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CNG BASED MOBILITY SYSTEM AND SOCIO-TECHNICAL CHALLENGES IN INDIA

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Abstract:

The challenge of vehicular related air pollution has been a curse on contemporary society and is a hot topic of debate at all levels (academician to politician). In the last couple of decades, the preservation of bio-diversity and conservation of the environment has assumed great significance in around the world. People and institutions alike have been battling it out for a "cleaner and greener world". In this discussion on the application of natural gas vehicles or CNG can promote the cleaner and greener world. The interview with CNG experts suggests that CNG program in Indian cities is progressing stage and it could become the world's largest natural gas vehicle program. However, in recent time CNG option is not much preferable due to constant increasing fuel price, increased private vehicles and decreased public transport, lack of effort in small scale market development, infrastructural problems, improvement of diesel/petrol technology and lack of social awareness on acceptance of environment friendly fuels. Besides, the future vision of this program will expand to all over the Indian cities it would not possible without systematic understanding of current socio-technical challenges and with possible solution.

KEY WORDS:

CNG, Transport, Technical, Policy/Program

INTRODUCTION

The regulatory and judicial mandates are commonly cited as the major driving force for running the CNG program in Indian cities. It has proved that public campaign against diesel/petrol vehicles to improve local air quality was the prime force of moving diesel/petrol to CNG base mobility system in Urban India. During the past decade, after the success of CNG modal in Delhi this program covered in most 30 polluted Indian cities. Moreover, in future this program will also expand in other 200 Indian cities. The government foresees very significant investments need into the next 15 years for expanding this program there will 298 cities seen as the potential target until 2014. According to GAIL future plan 'The Road Ahead' mentions that we will be investing around 8 billion USD for manufacturing four million CNG vehicles. Even, the PNGRB estimates that in the next five years, around 13 billion USD will be required for expansion of the natural gas grid, and an additional 2.2 to 3.3 billion USD required in expanding four city gas distribution networks. At present, the GAIL has 7000 km networked pipeline it has the capacity to carry 155 MMSCMD of natural gas. The Reliance Gas Transportation Infrastructure Ltd (RGTEL) has commissioned the 1400 km pipeline for transporting gas in Western Part of India. Other companies GSPL have 300 km and ONGC Assam Gas 175 km transmission pipeline network. However, the most of the pipelines concentrated in the western and northwestern India. Also, there are 18 city gas distribution companies and 829 different types of CNG stations running in Indian cities. Although, Nijbor study suggested that the CNG program in India is widely successful but as to compare diesel and petrol CNG

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programm is developing stages. It requires more socio-technical learning in trams of wide scale of expanding this program in others Indian cities.

RESEARCH METHOD

This study based on expert interview method and document analysis. The main research question is what are the key challenges face by CNG program in India? And what would be the possible solution? In CNG based mobility system two basic unite social and technical both are working together than make mobility system. The technical element is related with technology specific and social element include with institutions and organization such as natural gas industries/companies, engineers, fuel suppliers, government at all levels, suppliers of equipment including part, service provider, vehicle repairers, consumer, environmentalist (NGO), researchers and policy makers. Both elements are important unite of analysis in CNG based mobility system. Therefore, in this study we purposefully identified 30 experts who has been long timeworking on CNG program in Indian cities. They know vision, goal, problems and possible solution on the CNG program in India.

CURRENT CHALLENGES IN CNG BASED MOBILITY SYSTEM IN INDIA

The CNG experts exposed present CNG based mobility system is facing two types of challenges, first technical related to technology specific like engine efficiency, conversion cost, safety, emission control etc. Second, policy and program related to infrastructure, institutions, legislation, market development spatial, cultural, social acceptance of CNG vehicles, environment and health.

TECHNICAL CHALLENGES

The main composition of CNG is methane which is a 94 percent. Hence, the properties of CNG fuel are almost similar to that of methane. The methane and ethane content are high and the CNG stored very high pressure so that it fuel characteristics different compeer to gasoline/diesel/petrol. CNG is cleaner burning fuel because of the vehicles burning natural gas emissions substantial lesser amounts of pollutants than petroleum powered vehicles. It reduces non-methane hydrocarbons 50 percent, NOx by 50-87 percent, CO 20 to 30 percent. The combustion of CNG fuel produce less level of particulate matter meanwhile the challenge is it would not reduce pollutant at the level of 70 to 90 percent. Even, the unique physical characteristics of a CNG fuel system are it stored at high pressure so high presser CNG gas can result in the creation of a fire hazard.

SAFETY CHALLENGES

The issues of safety in CNG vehicles are related to cylinder and linkage of gas. In CNG vehicles if the cylinder improper installed, cylinder failures, no inspection of cylinders, lack of information and service fail, failure of properly maintain cylinder, fire and accident all are important current safety challenges related into CNG vehicles. To overcome of these issues the government set up a separate safety council it identify solutions a remedial action. Even if in safety side CNG cylinder requires more technical awareness.

MAINTENANCE PROBLEM IN CNG VEHICLES

The CNG vehicle is different compeer to diesel/petrol. It required engine, fuel system, cylinder inspection maintenance. The CNG engine operates in a similar way as a gasoline engine, but it required higher temperature and more maintenance. Interview with the CNG automobile repairer and CNG users said CNG automobile required two or three months a time maintenance because it engine and cylinder need higher compression compare to others vehicles. It maintenance cost also very high compare to diesel/petrol vehicles. On the engine side, there are four types of CNG engines used by CNG vehicles (1) dual fuel (2) bi-fuel (3) mono fuel and (4) tree fuel. Dual fuel engine is a conventional diesel engine which burns either gaseous fuel diesel or diesel or both at the same time. Bi-fuel engine is developing from conventional petrol engine, where the fuel system has modified either on petrol or gas. Mono fuel has designed and optimized to operate only on natural gas. Tree fuel has recently developed engine technologies which mix combines of flex-fuel vehicle and a natural gas vehicle. A flex-fuel vehicle uses gasoline and ethanol. The majority vehicles use the duel fuel engine, but we need more research on the engine side because still we need more engine efficiency compare to conventional engine. However, in the

technology side many innovations have done it improved technical efficiency but still we need more strengthen policy and program.

CHALLENGES OF POLICY/PROGRAMM

The vision of CNG program is a large number of Indian cities embarking on CNG based mobility system. It is essential because this program is well defined for maximum benefit of environment and health. Therefore, it is important to consider identified which factors influence on further strengthen CNG policy/program in Indian cities.

INCREASING PRIVATE VEHICLES

According to the Ministry of Road Transport & Highways, Government of India, (2009) the annual growth rate of motor vehicles in India is increase around 10 percent during the last decade. This growth rate increased in selected mega cities, although it is not the basic problem increase number of vehicles but increases private vehicles and decrease public vehicles in India. It is significant challenge because the majority of public vehicles in Indian cities based on CNG. However, if we compare pattern of vehicular growth during the year 2000 to 2009, in selected Indian cities Nagpur 84%, Varanasi 84%, Surat 83%, Coimbatore 83%, Bhopal 81%, Vadodra 81%, Vishakapatnam 81% and Lucknow 80% than we find increased private two wheelers it running by petrol/diesel. On the opposite, the share of public buses is negligible in most Indian cities compare to private vehicles. Two wheelers and cars together constituted at least 90% of the total vehicles in Ahmedabad 91% Delhi, Lucknow 93% and Nagpur 91% whereas in these city buses constitute only 1%, 07%, 03% and 0.4% respectively. It predicted the benefits of CNG transition are not visible due to the growth of private diesel vehicles in Indian cities. This is the most current significant challenge facing by the CNG based program in India.

INCREASING CNG FUEL PRICE

The success of CNG program linked to the behavior of diesel/petrol Vs CNG prices in the market. At the beginning of the CNG program price was 8 to 17 per Kg at present this price is two times higher. If we compare diesel price with CNG, have no much difference in Delhi, CNG costs around Rs 38.35 per Kg while diesel around Rs 42 per liter. The difference between CNG and diesel is around 4 Rs at present. Even, diesel/petrol offers other benefits and available everywhere. There are no long queues for refueling. As the case with CNG, it is the challenging fact.

The question is if increasing CNG prices at present rate than what meaning of clean fuel programs. The expert suggests that fuel taxation policies or favorable taxation is an important instrument to maintain the price differential for encourages the environmentally accepted fuels. The EPCA committee suggested the government frame the facial policy for wider diffusions of environmentally acceptable fuel in India. However, the national government does not have any direct facial policy to promote the CNG program in the cities. Even, the uncontrolled facial regime, and the state government left the taxation issue on natural gas. As a result, different states are charging different amounts of sales tax and entry tax. The sales tax on natural gas is different in every state, not any single price policy to control the issue of price hike. It is fact that government should be set proper taxation structure to control fuel price hick. Without proper tax plan CNG program will not meaning in the near future so prime requirement is the government should be rationalized diesel/petrol Vs CNG price.

MARKET DEVELOPMENT

The market development of natural gas as a transportation fuel has pushed through various policies and instruments such as legal-regulatory mandates, fiscal policy, R&D and consumer awareness. In India, there is a limited market driven approaches and models for the promotion of CNG as a transport fuel. Therefore, current challenge is creation of small scale CNG market because not a viable scale of CNG fuel demand in large market. The economic rationale for set up large scale of refueling stations, pipeline, and other infrastructure will not be effective if cities do not have the sufficient mass of CNG vehicles to ensure a viable scale of the CNG market demand. At present, public transport is prime consumer of CNG but at present it share is decreasing in many cities so that not seeing long term viability in the CNG business market. The expert suggest emerging need is strengthen the CNG market through development of CNG business model, target other market stakeholder, investing in R&D, strengthen regulatory framework. Some of the cities in India followed joint venture or public-privet business model. However, we need more

decentralized CNG business modal in India with controlled by the government and others stakeholders.

RELATED INFRASTRUCTURES

The success of CNG program determined by necessity of the supply network such as supply pipeline, refueling stations, availability of fuel, number of vehicles and daily consumption. If compare the CNG infrastructure with others countries than find India is still growing stage. At present, total 11 million CNG vehicles users. In Asia Specific region share of natural gas vehicles leading with 78 percent than come Latin America region 22 percent. The Bangladesh and Pakistan are neighbor country having the highest number of NGV. India ranked 5 percent of the market share still it is growing stage. The developing refueling stations are another challenge. There are almost 17000 NGV fueling stations in worldwide. Over the half of these are located in five countries Armenia, Bulgaria, Peru and Thailand. Those countries have represented the most remarkable growth in terms of number of refueling stations. The ideal ratio of per one fueling station is 600 to 1000 vehicles is an economically sustainable ratio. The worldwide this ratio are 672 vehicles per one refueling station some countries like India 1400 per one fuel station this ratio indicates set up new refueling stations in order to avoid long queues on the stations.

CNG KIT PRICE

A CNG kit consists of a CNG tank. This tank contains the gas that used to power in the engine. There are many types of CNG kit available in the market, but the Italian and Chinese kits are most famous in the Indian market. In recent times, CNG kit price has gone up 18000 to 50000 because of increases CNG fuel price. According to Times of India NEWS paper (07/11/2012) CNG kit sales have dropped over 60 percent. As similar the interview with CNG kit fitment, explain in the beginning of CNG when fuel price very low and at that time around 50 to 60 kit fitting every month. Nowadays we are getting one or two CNG kit fitting. If CNG fuel price continuously increase at the same rate than enforced to close CNG kit fitting business, reason is no profit in this business. It is a critical challenge facing by CNG kit fitters due to the constant increase CNG fuel price in the Market.

IMPROVING PETROL/DIESEL TECHNOLOGY

In India CNG program has forced by the Supreme Court because of harmful emission of diesel/petrol driven vehicles. In the meantime, at globally petrol/diesel technology itself is improving dramatically in response to the stringent emissions standards set by industrialized nations US, Europe and Japan. Those countries have tightened their emissions standards to phase in the clean diesel fuels and technologies. The US and Japan enforced Euro IV and V norms therefore, the cleaning up petrol/diesel possible due to significant improvement of emissions control technologies. Vehicular pollution control depends on the quality of fuel. Hence, in India Supreme Court has legally enforced the quality of petrol/diesel by introducing Bharat Stage Norms II and III (equivalent to Euro norms) it notifies the requisite specifications for gasoline and diesel. After the implementation of BS norms the sulphur content in diesel reduced from 0.25 percent to 0.005 percent by April 2010, the amount of sulphur in diesel is propose to be 0.035 percent (350 mg/kg) in all over the country. It indicated through BS norms diesel technology is radically reducing the low level of pollutant. It is a significant fact facing by the CNG program in India because diesel itself an environmentally acceptable fuel.

PUBLIC AWARENESS

The public awareness or consumer education is must for a wider diffusion of environmentally acceptable fuel. It accepted that importance of clean fuel program in India and around the world is energy security and environmental imperatives. India is becoming increasingly dependent on oil importing country. It imports 75 percent of crude oil only for transportation if petroleum price not stable so this sector face more crisis. Other side, the Indian economic growth rate continues at the present rate so by 2030 India will import more than 85 percent of crude oil. It will create more vulnerable situation. Therefore, the CNG program in India has forced by the Supreme Court the reason of environment and public health. This is the main concern of widely acceptance of the CNG program in Indian cities. The common people may be not fully aware on benefit of CNG program. However, the consumer point of view lack of education on CNG safety issues, fuel information, availability of pump, timing, traffic, CNG retro fitment initial cost and saving. Those types of main issues relate to the consumer awareness. The interview with CNG users explain we want information regarding distance between one CNG refueling station to another's because some time

we worry about refueling station if we drive in long ways. Another, issue is many consumers could not aware about which CNG kit is appropriate for car it price, performance etc.. Those types of awareness issues would resolve after making proper information system through internet, radio channels and poster.

DISCUSSION

Air pollution problems in urban areas increase due to driven diesel/petrol vehicles it is ever-increasing problem for India and other more developing countries. In recent time, one group of technical experts has suggested the use of environmental friendly fuels like CNG as an alternative fuel for diesel/petrol based automobiles. They have estimated that apart from being less hazardous, it is also environmental friendly, and help to reduce the level of pollutant emissions drastically or cost effectively. Another group of technical expert claims that in recent time, the mandating a single fuel over the consumers is anything but the CNG is solution. Besides, they argue there are other fuel options that are as good in terms of emissions and ecological security. Such fuel is Ultra Low Sulphur Diesel (ULSD) hydrogen; electric-hybrid fuel cell gives lesser emissions than CNG this argument claim just the opposite of CNG. The conclusion is that both are comparable fuels in terms of "emission merit", but the CNG option is better compeer than diesel/petrol. Nevertheless, CNG option is not much preferable due to ever increasing its fuel price. Consumer point of view, CNG should cheaper compare to diesel at international level price gap between petrol/diesel vs CNG is 30 percent less should be formally accepted, but in India we seen it is unfavorable fact. Now another discussion is how we should rationalize fuel price mechanism or maintain price gap in the changing situation.

Another, discussion is in many cities public transport converted into CNG. It only one of the sectors demanded large scale CNG fuel, but in recent time we have seen public transport are constantly decreasing and increasing private transport. This is another type of policy debate related to success and failure of the CNG program in India. The CNG program in Indian cities is progressing and India could become the world's largest natural gas vehicle market if it can manage the policy and substantial investment it is challenging fact on further expand of CNG prgramm. Therefore, government should subsidies production of CNG vehicles, improving security of supply by replacing an imported fuel with a domestically abundant fuel, and overall gas market development. Government should also stimulate CNG at different levels applying co-coordinated or integrated approach with all stakeholders (global-national and regional). The co-ordination between automakers, fuel suppliers and government are essential. Another type co-ordination is identifying the target group or market, vehicle portfolio selection, asymmetric incentives for urban and rural stations and fuel standardization is necessary.

CONCLUSION

The low carbon CNG mobility system in India is the early phases of a low-carbon transition in the transport domain. The main drivers of this transition are climate change and energy security, but these drivers are not yet very strong, whereas the mechanisms of inertia and stability of the high carbon mobility system are still substantial. Other side, the effort of government policy and executive body could not get a success in implementing wide scale of low carbon mobility system. We need for applying a large scale collaborative mechanism (integrated approach with all stakeholders) to overcome of the current challenges. The CNG expert suggest interactions between industry, policy makers, consumers and civil society is necessary for success and further expand of CNG program in India. Along with, need to understand changing behavior of all stakeholders in terms of which cooperation and support can be obtained, so that real vision/goal can take place.

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