂ eq/km	
Description:	CH ₄ emission factor of CNG buses per kilometre in CO ₂ eq	
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. Value of 7 715 mg CH ₄ of IPCC is multiplied with the GWP of 21 for CH ₄ to calculate CO ₂ eq	Has been checked against the official IPCC source and found correct OK.

Data / Parameter:	EF _{KM,LPG,C/T,CH4}	Validation
Data unit:	gCO ₂ eq/km	
Description:	CH ₄ emission factor of LPG cars and taxis per kilometre in CO ₂ eq	
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 ₂ eq	Has been checked against the official IPCC source and found correct OK.

Data / Parameter:	N _{x,C/T}	Validation
Data unit:	Vehicles	
Description:	Number of passenger cars (C) and taxis (T) using fuel type x	
Source of data to be used:	Seoul Metropolitan City and Korea Energy Economic Institute	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.	
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Data / Parameter:	P	Validation														
Data unit:	Passengers															
Description:	Total passengers transported by the project															
Source of data to be used:	Incheon Metro	According to methodology OK.														
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	<div>Table 19: Million Passengers per Year</div> <table><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>90</td><td>95</td><td>95</td><td>96</td><td>96</td><td>97</td></tr></table> <div>For projections based on file 12, KDI, 2008</div>	2015	2016	2017	2018	2019	2020	2021	84	90	95	95	96	96	97	Table was adapted to starting year 2015 CL 11, data checked with [19] OK.
2015	2016	2017	2018	2019	2020	2021										
84	90	95	95	96	96	97										
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).	According to methodology OK.														
Any comment:																

Data / Parameter:	EC _{PJ}	Validation														
Data unit:	MWh															
Description:	Electricity consumed by project metro															
Source of data to be used:	Incheon Metro	According to methodology OK.														
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	<p>Table 20: Traction Energy per Year in MWh</p> <table><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>25 704</td><td>26 928</td><td>28 152</td><td>28 519</td><td>29 009</td><td>29 376</td><td>29 866</td></tr></table> <p>For projections based on file 13, Incheon Metro Line 2, 2010</p>	2015	2016	2017	2018	2019	2020	2021	25 704	26 928	28 152	28 519	29 009	29 376	29 866	Table was adapted to starting year 2015 CL 11; data checked with [20] OK.
2015	2016	2017	2018	2019	2020	2021										
25 704	26 928	28 152	28 519	29 009	29 376	29 866										
Description of measurement methods and procedures to be applied:	Traction energy only Monitoring frequency: Continuously, aggregated at least annually	According to methodology OK.														
QA/QC procedures to be applied:	Control with electricity invoices. The electricity metres are calibrated by the local electricity board. The electricity metres are not owned or managed by Incheon Metro but by KEPCO. The latter is also responsible for their periodic calibration. Electricity metres are calibrated, depending on the electricity metre type, every 7 to 15 years based on regulations of the Ministry of Knowledge Economy (file 66).	CL34, adapted And checked with [94], OK.														
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”.	According to methodology OK.														

Data / Parameter:	MS _i	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 realised d 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 based on a complete survey made on SML9 line (VCS project) 2011: Passenger car: 9.9% Taxi: 8.2%	Survey [96] table summary OK.

	Motorcycle: 0.2% Bus: 71.2% NMT and induced traffic: 28.9% Other metro: 44.8% Induced traffic (would not have made trip): 0.7% The total is more than 100% as passengers can use various modes in the baseline from their trip origin to their trip destination.	
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.	According to methodology OK.

Data / Parameter:	N _B	Validation
Data unit:	Buses	
Description:	Number of buses circulating in the city	
Source of data to be used:	Incheon Metropolitan City	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: year 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}	Validation
Data unit:	Passengers	
Description:	Average occupancy rate of buses and taxis	
Source of data to be used:	Survey realised d 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	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:	Calculation for buses based on PKM divided by total distance of buses. Total distance and total passengers are reported regularly by the bus company. Passenger trip distance is either reported or based on a survey of bus users. Calculation for taxis based on published data (as in baseline) or on survey using the TORs of the approved methodology. Independent published data or in accordance with TORs of methodology Monitoring frequency: Year 1,4, and 7	CL 26, adapted, and according to methodology OK.
QA/QC procedures to be applied:		

Any comment:		
Data / Parameter:	NIZ_{C,T}	Validation
Data unit:	Vehicles	
Description:	Number of cars/taxis using affected roads	
Source of data to be used:	Survey realised d by project proponent or 3 rd party	CL 31
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	CL 31, explanation accepted. 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 42).	In [63] the roads, points and days/ hours are listed OK.
Any comment:		

Data / Parameter:	TDIZ_{C,T}	Validation
Data unit:	Kilometres	
Description:	Distance driven by taxis and passenger cars on affected roads	
Source of data to be used:	Survey realised d 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	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 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	Validation
Data unit:	Km/h	
Description:	Vehicle project speed on affected roads; Average moving speed is recorded.	
Source of data to be used:	Survey realised d by project proponent or 3 rd party	CL31, explanation accepted, [63] 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. Monitoring frequency: annual	CL31, explanation accepted, 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.	In [63] the roads, points and days/ hours are listed OK.
Any comment:	Only passenger cars and taxis.	According to methodology, OK.

Data / Parameter:	EC_{EL,R}	Validation
Data unit:	MWh	
Description:	Quantity of electricity consumed by the baseline metro line per annum	

Source of data to be used:	Incheon Metro	According to methodology, OK.
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	59,143 (file 8, Incheon Metropolitan Metro, 2010)	Checked with [14] (error in table ID_17 cell J5 where it should read kWh instead of mwh) 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}	Validation
Data unit:	Passengers	
Description:	Total passengers transported by baseline metro lines per year	
Source of data to be used:	Incheon Metro	According to methodology (rail operator) OK.
Value of data applied for the purpose of calculating expected emission reductions in Section B.5	80 133 000 (file 8, Incheon Metropolitan Metro, 2010)	Checked with [14] table 17.1,2 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 suburban rail.	According to methodology, OK.

The monitoring manual for Incheon Metro Line 2 was received during the on-site visit as “CDM Monitoring Manual Incheon Metro Line 2, version 1.0, 03.01.2012”. The requirements of the methodology are respected. Three clarification requests had to be raised, CL 33 states that the parameter $N_{x,CT}$ is inconsistent with the monitoring manual, which was amended in a new of the monitoring manual (CDM MM Incheon Metro Line 2, version 1.1, 07/03/2012, [97]) of the manual; CL 34 and CL 36 ask for a clarification regarding the calibration of the electricity metres and the exact measurement of the electricity. Both CLs were cleared by amending the PDD and supplying additional documents. The measurement of the traction energy (CL 36) for the new Line 2 is described in detail in file 67 [95]; the electricity distribution, the calibration frequencies, the transmission losses, the value control, the invoice contain and the calculation of traction electricity consumption is shown in diagrams and explanations.

FAR1 was raised, since 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 validation and therefore listed in Chapter B.7.1 and will not be measured a second time. The explanation is correct and FAR1 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 06/03/2012 [97], the PP is able to implement the monitoring according to the monitoring plan.

No.:	CL 11	Reference: PDD Annex 3
Validator request:	The end date of construction is mentioned as 18/11/2014. Why is the first crediting period already starting at the beginning of 2014?	

Project owner response:	Crediting period start is 01/01/2015	
Validator conclusion:	Tables with starting date 01/01/2015, OK, CL 11 closed.	Date: 12/04/2012

No.:	CL 26	Reference: PDD table A1
Validator request:	There seems to be two kinds of taxis in Incheon, the private and the general ones, for which consumption rates and occupation rates are different. There is insufficient information about the actual situation and the used values.	
Project owner response:	There are private and corporate taxis. These are however not 2 types of modes of transit and are therefore not separated. For calculation of fuel consumption data on each type was weighted with numbers. The PDD in Section B.6.1. has been amended to clarify.	
Validator conclusion:	OK, the amendment in Section B6.1 is clear and correct, CL 26 closed.	Date: 12/04/2012

No.:	CL 31	Reference: PDD B7.1
Validator request:	It is not clear how it will be assured that the measurements of NIZ, V _P and OC will always be done in the same way. DOE did not get any TORs.	
Project owner response:	V _P is based on moving and average speed. file 42 contains the points of measurement. Therefore the method of measuring is irrelevant. If an 3 rd party source such as in the baseline continues to publish speed data latter will be used. OC: Information has been added 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 42)	
Validator conclusion:	OK, OC for motorcycles have been added, CL 31 closed.	Date: 12/04/2012

No.:	CL 33	Reference: PDD B.7.1
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 vs 1.1 has changed this.	
Validator conclusion:	OK, new version of monitoring manual [97], CL33 closed.	Date: 12/04/2012

No.:	CL 34	Reference: PDD B.7.1 and monitoring manual
Validator request:	It is not clear whether the electricity metres will be calibrated by an officially accredited organisation.	
Project owner response:	According to government regulations the electricity metres (depending on the type) are calibrated every 7 - 10 years. This is for total electricity consumption. The electricity metres are from KEPCO and managed by KEPCO and not the metro. Therefore, the metro i.e. the PP does not calibrate the metres because it does not have the competence to do this. The PDD has been amended. See also file 66.	
Validator conclusion:	OK, the official ordinance in file 66 (6.4.2011) [94] gives enough evidence that the electricity metres have to be calibrated by an accredited company. CL34 closed.	Date: 12/04/2012

No.:	CL 36	Reference: PDD B.7.1 and monitoring manual
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 1 500 V DC. In between there are other consumptions and losses.	
Project owner response:	See details in file 67. The PDD has been amended in Section B.7.2.	
Validator conclusion:	The explanation and amendments are reasonable. CL 36 closed.	Date: 12/04/2012

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 closed.	Date: 12/04/2012

3.8 Sustainable development

The letter of approval from the host party was not available therefore CL1 was raised. It was received on 18/07/2012 and confirmed that the project contributes to sustainable development in the Republic of Korea (point 3 of LoA issued).

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 16/07/2012, CL 1 closed.	Date:	18/07/2012

3.9 Local stakeholder consultation

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

The EIA included a stakeholder meeting. The stakeholder meeting was publicly announced in two newspapers 16/12/2008. [51, Gathering resident comments] The results of the EIA were also on various public websites open for comments. Three stakeholder meetings were organised and residents could enter their written comments up to one week after these meetings:

- 23/12/2008 at Namgu Conference Room
- 23/12/2008 at Namdonggu Community Service Center of Seochang, Jangsu
- 24/12/2008 in Seogu at the Welfare Hall of Guemdan
- 17/03/2009 a public hearing announced previously through newspaper ads was realised at the Cultural Center of Seogu

The stakeholder suggestions are recorded [51] and include:

- Minimise environmental impacts from noise and vibration;
- All sections should be underground;
- Make the metro in its elevated sections more attractive (visual pollution);
- Have a good connectivity.

SQS states that the stakeholder consultation was adequate, all local comments were addressed but could not be satisfied 100% due to cost reasons.

3.10 Global stakeholder consultation

The PDD v1.0 of 25/10/2011 [1] was published on 17/11/2011 for 30 days on the UNFCCC website; no comments were received.

3.11 Environmental impacts

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 include that the metro meets the demand of passengers in terms of convenience, punctuality and reliability. Social benefits are expected due to traffic improvement. The reduced 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.

Impacts identified are some topographical changes, air pollutant from operating construction equipment, noise and vibration during construction and operation, wastewater and waste from construction workers, and wastewater from passengers using stations.

To minimise the effect of dust and noise the EIA recommends the installation of wind screens and temporary noise absorbing panels, periodic watering, treatment of the wastewater and establishment of a monitoring and planning system to mitigate negative environmental impacts. A planning direction is set-up to minimise effects on air, water, land and living environment around the planned route.

CL 32 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 [91] and the PDD was amended accordingly:

In accordance with the "Metro Act" Art. 4, clause 3 the Incheon 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 Incheon Metro Line 2 as of 07/06/2011. The same Ministry also confirms that the environmental impact assessment of Incheon Metro Line 2 has been realised in accordance with the "Law of EIA" Art. 18 Clause 3, as of 10/06/2009 and that the natural disaster impact assessment is in accordance with the natural disaster Art. 4 as of 02/04/2009.

The appropriate documents were proved by SQS and are in accordance with the declarations in the PDD. Therefore, the legal compliance of the project is given.

No.:	CL 32	Reference:	PDD D2
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. The metro act is not mentioned.		
Project owner response:	See all approvals in file 64. The PDD has been amended in Section D2		
Validator conclusion:	OK, there are three statements saying that the project is in accordance with the law of environment impact assessment article 18 clause 3, with the law of natural disaster article 4, and with the transportation impact analysis, CL 32 closed.	Date:	12/04/2012

3.12 Validation protocol

In order to ensure transparency and organise the corrective or additional information and measures, a valida-

tion 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 the reviewer are included in Appendix D to this report. Local support was provided by Mr Byungho Ko, Republic of Korea.

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

02/02/2012

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 	Office	Team members of Grütter Consulting
10.45	13.00	Discussion of the project documents (cont.): <ul style="list-style-type: none"> • Investment analysis • Sensitivity • Common practice 	Office	Team members of Grütter Consulting Financial specialists of IURCH
13.00	14.30	Lunch break		
14.30	16.30	Visit Metro Incheon: Construction sites, survey points, affected roads, electricity monitoring	On sites	Team members of Grütter Consulting Staff of IURCH
16.30	18.30	Discussion of the project documents (cont.) <ul style="list-style-type: none"> • Postponed items from morning discussion 	Office	Team members of Grütter Consulting
19.00		Dinner		

03/02/2012

From	To	Subject	Where	Who
08.30	10.30	Discussion of the project documents (cont.) <ul style="list-style-type: none"> • Environmental impact • Stakeholders' comment • Monitoring plan 	Office	Team members of Grütter Consulting
10.30	11.00	Final discussion Metro Incheon	Office	Team members of Grütter Consulting
11.00	16.00	Trip to Daegu		

8 Appendix B: Interviews

02/02/2012		
Name	Position	Issue
Rohini BALASUBRAMANIAN	Grütter Consulting	PDD, general questions
Jongmin LEE	South Pacific Consulting	PDD, general questions
Jongwan LEE	South Pacific Consulting	PDD, general questions
Daegeon KIM	Incheon Urban Railroad	Finance, environmental aspects
Eunmong KIM	Taeyoung	Construction site
Byungho KO	KFQ, local expert	Specific questions

03/02/2012		
Name	Position	Issue
Rohini BALASUBRAMANIAN	Grütter Consulting	PDD, general questions
Jongmin LEE	South Pacific Consulting	PDD, general questions
Jongwan LEE	South Pacific Consulting	PDD, general questions
Sangyeol LEE	Incheon Urban Railroad	Technical questions of project
Daegeon KIM	Incheon Urban Railroad	Finance, environmental aspects
Byungho KO	KFQ, local expert	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	Version
1	PDD Incheon vs. 1.0.docx	25/10/2011
2	CER sheet Incheon vs 1.0-1.xls	03/12/2011
3	Requests_IncheonValResp.docx	13/03/2012
4	PDD Incheon vs. 1.2, 21/06/2012	21/06/2012
5	CER sheet Incheon vs 1.1.xls	06/03/2012
6	File 1 taxi data.xlsx	20/10/2011
7	File 2 taxi occupation rate.xlsx	16/09/2011
8	File 3a SFC cars.xlsx	11/08/2011
9	File 3b Korea Energy Managment Corp.pdf	16/06/2011
10	File 4 pax car registration.xls	19/02/2011
11	File 5 occupation rate cars.xlsx	16/09/2011
12	File 6 bus info.xlsx	20/10/2011
13	File 7 trip distance bus.xlsx	20/10/2011
14	File 8 pax and elec existing metro.xlsx	21/09/2011
15	File 9a CM_REPUBLIC OF KOREAN1.doc	03/02/2011
16	FILE 9b CM.xls	03/02/2011
17	File 10 Statistics of electric power in Korea_201005.pdf	07/02/2011
18	File 11 survey SMLalt.xls	16/09/2011
19	File 12 forecast_passenger.xls	21/09/2011
20	File 13 electricity line 2.xlsx	21/09/2011
21	File 14 phd_incheon.xlsx	07/10/2011
22	File 15 dates of metro lines.xlsx	18/10/2011
23	File 16 Incheon Registration.xlsx	18/10/2011
24	File 17 vehicles.xlsx	18/10/2011
25	File 18 map.xlsx	19/10/2011
26	File 19 mode split incheon.xlsx	19/10/2011
27	File 20a FSR.xlsx	27/10/2011
28	File 20b FSR.pdf	13/10/2011
29	File 21 trains.xls	19/10/2011
30	File 22 incheon_busroute_replacement.xlsx	19/10/2011
31	File 23 Road network Korea.pdf	19/10/2011
32	File 24 GTZ MRTS options.pdf	02/08/2009
33	File 25 prior consideration form.pdf	08/10/2011
34	File 26a population seoul.pdf	18/04/2011
35	File 26b population BUSAN.pdf	19/02/2011
36	File 26c population Daegu.pdf	19/02/2011
37	File 26d population Gwanju.pdf	19/02/2011
38	File 26e population Daejeon.pdf	19/02/2011
39	File 26f population Changwon.pdf	18/04/2011
40	File 26g population Ulsan.pdf	19/02/2011
41	File 26h population Suwon.pdf	18/04/2011
42	File 26i population seongnam and goyang.pdf	18/04/2011
43	File 26j population Yongin.pdf	20/05/2011
44	File 27 biofuel.pdf	13/10/2011
45	File 28 biofuel 2.pdf	27/09/2011
46	File 29 biofuel usage.xlsx	04/10/2011
47	File 30 DNP 2009 colombia.pdf	07/12/2009
48	File 31 BRT data Guadalajara.xls	16/08/2010
49	File 32 BRT Guatemala.xls	08/02/2011
50	File 33a Incheon EIA, 1000 Summary.docx	14/10/2011
51	File 33b Incheon EIA, 6000 Gathering resident comment.docx	14/10/2011
52	File 33c Incheon EIA, 11000 The selection of alternatives and assessments.docx	14/10/2011
53	File 33d Incheon EIA, 12000 Overall assessment and conclusions.docx	14/10/2011

54	File 33e Incheon EIA, incheon_EIA_line2.pdf.docx	06/10/2011
55	File 34 bussystems ie, 2002.pdf	23/08/2002
56	File 35 gov subsidy.xlsx	13/10/2011
57	File 36 gov subsidy.xlsx	20/10/2011
58	File 37 metro performance.xlsx	13/10/2011
59	File 38 GTZ MRTS training.pdf	23/05/2011
60	File 39 Flyvberg urban rail.pdf	27/07/2011
61	File 40 comparison actual to projected daegu.xlsx	13/10/2011
62	File 41 finance CDM Incheon.xlsx	27/10/2011
63	File 42a Affect_road_Incheon.xlsx	27/10/2011
64	File 42b utis BIS.xlsx	21/10/2011
65	File 42c Affected road incheon.xlsx	27/10/2011
66	File 43 stakeholder_meeting report.xlsx	20/10/2011
67	File 44 stations and distances metro.xlsx	21/10/2011
68	File 45 train_tech_incheon.xlsx	25/10/2011
69	File 46 bussystems ie, 2002.pdf	23/08/2002
70	File 47 capital cost of metros.pdf	04/07/2011
71	File 48 finance CDM Daegu.xlsx	27/10/2011
72	File 49 Finance model_SML9_EN.xls	25/02/2011
73	File 50 finance model DF.xlsx	09/04/2011
74	File 51 DPR Phase II corridors final 2005.pdf	20/08/2009
75	File 52a Korea Emission standard.pdf	14/10/2011
76	File 52b global standards emissions.pdf	14/10/2011
77	File 53 corinair.pdf	14/08/2010
78	File 54 engine size korea.pdf	14/10/2011
79	File 55 investment docs FSR.xlsx	14/10/2011
80	File 56 expected_revenue_incheon.xlsx	26/10/2011
81	File 57 incheon op exp.xlsx	26/10/2011
82	File 57b OC details.xlsx	06/03/2012
83	File 58 revenue_and_cost_incheon.xlsx	27/10/2011
84	file 59 CER price.xlsx	13/10/2011
85	File 7 trip distance bus.xlsx	06/03/2012
86	File 41 finance CDM Incheon vs 6.3.2012.xlsx	06/03/2012
87	file 60 occupation rate motorcycles.xls	18/02/2011
88	File 61 SFC motorcycle.xls, 2009	05/03/2012
89	File 62 biofuel usage.xlsx	02/03/2012
90	File 63 DNA_confirm and form.xlsx	29/02/2012
91	File 64 approvals.xlsx	02/03/2012
92	File 65a projection electricity consumption.xlsx	29/02/2012
93	File 65b.pdf	27/02/2012
94	File 66 calibration law.xlsx	06/03/2012
95	File 67 Electricity incheon.xlsx	13/03/2012
96	File 11 survey SMLneu.xls	06/03/2012
97	Monitoring Manual Incheon Metro 1.1.pdf	06/03/2012
98	Mode of Communication, Incheon.pdf	02/03/2012
99	File 41 finance CDM Incheon vs 6.3.2012.xlsx, corrected	22/04/2012
100	Letter of Approval of Switzerland	30/05/2012
101	Letter of Approval of the host country Republic of Korea	18/07/2012
102	File 68a new: City population and LUZ	14/06/2012
103	File 68b new Population data Korea and LUZ	14/06/2012
104	Tool to calculate the emission factor for an electricity system, v1	
105	Public Transport Reforms in Seoul: Innovations Motivated by Funding Crisis. Journal of Public Transportation, Vol. 8, No. 5, 2005	2005
106	File 47 finance version 1.1 DMRC.xlsx	28/05/2011
107	File 2 Passengers and OP cost DMRC.xls	2009
108	file Incheon Line 2 Operational Cost Evaluation (08 Nov 12)_1	11/2012

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

11 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
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

Appendix F: Validation Protocol

Swiss Association for Quality and Management Systems (SQS)

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Appendix F: CDM Validation Protocol

Enterprise

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Company:
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Service

Audit/Assessment:
Audit/Assessment beginning/end:
Project name:
GBZ/Report-No.:

CDM Validation
15/11/2011 – 12/11/2012
Incheon Metro Line 2
324169 / P32041.33

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

7 Transport
ACM0016, version 2.0
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	CL 1 OK	OK
	Comment: CL 1: Letter of approval not yet received LoA received on 18/07/2012				
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	CL 1 OK	OK
	Comment: CL 1: Letter of approval not yet received LoA of Korea received on 18/07/2012, a) OK, b) OK c) OK d) it refers exactly to Incheon Metro Line 2 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.				
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	CL 1 OK	OK
	Comment: CL 1: 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	CL 1 OK	OK
	Comment: CL 1: 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 20/07/2012.				
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	CL 1 OK	OK
	Comment: CL 1: 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

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Comment: Switzerland is party to the Kyoto Protocol.				
1.2.1 [1] 52	<p>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.</p> <p>Comment: Participants are listed in tabular form in the PDD. CL 1: Letter of approval not yet received. LoA of Switzerland received on 30/05/2012, it confirms</p> <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) <p>CL1 closed. No other entities are included.</p>		DR	OK CL 1	OK
1.2.2 [1] 53	<p>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.</p> <p>Comment: CL 1: Letter of approval not yet received. See above CL 2: MoC not yet received. → MoC has been submitted in Form F-CDM-MOC → CL 2 closed.</p>		DR	CL 1 CL 2 OK	OK
1.3	PROJECT DESIGN DOCUMENT				
[1] 55	<p>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.</p> <p>Comment: The latest template was used: CDM-PDD version 03 in effect as of 28/07/2006</p>		DR	OK	OK
1.3.1 [1] 56	<p>The DOE shall determine whether the PDD is in accordance with the applicable CDM requirements for completing PDDs.</p> <p>Comment: Guidelines for completing the PDD and the proposed new baseline and monitoring methodologies version 07.</p>		DR	OK	OK
1.4	PROJECT DESCRIPTION				
[1] 58	<p>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.</p> <p>Comment: PDD is clear and understandable. Some clarification requests had to be raised: CL 3: Geographical coordinates CL 4: Definition of Seoul National Capital Area CL 6: Inconsistencies in figure 1 CL 7: There is a 3rd line of the metro planned, when and where? CL 8: Inconsistency in map 3 CL 17: Printing error on p.26 of original PDD CL 23: In file 16 the representative of IURCH is Mr. Jung Yeungeul, in Annex 1 of the PDD it is Mr</p>		DR	CL 3 CL 4 CL 6 CL 7 CL 8 CL 17 CL 23 CL 37 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	Keuncheon Lee, what is right? CL 37: The project titles are not throughout the documents identical. All CLs are closed.				
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. Comment: The description of the project is accurate and gives a good picture of what will be realised. It covers all relevant elements.		DR	OK	OK
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 Comment: The site visit on 02/02/2012 at construction sites gave a good accordance with the description in the PDD.		I	OK	OK
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. Comment:		NA		
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. Comment:		NA		
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. Comment: Pre-project situation described in the PDD, Metro Line 1 is already existing, the new Line 2 is independent and leads in other directions.		DR	OK	OK
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. Comment: ACM0016 v2 is valid until 25/07/2012.		DR	OK	OK
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. Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL13 → closed.		DR	CL13 OK	OK
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; (d) Additionality;		DR	CL13 OK	OK

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.
	(e) Monitoring methodology.				
	Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL13 → 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	CL13 OK	OK
	Comment: Table 2 in the PDD Some uncertainties in the bio fuel → CL13 → 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 needed.				
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:				
1.5.2.8 [1] 75	In no circumstance shall the DOE consider the submission of a request for registration as seeking clarification from the CDM Executive Board on the applicability of a methodology.		NA	NA	
	Comment:				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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.		DR	OK	OK
	Comment: Figure 3, p.15 PDD version 1.				
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.		I	OK	OK
	Comment: Site visit of 03/02/2012. For including or excluding gases the conservative way was used.				
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.		DR	OK	OK
	Comment: Baseline identification was exactly done according to the methodology.				
[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.		DR	OK	OK
	Comment: Baseline identification was exactly done according to the methodology.				
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.		DR	OK	OK
	Comment: All the assumptions and data used by the PPs are listed in the PDD, including their references and sources. 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.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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	CL10 CL11 OK	OK
	Comment: CL11: The end date of construction is mentioned as 18/11/2014. Why is the first crediting period already starting at the beginning of 2014? CL10: Inconsistency in table A.4.4. → Adaption of crediting period and amendment of PDD. → CL10 and CL11 closed. 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. All estimates of the baseline emissions can be replicated using the data and parameter values provided in the PDD.				
1.6	ADDITIONALITY OF A PROJECT ACTIVITY				
[1] 94	The PDD shall describe how a proposed CDM project activity is additional.		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	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 I	OK	OK
	Comment: See part 3 and site visit together with a local expert.				
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 I	OK	OK
	Comment: See part 3 and site visit together with a local expert.				
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 09/06/2009 which is after 02/08/2008. The starting date was verified by looking into the contract by the local expert.				
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 02/08/2008) or an existing project activity (a project activity with a start date before 02/08/2008).		DR	OK	OK
	Comment: Starting date after 02/08/2008.				
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	CL16 OK	OK
	Comment: Information letters were sent and acknowledged, CL16 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, con-		NA		

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.
	tracts 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. 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. Comment:		NA		
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. Comment: Alternatives according to the methodology.		DR	OK	OK
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. Comment: CL14 had to be raised since it was explicitly said in the PDD that all alternatives are legal compliant. The PDD has been amended and CL14 could be closed.		DR	CL14 OK	OK
1.6.3	Investment analysis (see protocol 3)				
[1] 108	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: (a) The most economically or financially attractive alternative; or (b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs). Comment: See VR 3.6.3 investment analysis.		DR	OK	OK
[1] 109	PPs can show this through one of the following approaches, by demonstrating that: (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; (b) The proposed CDM project activity is less economically or financially attractive than at least one other credible and realistic alternative; (c) The financial returns of the proposed CDM project activity would be insufficient to justify the required investment. Comment: See VR 3.6.3 investment analysis.		DR	OK	OK
[1] 110	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". Comment: Latest guidance was used.		DR	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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 I	OK	OK
	Comment: See financial file 41 and VR 3.6.3.				
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>		DR	OK	OK
	Comment: No benchmark, NPV analysis.				
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>		DR I	OK	OK
	Comment: FSR was used, 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.				
1.6.4	Barrier analysis (see Protocol 3)				
[1] 115	<p>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:</p> <p>(a) Prevent the implementation of this type of proposed CDM project activity;</p> <p>(b) Do not prevent the implementation of at least one of the alternatives.</p>		NA		
	Comment: No barrier analysis.				
1.6.4.1 [1]	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.		NA		

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
116	<p>sis. This does not refer to either:</p> <p>(a) Risk related barriers, for example risk of technical failure, that could have negative effects on financial performance, or</p> <p>(b) Barriers related to the unavailability of sources of finance for the project activity.</p>				
	Comment:				
1.6.4.2 [1] 117	<p>The DOE shall apply a two-step process to assessing the barrier analysis performed as follows:</p> <p>(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;</p> <p>(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.</p>		NA		
	Comment:				
1.6.5	Common practice analysis				
[1] 119	<p>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.</p>				OK
	<p>Comment:</p> <p>CL18: In table 11, 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 “... <i>Yongin is a major city in the Seoul National Capital Area, located in Gyeonggi Province</i>” and Goyang is linked over metro Line 3 with Seoul. → See response and explanations by PP → CL18 closed.</p> <p>CL38: 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. → see answer by PP → CL38 closed</p>				
1.6.5.1 [1] 120	<p>The DOE shall use its local and sectoral expertise to:</p> <p>(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;</p> <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 re-</p>		DR	CL18 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>gion;</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 raised the question about the existing MRTS and the LUZ with more than 1 million inhabitants; the question was answered and confirmed by the local expert → CL18 could be closed. See also above.</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
	Comment: Monitoring manual received, version 1.1. of 07/03/2012.				
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 <i>ex-post</i> and verified.</p> <p>Comment: See under 3.2.2.</p>				OK
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
	Comment: See below				
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
	Comment: 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	<p>The DOE shall, by means of document review and interviews with local stakeholders as appropriate, determine whether:</p> <p>(a) Comments by local stakeholders that can reasonably be considered relevant for the proposed CDM project activity, have been invited;</p>		DR I	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	(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. Comment: Described completely in the PDD Section E.1. List of all comments could be seen, some propositions could not be realised because of financial aspects.				
1.10	ENVIRONMENTAL IMPACTS				
[1] 131	PPs 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. Comment: EIA could be seen, .		DR	OK	OK
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. 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.		DR I	CL32 OK	OK

Protocol 2: Specific validation activities

2.1	BACKGROUND				
[1] 134	PPs 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. Comment:			NA	
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. 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".			NA	
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 of 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 been resolved to the satisfaction of the DOE.			NA	
	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			NA	

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

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

	<p>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.</p>				
	<p>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.</p>				

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 25.07/2012.				
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 2 (ML2) → Letter from Incheon Metropolitan City to IURCH 04/10/2011 (but see CL9 concerning increasing Bus traffic) CL9: A letter in file 22 speaks of increasing intra-bus usage; why? → PP: The usage in the sense of occupation rate shall be improved while the absolute number of buses and the overlapping bus lines shall be reduced → CL9 closed CL12: Which Bus lines could be replaced? → Some additional information about the planned study have been added. CL12 closed.</p>		DR	CL9 CL12 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 ML2 → 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
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 		DR I	CL13 OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	<p>gaseous fossil fuel is used in the project activity compared to the baseline scenario;</p> <ul style="list-style-type: none"> 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. 				
	Comment: CL13: Bio fuel.				
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 Line 1 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: Metro Line 2 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 entire larger urban zone of the city (LUZ).</p>		DR	CL4 OK	OK
	Comment: CL4: LUZ, Greater and Capital Metropolitan Area are not so clearly defined. Answer is satisfying and CL4 could be closed.				
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	CL7 OK	OK
	Comment: CL7: Line 3 is therefore excluded? How is the handling of this? Answer was given and CL7 could be closed.				
3.1.3.3	<p>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.</p>		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?				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.	
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			CL25 CL26 CL27 CL28 CL32 CL33 CL34 OK	OK	
	Boundary checklist					Yes / No
	Source and gas(es) discussed in the PDD?					See VR
	Inclusion / exclusion justified?					Yes
	Explanation / Justification sufficient?					Yes
	Consistency with monitoring plan?					Yes
	Comment: See Table A1 "Baseline Parameters" CL 25 – CL 34, all could be closed.					
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			CL24 OK	OK	
	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: CL24: It was not clear, why the emission grid factor is calculated over a three year period whereas the loss factor TDL is averaged just over one year. The answer was given by the PP and is satisfying. CL24 could be closed.					
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	
	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 VR					
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	CL31 OK	OK	
	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?					CL31, Yes
	Comment: CL31: It is not clear how it will be assured that the measurements of NIZ, VP and OC will always be done in the same way. DOE did not get any TOR's. Answer OK, CL31 closed.					

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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	CL15 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	CL14 OK	OK
	Comment: CL14 legal compliance not mentioned, but all requirements are met.				
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
	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]				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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		
	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.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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	CL18 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.				
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				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.2.1.1	<i>SFCC,G/D/LPG Specific fuel consumption for passenger cars using G,D,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			
	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.				
3.2.1.2	<i>SFCT,LPG Specific fuel consumption for taxis using 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			
	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.				
3.2.1.3	<i>SFC_{M,G} Specific fuel consumption for motor cycles using gasoline</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.				
3.2.1.4	<i>SFC_{D,CNG} Specific consumption of buses using diesel or CNG</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.				
3.2.1.5	<i>N_{I,x} Numbers of vehicles per category I using fuel type x</i>		DR	OK	OK
	Data Checklist	Yes/No/NA			
	Title in line with methodology?	Yes			
	Data unit correctly expressed?	Yes			
	Appropriate description of parameter?	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.	
	Source clearly referenced?	Yes				
	Correct value provided?	Diff. values yes				
	Has this value been verified?	Yes				
	Choice of data or measurement methods correctly justified?	Yes				
	Comment: See VR 3.5.4					
3.2.1.6	<i>OC_C Average occupation rate for passenger cars</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.					
3.2.1.7	<i>OC_T Average occupation rate for taxis</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?	CL26				
	Source clearly referenced?	Yes				
	Correct value provided?	Yes				
	Has this value been verified?	Yes				
	Choice of data or measurement methods correctly justified?	Yes				
	CL26: There seem to be two kinds of taxis in Incheon, the private and the general ones, for which consumption rates and occupation rates are different. There is insufficient information about the actual situation and the used values. The PDD was amended in Section B.6.1., CL26 could be closed.					
Comment:						
3.2.1.8	<i>OC_M Average occupation rate for motor cycles</i>			DR I	CL5 OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	CL5				
	Appropriate description of parameter?	CL5				
	Source clearly referenced?	CL5				
	Correct value provided?	CL5				
	Has this value been verified?	CL5				
	Choice of data or measurement methods correctly justified?	CL5				
	CL5: There are no motorised rickshaws and no motorcycles. Answer by the PP: No motorised rickshaws. This has been corrected. There are motorcycles.This has been included in the CER sheet and the PDD. CL5 could be closed.					
Comment:						
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				

	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 VR 3.5.4.																						
3.2.1.10	<table><tr><td colspan="2"><i>PBL_B Passengers transported by baseline buses per annum</i></td></tr><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>	<i>PBL_B Passengers transported by baseline buses per annum</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	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
<i>PBL_B Passengers transported by baseline buses per annum</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																						
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																						
3.2.1.11	<table><tr><td colspan="2"><i>TDBL_{P,B} Average trip distance of passengers using buses</i></td></tr><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>	<i>TDBL_{P,B} Average trip distance of passengers using buses</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	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
<i>TDBL_{P,B} Average trip distance of passengers using buses</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																						
Correct value provided?	Yes																						
Has this value been verified?	Yes																						
Choice of data or measurement methods correctly justified?	Yes																						
	Comment: OK.																						
3.2.1.12	<table><tr><td colspan="2"><i>DD_B Total distance driven by baseline buses per annum</i></td></tr><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>CL25</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>	<i>DD_B Total distance driven by baseline buses per annum</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?	CL25	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	CL25 OK	OK
<i>DD_B Total distance driven by baseline buses per annum</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?	CL25																						
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.																						
3.2.1.13	<table><tr><td colspan="2"><i>AD_B Average annual distance driven by buses</i></td></tr><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>	<i>AD_B Average annual distance driven by buses</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	Correct value provided?	Yes	Has this value been verified?	Yes	Choice of data or measurement methods correctly justified?	Yes		DR I	OK	OK
<i>AD_B Average annual distance driven by buses</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																						
Correct value provided?	Yes																						
Has this value been verified?	Yes																						
Choice of data or measurement methods correctly justified?	Yes																						
	Comment: See VR 3.5.5.																						

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.2.1.14	<i>AD_T Average annual distance driven by 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			
	Correct value provided?	Yes			
	Has this value been verified?	Yes			
	Choice of data or measurement methods correctly justified?	Yes			
	Comment: See VR 3.5.5.				
3.2.1.15	<i>NIZ_{C,T,BL} Number of cars, taxis on affected roads per annum in the baseline</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 3.5.5.				
3.2.1.16	<i>V_B Vehicle baseline speed 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			
	Source clearly referenced?	Yes			
	Correct value provided?	Yes			
	Has this value been verified?	Yes			
	Choice of data or measurement methods correctly justified?	Yes			
	Comment:				
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>PEL,R Total passengers transported by metro per year</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: See VR 3.7					
3.2.2.2	<i>EC_{EL,R} Quantity of electricity consumed by the baseline metro per year</i>			DR I	CL36	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?	CL36				
	Frequency of monitoring/recording	Yes				
	Is value applied verified and correct?	Yes				
	Is monitoring equipment calibrated?					
Are QA/QC procedures defined and applied?						
Comment: CL36: 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 1 500 V DC. In between there are other consumptions and losses. The answer by the PP is still not satisfying → CL36 is still open.						
3.2.2.3	<i>NCV_{G/D/CNG/LPG} Net calorific value of 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: See VR 3.7 and 3.5.5.						
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: 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				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.	
	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.					
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: See VR 3.7.					
3.2.2.7	<i>N_{x,CT} Number of passenger cars and taxis using fuel type x</i>			DR I	CL33 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?	CL33				
	Frequency of monitoring/recording	Yes				
	Is value applied verified and correct?	Yes				
	Is monitoring equipment calibrated?					
	Are QA/QC procedures defined and applied?					
	Comment: CL33: The description of the parameter N _{x,CT} is inconsistent with the monitoring manual (number of cars or % of types?). MM was changed → CL33 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: See VR 3.7.					
3.2.2.9	<i>EC_{PJ} Electricity consumed by MRTS (trains)</i>			DR I	OK	OK
	Data Checklist	Yes/No/NA				
	Title in line with methodology?	Yes				
	Data unit correctly expressed?	Yes				

	Requirement		Ref.	MoV	Draft Concl.	Final Concl.
	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.					
3.2.2.10	<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?					
	Comment: See VR 3.7					
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: See VR 3.7.					
3.2.2.13	<i>NIZ_{C,T} Number of cars, taxis using affected roads</i>			DR I	OK	OK

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
	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	TDIZ _{C,T} Distance driven by taxis and passenger cars on affected roads		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					
3.2.2.15	V _P Vehicle project speed on affected roads				
	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					
3.2.2.16	BTD _{p,i} Baseline trip distance of the cluster p of surveyed passengers using mode 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: See VR 3.5.5.and survey				
3.2.2.17	<i>IPTD_{p,i} Indirect project trip distance of the cluster p of the surveyed passengers using mode i</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 3.5.5. and survey				
3.2.2.18	Is the set of monitored data and parameters complete?		DR I	OK	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				
3.3.1.1	Is the survey conducted according to annex 4 of the methodology?		DR	CL22 OK	OK
	Comment: Yes, but not touching Metro Line 2. The survey was used from Metro Line 9 Seoul. CL22: The <i>ex-ante</i> calculation of emission reductions is based on a survey which was done for metro Line 9 in Seoul. There is not enough evidence given why the survey for Seoul could also be used for the new metro line in Incheon. Explanation by PP is satisfactory, CL22 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: Yes, it was taken from Seoul Metro Line 9				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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
	Comment: Yes.				
3.3.1.7	Are the relevant vehicle categories chosen according to the methodology?				
	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	CL5 OK	OK
	Comment: CL5, a wrong emission factor led to a reduction of around 25%.				
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 <i>ex-ante</i> emissions.				
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.				
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.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
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 Metro Line 9 Seoul.				
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
	Comment: Yes.				
3.3.2.8	Are the final total project emissions plausible and conservative?		DR	OK	OK
	Comment: Yes for the <i>ex-ante</i> 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.				

	Requirement	Ref.	MoV	Draft Concl.	Final Concl.
3.3.3.8	Do the visible speeds on some affected roads correspond to those encountered during the site visit?		I	OK	OK
	Comment: Seogokro was visited, the speed of 31 km/h is 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
	Comment: No leakage was applied for <i>ex-ante</i> 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, but see CL5.				

Protocol 4: Summary of Requests

No.:	CL 1	Reference:	VVM 44: Letter of Approval
Validator request:	LoAs 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 16/07/2012, CL 1 closed.	Date:	18/07/2012

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 [98]. Form F-CDM-MOC was used. CL 2 is closed.	Date:	12/04/2012

No.:	CL 3	Reference:	PDD A 4.1.4
Validator request:	The geographical coordinates are not written in the correct format (x,yyyy °) and are not representing the headquarter of the metro.		
Project owner response:	Has been updated		
Validator conclusion:	Adaption OK, CL3 closed.	Date:	12/04/2012

No.:	CL 4	Reference:	PDD A 4.1.4
Validator request:	The context between a "larger urban zone LUZ", the "capital metropolitan area" is not defined clearly enough. See also CL 18.		
Project owner response:	Has been clarified in Chapter A.4.1.4 and made consistent between chapters		
Validator conclusion:	Adaption OK, CL4 closed.	Date:	12/04/2012

No.:	CL 5	Reference:	PDD A 4.3
Validator request:	There are no motorised rickshaws and no motorcycles.		
Project owner response:	No motorised rickshaws. This has been corrected. There are motorcycles. This has been included in the CER sheet and the PDD. The file 11 was updated and an error has been found concerning EF for rail in file 11. Therefore, the CER sheet as well as the PDD were updated.		
Validator conclusion:	The error resulted in a reduction of estimated yearly CER's of about 25%. CER-sheet and PDD adapted, CL5 closed.	Date:	12/04/2012

No.:	CL 6	Reference:	PDD A 4.3 and figure 1
Validator request:	It is not clear why there is only data up to 2006. Furthermore figure 1 does not seem to be complete and adequately labeled.		
Project owner response:	The last year i.e. 2006 is based on the metropolitan transportation authority 12/2007. This information is only collected every 4-5 years and no newer data source is available. The information of the label has been added in the figure.		
Validator conclusion:	Explanation is satisfying, CL6 closed.	Date:	12/04/2012

No.:	CL 7	Reference:	PDD p. 9
Validator request:	The planned 3 rd line mentioned in the PDD lacks a little more information.		
Project owner response:	Somme additional information has been added but as of today no detailed planing has started.		
Validator conclusion:	OK, the additional information was added in the footnote 12, CL7 closed.	Date:	12/04/2012

No.:	CL 8	Reference:	PDD, p. 9, map 3
Validator request:	The source for map 3 (file 44) is not clear since it could not be found.		
Project owner response:	File 44 indicates the stations and distances which were used to construct the map 3. The source of file 44 is The Ministry of Land, Transportation and Maritime Affair. The map without stations is		

	based on Incheon Transport Corporation	
Validator conclusion:	OK, some explanation was added, CL8 closed.	Date: 12/04/2012

No.:	CL 9	Reference: PDD p. 12, file 22
Validator request:	The letter in file 22 speaks of " <i>increasing intra-bus usage</i> ", which could be misinterpreted as new bus lines through the project will be created. The site visit showed however, that there must be a translation error.	
Project owner response:	No this is correct. The usage in the sense of occupation rate shall be improved while the absolute number of buses and the overlapping bus lines shall be reduced	
Validator conclusion:	OK, the explanation is satisfying, being consistent, CL9 closed.	Date: 12/04/2012

No.:	CL 10	Reference: PDD p. 12 A 4.4
Validator request:	The years for the first crediting period (2015 – 2021) are not consistent with the different tables in Annex 3 (but see also CL 11).	
Project owner response:	The start is 1.1.2015. PDD has been corrected	
Validator conclusion:	OK, the appropriate tables were amended, CL10 closed.	Date: 12/04/2012

No.:	CL 11	Reference: PDD Annex 3
Validator request:	The end date of construction is mentioned as 18/11/2014. Why is the first crediting period already starting at the beginning of 2014?	
Project owner response:	Crediting period start is 01/01/2015	
Validator conclusion:	Tables with starting date 01/01/2015, OK, CL11 closed.	Date: 12/04/2012

No.:	CL 12	Reference: PDD table A2
Validator request:	There is not enough information about bus lines which could be affected / closed with starting of the new metro.	
Project owner response:	Some additional information about the planned study have been added. As of the current stage detailed information is however not available as this will be studied in detail once the project starts operations.	
Validator conclusion:	OK, the mentioned study is planned within 6 months after the operational start, CL12 closed.	Date: 12/04/2012

No.:	CL 13	Reference:
Validator request:	There is insufficient information about the possible actual and future use of biofuels for buses. Especially it is not clear <ul style="list-style-type: none"> - whether there is actually no use of biofuel for buses - what will happen to the project if in the future the use of some biofuel would become mandatory for some motorised vehicles. 	
Project owner response:	No biofuel is used. See confirmation letter of public transportation system file 62 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}	
Validator conclusion:	OK, clarifications have been amended and a new file 62 was added, CL13 closed.	Date: 12/04/2012

No.:	CL 14	Reference: PDD p. 16
Validator request:	It is not clear from the PDD, if all options are consistent with laws and regulations.	
Project owner response:	The PDD has been amended.	
Validator conclusion:	OK, the sentence was added on page 17 of the new version of the PDD, CL14 closed.	Date: 12/04/2012

No.:	CL 15	Reference: PDD p. 19 and file 20
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Validator request:	The proof for increasing traffic with private cars (file 20) is rather old; isn't there any newer data available?	
Project owner response:	This is based on the assessment of scenarios and options in the FSR for the metro. It is thus appropriate in fact to use the data available as of time of decision taking. Comparable studies of speed and vehicle growth have not been made since 2006 (date of study mentioned). Also it is not believed that such figures will revert in short time.	
Validator conclusion:	OK, explanation is plausible and no other data available, CL15 closed.	Date: 12/04/2012

No.:	CL 16	Reference: PDD B.5 prior consideration
Validator request:	The acknowledgment of the prior consideration form by the Korean DNA seems not to exist, at least it is not documented.	
Project owner response:	See file 63	
Validator conclusion:	OK, a new file 63 was added, the acknowledgment dates of 02/09/2011, CL16 closed.	Date: 12/04/2012

No.:	CL 17	Reference: PDD p. 26
Validator request:	There seems to be a printing error "... IEA estimates initial capital costs for underground MRTS between 60-7180 million USD/km...", should probably read ... 60-180 million USD/km ...	
Project owner response:	Has been corrected	
Validator conclusion:	Printing error, CL17 closed.	Date: 12/04/2012

No.:	CL 18	Reference:
Validator request:	In table 11, 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.	
Project owner response:	Capital Metropolitan City is taken as area based on LUZ as indicated in the methodology. This is not equivalent to the Seoul National Capital Area (SNCA) which is much larger. Seoul Metropolitan City definition is taken as on the official website of Seoul Metropolitan Government (http://english.seoul.go.kr/gtk/main.php) SNCA is over 11 000km ² and includes the entire Province of Gyeonggi and is thus more than an urban area. This can also be seen in the urbanization of SNCA which only comprises a part of the entire area. Goyang and Yongin do not form part of Seoul Metropolitan City. Goyang is connected with Line 3. However this is the Ilsan Line which is the extension of Line 3 and which is not operated by Seoul Metro but by Korail which operates the national rail infrastructure. This is not the case with Incheon and Seoul where the metro operates the lines which run partially in Seoul and partially in Incheon.	
Validator conclusion:	OK, according to the local expert the explanation of the PP is correct (document of 17/03/2012), CL18 closed.	Date: 12/04/2012

No.:	CL 19	Reference: PDD p. 26 and finance file
Validator request:	There is not enough information about operational costs like number of employees, details of energy, maintenance and administrative cost, and others.	
Project owner response:	See file 57b for details	
Validator conclusion:	OK, file 57b gives enough information for the judgment of the financial analysis, CL19 closed.	Date: 12/04/2012

No.:	CL 20	Reference: PDD p. 25
Validator request:	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.	
Project owner response:	The NPV is calculated based on constant WONS. Therefore inflation is not included in any revenue, investment or cost estimate. The full fare rate of 1 100 Won used corresponds to the metro fare charged 2009 (idem to the cur-	

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	rent fare rate if not paying cash).	
Validator conclusion:	OK, explanation is accepted, CL20 closed.	Date: 12/04/2012

No.:	CL 21	Reference: PDD table 7
Validator request:	In table 7, there is no salvage value. However there are 2% land costs in the investment costs, which probably will be sellable after 30 years (see also PDD Busan, where the landcosts appear as salvage value).	
Project owner response:	Land has been included with 100% of value with the same distribution central government and municipality as the other investments. The PDD has been updated on the changed results. See also new file 41 finance	
Validator conclusion:	New financial analysis and amendment of PDD: The overall conclusions did not change with this (minor) change. But the CER's in the assumptions are still the old ones.	Date: 12/04/2012
Project owner response:	Financial file corrected	
Validator conclusion:	OK, has no influence on the PDD, CL21 closed.	Date: 23/04/2012

No.:	CL 22	Reference: PDD p. 52, B6.3
Validator request:	The <i>ex-ante</i> calculation of emission reductions is based on a survey which was done for metro Line 9 in Seoul. There is not enough evidence given why the survey for Seoul could also be used for the new metro line in Incheon.	
Project owner response:	Both are in the same LUZ. The geographical boundary taken is SMA. The Line 9 connects Seoul with Incheon and is a new line. A full survey of 8,000 users was made on this metro line according to ACM0016 (Line 9 is a VCS project). The project line is not yet operational and therefore to perform projections a survey must be done on another line or data must be used from other cities. Line 9 is considered as ideal as in the same region, with the same type of users and therefore with similar travel patterns potentially concerning modes and trip distances. While actual performance will vary, this will be monitored once the metro project line is operational – however for projection purposes it is considered a very good approximation.	
Validator conclusion:	OK, the above explanation is accepted. For the <i>ex-ante</i> estimation of CER's there is indeed no other choice than to take a survey in a similar surrounding. CL22 closed.	Date: 12/04/2012

No.:	CL 23	Reference: PDD Annex 1
Validator request:	The representative of IURCH according to file 16 is Mr Jung Yeungeul, in Annex 1 of the PDD however Mr Keuncheon Lee figures as representative.	
Project owner response:	Mr KeunCheon has been designated by the company for the CDM project. The person listed in the Annex 1 of the PDD or the MOC need not be the legal representatives of the company. The company itself designates whom it wants to list. Annex I is also identical with the MOC signed.	
Validator conclusion:	OK, some minor amendments were added in the new PDD, CL23 closed.	Date: 12/04/2012

No.:	CL 24	Reference: PDD B6.2 p.48
Validator request:	It is not clear why the value for the TDL (1.67%) was chosen as average over just 1 year whereas the grid emission factor has to be calculated from a 3-years average.	
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:	OK, explanation accepted, CL24 closed.	Date: 12/04/2012

No.:	CL 25	Reference: PDD table A1
Validator request:	There are several inconsistencies in table A1: - DD _{B,D} is based on file 6, but the data are given for 2010 and not 2009;	

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	<ul style="list-style-type: none"> - PBL_b again is given for 2010 and not for 2009; - TDBL_P is coming from file 7; there is a printing error in the formula (Average Time from origin to destination X Busan Bus Average Speed). 	
Project owner response:	Bus data is all from 2010. Has been corrected. TDBL is correctly listed as file 7. The formula in G13 of file 7 is correct and the printing error Busan instead of Incheon has been corrected. See corrected file 7	
Validator conclusion:	Corrections and amendments OK, CL25 closed.	Date: 12/04/2012

No.:	CL 26	Reference: PDD table A1
Validator request:	There seem to be two kinds of taxis in Incheon, the private and the general ones, for which consumption rates and occupation rates are different. There is insufficient information about the actual situation and the used values.	
Project owner response:	There are private and corporate taxis. These are however not 2 types of modes of transit and are therefore not separated. For calculation of fuel consumption data on each type was weighted with numbers. The PDD in Section B.6.1. has been amended to clarify.	
Validator conclusion:	OK, the amendment in Section B6.1 is clear and correct, CL26 closed.	Date: 12/04/2012

No.:	CL 27	Reference: Survey file 11
Validator request:	Please send the following samples out of the survey to the validator: 17, 101, 202, 303, 390, 404, 414, 505, 511, 526, 606, 707, 799, 808, 816, 909, 1010, 1111, 1181, 1201, 1302, 1303, 1401, 1501, 1601, 1701, 1801, 1901, 2001, 2102, 2203, 2304, 2305, 2406, 2452, 2507, 2608, 2709, 2800, 2863, 2895, 2901, 2925, 3001, 3102, 3203, 3304, 3405, 3506, 3607, 3708, 3809, 3987, 4001, 4006, 4112, 4178, 4198, 4203, 4203, 4207, 4270, 4304, 4338, 4405, 4414, 4506, 4507, 4508, 4601, 4701, 4801, 4819, 4901, 4924, 5001, 5102, 5103, 5204, 5305, 5406, 5507, 5560, 5608, 5709, 5801, 5802, 5903, 5920, 5990, 6001, 6102, 6200	
Project owner response:	Have been sent	
Validator conclusion:	OK, the samples of the survey were checked by the local expert by using the database in the internet "naver.com" CL27 closed.	Date: 12/04/2012

No.:	CL 28	Reference: PDD
Validator request:	It is not clear how the electricity consumption <i>ex-ante</i> of the project was estimated.	
Project owner response:	See file 65	
Validator conclusion:	OK, new file 65 was added, CL28 closed.	Date: 12/04/2012

No.:	CL 31	Reference: PDD B7.1
Validator request:	It is not clear how it will be assured that the measurements of NIZ, V _P and OC will always be done in the same way. DOE did not get any TOR's.	
Project owner response:	V _P is based on moving and average speed. file 42 contains the points of measurement. Therefore the method of measuring is irrelevant. If an 3 rd party source such as in the baseline continues to publish speed data latter will be used. OC: Information has been added 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 42)	
Validator conclusion:	OK, OC for motorcycles have been added, CL31 closed.	Date: 12/04/2012

No.:	CL 32	Reference: PDD D2
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. The metro act is not mentioned.	
Project owner response:	See all approvals in file 64. The PDD has been amended in Section D2.	
Validator conclusion:	OK, there are three statements saying that the	Date: 12/04/2012

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	project is in accordance with the law of environment impact assessment article 18 clause 3, with the law of natural disaster article 4, and with the transportation impact analysis, CL32 closed.	
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No.:	CL 33	Reference:	PDD B.7.1
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 vs 1.1 has changed this.		
Validator conclusion:	OK, new version of monitoring manual, CL33 closed.	Date:	12/04/2012

No.:	CL 34	Reference:	PDD B.7.1 and monitoring manual
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 66.		
Validator conclusion:	OK, the official ordinance in file 66 (6.4.2011) gives enough evidence that the electricity meters have to be calibrated by an accredited company. CL34 closed	Date:	12/04/2012

No.:	CL 36	Reference:	PDD B.7.1 and monitoring manual
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 1 500 V DC. In between there are other consumptions and losses.		
Project owner response:	See details in file 67. The PDD has been amended in Section B.7.2.		
Validator conclusion:	The explanation and amendments are reasonable. CL36 closed.	Date:	12/04/2012

No.:	CL 37	Reference:	PDD and monitoring manual
Validator request:	The project titles are not throughout the documents identical.		
Project owner response:	Should be consistent now		
Validator conclusion:	Is consistent, CL37 closed.	Date:	12/04/2012

No.:	CL 38	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 being taken. The PDD was adapted. See files 68a and 68b for more details.		
Validator conclusion:	PDD was adapted, new files included, CL38 closed	Date:	26/06/2012

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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:	12/04/2012