Transportation Impacts on Climate Change

Name

Institution

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Overview

Transport relates to 26 percent of worldwide Carbon IV Oxide (CO_2) discharges and is regarded as one of the manufacturing regions where secretions are continually on the rise. Road freight, car use and aviation are fundamentally the main donors to greenhouse gasses from the transportation department prompting various researches on method of reducing emissions which is an environmental impact. Combating greenhouse gas emissions (CGH) is a fundamental social aim towards mitigating climate variation. A renowned vindication technique is to evaluate stratagem techniques that might be used in distinct tasks to attain the required CGH reductions.

Brief History

Climate change is arguably one of the most pressing matters that faces society and entails the adoption of effective and prompt innovations in various sectors of the global economy. This is fundamentally the case in the departments that are highly reliant on fossil fuel resources such as paper, chemical and steel whose procedures emit the biggest quantities of anthropogenic CHG emissions which is apparently the major cause of climate change. For many years, such industries have been exposed to heightening customer, institutional and social pressures; pressures that have compelled corporations towards the instigation of technological and management systems with the aim of reducing the total amount of emissions (Chapman, 2007). A few years ago, the uncertainty surrounding climate variation strategies has considerably transformed the competitive scenery and operations of the transportation business and pinpointed the major responsibility that firms may play in diminishing CO_2 discharges using technological evolution (Mashayekh et al., 2012). Provided the complex status of the innovation procedure, majorly because of an interactive association with the market, various researches have been

advanced to provide insights into the form of technological innovations. Transportation companies have instigated for decreasing the amount of emissions from their commodities in a generation of regulatory uncertainty.

Climate Change

Overview

In the course of the last century, anthropogenic emissions have endangered significant changes in climate within a relatively short timeframe (Mashayekh et al., 2012). Global heating is a well-recognized phrase referring to the restrained rise in the Earth's mean temperature. Rise in the average temperature is primarily brought about by the collection of greenhouse gases in the universe accumulated from relentless ignition of fossil fuels and alternates in use of land over the 20th century (De Stefano, Montes-Sanch & Busch, 2016). The human indication has become frighteningly clear in the climate documentation where the magnitude and rate of global warming because of GHG has become close to real number, and witnessed escalations in temperature. Research reveals that the transport sector is largely responsible for a big portion of the gases accumulated in the atmosphere.

Apparently, the automobile industry produces quite a good portion of the toxic gases because of the big number of vehicle manufacturing companies. Any alteration in the organization of the atmosphere entails a novel symmetry to be upheld; a balance eventually attained by variations to global weather. Radiative forcing that refers to the modification of the equilibrium between arriving solar radioactivity and leaving ultraviolet radiation that is a result of variations in the structure of the Earth is investigated by deploying global climate methods (GCMs) indicating the correlations of the Earth, oceans, landmasses, as well as ice sheets (DeCicco, 2013). By foreseeing how the universal climate will reply to numerous worries,

proposals can be conducted to illustrate the manner in which universal climate will modify under distinct circumstances. According to six discharge scenarios deployed by the IPCC, Carbon IV Oxide is anticipated to rise in the course of the coming century from the current 359 segments per million to a whopping 545-970 segments per million (Kwan & Hashim, 2016).

It apparently translates to an escalation in universally averaged temperature ranging 1.4 and 5.8 degrees Celsius, and therefore results to an escalation in dangerous weather occurrences in addition to intensification in sea levels. It is worth noting that at this point, the transportation industry must do everything in its power to ensure such figures do not peak because of the dangerous implications that will affect the world. Nonetheless, predictions conducted with the GCMs require considerable outlook as they represent an oversimplification of what is a vibrant and complicated framework (Kwan & Hashim, 2016). Essentially, the increasing amount of emission scenarios considered in this case pinpoints the uncertainty in formulating predictions, and the future is unclear as to the extent of behavioral and technological changes that will take place. Since the transport (automobile industry) started making cars and other transportation items, global warming has been continually on the rise. Still, the expansion in CO_2 discharges is untenable, therefore bound to exceed the degree of required stabilization (Kwan & Hashim, 2016). Also, the radiative forcing witnessed from CO_2 is because of discharges in the course of the last ten decades. It is this apathy that translates to the fact that some of anthropogenic climate variations may have more effects on climate change.

Transportation and Greenhouse Gas Emissions

Almost all human activities have an effect on the atmosphere, and transportation is therefore not an exclusion. Irrespective of the fact that transportation is very crucial to any

economy and people's wellbeing, as a sector it is apparently one of the biggest emitters of greenhouse gas emissions. According to current GHG emission reporting requirements (Greenblatt & Saxena, 2015), the transportation department directly accounted for about 28% of the typical United States discharges in the year 2006 rendering it the second in magnitude source of GHG with power generation coming out top at 35%. Approximately 98% of GHG transportation discharges emanated from direct burning of fossil fuels, others as a result of CO_2 emissions from Hydrofluorocarbons (HFCs) and electricity (rail) emitted from refrigerated transport, as well as vehicle air conditioners. Apparently, transportation is the biggest end-use sector producing CO_2 which is considered the most predominant greenhouse gas (Greenblatt & Saxena, 2015). As indicated in Figure 1 below, road users consume the highest amount of fuel compared to other means of transport.

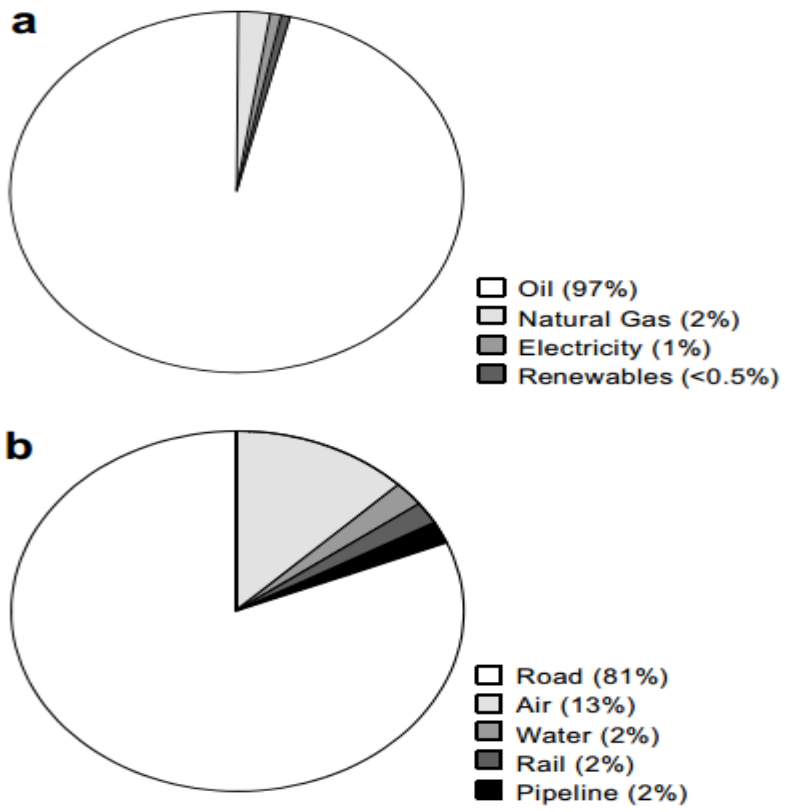

Figure 1 Fuel Use in Transportation Sector

Approximations of GHG emissions do not involve additional lifecycle of production associated with transportation; for instance, the mining and refining of fuel, as well as the manufacture of vehicles and other transportation machines which are essentially a momentous source of international and domestic emissions. Reports reveal that when emissions from the electricity sector are dispersed to economic classes, industry accounts for the biggest share of United States GHG emissions that stands at approximately 29% followed by emissions from transport at 28% (Kwan & Hashim, 2016). This residential and commercial industries are fundamentally accountable for a considerable section of discharges, each accountable for the 17 portion of the general discharges from power that are dispersed because of their comparatively enormous stake of the power intake. Starting from 1995, the conveyance industry is the quickest rising bases of the US GHGs. Actually, the escalation in movement discharges depicts 50% of the total rise in the country's GHGs starting from 1995 (Kwan & Hashim, 2016). The biggest sources of transportation of GHGs in 2007 were passenger vehicles with 34%, light duty trucks (sport utility cars), minivans and pickup trucks with 28%. Below is a figure of the world's emission flow chart.

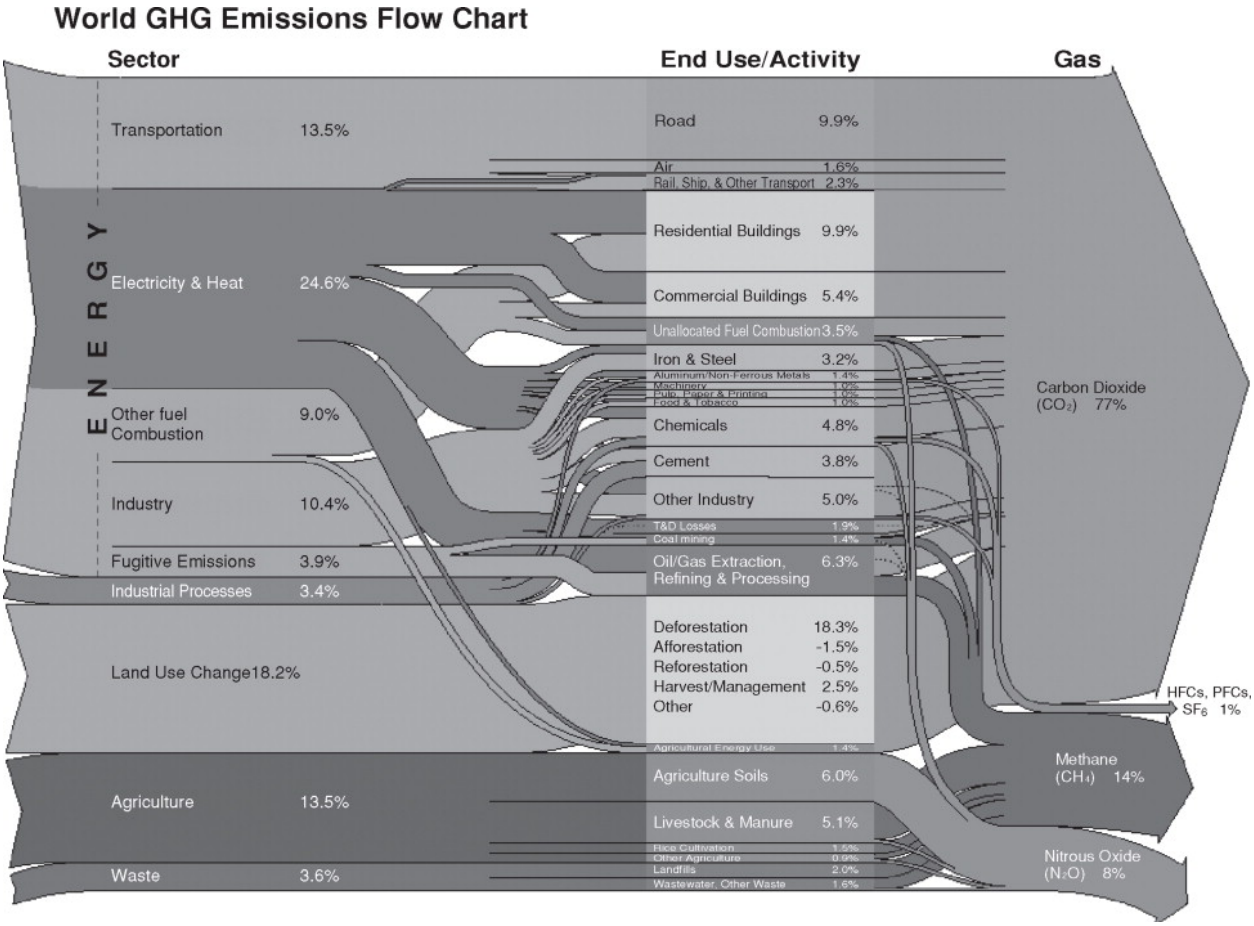

Figure 2 World GHG Emission Flow Chart

Together with motorcycles, the light duty cars comprised about 63% of overall transportation of GHG emissions. Others in this category were freight trucks with a total of 20%, commercial aircraft (7%) and various other non-graded sources that completed the final 7%. Apparently, these are numbers that involve direct emissions out of fossil fuel combustion and HFC productions from refrigerated transport and mobile air conditioners allocated to the various car types. Research has revealed that fuel utilized in global transport by marine and aircraft bases is not included in global greenhouse gas stocks (Greenblatt & Saxena, 2015). Nonetheless, global trade has been on the rise in recent years, therefore heightening transportation's role as a source of universal emissions that leads to climate change. Further, it should be noted that aircraft can have some complex and unique impacts on the atmosphere because of the release of water vapor

and emissions at high altitude. For example, jet aircraft develop contrails or condensation trails at cruise altitude in upper atmosphere because of the combination of water vapor in the craft's engine exhausts in addition to the miniature ambient temperatures that are prevalent at high altitudes (Kwan & Hashim, 2016). The contrails impact the cloudiness of the atmosphere, thus may impact climate and atmospheric temperature. This can be seen in Figure 3.

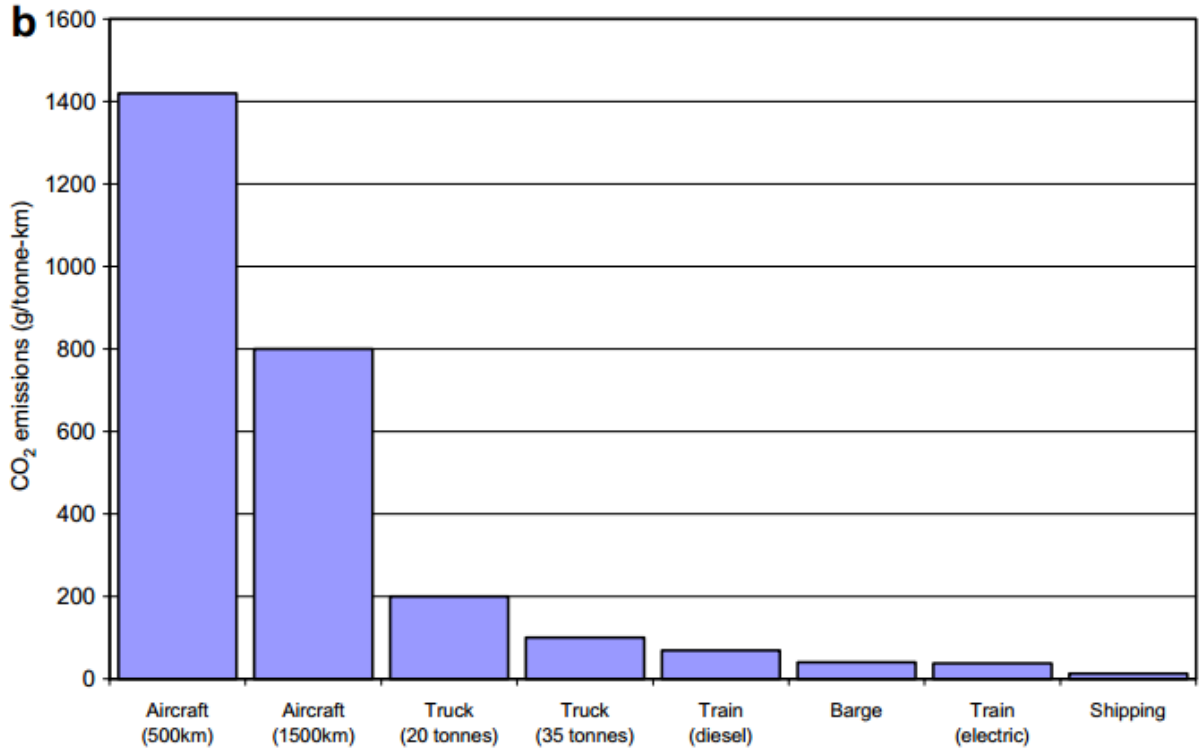

Figure 3 Carbon Dioxide Emissions for Long Distance

The Role of Transport

Oil is arguably the overriding fuel source for matters of conveyance with road transport being accountable for over 80% of total energy utilized within the sector (Kwan & Hashim, 2016). It is worth noting that this dependence of fossils renders transport a key emitter of

greenhouse gases, and it is one of the few industries that are recording increasing emissions. Therefore, the effect of universal climate is never confined to car discharges as the distribution and production of fuel from oil in what is termed as a 'wells to wheels' model that manufactures momentous levels of greenhouse gas. For instance, consideration of the general CO_2 discharges from a standard vehicle revealed that approximately 75% emanated from fuel deployment while 9% was from producing vehicles while another 15% was recorded after losses and discharges in the fuel supply framework (Kwan & Hashim, 2016). Transport was fundamentally one of the main sections pinpointed to be handled by the 1997 Kyoto procedure with the objective of diminishing global GHGs by approximately 5% of the 1990 quantities by 2012.

Thus, since the late 90s, transport has been a subject of debate in the radical programs of many industrialized nations who were part of the agreement. Research reveals that the transport accounts for 27% of universal discharges of which about two-thirds comes from richer nations. Road transport apparently is the largest emitter of greenhouse emissions, as far as the transport industry is concerned despite the fact that motor cars are not completely responsible for the total amount of emissions. Taxis, city to city buses play a big role polluting the atmosphere; however, the main emitter is road merchandise that generally assumes more than three quarters of all of the road transport combined. Apart from the road industry, the largest emitter of climate change is air travel. Actually, aviation is more ecologically destroying that can be revealed by CO_2 discharge figures (Greenblatt & Saxena, 2015). This is because of the fact that greenhouse gases are discharged straight into the upper troposphere where the localized impacts can be highly destroying compared to the impacts of solely CO_2. Though the real CO_2 discharges and energy consumption from aviation are seem comparatively low when equated to motor cars, it is proposed that growth in air travel is considered the largest anxiety.

Air travel depicts the largest expansion when pooled with other means of transport, and it is projected to rise as high as 5% or even beyond per annum for the next ten years. Research reveals that all transport departments are undergoing growth, and unfortunately the considerable trend can be seen: the models which are undergoing the highest growth are the most contaminating. Motor cars and aviation are greatly the preferred modes of human transport but are additionally highly damaging (Kwan & Hashim, 2016). Road freight and air travel are both the sectors with the highest CO_2 discharges and biggest growth. Therefore, scholars propose the requirement to halt the association between today's activities of freight and passengers transportation with the most contaminating models. Decisions should be made if the preferred modes of movement should be less polluting via technological variation, or alternative methods should be transformed into more attractive channels using behavioral change propelled policy. Essentially, the largest tests are car usage, the escalation in road freight as well as the rapid rise in aviation (Shaheen & Lipman, 2007). Therefore, the effect of expansion in car use, freight and aviation with regards to climate variation should be evaluated clearly with room provided for future research.

Determinant of Car Emissions

For evaluating transportation-related GHG discharges, a major observable variable is transportation activity which is known as the total travel distance (it is calculated by vehicle miles of travel (VMT). Research notes that VMT determinants include income, as well as settlement patterns in addition to the prices of cars, roads, fuels, parking, as well as automobile supporting services and infrastructure. These are some of the essential constructs that are both shaped and modified by the share of the model compared to other methods of transportation. Transportation of GHG discharges are also dependent on vehicle energy intensity; a metric is

observable and determined by the rates of energy consumed per particular distance (Mashayekh et al., 2012). Therefore, it is an indication that manufacturing companies have various options to regulate the levels of energy consumption, and ultimately reduce gas emissions. The automobile industry is largely dependent on vehicle engineering and design in addition to behavior and driving patterns. Some of these aspects may influence technological progress, incomes, tastes, operational factors, prices, and strategies involving fuel and vehicle use regulations.

It is essential to note GHG discharges are greatly dependent on energy and carbon construct. In most cases it is provided as grams of CO_2 - equivalent for megajoule (gCO2e/MJ); calculated by lifecycle analysis, this construct in mainly referred to the carbon intensity to fuel. The phrase that will be applied in this case is 'fuel system GHG effect'. It is essential to note that the terminology focuses on the fact that the GHG discharges and emissions effects involve releases in addition to sequestration, and uptakes are relevant in the entire framework of consumption of fuel and manufacture such as supply chains and associated industrial tasks plus fuel production (Shaheen & Lipman, 2007). This is also a pointer to the fact that the entire process of global warming can be reduced at the production stage to save the world from impending dangers of climate changes. Irrespective of the fact that LCA founded 'carbon footprints' are considerably deliberated and fuel carbon intensity has been an object of regulation for the past few years, this aspect is the most analytically troubling but the most fundamental regarding the climate problems (Greenblatt & Saxena, 2015). It should be noted that carbon intensity is an abstraction correlated with a complicated system, and therefore not directly quantifiable. Carbon intensity is never similar to chemical carbon content but the latter may be involved when approximating the former. For example, biogenic carbon is in most cases

excluded when computing the carbon intensity of biofuels, a convention related to the conceptual matters discussed by various researches.

Strategies to Reduce Emissions

Climate change is speedily turning out to be one of the most tangible matters which require addressing to avert major environmental ramifications in the years to come (Kwan & Hashim, 2016). Recent alteration in public forum has been created by the physical indications of changes in climate such as melting glaciers, drought and severe storms, increasing sea levels as well as higher mean universal temperatures. Conveyance is a critical emitter of CO_2 plus other greenhouse gas discharges from anthropogenic activity, and it is responsible for roughly 15% of the typical human discharges universally and approximately 28% of them in the United States alone (Kwan & Hashim, 2016). It is fortunate that strategies and technologies are sprouting to enable combating with the climate change. Some of the strategies include fuel and automotive technologies, mobility management policies and intelligent transportation strategies (ITS) that are aimed at decrease of the demand for private cars and other modes of transport.

In as much the climate variation profit of becoming evolving vehicle and engine innovations are comparatively well comprehended, there are lesser researches present for the energy, as well as discharge effects of ITS and other mobility organization policies. Rich nations around the world have noted that mobility management and ITS will essentially play bigger roles in diminishing the consumption of fuel (Kwan & Hashim, 2016). Researches are in many cases based on scenario analysis, simulation models, as well as limited deployment knowledge. Therefore, advanced research is required to quantify added effects. Of the nine ITS innovations

advanced, electronic toll collection, traffic signal control, bus rapid transfer, as well as individual information have been utilized broadly and demonstrated positive results but many of them are on a confined basis. Apparently, mobility management methods that have proven the biggest CO_2 decrease possibility to date involve road valuing strategies such as barricade and congestion, as well as car sharing that is short term for auto access (Kwan & Hashim, 2016). Other strategies that have depicted CO_2 decrease potentially involve low velocity models, combined district smart cards, ride and park facility, carpark cashing out, carpooling, telecommuting and smart expansion.

Concluding Remarks

The utilization of energy accounts for an essential percentage of all the anthropogenic discharges of GHGs and in many revolutionized nations conveyance of fuel deployment manufactures is an essential part of the energy-correlated discharges. In the United States, discharge of GHGs out of transportation stands at about 27% of human GHG emissions, whereas on the global front, transportation accounts for 14% of GHGs. Additionally, transportation department discharges are anticipated to rise speedily in the course of the next few years. It is worth noting that the International Energy Agency (IEA) discharges in industrialized nations will soar up by roughly 60% starting from 2017 and to 2050 (Greenblatt & Saxena, 2015). Discharges in developing worlds are anticipated to ramp up even further in various cases; for instance, Indonesia and China have more than double numbers compared to the previous amount in the same period.

The rises are present because of increases in goods movement, and individual travel made worse by continuing high dependence on fossil fuels pertaining to transportation power. Global individual transportation is anticipated to rise twice annually from 2017 to 2050, whilst global

freight transportation is expected to grow on the same rate during the time mentioned. Worsening the matter is that transit modal share has diminished because of lesser density use of land because of greater convenience of private transportation in terms of aviation and personal vehicles, and indication that no solution to this problem will be arrived at soon. Nonetheless, solutions are required to decrease emissions in addition to consumption of energy from the transportation industry. It is now broadly considered as one of the major factors in changing climate (Mashayekh et al., 2012). The manufacture and utilization of fuels and its products for transportation lead to discharges of other essential GHGs apart from CO_2, methane and nitrous oxide. The discharges can be essential for various types of transportation channels and fuels. Moreover, other methods of transportation, for example refrigerants for automotive air conditioners lead to momentous releases of GHGs. In general, the discharges are imperative due to the considerably heightened ‘global warming possibility’ figures of the gases.

References

Chapman, L. (2007). Transport and climate change: A review. *Journal of Transport Geography*, *15*(5), 354-367.

DeCicco, J. M. (2013). Factoring the car-climate challenge: Insights and implications. *Energy Policy*, *59*, 382-392.

De Stefano, M. C., Montes-Sancho, M. J., & Busch, T. (2016). A natural resource-based view of climate change: Innovation challenges in the automobile industry. *Journal of Cleaner Production*, *139*, 1436-1448.

Greenblatt, J. B., & Saxena, S. (2015). Autonomous taxis could greatly reduce greenhouse-gas emissions of US light-duty vehicles. *Nature Climate Change*, *5*(9), 860-863.

Kwan, S. C., & Hashim, J. H. (2016). A review on co-benefits of mass public transportation in climate change mitigation. *Sustainable Cities and Society*, *22*, 11-18.

Mashayekh, Y., Jaramillo, P., Samaras, C., Hendrickson, C. T., Blackhurst, M., MacLean, H. L., & Matthews, H. S. (2012). Potentials for sustainable transportation in cities to alleviate climate change impacts. *Environmental Science & Technology*, *46*(5), 2529-2537.

Shaheen, S. A., & Lipman, T. E. (2007). Reducing greenhouse emissions and fuel consumption: Sustainable approaches for surface transportation. *IATSS Research*, *31*(1), 6-20.