NAMA Proposal and MRV Method

Development of Bus Rapid Transit (BRT) in Greater Jakarta (Jabodetabek BRT NAMA)

Low Emission Capacity Building (LECB) Indonesia 2014
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Summary

Development of Bus Rapid Transit (BRT) in Greater Jakarta
(JABODETABEK BRT NAMA)

The development of the Bus Rapid Transit (BRT) in greater Jakarta aims to reduce greenhouse gas (GHG) emissions for climate change mitigation. Successful implementation of this project can lead to reduced congestion, which can increase overall productivity of the city, leading to economic advancements. There are also health benefits resulting from the reduced pollution of better flowing traffic.

The project will involve the governments of: (1) DKI Jakarta; (2) Bogor City; and (3) Tangerang City. This project will procure 380 gas-fueled buses in DKI Jakarta, 50 and 110 diesel buses in Bogor and Tangerang respectively. Additionally, bus lanes, terminals and fuel stations will also be constructed. The increased provision of public transport services should encourage greater transition away from private transport. The project will take place from 2015-2018 and will cost an estimate of USD 3.25 billion or IDR 3.9 Trillion. The expected GHG emission reduction was calculated to be 0.64 million tons CO$_2$ eq in 2018, and cumulative in 4 years to be 1.8 million tons CO$_2$ eq. The finance source of this project is expected to be funded by government budget or with public and private partnership, in which DKI Jakarta will requires IDR 3.1 trillion, Tangerang City IDR 716 billion, and Bogor City IDR 150 billion.

Strong policies are required to ensure the success of this project since the constraint for citizens to switch to public transportation is not only the availability of the vehicles, but also the security of comfort of the whole journey. Careful planning is needed to reduce the potential of unintended consequences from the issuance of policies for implementation of this BRT NAMA, for example increasing parking fees in buildings would also lead to more cases of illegal parking on roadsides that can further exacerbate the congestion problem. Vulnerable groups like the poor will benefit from this project, as the reduced congestion will not only reduce their exposure to pollution, but also elevate the economic welfare of the community through increased access to economic activities through better public transportation.
Nationally Appropriate Mitigation Action
Bus Rapid Transit (Trans Jabodetabek)

**Bus Rapid Transit (Trans Jabodetabek)**

**Project description:** mass transportation infrastructure development (Bus Rapid Transit)

**Project owners:** 3 Cities Government: Jakarta, Bogor and Tangerang.

**Estimated project cost:** USD 3.25 billion (IDR 3.9 Trillion)

**Project scope:** procurement of 520 gas-fueled bus, terminal construction, bus corridor construction and gas-fueling stations construction.

**Project duration:** 2015-2018

**Expected GHGs emission reduction:** 0.64 million tons CO₂ eq in 2018, cumulative in 4 years 1.8 million tons CO₂ eq

**Financing source:** Public – Private Partnership

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**Measurement, Reporting, Verification (MRV) Approach**

Bus Rapid Transit (Trans Jabodetabek)

*Figure 1. Concept of emission reduction of BRT*

"GHG emission reduction of the BRT NAMA project is from the improvement of transport system efficiency (use high seat capacity buses instead of private vehicles) and from the use of natural gas instead of diesel."
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A. GENERAL DATA OF NAMAs

1. Project Name: The Development of Bus Rapid Transit (BRT) in Greater Jakarta (JABODETABEK)

2. Coordinating Agency
   a. Coordination of Activity
      – Government of DKI Jakarta/BLHD of DKI Jakarta
      – Government of Tangerang City/BLHD of Tangerang City
      – Government of Bogor City/Bappeda of Bogor City
   b. National Coordination of Activity
      – Ministry of Transportation
      – Ministry of Finance

3. Estimated GHG Emission Reduction
   The expected GHG emission reduction is around 0.640 million tons CO2-eq, with detail reduction potential each year (2015 – 2018) presented in Table 1.
   Table 1 Expected GHG emission reduction 2015 - 2018

<table>
<thead>
<tr>
<th>City/Province</th>
<th>Million Ton CO2-e</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015</td>
</tr>
<tr>
<td>Bogor</td>
<td>0.023</td>
</tr>
<tr>
<td>Tangerang</td>
<td>0.053</td>
</tr>
<tr>
<td>DKI Jakarta</td>
<td>0.205</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.281</td>
</tr>
</tbody>
</table>

4. Estimated Investment and Project Cost
   a. DKI Jakarta : Rp. 3.1 trillion,
   b. Tangerang City : Rp. 716 billion,
   c. Bogor City : Rp. 150 billion,
   d. Total : Rp 3.9 trillion

5. Project Duration
   a. DKI Jakarta: 2015- 2018
   b. Tangerang City: 2015 – 2018
   c. Bogor City: 2015 – 2018

6. Contact Person/Department
   a. DKI Jakarta
      Name of Agency : Badan Pengelolaan Lingkungan Hidup Daerah (BPLHD) DKI Jakarta
      Contact Person : M. Tauhid Tjakra Amidjaja/Head of BPLHD DKI Jakarta
      Postal Address : Jl. Casablanca Kav. 1 Kuningan, Jakarta Selatan
      Telephone/Fax : (021) 5209651, 5209652, 5209653, 5209645 / (021) 5209643
      Email Address : bplhd@jakarta.go.id / webmin_bplhd@yahoo.com
   b. Tangerang City
      Name of Agency : BPLHD Tangerang City
      Contact Person : Liza Puspadewi / Head of BPLHD Kota Tangerang
      Postal Address : Jl. Satria Sudirman no 1, Tangerang
      Telephone/Fax : (021) 55768703 / (021) 55768703
      Email Address : blhd@tangerangkota.go.id
   c. Bogor City
      Name of Agency : Bappeda (Regional Development Planning Board) of Bogor City
      Contact
7. Implementing Partners

a. Name of agency: PT TransJakarta
   Contribution: Operator of BRT DKI Jakarta
   Contact Person: Mr. Bagus Darmawan, Staff of PT. TransJakarta
   Postal Address: Jalan Mayjen Soetoyo No 1 RT/RW 005/012 Kelurahan Makasar, Kecamatan Kebon Pala, Jakarta Timur 13650
   Telp/Fax/Email: 021-80879449/021-80879453

b. Name of agency: PPD (Perusahaan Pengangkutan Djakarta) and Mayasari Bakti
   Contribution: Operator of APTB (Angkutan Perbatasan Terintegrasi Bus-way or Busway-integrated border transport) Kota Tangerang
   Postal Address: Jl. Raya Bogor Km. 24 No. 71, Ciracas, Jakarta Timur 13750,
   Telp/Fax/Email: (021) 8401903 / (021) 8400562

c. Name of agency: PT Sinar Jaya
   Contribution: Operator of APTB/BTS Kota Bogor
   Postal Address: Jl. Diponegoro No. 70, Tambun-Bekasi
   Telp/Fax/Email: (021) 8804666, 8804688, 8818649, 88355865

8. Project registered at UNFCCC NAMA registry? NO

B. PROJECT DESCRIPTION

1. Project abstract
   Increasing demand of personal mobility as a consequence of ever increasing economic activity in Greater Jakarta (Jabodetabek) requires the availability of efficient transportation system. In this regard, quality mass public transport is considered the most suitable system as it will facilitate modal shift from personal to mass transport with a rapid transit in each of bus stop and therefore reduce traffic congestion, shortening travel time, improve energy efficiency, and reduce GHG emissions and air pollution. Use of gas instead of diesel fuel in the BRT will further reduce GHG emissions and air pollutions in the city and also reduce the dependency of oil import. In mega city and economic center like DKI Jakarta where many workers commute daily from its surrounding cities, reduced traffic congestion will reduce commuting time and eventually will improve the productivity of the workers. In addition, modal shift from personal to mass public transport will also reduce transport cost.

   This proposal is a project NAMAs concerning mass transportation infrastructure development for the provision of public transportation for commuters within and from outside DKI Jakarta as many workers in DKI Jakarta reside in surrounding cities such as Bogor City and Tangerang City. The project activities, i.e. infrastructure development, will take place in each of those regions. Administratively, the proponents of this NAMAs project consist of 3 parties i.e. Government of DKI Jakarta, Bogor City, and Tangerang City. Government of DKI Jakarta facilitates movement of all commuters from outside and within DKI Jakarta. The project covers procurement of gas-fueled buses (TransJakarta Busway) and construction of bus lanes (Busway corridors), bus stops, and gas refueling station/units. Government of Bogor City
facilitates public transport for commuters from Bogor to DKI Jakarta and Government of Tangerang City facilitates public transport for commuters from Tangerang to DKI Jakarta. In these two cities, Bogor and Tangerang, the project covers procurement of diesel buses for APTB/BTS (Busway-integrated border transport) and construction of bus lane (bus corridors), bus terminals, and pedestrian. Diesel bus is to be used in Bogor and Tangerang as there is no gas distribution infrastructure system in this region. These infrastructure projects are interdependent and should be implemented simultaneously to achieve an integrated public transportation system. As these projects are interdependent, they are bundled as one NAMAs project and called as “Bus Rapid Transit (BRT) Development of Greater Jakarta”. This proposed NAMAs project will be implemented during 2015 to 2018 with a total budget of Rp. 3.9 Trillion and expected emission reduction of 0.640 million tons CO2-eq. The types of GHG covered in this project are carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).

This NAMAs projects is to be proposed as unilateral NAMAs, which is funded by domestic sources. The investment of the project is expected to be funded using domestic budget, i.e. APBN/APBD (Central Government Revenue and Expenses Budget or Local Government Revenue and Expenses Budget). Other expenditures related to NAMAs activities including MRV process are expected to be funded by other domestic sources, one of them is ICCTF. The status of the project currently has not been link to ICCTF. The MRV process of this proposed unilateral NAMAs will be carried out domestically using international guidelines.

2. Project objectives
The proposed NAMAs project aims to develop a BRT system in order to encourage modal shift from private to public transportation through which reduction of transport fuel consumption could be achieve and therefore reducing the GHG emissions and improving urban air quality. The reduction of this transport fuel consumption is expected to be the outcome from increased efficiency in transport (lower energy consumption per passenger kilometer) and reduction of traffic congestion. Other factor that will further reducing the GHG is substituting diesel oil by natural gas in the BRT.

3. Scope of the project
Brief of scope of the projects in each region is summarized as follows.
DKI Jakarta
a. Procurement of 380 gas fueled buses in 2015 - 2017
b. Construction of 3 new corridors (bus lane), 49.3 km in 2016-2017
c. Construction of 5 gas refueling stations in 2015 - 2017

Kota Bogor
a. Procurement of 50 buses in 2015-2017
b. Construction of bus terminal in 2015

Kota Tangerang
a. Procurement of 110 buses in 2015 - 2017
b. Improvement of terminals buses in 2015
c. Construction of corridors (bus lane), 63 km in 2015 - 2017

4. Integration into relevant national policies
The projects are in line with RPJMD (Regional Midterm Development Plan) and RAD GRK (Regional GHG Mitigation Action Plan) of each region. For DKI Jakarta, the project is explicitly stated in RPJMD and RAD. BRT Jabodetabek has been started from 2004 in DKI Jakarta, funded using APBD (regional government budget).

5. Project outputs and outcomes

The outputs of this proposed NAMAs project are procured new buses and constructed supporting BRT systems (bus corridor, bus stops/stations, pedestrian, etc.). The project will also produce several outcomes, namely availability of efficient and integrated city transport in the Greater Jakarta area, reducing traffic congestion, shortening travel time, improving energy efficiency, reducing oil fuel consumption and dependency of oil import, reducing of commuting time and eventually will improve the productivity of the workers, and reducing transport cost due to modal shift from personal to mass public transport. Among of these outcomes, reduced oil fuel consumption due to improved transport efficiency as well as diesel oil substitution by natural gas is the only parameter that can be measured and monitored. GHG reduction is then estimated using reduced oil fuel consumption and gas consumption data in Table 2 and GHG emission factors.

Table 2 Expected reduced oil fuel consumption (kliter) and gas consumption (kLEP)

<table>
<thead>
<tr>
<th>Year</th>
<th>DKI Jakarta</th>
<th>Tangerang</th>
<th>Bogor</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reduced oil fuel consumption</td>
<td>Gas consumption</td>
<td>Reduced oil fuel consumption</td>
<td>Reduced oil fuel consumption</td>
</tr>
<tr>
<td>2015</td>
<td>96,242</td>
<td>11,406</td>
<td>22,789</td>
<td>9,831</td>
</tr>
<tr>
<td>2016</td>
<td>128,425</td>
<td>14,588</td>
<td>35,315</td>
<td>17,205</td>
</tr>
<tr>
<td>2017</td>
<td>168,836</td>
<td>18,912</td>
<td>47,841</td>
<td>24,579</td>
</tr>
<tr>
<td>2018</td>
<td>210,982</td>
<td>23,413</td>
<td>60,367</td>
<td>24,579</td>
</tr>
</tbody>
</table>

The GHG reduction resulted from the implementation of this proposed NAMAs during 2015-2018 is shown in Figure 1. Assuming the BRT project under this NAMAs will continue until 2030 with number of operating busses as planned in 2018 through good maintenance, retrofit, and buses renewal, GHG reduction will be 0.64 million-ton CO₂ per year. As comparison, BRT project according to RAD DKI Jakarta is expected to achieve a reduction of 2.3 million ton CO₂ in 2030. To achieve GHG emission reduction target from BRT project under RAD, the Government of DKI Jakarta not only has to extend and keep the BRT project plan in 2018 until 2030 but also has to expand this proposed NAMAs project.
<table>
<thead>
<tr>
<th>Region</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogor</td>
<td>0.023</td>
<td>0.041</td>
<td>0.058</td>
<td>0.058</td>
</tr>
<tr>
<td>Tangerang</td>
<td>0.053</td>
<td>0.081</td>
<td>0.110</td>
<td>0.139</td>
</tr>
<tr>
<td>DKI Jakarta</td>
<td>0.205</td>
<td>0.272</td>
<td>0.355</td>
<td>0.443</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.281</td>
<td>0.394</td>
<td>0.523</td>
<td>0.640</td>
</tr>
</tbody>
</table>

Figure 1. GHG emission reduction potential of the BRT NAMAs

Assuming the BRT project under this NAMAs will continue until 2030 with number of operating busses as planned in 2018 through good maintenance, retrofit, and buses renewal, GHG reduction will be 0.64 million-ton CO₂ per year. As comparison, BRT project according to RAD DKI Jakarta is expected to achieve a reduction of 2.3 million ton CO₂ in 2030. To achieve GHG emission reduction target from BRT project under RAD, the Government of DKI Jakarta not only has to extend and keep the BRT project plan in 2018 until 2030 but also has to expand this proposed NAMAs project.

6. Project Implementation Strategy

The implementation of this proposed NAMAs project needs preparatory activities, construction and procurement activities of BRT, managing the BRT operation, registry process, etc. Within the context of preparatory activities, the project proponent should first establish project organization for construction, procurement, and operation of the BRT. Secondly, the project team should conduct stakeholder consultation at regional as well as central government and public socialization of BRT development plan. As the BRT project implementation in DKI Jakarta will use gas-fueled busses, the availability of gas supply has to be secured during stakeholder consultation.

In addition to preparatory activities that are commonly practiced for infrastructure development project, the project proponent should prepare organization as well resources for managing NAMAs and MRV processes. It should be noted that the MRV process will require data and information that will support measurement, monitoring, reporting and verification of NAMAs implementation and its impact. Since this NAMAs project is related to RAN/RAD, intensive communication between NAMAs project team with RAN/RAD Secretariat (Bappenas), steering committee of climate change national coordination team (SC-CCNCT), and the corresponding National MRV commission.

During the implementation of the BRT project, the NAMAs project team should continue to prepare all the data and information needed for MRV process. The proposed NAMAs is categorized as unilateral NAMAs and project funding is to be obtained from domestic sources. The BRT development project is a government project where the investment is provided by both central government and regional government. Additional costs related to the submission of the BRT development project into NAMAs project are also to be funded from domestic sources, i.e. APBN/APBD, ICCTF (Indonesian Climate Change Trust Fund), etc.

7. Planned Activities

This NAMAs project is grouped into three stages of activity, i.e. preparatory, construction and procurement, and operational stages. The operational stage includes activity related to MRV process. The preparatory are to be conducted by the project proponent through internal meeting, consultation with relevant stakeholders, and recruitment for additional manpower to handle NAMAs and MRV processes. The construction and procurement activities are described as follows:
**DKI Jakarta**

BRT project of DKI Jakarta is part of development plan listed in RPJMD of DKI Jakarta 2013-2017 and also part of DKI Jakarta’s GHG mitigation action plan (RAD GRK) stated in Governor Regulation of DKI Jakarta No. 131/ 2012. According to the RPJMD, BRT development includes:

a. Procurement of 180 gas-fueled buses in 2015
b. Procurement of 200 gas-fueled buses in 2016 and 2017
c. Construction of bus lanes (Busway corridor) No.13, 14, 15 in 2016 and 2017
d. Construction of gas refueling stations and the corresponding gas supply system in 2015-2017

The above new buses are to be distributed to existing corridors (No.1 to 12) and new corridors (No. 13 to 15) as follows:

a. Addition of 180 new buses in 2015 is to be distributed to corridors No. 1 to 12; each corridor will have additional 15 new buses

b. 60 new buses will be operating in new corridor No. 13 (Ciledug-Blok M, 14.6 km) which is planned to be ready in 2016.

c. 70 new buses will be operating in new corridor No. 14 (Manggarai-UI, 17 km) which is planned to be operational in 2017.

d. 70 new buses will be operating in new corridor No. 15 (Pondok Kelapa-Blok M, 17.7 km) which is planned to be operational in 2017.

**Tangerang City**

The mass transport infrastructure development project of Tangerang included in this NAMAs proposal consists of bus procurement and improvement of Poris Plawad bus terminal associated with Tangerang-Jakarta route. The buses are to be operated as APTB connecting transport system Tangerang - Jakarta. The bus terminal improvement is a necessary to attract Tangerang-Jakarta commuters to shift from personal to public transport. According to JICA feasibility study of BRT in Greater Jakarta (Sitramp, 2012), the APTB buses needed in 2015 is as follows:

a. 10 buses for Route Tangerang - Taman Anggrek (S. Parman)
b. 10 buses for Route Tangerang – Pulogadung
c. 30 buses for Route Tangerang - Ancol

After 2015, additional buses needed for each of the above routes are as follows:

a. 2015 : 50 Buses
b. 2016 : 30 Buses
c. 2017 : 30 Buses

The routes of APTB buses is as follows:

Route 1: Tangerang – Taman Anggrek, 32 Km (operational)
Route 2: Tangerang – Pulogadung, 41 Km (operational)
Route 3: Tangerang – Ancol, 60 km (planned)
Route 4: Ciledug – Kreo (part of Route Ciledug – Blok M), 2 – 3 km (planned)

**Bogor City**

The mass public transport infrastructure development needed in 2015-2017 for connecting Bogor City to DKI Jakarta is as follows:

a. Procurement of 50 units BTS buses for Route Bogor – Jakarta
b. Construction of terminal to support BTS

Development plan after 2017 has not been established as further development of BTS bus fleet is subject to performance evaluation of the existing buses and also dependent on the permit process at Ministry of Transportation.

The operational activities basically comprises of two components, i.e. transportation services as commonly practice in the DKI Jakarta and activities that support data collection needed for MRV and NAMAs registry processes. For example, recording of buses operation that includes daily number of buses of each corridor, fuel consumption, bus occupancy, passenger – km travelled, etc. Questionnaire survey to determine modal shift of passenger (shifting from private car and other ordinary public transports) will be carried out during this operational stage. These collected data will be used as the basis for calculating NAMAs impact, particularly GHG emission reduction that will be reported and verified by MRV commission.

8. Linkage to ICCTF

The project investment is expected to be funded from APBN/APBD. Other expenditures related to NAMAs activities including registry and MRV processes are expected to be funded by other domestic sources, one of them is ICCTF. Status of the project currently has not been link to ICCTF.

C. PROJECT TARGET (AMBITION)

1. GHG mitigation potential

According to RAD GRK DKI Jakarta, GHG reduction potential from the BRT development (Busway) project is 2.5 million ton CO\textsubscript{2} in 2030. The expected reduction to be achieved from the proposed BRT NAMAs is about 0.28 million ton CO\textsubscript{2} in 2015 and will increase up to 0.64 million ton CO\textsubscript{2} in 2018. The yearly breakdown of this expected GHG reduction can be seen in Tabel 1.

2. Development benefits

The proposed NAMAs, if implemented, will have following development benefits/co-benefit (economic, social, environmental, human resources development and institutional strengthening):

- improvement of efficiency in transport system will lead to the reduction of domestic oil fuel consumption and oil fuel import dependency,
- utilization of natural gas for BRT will increase domestic utilization of natural gas and stimulate the domestic gas resources development,
- improvement of Jakarta image as megacity with good, efficient, and clean mass transport system will lead to improvement of Jakarta as tourist destination,
- efficient and integrated transport system in DKI Jakarta and surrounding cities will lead to shorter commuting time and cheaper transport cost, which both will increase commuter productivity
- improve urban air quality resulted from less traffic congestion and the use of natural gas instead of oil fuels (DKI Jakarta)
- improvement of manpower quality in operating the transport system will lead to improved public transport safety
• improvement of coordination among institutions that are involved in this BRT NAMAs project, i.e. Government of DKI Jakarta, Bogor City, Tangerang City, West Java Province, Banten Province, Ministry of Transportation, Bappenas, Ministry of Environment, etc., and
• improvement of internal unit coordination within each Government, i.e. Regional Environmental Office (BLH), Regional Development Planning Board (Bappeda), and Regional Transport Office (Dinas Perhubungan).

3. Financing mechanism
This NAMAs projects is to be proposed as unilateral NAMAs. The investment of BRT project is to be funded using APBN/APBD, therefore, the project financing mechanism will follow existing procedures for government budgeting. Usually the government budget is in the form of block grant for infrastructure development, where it does not involve loan and repayment. Other expenditures related to NAMAs activities, including registry and MRV processes are expected to be funded from other domestic sources, one of them is ICCTF.

4. Stakeholder involvement

DKI Jakarta
The project proponent of this proposed NAMAs project is Government of DKI Jakarta, which will be represented by Governor of DKI Jakarta. During the development process of this NAMAs, BLHD DKI Jakarta (Environmental Agency of DKI Jakarta) functions as coordinator of all project stakeholders, i.e. Dinas Perhubungan DKI Jakarta (Transportation Office of DKI Jakarta), Dinas Perindustrian dan Energi DKI Jakarta (Industry and Energy Office of DKI Jakarta), Ministry of Transport, and PT. Trans-Jakarta. Dinas Perhubungan provides data related to busway operation plan, i.e. number of busses, bus trips, length of corridor, and km-passenger while Dinas Perindustrian dan Energi provides data related to gas supply plan (locations and capacity of SPBG and MRU). This BRT NAMAs will be consulted with Ministry of Transport, which is the responsible party in national transportation development as well as in NAMAs development in transport sector. PT. TransJakarta will function as the operator of TransJakarta busses.

During the implementation of this NAMAs project, wider stakeholders will be involved, including Bappenas, Ministry of Environment, Ministry of Public Work, Public Work Office of DKI Jakarta, Police Department, Bussway customers, Ministry of Finance, etc. In addition, another stakeholder that will be involved specifically in the process of NAMAs development, registry, and MRV are secretariat of RAN/RAD, National MRV Commission, Steering Committee of Climate Change National Coordination Team (SCCCNCT), Indonesian Climate Change Trust Fund (ICCTF), etc.

Kota Tangerang
The project proponent of this proposed NAMAs project is Government of Tangerang City, which will be represented by the City Mayor. During the development process of this NAMAs, BLHD Kota Tangerang functions as coordinator of all project stakeholders (Dinas Perhubungan Kota Tangerang and Dinas Perhubungan Propinsi Banten, Ministry of Transport, and operator of APTB (PT PPD and Mayasari Bakti)). Dinas Perhubungan Kota Tangerang provides data related to APTB operation plan, i.e. number of buses, bus trips, and km-passenger. This BRT NAMAs will be consulted with Ministry of Transport and Dinas Perhubungan Propinsi Banten.
During NAMAs project implementation, wider stakeholders will be involved, including Bappenas, Ministry of Environment, Ministry of Public Work, Public Work Office of Tangerang City, Police Department, APTB customers, Ministry of Finance, etc. In addition, another stakeholder that will be involved specifically in the process of NAMAs development, registry, and MRV are secretariat of RAN/RAD, National MRV Commission, Steering Committee of Climate Change National Coordination Team (SCCCNCT), Indonesian Climate Change Trust Fund (ICCTF), etc.

**Kota Bogor**

The project proponent of this proposed NAMAs project is Government of Bogor City, which will be represented by the City Mayor. During the development process of this NAMAs, Bappeda Kota Bogor functions as coordinator of all project stakeholders (Dinas Perhubungan Kota Bogor and Propinsi Jawa Barat, Ministry of Transport, and operator of BTS (PT Sinar Jaya)). Dinas Perhubungan Kota Bogor provides data related to BTS operation plan, i.e. number of buses, bus trips, and km-passenger.

This BRT NAMAs will be consulted with Ministry of Transport and Dinas Perhubungan Propinsi Jawa Barat. During implementation of NAMAs project, wider stakeholders will be involved, including Bappenas, Ministry of Environment, Ministry of Public Work, Public Work Office of Bogor City, Police Department, APTB customers, Ministry of Finance, etc. In addition, another stakeholder that will be involved specifically in the process of NAMAs development, registry, and MRV are secretariat of RAN/RAD, National MRV Commission, Steering Committee of Climate Change National Coordination Team (SCCCNCT), Indonesian Climate Change Trust Fund (ICCTF), etc.

**D. PROJECT FEASIBILITY**

1. **Project structure**

   Project structure (Figure 2) involves project proponent (Government of DKI Jakarta, Tangerang City, and Bogor City), NAMAs development coordinator and coordination process, BRT operator, SCCCNCT, Secretariat of RAN GRK, Bappenas and PEP process, Ministry of Finance, Ministry of Environment, NAMAs Registry System, and MRV commission and mechanism.
2. Financial feasibility

This investment of the BRT development is funded using APBN/APBD, therefore, this NAMAs is to be proposed as unilateral NAMAs. Financing mechanism of the project will follow existing procedures for government budgeting that is usually in the form of block grant for infrastructure development where it does not involve loan and repayment schemes. Additional budgets for associated NAMAs activities such as coordination meeting, establishment, capacity building and operation of MRV system are also to be raised from domestic sources such as ICCTF.

**DKI Jakarta:**

The investment costs needed for the development of BRT system in DKI Jakarta:

- a. Bus procurement in 2015: 180 x Rp 3.7 billion = Rp. 666 billion
- c. Construction of 3 new corridors in 2016-2018: Rp 1.5 trillion
- d. Construction of 2 SPBG in 2015: 2 x Rp 50 billion = Rp. 100 billion
- e. Construction of 3 MRU in 2015: 3 x Rp. 20 billion = Rp 60 billion
- Total: Rp. 3.1 trillion

**Tangerang City:**

The investment costs needed for the development of BRT system in Tangerang City:

- a. 2015: 50 x Rp 1.3 billion = Rp. 65 billion
- b. 2016: 30 x Rp. 1.3 billion = Rp. 39 billion
- c. 2017: 30 x Rp. 1.3 billion = Rp. 39 billion
- d. Development of supporting infrastructure = Rp. 573 billion

Total investment of transport system development in Tangerang City is Rp. 716 billion.

**Bogor City:**

The investment costs needed for the development of BRT system in Bogor City:

- a. Procurement of 50 buses: 50 x Rp 1.3 billion = Rp. 65 billion.
- b. Construction of terminal infrastructure: Rp. 85 billion
Total investment needed for mass public transport in Bogor City is Rp. 150 billion

3. **Technological feasibility**

The BRT to be developed in this project in principle is an expansion of existing similar system, i.e. Busway running in dedicated bus lane (corridor) while APTB/BTS using normal roadways, the use of natural gas (CNG) in busway is common practice in existing busway system, and construction of bus lane/corridor and bus stop is also common practice. As no untested new technology is involved in this project, therefore in conclusion the project is technically feasible.

4. **Risk assessment**

Risk associated with this NAMAs project comprises of technological risks, management risks, financial risks, and social risks. Technological risks include failures that the busway or APTB/BTS fail to perform as expected, for example the busway cannot be fueled with natural gas, gas station (SPBG) and MRU cannot refuel the bus. Management risks include failure in the coordination among institutions involved in the BRT project as well as NAMAs project (see project stakeholders), for example the BRT project cannot secure gas supply to SPBG and MRU. Financial risks include failure in delay of disbursement or insufficient APBN/APBD budget for infrastructure of investment. Social risks include failure to gain support from the general public in BRT development that lead to boikot or disturbance the operation of BRT system. The result of qualitative assessment to the above risks is presented in the following matrix (Tabel 3).

Table 3 Assessment matrix of risks associated with this NAMAs project

<table>
<thead>
<tr>
<th>Type of Risks</th>
<th>Qualitative assessment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological</td>
<td>✔</td>
<td>Low failures in existing similar system; do not use untested technology</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td>Not all of the institutions involved in the BRT NAMAs projects are within the control and command of NAMAs coordinator</td>
</tr>
<tr>
<td>Financial</td>
<td>✔</td>
<td>Important infrastructure project will receive high priority</td>
</tr>
<tr>
<td>Social</td>
<td>✔</td>
<td>Existing similar BRT system receive public supports</td>
</tr>
</tbody>
</table>

As project management is an important factor for the success of this NAMAs project, in overall the risk level of this proposed NAMAs project is ‘medium’. To mitigate this risk, the project coordinator has to give more attention and preparation to this aspect.

5. **Time frame of project implementation**

<table>
<thead>
<tr>
<th>Project</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKI Jakarta</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement of 180 gas-fueled bus</td>
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<td></td>
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<tr>
<td>Procurement of 200 gas-fueled bus</td>
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<tr>
<td>Construction of bus lanes (Corridor)</td>
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<tr>
<td>Construction of SPBG/MRU and gas supply</td>
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<tr>
<td>Tangerang City</td>
<td></td>
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<tr>
<td>Procurement of 50 buses for 3 route</td>
<td></td>
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<tr>
<td>Procurement of 30 buses for 3 route</td>
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<tr>
<td>Procurement of 30 buses for 3 route</td>
<td></td>
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<tr>
<td>Bus terminal (Poris Plawad) improvement</td>
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<tr>
<td>Bogor City</td>
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<tr>
<td>Procurement of 50 BTS buses</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Construction of terminal to support BTS</td>
<td></td>
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</tr>
</tbody>
</table>
Measurement, Reporting and Verification (MRV) Method for NAMA Project

Bus Rapid Transit (BRT) Development of Greater Jakarta
MRV for NAMA Project:
Bus Rapid Transit (BRT) Development of Greater Jakarta

Project Brief
The proposed NAMAs is infrastructure development project for the provision of public transportation for commuters from outside and within DKI Jakarta as many workers in DKI Jakarta reside in surrounding cities of DKI Jakarta. Administratively, the NAMAs project is composed of three proponents, i.e. government of DKI Jakarta, Kota Bogor, and Kota Tangerang.

In DKI Jakarta, the transportation project covers procurement of gas-fuelled buses (TransJakarta Busway) and construction of bus lanes (Busway corridors), bus stops, and natural gas (CNG) refuelling stations/units. In total there will be 3 new corridors with total road length of 50 km; 380 new gas-fuelled buses and 5 new gas refuelling stations.

In Bogor and Tangerang, the project covers procurement of diesel buses for APTB (Angkutan Perbatasan Terintegrasi Bus-way) or Busway-integrated border transport and construction of bus lane (bus corridors), bus terminals, and pedestrian lane. Diesel bus is to be used in Bogor and Tangerang as there is no gas distribution system in this region. In total there will be 110 new APTB buses in Tangerang City and 30 new APTB buses in Bogor City. The NAMAs project for Tangerang city include construction of bus terminal connecting Tangerang to Jakarta and improvement of pedestrian lane associated to the terminal (to attract commuters to use public transport instead of private cars).

According to the NAMAs proposal, the infrastructure development project will begin in 2015. The duration of the NAMAs project is 5 years, from 2016 to 2020. The project will have the potential to reduce GHG emissions amounting to 700,000 ton in 2020.

Methodology
The expected GHG emission reduction of the BRT NAMA project is from the improvement of transport system efficiency (use high seat capacity buses instead of private vehicles) and from the use of natural gas instead of diesel (in DKI Jakarta busway). The indicator to be used to measure the emission of the NAMA project is the amount of gas consumption for busways and diesel consumption of APTB for fulfilling passenger transport demand (passenger-km per year).

The methodology for measuring the GHG reduction of the BRT NAMA is derived from Tier 2 methodology of IPCC i.e. by using detail activity data and local emission factor. The baseline (reference) emission is to be determined based on oil fuel consumption for fulfilling the same transport demand if the BRT system is not available. The oil consumption is to be estimated from modal shift due to the availability of BRT and the oil consumption pattern of each transport mode that shift to BRT. The information related to reference emissions is to be collected and analysed from passenger questioner survey (to determine modal shift, fuel
consumption, annual transport demand). The concept of emission reduction calculation is shown in Figure 1. This NAMAs is a project NAMAs but is carried out in stages (by increasing the number of new buses) therefore the baseline emission and NAMAs emissions both increase with time.

![Figure 1. Concept of emission reduction of BRT](image)

The emission reduction of the BRT NAMA is treated and considered as a “Project” emission reduction i.e. emission reduction resulted from the implementation of a specific GHG mitigation project (not mitigation actions implemented in a sector). The MRV methodology to be applied in this NAMA is, first, to estimate the emission reduction based on assumed performance (ex-ante) and, second, to adjust the estimated values (ex-post) based on the monitoring/measurement of the performance.

The logic/concept of the emission reduction estimate is illustrated in Figure 2. As shown in the figure the BRT bus takes passengers that originally use various forms of vehicles. The emissions that would be resulted when these passengers are not riding BRT bus is considered as the baseline emission. The NAMA project emission is the emission that will be resulted when those passengers are riding BRT.

![Figure 2. Logic of emission reduction from BRT project](image)

**Assumptions**

The BRT bus is always full. Passengers that step down in a bus stop is substituted by the same number of passenger stepping on the bus. The mix of passengers in terms transport mode previously used (before using BRT) are the same at all point of entry into the BRT bus. Therefore the emissions reduction calculation can be simplified by considering that the
passengers use the whole length of the BRT corridor. The schematic explaining the bus load assumptions is shown in Figure 3.

![Figure 3. Illustration of bus load assumption](image)

The distance travelled by BRT passengers before riding BRT bus may be different (farther or shorter) with the distance travelled when riding BRT bus. In the ex-ante calculation it is assumed that the distance travelled by a BRT passenger before and after riding BRT bus is the same.

The travel mode shift of some passengers from regular bus to BRT bus will in practice make the regular bus to stop operating because the bus will continue to be used by passengers that are not moving to BRT bus. To simplify calculation, this MRV methodology assumes that the mode shift will proportionally reduce the number of travel by the regular bus. For example, there are 160 passengers riding 4 different regular 40-seater buses from point A to B. If 40 of this bus passengers move to ride BRT instead of regular bus, then the number of regular bus operating serving point A to B is reduced to 3 (to serve remaining 120 passengers not moving to BRT). This assumption is illustrated in Figure 4. If there are 30 passengers moving from 3 regular buses to BRT, the number of regular bus that is reduced due to mode shift to BRT is 30/40 = 0.75 buses. This is to say that under baseline condition (without BRT existence), the 30 passengers are served by 0.75 bus. The emission under baseline condition is calculated based on fuel consumption of this 0.75 bus.

![Figure 4. Illustration of bus reduction due to shift mode from regular bus to BRT bus](image)
While BRT has the potential to encourage mode shift from private to public transport and therefore reduce the number of vehicles in roads, conversion of existing roads become bus lane dedicated for BRT has the potential to increase traffic congestion in the remaining lanes and therefore reduce transport efficiency and in turn increase GHG emissions. In this MRV methodology it is assumed that the potential to cause more congestion is compensated (cancelled-out) by reduction of vehicle population due to mode shift from private to public transport.

By using the above assumptions, the GHG reduction potential of the NAMA project is calculated as the difference between GHG emission of BRT buses and GHG emission that would be emitted at the absence of BRT buses (the BRT bus passengers remain using private vehicles of ordinary buses). GHG emission from a transport demand is calculated using the following formula:

\[
\text{GHG emission} = \text{Transport demand} \times \text{Specific Fuel Consumption} \times \text{Carbon Intensity of Fuel}
\]

where:

<table>
<thead>
<tr>
<th>Transport demand</th>
<th>Total passengers and total distance travelled per year (passenger-km/year). This is obtained from number of vehicles times the average occupancy rate of vehicles and total distance travelled per year, calculated from the length of corridor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific fuel consumption</td>
<td>Fuel consumed per passenger for each kilometre travelled (liter/ passenger-kilometer). This parameter is obtained from fuel economy (consumption per kilometer travelled) divided by average occupancy rate of the vehicle. Specific fuel consumption of large public transport is much smaller than that of private vehicles.</td>
</tr>
<tr>
<td>Carbon intensity of fuel</td>
<td>Amount of CO2 released per liter fuel consumed (emission factor)</td>
</tr>
</tbody>
</table>

Thus, GHG emission = \( \frac{\text{Passenger-km}}{\text{year}} \times \frac{\text{liter}}{\text{passenger-km}} \times \frac{\text{kgCO2}}{\text{liter}} \)

GHG emission reduction of the NAMA project is the difference between emission of BRT bus and emission of vehicles from which the BRT bus passengers originate. The emission is calculated using the following formula:

\[
\text{GHG reduction} = \left( \frac{\text{Pass-km}}{\text{year}} \times \frac{\text{liter}}{\text{pass-km}} \times \frac{\text{kgCO2}}{\text{liter}} \right)_\text{BRT} - \sum_i \left( \frac{\text{Pass-km}}{\text{year}} \times \frac{\text{liter}}{\text{pass-km}} \times \frac{\text{kgCO2}}{\text{liter}} \right)_\text{Baseline}
\]

As a case example, a 60-seat BRT bus serving 15-km corridor is operating with the following conditions:
Mix of BRT bus passengers:
20 passengers originally using private cars
15 passengers originally using motorcycle
18 passengers originally using ordinary buses
4 passengers originally using taxis
3 passengers originally from 3-wheelers

The average occupancy and fuel economy of vehicles are as follows:

Private car: 1.3 passenger/veh., 0.083 liter/km travelled
Motorcycle: 1.2 passenger/veh., 0.025 liter/km travelled
Ordinary bus: 40 passenger/veh., 0.5 liter/km travelled
Taxis: 1.1 passenger/veh., 0.083 liter/km travelled
3-wheeler: 1.1 passenger/veh., 0.050 liter/km travelled

Thus, number of vehicles replaced (stop operating) due to shifting to BRT buses are as follows:

Private cars: 20 passenger/(1.3 pass/veh.) = 15.4 cars
Motorcycle: 15 passenger/(1.2 passenger/veh.)= 12.5 motorcycles
Ordinary bus: 18 passenger/(40 passenger/veh.) = 0.45 ordinary bus
Taxi: 4 passenger/(1.1 passenger/veh.) = 3.64 taxis
3-wheeler = 3 passengers/(1.1 passenger/veh.)=2.7 3-wheelers

Assuming that on average the BRT is operating back and forth 5 times per day (averaged from 365 days/year) and the corridor distance is 15 km then the distance travelled per cycle is 2x15=30 km and the total distance travelled per year is 30 km x 5 x 365 = 54750 km. The fuel consumption of vehicles are as follows:

Private cars: 15.4 veh x 0.083 liter/veh-km x54750 km/year =70192 liters gasoline
Motor cycle: 12.5 veh x 0.025 liter/veh-km x54750 km/year = 17109 liters gasoline
Ordinary bus: 0.45 veh x 0.5 liter/veh-km x54750 km/year = 12319 liters diesel oil
Taxi: 3.6 veh x 0.083 liter/veh-km x54750 km/year = 16591 liters gasoline
3-wheeler: 2.7 veh x 0.05 liter/veh-km x54750 km/year = 7466 liters gasoline

It is assumed that those annual fuel consumption would have occurred in the absent of BRT buses. GHG emissions resulted by those fuel consumption is considered as the baseline emission of BRT NAMA project.

Using emission factor of gasoline and diesel of respectively 2.6 kgCO2/liter and 3.0 kgCO2/liter, the baseline emission of BRT NAMA project is : 

$$\left( (70,192+17,109+16,591+7,466) \text{ liter} \times 2.6 \frac{\text{kgCO2}}{\text{liter}} \right) + \left( 12,319 \text{ liters} \times 3.0 \frac{\text{kgCO2}}{\text{liter}} \right) = 326,488 \text{ kgCO2/year}$$

The GHG emission of the BRT NAMA project is calculated using similar approach i.e. based on travel demand, occupancy rate of bus, fuel economy of the bus and emission factor of natural gas used by BRT buses. Assuming 1 BRT bus with fuel economy of 0.50 liter/veh-km and annual distance travelled of 54 then the fuel consumption of the bus is:
Using gas emission factor of 1.7 kgCO2/LEP, then the GHG emission of the BRT NAMA project is:

\[
27,375 \text{ LEP} \times \frac{1.7 \text{ kgCO2}}{\text{ LEP}} = 46,538 \text{ kgCO2/year}
\]

Thus the emission reduction of the BRT NAMA project is:

\[
(32,6488 - 46,538) = 279,951 \text{ kgCO2/year}.
\]

Using the above example data GHG emission reduction calculation for one BRT bus serving one corridor is summarized in Table 1.

Assuming that the characteristics of the BRT passengers (origin of passenger) are the same for each bus and each corridor, then the total emissions reduction of BRT NAMA project is linear with the total number of bus and with the distance of corridors. This assumption is needed to extrapolate the above calculation which is based on 1 BRT bus and 1 corridor. For example, if the NAMA project consists of the 180 buses with following distribution of bus and corridors: Corridor A (15-km), 30 buses; Corridor B (30 km), 70 buses; and Corridor C (25 km), 80 buses then the emission reduction would be:

\[
30 \times 279,951 \times \frac{15}{15} + 70 \times 279,951 \times \frac{25}{15} + 80 \times 279,951 \times \frac{30}{15} = 85,851,594 \text{ kgCO2/year}
\]

The above calculations are ex-ante estimation using assumptions and data available from previous surveys, literature or default values. Within the framework of verification (MRV) of NAMA project, the emission reduction of the BRT NAMA project should later be adjusted (ex-post) based on actual data collected through passenger surveys especially the transport mode used in the absence of BRT buses.