UNDA Seventh Tranche

Project 10/11E: Facilitating Climate Change adaptation in transport
through addressing the energy-environment linkage

*[Development and implementation of a monitoring and assessment tool for
CO_2 emissions in inland transport to facilitate climate change mitigation]*

EVALUATION REPORT

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United Nations Economic Commission for Europe (UNECE)
Transport Division

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Executive Summary

An international consultant was engaged to evaluate the post-implementation performance of the UN Development Account Project "*Facilitating the climate change adaptation in transport through addressing the energy-environment linkage – Development and Implementation of a Monitoring and Assessment Tool for CO$_2$ emissions in inland transport to facilitate Climate Change mitigation (10/11E)*". The evaluation was conducted on the basis of a desk review of all the relevant documents and more specifically an in-depth review of the development of the ForFITS model achieved under the project, that evaluates the impact of selected policy variables on the aggregate CO$_2$ emissions from inland transport systems (though maritime and aviation sub-sectors were added subsequently). This report summarizes the findings, conclusions and recommendations of the evaluation.

Findings
The planned outcomes of the project have been successfully achieved although some adjustments were made to the original approach by developing the ForFITS model in-house, using expertise available within the Transport Division of UNECE, instead of outsourcing the task to external consultants. This has resulted in some savings in the original budget but more importantly in enhancing further the expertise of the UNECE staff and anchoring the ForFITS model within the Transport Division which will make it feasible to refine the model further and provide support to potential users of the model.

Prior to developing the model a campaign of awareness, stakeholder consultations and incorporation of expert inputs were successfully undertaken with full collaboration and participation of the Regional Commissions. After developing the model, a validation exercise was professionally conducted in seven pilot countries covering all regions of the UN and 140 people trained through several training workshops. A post-workshop survey of participants shows great satisfaction and further interest in using the model in practice. The model and related documents are available free of charge on the UNECE website.

Although validated and ready for application, the ForFITS model can be further refined and made more accurate and versatile by improving some of the empirical relationships among key variables used in the model – for example, the correlation between the share of light freight vehicles in total road freight and the GDP per capita is something that could be further elaborated and analyzed on the basis of more historical data. The model can also be modified in its scope and structure to allow development of a sub-model that will enable application of ForFITS at the project level in addition to national and local levels.

Notwithstanding the above, a lot of effort has gone into the development of the model to make sure it is flexible in terms of input data requirements. The multilevel structure of the model (modes, vehicle classes, technologies, etc.) enables the user to run the model at different levels of detail depending on data availability which is the key feature of ForFITS. The huge amount of default information in the Inputs Excel file is particularly commendable and a big asset.

Recommendations.

As a follow-up project, more effort and resources should be invested in further refining the

internal empirical relationships used in the ForFITS model including effects of vehicle speed changes, possibly using elasticities, and the model should be made more versatile by developing a sub-model that makes it applicable at the project evaluation level. On the other hand, the evolution of the average vehicle speed could be a user input (the user may need to make calculations aside of the model to input this information).

Other useful additions to the model that will contribute greatly to modelling CO_2 emissions include – incorporation of non-road mobile machinery (such as, construction equipment, tractors in the agriculture sector, heavy machinery and vehicles in the mining sector, etc.); extension to calculate other greenhouse gases and local pollutants; development and addition of an infrastructure module to be linked with vehicle usage and road safety; improved characterization of the light freight vehicles to make more accurate projections; and improvements on how to project the evolution of the load per vehicle over time specially in the case of passenger transport.

The unit in the Transport Division responsible for developing the model should be further strengthened and mandated to provide support and training to users of the model, train the trainers, and facilitate the mainstreaming of the model in the transport operations of UNECE and other International Financing Institutions, such as the World Bank, EBRD, Asian development Bank, African Development and JICA.

In the short to medium term, the ForFITS team in the Transport Division in UNECE should team up with a worldwide professional entity such as the World Road Association (PIARC) to further develop the model, make it more user friendly to apply, and later in the long run, privatize its distribution and provision of technical support and training.

Introduction

A.   Purpose

1.   The purpose of the evaluation is mainly to review the implementation of the UN Development Account Project "*Facilitating the climate change adaptation in transport through addressing the energy-environment linkage – Development and Implementation of a Monitoring and Assessment Tool for CO_2 emissions in inland transport to facilitate Climate Change mitigation (10/11E)*" – and evaluate the extent to which the objectives were achieved and whether there was any contribution to organizational learning.

B.   Scope

2.   The scope of the evaluation includes:

(a) Assessment of the extent to the project has contributed to enhancing the awareness of the causality and interrelationship among transport, energy consumption and CO_2 emissions;
(b) Assessment of the extent to which the project has contributed to enhancing

the analytical and practical knowledge base for monitoring the current and future energy consumption patterns of land transport modes and their related CO_2 emissions;

(c) Evaluation of the efficacy of the project in developing, implementing, distributing and employing a suitable monitoring and assessment tool capable of assisting users to select effective measures to reduce CO_2 emissions from inland transport modes while addressing the energy-environment linkage; and

(d) Make recommendations for follow up actions and initiatives required to disseminate the knowledge created and enhance its use and impact while considering all potential spillovers.

C.   Methodology

3.   The evaluation is based largely on a desk review of documents obtained from project files; official records; and related information and available resources on the internet. Project staff was contacted to obtain clarifications and any missing data. Furthermore, the report on the responses obtained to the questionnaires administered to participants of training workshops on application of the ForFits model were also reviewed and evaluated. Three criteria were used for this evaluation: relevance, effectiveness and efficiency.

Findings

A. Background

4.   According to published reports[1] transport is responsible for 13 percent of Green House Gases (GHG) emissions and 22 percent of the total CO_2 emissions from fuel combustion (mainly diesel and gasoline). Furthermore, CO_2 emissions from the power sector and the on-road transportation sector are estimated to exert the largest net positive radiative forcing effect on climate[2]. In view of the fact that a large set of policies related to evolution of macroeconomic parameters, cost of owning and operating transport vehicles and technological or structural changes in the transport system have a significant impact on the evolution of the transport system itself and therefore on the total emission of CO_2 into the atmosphere, UNECE found it prudent to undertake a project that would model this relationship and use the model to test and compare the effects of different policy interventions on total CO_2 emissions, or to estimate the current levels of CO_2 emissions in the transport sector and make informed decisions on setting targets to reduce the CO_2 emissions and minimize their impact on climate change.

5,   In 2008, the UNECE Transport Division called on the UN Development Account (UNDA) for funds to build this project together with all UN Regional Commissions. The UN General Assembly endorsed the proposed project in 2009 and in 2010 the UN

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[1] IPCC, 2007; and IEA 2011a
[2] Unger, et al, 2009

Department of Economic and Social Affairs (DESA) approved the Project Document describing in detail the major phases and activities of the three-year project. The project was formally launched in 2011 and completed in 2013.

6. *Development Objective of the Project.* The main development objective of the project was to enhance international cooperation and planning towards sustainable transport policies and the specific project outcomes comprised: (a) increased awareness of the cause – effect relationship between the different transport modes, energy and CO_2 emissions based on internationally comparable information on inland transport CO_2 emissions; and (b) enhanced capacity to assess and monitor and to take actions to reduce transport CO_2 emissions, and enhanced capacity to assess and monitor the current and future energy consumption patterns of land transport modes and their respective CO_2 emissions by using the ForFITS model (developed under the project and made available free of charge via the internet).

7. The project therefore facilitated the development of an analytical and empirical model (ForFITS) that could be used to estimate the total CO_2 emissions from transportation vehicles at the national aggregate level as a function of key macroeconomic variables, cost of owning and operating transport vehicles and technological or structural changes in the transport system. This was followed by application of the model in pilot countries and training of selected participants from all regional commissions. The ultimate use of the model would be in testing various policy variables to evaluate their impact on CO_2 emissions and facilitate the implementation of optimal policies that would minimize CO_2 emissions and mitigate the impact on climate change through reducing the net radiative forcing, that is, the difference in the incoming and outgoing radiation of the sun, accounting for the major climate patterns experienced on earth.

B. Findings

8. *Project Phases/Components.* The project was implemented in three phases, namely, (a) Preparation of a Global Status Report; (b) Development of the ForFITS model; and (c) Training and capacity building in application of the ForFITS model.

(a) Preparation of a Global Status Report.

A questionnaire was administered to UN member states through all the Regional Commissions to gather information on transport statistics, policy measures being implemented and existing tools/methodologies available for modelling transport CO_2 emissions. This information was supplemented by in-house research on existing information (not foreseen in the Project Document). This included an in-depth review of about 17 different internationally available models and methodologies including 5 used for assessing historical emissions and 12 used for estimating CO_2 emissions and assessing the impact of different policy decisions. The information thus gathered and proposed methodology for developing ForFITS was additionally subjected to review by a meeting of international experts in the field and reviewed by a panel of peer reviewers who provided their views on the proposed ForFITS. The result was a very comprehensive report, the Global Status Report, which is also available to all via the internet.

Findings:

(i) The Global Status Report, including the UNDA report on "CO_2 emissions from inland transport: statistics, mitigation policies, and modelling tools", in of itself is a very valuable source of information and an excellent value addition to the knowledge base created by UNECE;

(ii) This phase of the project was a logical and intellectually sound approach to ensuring the development of the ForFITS model was demand responsive and anchored in an intellectual framework that was refereed by experts in the field and that it took account of all other past studies and research in developing the model such that it incrementally added to current practice; and

(iii) The amount of effort and time required in this phase was underestimated at the time of project preparation, but the additional time and effort was well spent and inevitable. Any compromise on this time or effort would have reflected adversely on the quality of the final product.

(b)   Development of the ForFITS Model.

After receiving comments, data and suggestions from all stakeholders and internal research by staff of UNECE, the next stage was to develop an analytical/empirical model to predict the aggregate amount of CO_2 emissions from transport vehicles used in inland transport for specific areas and countries as a function of a number of variables, among them policy variables that could be used to influence the extent of CO_2 emissions. During project formulation, the idea was to retain expert consultants to deliver this task. However, after realizing there was adequate capacity within UNECE staff to undertake this modelling effort, as well as recognizing the value of developing this knowledge base in-house, in terms of ownership, training, and professional enhancement, it was decided not to engage consultants. Furthermore, in the process of developing the model and based on feedback from expert meetings and peer reviewers, the scope was expanded to include maritime, aviation and pipeline modes in the model. This was a good move, given the strong inter-relationship among the various modes in meeting the demand for transport in any given country.

Structure of ForFITS Model. The basic parameters on which the CO_2 emissions are based in ForFITS is vehicle use and vehicle powertrain technology. These parameters are further broken down by vehicle types, passenger-kilometers (pkm) and ton-kilometers (tkm) in private and public use. Predictions of future usage are a function of largely the per capita GDP of an area or a country. Statistically significant correlations have been used from historical data and modern research, particularly for predicting vehicle ownership and the share of pkm on personal motorized passenger vehicles in the total pkm of personal motorized passenger vehicles and public passenger transport, excluding air transport. The demand for transport and hence the total pkm and tkm on the other hand is further correlated (in addition to GDP per capita) to a number of exogenous variables

including cost of driving or operating vehicles, environmental culture and the number of people per active bicycle in use. The platform used for the computer application is Vensim[3], an off-the-shelf computer software particularly suited to developing, analyzing, and packaging dynamic feedback models, in combination with user defined Excel Spreadsheets for data input and management.

In summary, ForFITS is a sectoral model, covering both passenger and freight transport services on all transport modes (including aviation and maritime transport), but mainly targeting inland transport (especially road, rail, and inland waterways). Pipelines are also considered in the model. Each mode is further characterized in sub-modes (when relevant) and vehicle classes. Vehicle classes are further split to take into account of different powertrain technologies and age classes and powertrains are coupled with fuel blends that are consistent with the technology requirements.

The model projects transport activities, energy use and well-to-wheel CO_2 emissions over a specified time span. Hence, sustainable transport can be assessed by simulation of Avoid-Shift-Improve policies that take into account, among other policy options, the expected evolution of the relevant macroeconomic parameters such as fuel taxation schemes, subsidies for cleaner vehicle technologies, road pricing, modal shift assessment, structural changes in the transport system, and introduction of sustainable biofuels.

Validation of the Model. The model was validated by application in seven pilot countries – three in the ECE region (France, Hungary and Montenegro), and one each from the other Regional Commissions, namely, Ethiopia (ECA), Chile (ECLAC), Thailand (ESCAP) and Tunisia (ESCWA). Local consultants were hired where needed to assit in the collection and synthesis of the national data required for input to the ForFITS model. Five scenarios, in addition to the base case (or the reference scenario) were defined and tested with the model, namely, oil price doubled by 2040; modal shift from private vehicles to public transport; penetration of more energy efficient technologies in the future; and introduction of sustainable biofuels. The report produced on the pilot applications is itself an excellent demonstration of the use of the ForFITS model and is freely available on the internet.[4]

Findings:

(i)   ForFITS is suitable for the analysis of transport systems having a regional, national and/or local dimension, with a primary focus on national systems.

(ii)   The pilot applications of ForFITS have demonstrated sufficiently the efficacy of the model.

(iii)   However, as pointed out in the report on the pilot applications, there is room for refinements in some areas as well as further additions to the capabilities of the

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[3] Venism: Computer simulation software, developed by VENTANA Systems, Inc.
[4] Report on application of ForFITS in seven pilot countries, available on the web:
www.unece.org/fileadmin/DAM/trans/doc/themes/ForFITS/Pilot%20report.pdf

model. These should be pursued in a follow-up phase to the project. For example, the model capability could be extended to permit the evaluation of the overall effects of changes in the transport system on the economic growth and *vice-a-versa*; where input data is not split between rural and urban areas, new regression curves are required based on national GDP per capita data for prediction of the share of pkm on personal motorized passenger vehicles; the relationships for fuel consumption improvement are based on simplifications of reality and could be refined for greater accuracy with more effort and time; and the correlation between the share of light freight vehicles in total road freight and the GDP per capita could be further elaborated and analyzed on the basis of more historical data

(iv)   ForFITS does not model the effect of vehicle speed changes in the transport system, which has significant impact on CO_2 emissions, as illustrated in the review of the numerous models and computer software available in the market. If this is included in the next version of ForFITs along with modifications required to make the model applicable at the project level (in addition to national or local level), it would be a tremendous value addition, especially given that billions of dollars are spent in improving rail and transport infrastructure to alleviate congestion. Such a modified model can then be interfaced with models such as the World Bank's Highway Development and Management model (HDM-4) to evaluate alternative investments in road infrastructure (particularly for urban areas) and select the most optimal options considering also the CO_2 emissions.

(v)   Further refinements are also possible and warranted in evaluating the impact of different technology choices for the powertrain. This will require further investigations of using differentiated assumptions for evolution of the costs of powertrain technology options at different times across the projection period.

(vi)   All in all, the model has been successfully validated with the best information available. However, one must recognize that calibrating the model against actual amounts of CO_2 emissions observed under different circumstances is very difficult if not impossible, because we cannot measure the total aggregate amounts of CO_2 emissions from the existing transport systems – they can only be estimated using analytical models at best. However, it is recognized that transport activity and energy use are parameters normally available in statistical sources that can be used for calibration. For instance, the ForFITS model was calibrated to match (in the base year of the simulation) historical values on passenger-km (pkm) and ton-km (tkm) and energy use in the transport sector.

(c)   <u>Training and Capacity Building</u>.

This is the third and last phase of the project. Because the first two phases took longer than anticipated in the Project, the activity of training and capacity building was carried out simultaneously with the piloting program. The use of training materials derived from the pilot applications proved particularly useful in the capacity building workshops. More than 250 participants took part in the awareness-raising and capacity building workshops

and about 140 participants were given specific hands-on training in the use and application of ForFITS model. It is reported that these participants are now fully capable of using the model independently. The awareness participants were largely policy makers, while the capacity building workshops was attended by local experts including researchers, university professors, and technical personnel working with national organizations. A satisfaction survey conducted after the workshops indicates that over 90 percent of the respondents expressed their satisfaction and commitment to use the ForFITS model in the future to evaluate strategies for sustainable transport. The model and its related documents are all available on the UNECE website, which has seen frequent hits – 7,900 hits recorded between March 2011 and December 2013.

The organization and conduction of the awareness and training workshops was done in collaboration with each UN Regional Commission and the workshops were held on UN premises. Six such workshops were held in the period August to December 2013, one in each region. The training and capacity building workshops were specifically addressed to experts in the field who had adequate qualifications to follow the technical content of the ForFITS model and would most likely use the model in the future.

Findings:

(i)   Although the time for training and capacity building may be deemed as being too short under the project, it seems this outcome was achieved satisfactorily considering that a sufficient number of personnel (140) from all the six regions of the UN are now trained and capable of using the ForFITS to assess, monitor and take actions to reduce transport CO_2 emissions and to assess and monitor the current and future energy consumption patterns of land transport modes and their respective CO_2 emissions.

(ii)   The staff did well to enhance their team by the addition of a staff fully responsible for organizing the workshops while the technical team could focus on the ForFITS model and training materials. Similarly, the convening power of the Regional Commissions was fully utilized to draw greater participation in the workshops – this greatly helped in managing the training and capacity building component in the short time available.

(iii)   The project completion report makes no specific mention of having trained a cadre of trainers who would further train others and enhance the capacity building exercise through multiplying the number of people capable of using the ForFITS model. This would be an essential component of any future follow-up actions to be considered by UNECE to improve the ForFITS model and make it available to more people such that it becomes the model of choice for analysis of policies and strategies to reduce CO_2 emissions in the transport sector.

9.   *Overall Performance*. Overall, the project has satisfactorily achieved the major outcomes as anticipated at the end of the project and elaborated in the results framework (see **Table 1** below) in the project document.

Table 1. Achievement of Expected Project Outcomes

Expected Outcome	Key Indicator	Achievement
Increased awareness of the cause and effect relationship between the different transport modes, energy and CO_2 emissions.	Number of Government and international organizations consulted about existing model and methodologies.	60 countries were consulted and responded to questionnaires and 17 existing models reviewed and included in the Global Status Report
	ForFITS developed and made available publicly	ForFITS model and all relevant documentation available on UNECE website
	Number of pilots where ForFITS was applied (at least one in every region of UN)	ForFITS piloted in one country from each UN region plus two additional countries in Europe
	Recommendations on common approaches to data collection and sampling of inland transport CO_2 emissions published in project report	Global Status Report
	Number of countries publishing inland transport CO_2 emissions statistics	60 countries and organizations provided the requisite information and over 100 sources are listed in the Global Status Report
	Number of countries that established national targets to reduce transport CO_2 emissions	Due to lack of time and delay in launching ForFITS, evaluation of this indicator postponed to later date when more data is available
Increased capacity to assess and monitor and take actions to reduce inland transport CO_2 emissions	Increased number of relevant personnel in the regions able to assess and monitor tranprot CO_2 emissions and to design the most effective interventions to reduce the emissions	254 participants attended awareness and capacity building workshops and in particular, 140 participants made capable to use ForFITS independently
	Number of countries that express intentions to follow-up after training (participant survey)	Of the 254 participants from seven countries trained and surveyed, 170 responded to the questionnaires. Of these 92% (156) expressed intention to use ForFITS in follow-up applications.
	Number of visits to the ForFITS website (web hits)	7,600 web hits registered between March 2011and December 2013

The development of the ForFITS model is a commendable effort and the fact that it was developed largely in-house is an added advantage. Because of that, some adjustments had to be made to the original plan for outsourcing the development of the model to external consultants and hence the budget outlay. Having developed and validated the model, along with having trained an adequate number of individuals in the various regions of the UN, the long term objective of enhancing international cooperation and planning towards sustainable transport policies is likely to be met. However, to enhance the chances of meeting the long term objective, it is necessary that there are follow up actions to ensure constant assistance to those who want to apply the model in different circumstances and an effort is made to mainstream the use of the model in UNECE's future activities related to climate change. With regard to relevance, effectiveness and efficiency of the project, the following may be stated:

(a) <u>Relevance</u>. The project was well formulated and highly relevant to achieving the development objective, particularly because in the absence of an analytical/empirical tool such as the ForFITS, it would be extremely difficult to predict the overall impact

of policy and technological choices to reduce the CO_2 emissions in the transport sector at the national or local level in aggregate. The model enables a rapid evaluation of several different policies and options to reduce the overall CO_2 emissions and therefore can be used by decision makers to adopt the most optimal or effective policies. As seem from the preliminary applications of the model in pilot countries, a series of actions that combine modal shift to public transport, variation of fuel price, penetration of new technologies and introduction of sustainable biofuels can reduce by 30 percent the total CO_2 emissions in the transport sector by 2040 in comparison with the reference scenario (the reference scenario takes into account the expected evolution of macroeconomic parameters but no policy intervention).

(b) <u>Effectiveness</u>. The main outcome of the project was the development of a suitable model to predict CO_2 emissions from inland transport systems and train personnel in using the model to evaluate policies and interventions that would reduce the overall emissions and ensure sustainability of transport development. This has been effectively achieved and the results have been demonstrated through pilot case studies in seven different countries. The project was also effective in enhancing the knowledge base within UNECE staff by the fact that the model was developed in-house instead of being outsourced to consultants. The full participation and involvement of the UN Regional Commissions throughout project implementation also effectively enhanced international cooperation towards sustainable transport policies.

(c) <u>Efficiency</u>. The planned budget for implementation of the project was USD 738,000.00 without counting the inputs of the UNECE staff on the team, which was significant. The actual expenditure at the end of the project was USD 674,544.00. Hence the project was implemented well within the planned budget with the added benefit of keeping the ownership of the model within UNECE and enhancing capacity and knowledge of its staff related to sustainable development in the transport sector. All the relevant documents including the ForFITS model, user's manual, the Global Status report and the pilot case study reports are freely available on the web and already attracting a great deal of interest from the general public.

Conclusions and Recommendations

10. *Conclusions*. The project has been implemented successfully and it has achieved the planned outcomes. It is also seen to have been very timely, given the importance of the subject, namely to put inland transport on a sustainable basis with respect to CO_2 emissions and climate change. The newly developed FoRFITS model can be regarded as a flagship contribution that has the right structure to evaluate policy options to deal with the rising threat from increased greenhouse gases emitted from transport vehicles. There certainly remain a few refinements to the model that are required to make the model more robust and versatile. A core cadre of personnel around the world has been trained to use the model for policy evaluation and the model is freely available on the UNECE website along with all requisite documentation. Nevertheless, the model is complex and will require support and advice from UNECE for a considerable period of time before it becomes the model of choice for applications related to setting and monitoring national targets of

CO_2 emissions and evaluating policy options to minimize their impact on climate.

The model at present does not take account of speed variations and their impact on CO_2 emissions. With little more effort and resources, the model can be refined to take account of vehicle speeds and made more versatile for application at the project level such that it can be used by countries and Development Partners to predict the amount and cost of CO_2 emissions resulting from alternative investment choices to deal with traffic congestion in the rapidly expanding urban areas, as well as investments in improving locomotive speeds in railway operations resulting from improved infrastructure.

11. *Recommendations*. The following recommendations are made on the basis of the above review and analysis:

(a) **Invest in more effort to refine the relationships used in the model** for which adequate data was not available to derive more robust regression curves or where greater predictive accuracy can be achieved through improving their statistical significance. For example, (i) modelling the overall effects of changes in the transport system resulting from external interventions or as a result of economic growth and related infrastructure investments; (ii) developing new regression curves based solely on national GDP per capita data for prediction of the share of pkm on personal motorized passenger vehicles in non-urban areas or at the national aggregate level; (iii) introduce speed as a variable and improve the fuel consumption relationships based on latest research available; (iv) use more data from empirical research to model the effect of changes in the fuel prices or technological advancement on the shift from private to public transport; (v) incorporate non-road mobile machinery (such as, construction equipment, tractors in the agriculture sector, heavy machinery and vehicles in the mining sector, etc.); (vi) extension to calculate other greenhouse gases and local pollutants; (vii) development and addition of an infrastructure module to be linked with vehicle usage and road safety; (viii) improved characterization of the light freight vehicles to make more accurate projections; (ix) improvements on how to project the evolution of the load per vehicle over time specially in the case of passenger transport; and (x) modify the model structure so as to include a sub-model that can be applied at the project level to model the impact of alternative investments to reduce traffic congestion on the total CO_2 emissions.

(b) **Strengthen the technical unit in UNECE** to provide continued support to users of ForFITS, engage in further research and refinement of the model, embark on a train-the-trainers program to increase dissemination of the knowledge base, and facilitate through a follow-on project the mainstreaming of the ForFITS model in transport operations of UNECE and other international financing institutions such as the World Bank, EBRD, Asian Development Bank, African Development Bank and JICA.

(c) **In the long run, privatize the ForFITS model**. In the short to medium term, engage a non-profit professional entity, such as the World Road Association – PIARC (formerly Permanent International Association of Road Congresses) to anchor further research and development of the ForFITS model, make it more user friendly to apply, and thereafter in the long run, privatize its distribution and provision of technical support and training.

Annex 1
Terms of Reference

Facilitating climate change adaptation in transport through addressing the energy-environment linkage – Development and implementation of a monitoring and assessment tool for CO_2 emissions in inland transport to facilitate climate change mitigation
UN Development Account Project 10/11E

I.   Purpose

The purpose of this evaluation is to assess the extent to which the objectives of the UN Development Account project *Facilitating climate change adaptation in transport through addressing the energy-environment linkage – Development and implementation of a monitoring and assessment tool for CO_2 emissions in inland transport to facilitate climate change mitigation (10/11E)* were achieved.

II.   Scope

The assessment will be guided by the objectives, indicators of achievements and means of verification established in the project document. The evaluation will consider the impact of the project on: a) the awareness of the causality and interrelationship between transport, energy and CO_2 emissions; and b) the enhancement of the ability to monitor and assess current and future energy consumption patterns of the land transport modes, as well as the related CO_2 emissions. In particular, the evaluation will address the efficacy of the project with respect to the development, implementation, distribution and use of a monitoring and assessment tool capable to assist users in the selection of effective measures to reduce CO_2 emissions in the inland transport sector while addressing the energy-environment linkage. The evaluation will consider potential spillovers from the project and will provide recommendations on initiatives to enhance its impact. As per the requirements of the UNDA, the evaluation will be conducted immediately after the end of the project. It will therefore not assess the medium or long-term impact of the project.

III Background

The evolution of CO_2 emissions in transport is influenced by the size of the population and way it changes, the structure and growth of economic activities, the nature of trade and its evolution characteristics. In parallel, transportation is affected by the evolution of energy prices and a number of policy instruments targeting land use allocation, fuel taxation, consumer information and road pricing. The combination of these elements led to fast growth in the global vehicle activity that was only partly counterbalanced by improvements of the vehicle fuel efficiency. This resulted in an increase in the total fuel consumption of the global transport sector. Combined with the strong dependency of transport on fossil fuels, this increase in fuel consumption has also increased the contribution to global CO_2 emissions from the transport sector.

The capacity to appropriately evaluate the effect of the elements influencing the evolution of transport activity, energy use and the related CO_2 emissions is important to facilitate the adoption of climate change mitigation measures in transport. The same capacity can also enable governments and the private sector to analyze different development scenarios. This capacity was limited by the lack of publicly available tools to assess the impact of policies and changes in transport activity, energy use and CO_2 emissions. This was especially relevant in developing countries, where most of the publicly available tools target the assessment specific transport projects.

This global project was initiated as early as January 2008. In its development it responded to the calls from the global meeting of transport ministers (International Transport Forum), held in Leipzig on 28-30 May 2008 to address the energy and climate change challenges for the transport sector, and the Ministerial Conference on Global Environment and Energy in Transport (MEET), held in Tokyo in January 2009, to improve energy efficiency and to reduce greenhouse gas emissions in the transport sector. The project was designed to provide a freely available assessment tool capable of linking transport activity, energy use and CO_2 emissions with national and local drivers. This modelling tool, meant to foster sustainable transport policies **For Future Inland Transport Systems, was named ForFITS**. Activities throughout the project aimed to improve the capacity, via the use of ForFITS, to assess transport, energy and CO_2 emission parameters in a range of different contexts, also taking into account the wide variations in terms of availability of information and statistics.

The project was funded by the 7th tranche of the UNDA, and was implemented from January 2011 to December 2013. ECE coordinated the global implementation of this project in cooperation with the other UN Regional Commissions – ECLAC, ESCAP, ESCWA and ECA – in their respective regions. The initial activities of the project focused on the measurement, reporting and verification of the statistical information concerning transport, energy and CO_2 emissions. It led to a report assessing available statistics, policy instruments and modelling tools. The central part of the project concentrated on development of the ForFITS model. This resulted in the free on-line release of the model and its user manual. The final part of the project focused on the parallel development of pilot cases and the implementation of capacity building activities, including workshops and training sessions in all five regions. These activities aimed to raise the awareness of policy makers of this tool, and to enhance the skills of local transport, energy and CO_2 emission policy analysts for the using ForFITS. The workshops also promoted dialogue across a wide range of stakeholders and encouraged the exchange of national experiences.

Awareness raising and training sessions were organized during the project, in all regions. Pilot cases were developed for each of the training sessions and used as training materials, including specific datasets in the ForFITS input file and specific ForFITS model runs. Additional training materials, mainly consisting of presentations, were prepared to facilitate the understanding of the different parts of the model in training sessions and to enhance the impact of the project in awareness raising events.

IV. Issues

The evaluation will assess the following key issues:

- Check that the activities planned during the project were effectively performed and that they have contributed to the aims of the project as intended, using the indicators of achievement and means of verification described in the project document;
- Provide an assessment of the quality of these activities and the supporting materials prepared in the course of the project, with the view to promoting ongoing sustainability of the project's achievements; and
- Propose potential follow-up activities to increase the impact of the project, and/or how to use the assets generated during the project (e.g. ForFITS model, user manual, training materials, and network of contacts) for future activities.

V. Methodology

A desk review will be undertaken of the materials prepared in the course of the project, including the review of statistics, policies and modelling tools on transport, energy and CO_2 emissions, the questionnaire developed to gather inputs for the preparation of the review, the ForFITS model, its user manual, the information of pilot countries contained in the last model release, the materials related to the organization and implementation of the workshops (agendas, lists of participants, tests, surveys, presentations and other items). If appropriate, the evaluation may rely on other methods to collect information in order to explore and triangulate the findings of the desk review, and may include interviews with key participants in the project, including not only beneficiaries but also meeting facilitators and other experts. The external evaluator will need to propose a specific and tailored methodology upon the inception briefing of the project.

VI. Evaluation Schedule
Contract Period: 1 March 2014 – 17 April 2014
Remuneration: 430.57 USD x 48 days = 20,667 USD (rounded to 20,000 USD)

1 March 2014: The materials collected and produced during the course of project will be provided electronically to the external evaluator.

31 March 2014: Submission of draft report for comments. The evaluator will collect additional data, if required, and conduct data analysis, so that a draft report can be produced by 31 march 2014 for comments.

 10 April 2014: Appropriate feedback to the evaluator on the draft report

17 April 2014: Submission of the final report and payment of 20,000 USD upon satisfactory completion of work and approval of the document.

VII. Resources

As per the requirements of the UNDA, 2% of the project budget is allocated for external project evaluation. The work of the external evaluator will be managed by the project manager and supported by two ECE staff members. They will address the queries of the

external evaluator and help him/her to collect relevant materials and to organize interviews with key stakeholders.

VIII. Evaluation report

The evaluation report shall be written in English and it will follow the UN Guidelines for evaluation of UNDA funded projects.

IX. Intended Use/Next Steps

The evaluation is expected to provide guidance on how to enhance the impact of the project. The advice provided may include recommendations on how to seek funding opportunities and partnerships to: a) optimize the use of the assets and training materials developed in the course of the project, b) improve their diffusion and outreach capacity; c) strengthen the networks developed; d) ensure that the assets generated (such as the ForFITS model) are properly used, e.g. by providing assistance to model users and maintaining the assets developed up to date; and e) further develop these assets in the future. These recommendations can be used to inform UNECE's work in the period 2014-2015. The outcomes of the evaluation will also contribute to the broader lessons learned of the UNDA, managed by UN DESA.

X. Criteria for Evaluators

Evaluators should have:
- an advanced university degree or equivalent background in transport, with specialized experience in modeling, as well as in areas such as project management and evaluation, social statistics, advanced statistical research and analysis.
- relevant professional experience in design and management of evaluation processes with multiple stakeholders, survey design and implementation, and project planning, monitoring and management.
- demonstrated methodological knowledge of evaluations, including quantitative and qualitative data collection and analysis for end-of-cycle project evaluations.

Evaluators should declare any conflict of interest to UNECE before embarking on an evaluation project, and at any point where such conflict occurs.

Annex 2
List of Documents Reviewed

The following documents were reviewed, apart from other general information resources on the internet:

1. Project documents: Endorsement by the UN General Assembly (March 2009); Project Document describing in detail the major phases and activities of the three-year project, as approved by the UN Department of Economic and Social Affairs (DESA), January 2011.
2. Project Brief – Project E: Project documents for the 7th tranche of the Development Account.
3. Agenda and Presentations at awareness and technical workshops.
4. Global Status Report on the global review of existing statistical data, policy measures and assessment tools concerning CO_2 emissions in transport – UNECE Project E: CO_2 emissions from inland transport, statistics, mitigation policies and modelling tools, October 2012.
5. Questionnaires (rail, road, inland waterways, and pipelines) used to obtain inputs for the preparation of the Global Status Report above.
6. Agenda and materials circulated at an International Expert Meeting (IEM) to disseminate information on the project, to share experiences and to explore possible synergies with other stakeholders –
7. Annual Progress Reports 10/11E: January 2012 (for 2011), January 2013 (for 2012), Informal Document No. 6 (February 2013) and ECE/TRANS/2014/5 on the project implementation - both presented at the UNECE Inland Transport Committee at its 75th and 76th sessions respectively
8. ForFITS: Coverage, Methodology and Input Data
9. ForFITS: User Manual and model files (Vensim packaged model and Excel input file) including detailed methodological information on the structure of the ForFITS model.
10. Capacity Building Reports: reports on workshops and training activities for policy makers and technical experts in all the regions associated with the UN Regional Commissions, including feedback summary report on workshop evaluation questionnaire.
11. ForFITS – Report on the seven pilot case studies
12. Final Report on Project 10/11E: Facilitating Climate Change adaptation in transport through addressing the energy-environment linkage, March 2014.

Annex 3
Follow-up Action Plan

The following action plan is recommend for follow-up activities to enhance the use of ForFITS and achieve the long run objective in a sustainable manner:

1. Fund a follow-up project to further refine some of the regression equations in the ForFITS model as summarized in the findings, include the differential effect on CO_2 emissions of varying vehicle speeds (including stop and go operations under congested environments) and modify the model to include a sub-model that can be applied at the project level to evaluate the impact on CO_2 emissions of alternative investment policies to reduce urban traffic congestion or improve railway infrastructure to increase operational speeds of the locomotives or rail transit (2014-2015).
2. Dedicate staff in the Transport Division, UNECE, and create a unit or team to continue improving and disseminating ForFITS and provide technical support to users (2014).
3. Strengthen the dedicated ForFITS team so that they can undertake further training programs, particularly to train internal staff of UNECE, train-the-trainers, train personnel in other International Financing Institutions, and anchor the training in existing training institutions in member countries (2014-2016).
4. Team up with a non-profit professional entity such as the World Road Association (PIARC) to jointly undertake research to improve the scope and performance of the ForFITS model, make it more user friendly with drop down windows for users to provide inputs, and in the long run privatize the distribution and technical support provision of ForFITS (long term).