Abstract of Thesis

Name	(Abdi Pratama)
Title	Study of emission control for passenger car in Indonesia through environmental impact evaluation (インドネシアにおける乗用車排ガス規制の環境影響評価)

Abstract of Thesis

Since September 2013, the Indonesian government has launched new policy named as Low Cost Green Car (LCGC). This has led to significantly increase in car purchases year by year. Meanwhile, the evaluation of environmental impact, which results from emission generation due to the increase of used cars, has not fully explored from previous studies. Therefore, to supplement these gaps, the research purpose of this thesis is to assess current emission generation and determine proper way to control emission level in the future. This main purpose is supported by the following specific objectives: (1) to analyze LCGC policy effect in terms of the change of emission amount of CO, HC, NO and CO_2 gases; (2) clarification of the necessity of the scrappage incentive program to reduce higher emission from older vehicles in terms of estimation of CO, HC, NO gas emissions; (3) to explore the possibility of idling-focused method as one of the technological approach to support emission control in the high traffic jam conditions in terms of CO, HC, NO gas emissions.

In Chapter 2, the effectiveness of policy under two scenarios: with and without LCGCs were examined. The affordable price of LCGCs and the strict enforcement of the vehicle purchase system allow us to estimate the growth in the amount of vehicles using minimum annual income as a measure of people' s ability to buy a new car. People, who has an annual income of US$4,500-$10,000, was considered to be likely to buy an LCGC. Annual travel distance was obtained from a survey of drivers, while the deterioration factor was found in the Euro 2 standard. The results showed that the LCGC policy will potentially cause a significant increase in emissions of CO, HC, and NO by 2030. The LCGC scenario predicted 1,390, 31, and 280 tons of CO, NO, and HC, respectively, compared with 670, 15, and 137 tons, respectively, for the scenario without LCGCs, an increase of 51.7%, 48%, and 51.2%, respectively. For amount of CO_2, although LCGC policy could save more than 104,881 tons, the gap is increasing until end of projection in 2030, 3.3 times bigger between corresponding year, 49,411 tons and 14,892 tons for with and without LCGC policy, respectively.

In Chapter 3, to dig into more detail about the LCGC policy, incentive scenario for people to replace their non-euro car with a newer LCGC car through a scrappage program was examined. Willingness to replace old car into an LCGC car was determined through a questionnaire survey. From this survey, the financial aspect still dominated the motivation behind the replacement. This was shown from the choice of the highest incentive fee of $2,000 USD per unit. By applying 78% and 82% to describe the probability of changing to the LCGC car and the incentive option of $2,000 USD, respectively, the incentive program proven that it can reduce the population of non-euro cars with targeted car age greater than 24 years. From the results, it can be seen that emission amount of CO, NO, and HC decreased significantly with CO by 59.3%, NO by 68.1%, and HC by 35.4% compared to without the scrappage incentive program by 2030. Since each unit was replaced with a LCGC car, the population balance was zero. The increase of the emission level from the additional number of LCGC cars was not significant compared to the emissions from non-euro cars.

In Chapter 4, the potential avoidable emissions through idling situation in Jakarta city, one of the busiest cities in the world for traffic, was analyzed. New monitoring method was developed using a global positioning system coupled with global system for mobile provider. We determined that more than 46% of the recorded travel distance occurred with an average speed <5 km/h. Expanding idling driving to <10 km added a +10% contribution to the avoidable emissions. The 46% portions contributed to the current emission levels. The increase of avoidable emissions was strongly related to the high growth rate of vehicles by more than 9% every year. This was larger when compared to the annual road growth that only averages 0.01%. Eliminating emissions during idling conditions using a technological approach was one of promising options.

In Chapter 5, conclusions and recommendations of all chapters. From this discussion, comprehensive and continuous policy should be proposed to assure successful emission control in the future.

様式７

論文審査の結果の要旨及び担当者

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論文審査の結果の要旨

2013 年以降インドネシア政府は、環境改善を念頭におき、低価格低環境負荷の乗用車の導入政策を開始したが、環境改善効果に関しては明らかにされてはいない。そこで、本論文では、第一に、CO、HC、NO、CO_2を評価指標として低価格低環境負荷乗用車の導入政策の効果を推定すること、第二に、低価格低環境負荷乗用車の普及において同時に必要とされる高経年乗用車の廃車促進政策による効果を推定すること、そして第三に、交通渋滞時のアイドリング時の対策による排出量抑制効果を推定すること、という３つの視点で低価格低環境負荷乗用車導入政策の評価をおこなっている。

第二章では、2030 年までを対象として低価格低環境負荷乗用車を導入した場合と導入しなかった場合の２つのシナリオを設計し、乗用車価格から所有者可能者を推定するモデルを構築し、低価格低環境負荷乗用車の普及台数の推算を通じて、両シナリオにおける排ガスの排出量推定を行い、CO で 51.7%、HC で 48%、NO で 51.2%増加するとの推算結果を得ている。これは、単純に、1 台あたりの排出量は低減するが、低価格であるがゆえに過剰な普及が推定されたことの反映であることを確認している。

第三章では、低価格環境負荷政策は、高経年乗用車の廃車促進政策と連動させることでより効果的な面を強調できることから、現在の乗用車所有者に対して、廃車促進誘因プログラムを設計し導入することによる効果を推定している。廃車促進誘因プログラムを通じて、車齢 24 年以上の乗用車が買い換えられていることで、CO で 59.3%、HC で 35.4%、NO で６8.1%の削減可能であることを示している。

第四章では、首都のジャカルタをとりあげ、渋滞に伴う、低走行時の排出負荷の削減可能性を、ジャカルタ市内を走行する乗用車の走行時間、走行距離を測定する方法を開発し、標本の実査を通じて、低走行時の排出負荷が全体の 46%を占めることを推算し、乗用車の台数の伸び率が 9%のところ、道路整備は 0.01%しか伸びない中で、低速走行時を考慮したアイドリング時の排出負荷の削減対策が今後重要となることを明らかにしている。

以上のように、本論文はインドネシアを対象として、低価格低環境負荷の乗用車の導入を通じた環境改善効果推定を可能とするモデルを開発し、その有用性に関し、現状の主要な要因を取り込んだ政策をデザインするとともに、ケーススタディを通じてその効果を明らかにしている。

よって本論文は、博士論文として価値有るものと認める。