



China

Assessment of TDM policies and their GHG impacts in Beijing and other Chinese cities

Good practice summary

[Results/insights]

The transport demand management (TDM) project, carried out by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Transportation Research Centre helped the Beijing Municipal Commission for Transportation (BMCT) define TDM policies and measures that had a potential to reduce GHG emissions and address transportation challenges in Beijing and other Chinese cities. The project developed a methodology to assess scenarios on likely impacts of TDM policies, defined methodologies to estimate GHG emissions and reductions, and developed a tool for Chinese cities to estimate these.

Scope covered

Functions

Measuring Reporting Verification Accounting

Administrative scope

National Regional City-level Policy/programme/project Corporate/Facility-level

Legal basis

[policies, regulations and commitments that the case study has to comply with]

There is currently no legal basis for the TDM policies.

Operational since

The design started in 2011, the project ended in February 2015.¹

How is this related to accounting?

[The following is based solely on the consultant's opinion]

» What kind of measures, policies, or commitments are a) monitored and included in an accounting system, b) only monitored, but not included in an accounting system, or c) not even monitored?

In its NDC China committed to lowering the carbon intensity of its GDP to 60-65% below 2005 levels by 2030 with GHG emissions peaking by the same year. A carbon intensity commitment can be understood as the level of GHG emissions per unit of economic activity, measured at a national level.

The methodology developed under the project allows assessing the impacts of TDM policies and measures at a sectoral and city level over time. This will help steering TDM policies and measures to contribute to China's NDC target as desired. The methodologies and assumption to estimate GHG emissions and reductions are based on the IPCC guidelines, in theory allowing use of the data in China's national GHG inventory in theory. Such alignment does currently not exist.

¹<http://mitigationpartnership.net/transport-demand-management-beijing>

Case description

Background

» What was the need, pre-conditions, and/or experiences that motivated the country to develop this system?

The rapid economic growth and development in China in the past three decades has led to an increase in the number of vehicles, and associated transportation and traffic problems in the country. In 2012, China emitted around 10.9 GtCO₂e and is amongst the world's top 10 emitters².

Beijing has seen a notable growth in population and vehicle registration in the last twenty years³ and has been one of the most affected cities facing an increase in air pollution, traffic congestion, and other related transportation problems.

GHG emissions could be mitigated by reducing the overall transportation activity and shifting transportation habits into less GHG intensive modes of transport. Transport management policies and measures aiming to achieve this have to be designed based on a level of understanding on which trips could be avoided or shifted to other modes and how vehicles should be improved. In order to design and steer effective mitigation actions in the transport sector, there is also a need for an MRV system, which allows estimating traffic related emissions and reductions achieved based on robust quantification methodologies.

General description of the system

[Questions below should be answered only when applicable]

» General definition/description of the system

» What are the main types of action that mitigate GHG emissions?

» What linkages to other systems/ system elements of environmental information (including adaptation to climate change or emissions trading schemes) do exist and why were they established? What linkages exist to other statistical/ monitoring systems?

» Which platforms are used to transport information and are they specific to the purpose of usage MRV information?

The TDM project helped to identify and develop effective measures for reducing CO₂ emissions, develop a methodology for quantifying transport emission reductions and disseminate measures and tools to other Chinese cities⁴. This case study will only focus on the first two activities.

In Beijing, transportation strategies have been implemented as an integrated programme that includes pull and push strategies. Push strategies are economic measures that lower the attractiveness of inefficient transport behaviour. An example of this would be a price reform.

Pull strategies are aimed to improve the attractiveness of efficient transport behaviour. An example of this would be incentives to promote walking, cycling, or the use of public transport. Beijing has developed a set of 28 specific TDM measures to control traffic. These measures can indirectly drive GHG emission reductions⁵. In the context of Beijing's Transit Metropolis Action Plan five key mitigation measures have been prioritised⁶:

1. Expansion of the metro network
2. Expansion of the bus network
3. Introduction of alternatively-fuelled busses
4. Vehicle registration restrictions
5. Congestion charges

²<http://www.wri.org/blog/2014/11/6-graphs-explain-world%E2%80%99s-top-10-emitters>

³http://www.namapartnership.org/-/media/Sites/NAMAPartnership/Publications%20Pdfs/Workshop%20Presentations/Side%20event%20at%20COP%2019/GIZ%20-%20MRV-PPT_NAMA-Partnership_final.ashx?la=da

⁴http://www.tdm-beijing.org/files/International_Review.pdf

⁵Slide 23, <http://www.tdm-beijing.org/files/Work-in-Progress-TDM-Beijing-brochure.pdf>

⁶Page 6, http://transport-namas.org/wp-content/uploads/2014/10/TRANSfer_MRV-Blueprint_Urban-Transport_China_draft.pdf

MRV and accounting systems, processes and procedures

[Questions below should be answered only when applicable]

- » How is information generated, communicated, integrated, and verified at each stage of the MRV chain?
- » What information needs to be gathered in order to quantify the effect of these actions?
- » How is such information gathered or estimated? By whom?
- » How is this information reported? How is it verified?
- » In what areas information is shared among accounting and MRV systems?
- » What kind of agreements are used to establish the relevant institutional roles?

Methodology to estimate GHG emissions

The GHG emission estimations methodology is compatible with the IPCC guidelines and the WRI Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).⁷ It is a tier 3 methodology that combines a top-down and a bottom-up approach. The top-down approach allows understanding GHG emissions during a specific time period using data at a geographical level (e.g. total fossil fuels sold in a year in the city of Beijing). The bottom-up approach allows estimating GHG emissions and reductions potentials using data measured at a source level (e.g. fuel consumption of buses per kilometre travelled in Beijing) and requires detailed information by transportation mode, vehicle type, trip purpose, and fuel type.⁸ Ideally, detailed bottom-up calculations complement most accurate top-down numbers to reduce uncertainties and provide more detail.

Setting the assessment boundary is a key step in the estimation of GHG emissions as it will define which transportation activities should be covered, what is the most appropriate geographic coverage, what means of transportation should be included in the assessment, what emission factors to use and what is the time period to be covered. In Beijing the territorial approach was used to define the boundary. This approach corresponds to the political sphere of influence of a city and covers all transport activities in the city. Activities from outside the boundary from inhabitants and non-inhabitants are not included in the assessment. Figure 1 illustrates the territorial approach.

Methodology to estimate GHG emissions

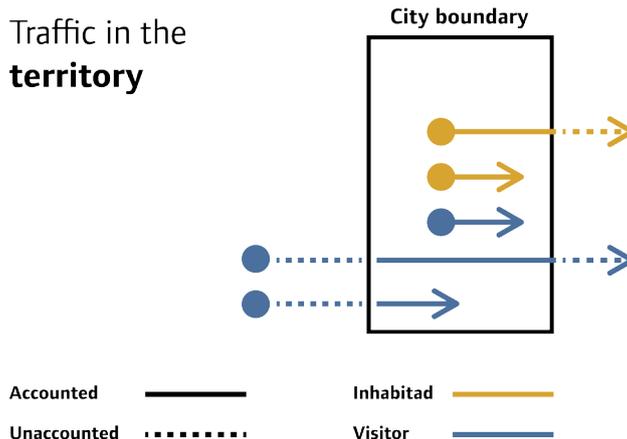


Figure 1 Consideration of trips under the territorial approach⁹

⁷<http://www.ghgprotocol.org/city-accounting>

⁸<http://sustainabletransport.org/download/modelling-ghg-emissions-of-road-transport-in-china-2/>

⁹<http://sustainabletransport.org/?wpdmdl=3797>

A recently published guidance document presents the methodology used for monitoring GHG Emissions of Transport Activities in Chinese Cities, including a step-by-step approach for data collection.¹⁰

Assessment of TDM Policies

A travel demand model based on a PTV Visum software package was used to estimate impacts of TDM policies under the project. It is now maintained by the Beijing Transportation Research Centre (BTRC). The tool allows estimating changes of vehicle kilometres travelled achieved by policies. The tool itself does not estimate GHG emissions but helps to model certain transportation variables such as congestion and mileage. The output data of the travel demand model is then used as input for a model calculating GHG emissions, which was developed under the project. The so-called China Road Transport Emission Model (CRTEM)/HBEFA-China (for reasons of simplicity referred to as HBEFA-China in the following) was developed by adapting an existing European model, called HBEFA. The adoption of HBEFA, which includes a database of national and city-level emission factors, an emission model and an interface to the travel demand model, was one of the three main tasks in the project. The tool was developed within a Microsoft Access and Visual Basic environment.¹¹ After identifying the assessment method and defining the assessment boundary, the HBEFA China model tool can be used to either estimate GHG emissions or assess GHG impacts of transportation policies. It also allows calculating emissions of other transport-related air pollutants.

As the travel demand model allows estimating traffic volumes for each street link, HBEFA China can identify emission hotspots in cities.¹² It can also predict changes in the fleet composition (e.g. caused by the licence plate lottery in Beijing). It further can simulate impacts of reducing congestion, as emission in free flow traffic are much lower than in congested traffic situations. It also allows to develop policy scenarios, an example of a report of emission impacts of policy scenarios is shown in Figure 2.

The HBEFA-China is not only used in Beijing, but also other Chinese cities such as Tianjin, Suzhou, Chengdu, Harbin and Shenzhen.¹³

Interfaces to different travel demand models can be included.

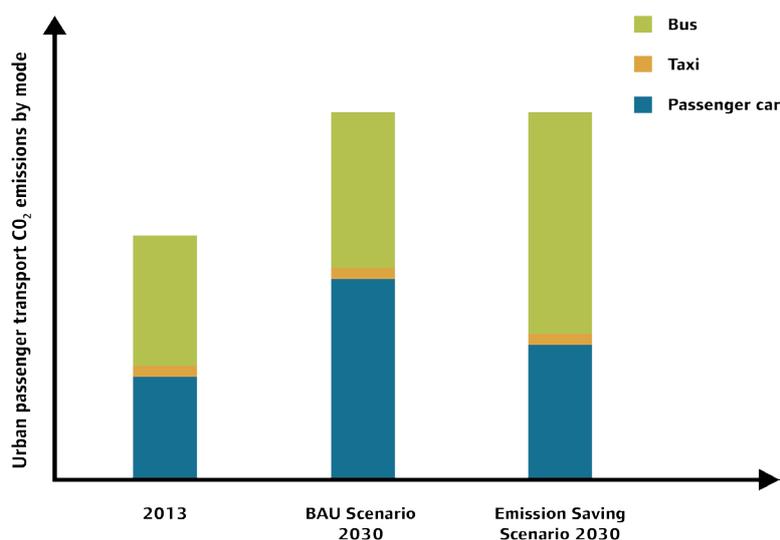


Figure 2 HBEFA China report on impacts of policy scenarios

¹⁰<http://sustainabletransport.org/monitoring-ghg-emissions>

¹¹<http://transport-namas.org/modelling-ghg-emissions-of-road-transport-in-china/>

¹²<http://sustainabletransport.org/?wpdmdl=3058>

¹³<http://sustainabletransport.org/flyer-china-road-transport-emission-model-hbefa-china/>

The Beijing Municipal Commission for Transportation (BMCT) is the lead institution in charge of developing and evaluating the impacts of TDM policies. More information on the institutional arrangements can be found below in the 'Institutions involved' section. The BTRC is in charge of gathering data and estimating the transportation sector GHG emissions. There are currently no institutional arrangements in place and data is shared on a voluntary basis. Quality control (QC) checks are carried by the BTRC and follow the QC checks recommended in the IPCC guidelines.

The establishment of institutional arrangements is the next step necessary to continue the TDM work, together with the implementation and enforcement of further TDM policies in Beijing.

Design and set-up

[Questions below should be answered only when applicable]

- » How was the system designed?
- » What was the overall process to set-up the system?

The first phase of the project was to understand which TDM policies were needed in Beijing. Good practices from other cities such as Berlin, Bogota, Mexico City, London, and Stockholm were analysed and projected to the city context. Stakeholder consultations took place involving national and international experts. During the consultation process, the involvement of international institutions such as Transport for London, Transport Canada, TransMilenio, among others, helped understand how specific measures were implemented in each city and which TDM policies might be the most appropriate for Beijing.

The project delivered recommendations on TDM policies for Beijing. No enforcement mechanism was discussed during this phase.

For the second stage of the project, BTRC and GIZ worked together to develop a methodology to estimate GHG emissions and reductions based on international guidelines, as mentioned above. Tools were adapted to a local context (i.e. the PTV Visum software package, HBEFA-China) to estimate impacts of policies and GHG emission reductions. Stakeholder consultation with support from transport planners, scientists and transport experts took place involving various Chinese cities, including Beijing and Shenzhen. During this work, the European HBEFA model was identified as the most appropriate tool as vehicle fleets in Europe and China were considered to be very similar. INFRAS, the Swiss consulting group that developed the European HBEFA model for various European governments, worked together with GIZ to use the European HBEFA model as a basis and adapt it to the Chinese context. In order to calibrate national traffic conditions and emission factors (EFs), more than 2000 hours of GPS data from taxis was gathered to deliver more accurate data to the model. This was done as a one-time activity and will only be repeated in case transit behaviour notably changes.

The HBEFA China model included emission factors that can be adopted to any Chinese city. The EFs database can be adopted to any Chinese city through input of local vehicle fleet characteristics and congestion levels. The next steps for the system is to set institutional arrangements, and measurement and reporting requirements.

²¹<https://openknowledge.worldbank.org/bitstream/handle/10986/23741/K8658.pdf?sequence=5&isAllowed=y>

²²IPCC 2006 guidelines

²³https://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.html

²⁴<https://www.anao.gov.au/work/performance-audit/administration-national-greenhouse-and-energy-reporting-scheme>

Improvement over time

» Is there an internal evaluation of the systems established aiming to enable improvement over time?

The HBEFA China model is not planned to be updated unless the transit behaviour changes in China and the vehicle fleet changes strongly over time.

Institutions involved

- » What institutional arrangements allow for the flow and integration of this information?
- » What types of entities take a role in the above structures?

Lead: BMCT: Political organisation responsible for the development of Beijing's transport system

Institutional arrangements: Beijing Transportation Research Centre (BTRC): Delivers transportation planning and modelling support.

Environmental Protection Bureau: provides data on pollutants and Traffic police supplies fleet data based on the vehicle registry.

Case learning

Why is it good practice

This project helped to establish a methodology and a tool that all Chinese cities can use for estimating GHG impacts of sustainable urban transport policies and measures. In future years, if desired, it either can feed into the national GHG inventory or be used to validate its data and results. It may also help providing accurate data using a bottom-up approach not only from Beijing but from other Chinese cities as well, where mitigation policies are monitored. CRTEM/HBEFA China can also help to predict air pollutant emissions, a major topic in Chinese cities. The feature to calculate emissions very detailed for each street link is especially useful to compile detailed air pollution emission inventories.

Good practices from other cities were analysed to implement the most appropriate TDM policies for Beijing and international tools were adapted to the Chinese context, saving financial, human and time resources in the process, while using a tried and tested tool.

Barriers surpassed

[barriers that have been surpassed till date]

Information: Chinese cities were – if any – using tools calibrated for other countries, which lead to high uncertainties with the resulting estimations. This was overcome by adapting the European HBEFA model to the Chinese context.

Barriers to overcome

[barriers that are still present and needed to overcome]

Information: Data availability and quality is still a barrier to overcome.

Institutional: Institutional arrangements have not been agreed. Local institutions help on voluntary basis; data supply agreements may be put in place to ensure reliable provision of data in the long-term. Furthermore, measures for the enforcement of TDM policies remain to be put in place.

Sociocultural: Data confidentiality approaches remain to be agreed with the different involved stakeholders and data providers.

Quantitative information

Funding obtained

Confidential

Funding required

Confidential

Staff

[Number of staff involved in the design and implementation of the case study]

Confidential

Time

[Time required to get to this stage]

1-1.5 years

Further information

Contact for enquiries

Daniel Bongardt, Senior Advisor 'Transport and Climate Change' GIZ
daniel.bongardt@giz.de

Sun Shengyang, Technical Advisor 'Transport and Climate Change' GIZ
shengyang.sun@giz.de

Website

www.sustainabletransport.org

References

GIZ. (2012). Reducing Carbon Emissions through Transport Demand Management Strategies A review of international examples. Retrieved from: http://www.tdm-beijing.org/files/International_Review.pdf

GIZ. (2013). Data Availability for Measuring and Reporting Transport related Greenhouse Gas Emissions in Chinese Cities. Retrieved from: <http://sustainabletransport.org/?wpdmdl=3005>

GIZ. (2016). Monitoring Greenhouse Gas Emissions of Transport Activities in Chinese Cities - A Step-by-Step Guide to Data Collection . Retrieved from: <http://sustainabletransport.org/monitoring-ghg-emissions/>

GIZ. (2013). TDM in Beijing A work in Progress. Retrieved from: <http://www.tdm-beijing.org/files/Work-in-Progress-TDM-Beijing-brochure.pdf>

GIZ. (2014). China Road Transport Emission Model (HBEFA China). Retrieved from: <http://sustainabletransport.org/flyer-china-road-transport-emission-model-hbefa-china>

WRI. (2015). Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. Retrieved from: <http://www.ghgprotocol.org/city-accounting>

Case study authors

Raúl Salas Reyes and Sina Wartmann, Ricardo Energy and Environment

Case study contributors

Daniel Bongardt, GIZ; Sun Shengyang, GIZ;

General Coordination

This series of fifteen case studies was prepared by Ricardo E&E for the project “Accounting Rules for the Achievement of the Mitigation Goals of Non-Annex I Countries”, implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of Germany (BMUB) supports this initiative based on a decision taken by the German Bundestag.



Empowered lives.
Resilient nations.



Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety