

# **Policy Implications of Problem of Banning Two-Stroke Auto-Rickshaws in Lahore**

MOHAMMAD RAFIQ KHAN

Research work on the problem of banning two-stroke auto-rickshaws in Lahore was undertaken in different contexts such as its impact on the socio-economic status of rickshaw drivers, factory workers engaged in rickshaw manufacture, rickshaw manufacturers, rickshaw users, etc, and quantification of its benefits and costs to have an idea about its socio-economic implications. As the preliminary enquiry revealed that the problem had many policy implications also, it was resolved to do some primary spade work with this reference in mind.

The primary data were collected through questionnaires developed for different stakeholders such as Transport Department, Government of the Punjab, Punjab Environment Protection Department, Manufacturers of Two-stroke and Four-stroke auto rickshaws, Rickshaw and Motorcycle Dealers Association, Rickshaw Drivers, Union, etc. The information collected was computed and interpreted in the form of descriptive research.

The findings suggested that the problem was not completely understood by the stakeholders. There was almost a complete consensus on the need to impose the ban but the strategy followed by the stakeholders including Government of the Punjab was extensively criticized and challenged by the affectees that included rickshaw drivers, two-stroke rickshaw manufacturers, rickshaw dealers and others. Our primary qualitative assessment was that the banning of two-stroke rickshaws was a complex problem whose nature and implications were not completely understood. To handle the gravity of this problem no systematic techno-economic study was carried out that would have formed a prelude to satisfy all affected parties.

## **1. INTRODUCTION**

The motorcycles and rickshaws, due to being equipped with 2-stroke engines, are the most inefficient vehicles in complete burning of fuel and thus contribute most to emission of air pollutants in the environment. The major pollutants from two-stroke engines are Carbon Monoxide (CO), Nitrogen Oxides (NO<sub>x</sub>), Hydrocarbons (HC) and Particulate Matter (PM). Their presence in the environment causes a number of respiratory diseases and other illnesses. For example, CO and NO<sub>x</sub> are notorious irritants of respiratory system and have potential suffocating action. PM causes premature death, and illness. Its presence is accompanied by increased hospital admissions for asthma and other bronchial conditions such as bronchitis, etc.

None of the locally assembled rickshaws meets standards fixed by Pakistan Standards Quality Control Authority (PSQCA) for smoke emission. According to the PSQCA code, two-stroke exhaust contains 4.5 per cent and old two-stroke has six percent carbon mono oxide<sup>1</sup>. The studies conducted in India, Bangladesh and Nepal; with or without the assistance of international institutions, have alarmed Asian Countries including Pakistan to be vigilant about the gloomy environmental future being created by three-wheelers and take protective measures to avoid future health averse situation. For example, a study conducted on Dhaka revealed that 2-stroke auto-rickshaws with number around 50,000, which is comparable to that in Lahore (Around 60,000) is responsible for 36 % of the total pollution caused by all vehicles on roads of Dhaka. That means that out of PM estimated as

34,733 tons per annum, the contribution by two stroke three wheelers comes out to be 12,504 tons per annum which is an alarmingly high figure for a medium size but highly populated Dhaka. A similar situation in Lahore has led to the issue that is the subject of analysis here.

The issue of banning two stroke engines in Punjab has been under active debate both in public and private sectors and also in public circles for the last few years. A number of arguments: some in favor and some against the ban have appeared in the print and electronic media. Reports have also appeared in the form of government press releases. The government has said a lot in favor of the ban, while the likely affectees in near future, particularly rickshaw drivers and two-stroke engine manufacturers, have also vented their grievances and fears through the media and have also organized rallies to express themselves publicly.

The active debate started in 2004 when Government of the Punjab announced intention to ban two-stroke engine operated vehicles in the Province after December 2004. Some analysts tried to compile the two-stroke vehicle statistics, views of the drivers of three wheelers, community users of rickshaws, government officials, etc, to alarm Government of the Punjab about the aftermath of the ban<sup>1</sup>. Soon after the ban, there appeared an article in “Jang “dated 5<sup>th</sup> March 2005 on this issue<sup>2</sup>. The analyst foretold, “The ban on manufacturing and plying two-stroke rickshaws may hit more than 0.3 million families in the province” that will finally translate into unemployment of hundreds of the workers in about a dozen two-stroke rickshaw factories and of rickshaws drivers”.

The rickshaw drivers are characterized by illiteracy, large size households with an average of four to six per family, rickshaw ownership, permanent settlement in big cities with small owned residences, rickshaw driving as a family business, etc. Their survival is tagged with staying in Lahore and other big cities due to more opportunities in these cities and better facilities such as health, education, etc. as compared to small towns.

## **2. BACKGROUND**

The protests against contamination of air environment by two-stroke vehicles particularly the auto-rickshaws form a long story. The major event that translated into intense consciousness of Punjab Government to make a strategic plan to ban two stoke vehicles in the Province is a Supreme Court Decision (The August Supreme Court, Lahore? In Suo Molu Case No 3.2003 that passed Order Dated May 23, 2003) that directed the Provincial Governments to control vehicular smoke and noise pollution caused by Motor Cab Rickshaws for the protection of the environment. In order to implement the Supreme Court’s Decision, a ban on auto-rickshaws was notified with immediate effect from January 1, 2005 (Government of the Punjab, Transport Department Notification No.SO-TR-1/Misc-71/88 (P-II) Dated Lahore January 2005).

After the ban was imposed, there were repercussions from different circles that were concerned in different contexts. The immediate affectees being rickshaw drivers, they challenged the imposition of ban in court and also protested on the roads particularly on that of Lahore, under the banners of the Rickshaw Drivers Union of the Punjab and demanded elimination of rickshaws from major cities according to a practicable plan that could save the subsistence living of large number of households in the Province. They were later joined by All Pakistan Auto Rickshaw Manufacturers Association on the plea that the industry would be doomed as a result of ban imposition. It demanded the government to extend for at least a year in deadline for banning the two-stroke rickshaw in the country as that would help in enabling industry to shift its manufacturing pattern to four stroke rickshaw manufacturing. To counter the moves by the activists from the affected parties, a rally was taken out on The Mall from GPO to Regal Chowk to draw attention of the government for the elimination of air pollution especially vehicular pollution on Saturday. Hundreds took part in the procession. The rally demanded the implementation of Government's Transport Policy in true spirit<sup>5</sup>. Meanwhile, Government of the Punjab also encouraged some new players to manufacture CNG based 4-stroke engines for production of environmentally safe rickshaws.

Taking into consideration the gravity of the situation, Government of Pakistan also stepped into the matter to assist concerned parties in resolution of the issue. According to a press report, there was a split between the Center and the Province about the imposition. One of the report states, "A federal government institution, Engineering Development Board (EDB) has decided not to deny permission to new two-stroke rickshaw assemblers. However, the Board has left the rest of the issue with the provincial governments to deal with this affair according to their local prevailing laws"<sup>3</sup>.

The Government of the Punjab has taken a tough stand on the ground that the ban was in the interest of providing a healthy environment to the citizens. Moreover, it claimed that Transport Department Government of the Punjab decided to ban the use of new two-stroke rickshaws as public transport after consultations with the manufacturers, Environment Protection Department and Pakistan Standards and Quality Control Authority. It is hopeful to control the situation but a tug of war between different parties is yet in progress. At the primary level, the study will focus on the nature of the problem and the strategy followed by the stakeholders to ban two-stroke auto-rickshaws in Lahore.

### **3. REVIEW OF LITERATURE**

Although, no study seems to have been undertaken that specifically focuses on 2-stroke rickshaws, a number of studies have been carried out that relate with the problem. Some of these studies are on general vehicular pollutants and damages caused by them and thus also offer some remedial measures<sup>7-10</sup>, some are general presentations on policy issues with regard to two and three wheelers made in

Workshop on Reduction of Emissions from 2-3 Wheelers, Hanoi, Vietnam (September 5-7, 2001)<sup>11-17</sup> and some on methodology of estimating benefits and costs of controlling air pollutants<sup>18-21</sup>. Some studies have tagged the problem of man pulled rickshaws with other studies. A few are outlined below below.

Ayana Goren and Sarah Hellman carried out a survey in 1999 to compare the frequency of respiratory symptoms, respiratory diseases and lung function of children residing in an area exposed to vehicular pollution to that of children residing in an area exposed to less air pollution<sup>7</sup>. The results indicated a trend of greater frequency of respiratory symptoms in exposed areas as compared to less exposed area. The difference was also interpreted in terms of difference in the socio-economic conditions of two groups.

In 2004, a Workshop was organized in Mexico<sup>8</sup>. The focus was on Air Quality in Mexico. The conclusions optimistically expressed the hope that new technologies and clean fuels especially ultra-low-sulfur-content gasoline and diesel could reduce pollution from new vehicles by more than 95 percent.

South Asian Network for Development and Environmental Economics has recently proposed to carry out a study to isolate the impact of vehicular pollution, particularly of three wheelers, on human health of Dhaka with an intention to associate strike days and non-strike days with reported non-trauma deaths and number of hospitalization cases, especially caused by cardiovascular and respiratory diseases, in the corresponding days<sup>9</sup>

Sister Community Partnerships between USA and India in context of fuel efficiency of three wheelers have translated into the research results given below for reducing air pollution<sup>10</sup>.

- “Firstly, a commercially available, lighter-weight, rickshaw with a low-pollution four-stroke engine replacing the traditional two-stroke engine
- Based on a positive result from a wide-scale city trial, full commercialization of a simple hybrid system using a small gasoline engine and high-performance batteries
- Hydrogen fuel cell powered prototype rickshaw, that could be commercially viable if adequate support infrastructure can be put in place
- Significant improvements in energy efficiency, and substantial reductions in greenhouse gas emissions and other pollutants
- Clean air in Indian cities
- Thriving commercial relations between Indian and US companies and cities”

The presentations made in the conference in Hanoi were of general nature and dealt with the policy issues<sup>11-17, 23</sup>. These presentations also included useful studies on India, Pakistan, Bangladesh and Nepal. Almost all the papers dealt with the strategies to reduce air pollution from vehicles on road. Some of them also included useful data about the extent to which different vehicles including

two-stroke rickshaws polluted environment and also provided useful data for calculating air pollution costs.

The study from Pakistan presented the results of an education campaign on reduced lubrication for rickshaws in Pakistan<sup>23</sup>. According to this report, the major functions of lubrication are reduction of friction, removal of heat, reduction of noise, detergency, reduction of smoke and reduction in exhaust blockade provided these are used in optimal proportion with motor fuel. The standards are 2% but rickshaw drivers use lubricants up to 12.5% concentration. The study highlights the environmental effects of excessive use of lubricants that translate into poor mileage, engine heating, dense smoke high noise, and high carbon monoxide emission in the exhaust. For example if lubricant used is 12.5%, it emits dense smoke and 1.8% CO as compared to invisible smoke and 0.6% CO if the concentration is 2%.

The remaining studies dominantly carried by World Bank and other international institutions<sup>18-22</sup> mostly deal with the easing of traffic in different cities with a focus on Dhaka with special reference to main-pulled rickshaws, After a comprehensive review, the objectives of the work being reported here were defined as follows.

#### **4. OBJECTIVES OF RESEARCH**

The objectives of the preliminary research enquiry into the complexity of the problem were as follows:

- Development of pattern of growth of rickshaws in Lahore over time.
- Understanding the nature of pollutants liberated into the environment and damages caused by them.
- Understanding the difference between two stroke and four stroke engine technology.
- To judge whether the decision of banning two stroke rickshaws by Government of the Punjab had a rational basis.
- To fix the future directions of research to identify the implications of banning two stroke engine rickshaws and suggest measures to pacify the affectees.

#### **5. RESEARCH METHODOLOGY**

The research methodology involved the collection of data at both secondary and primary levels:

##### **5.1. Secondary Data**

The secondary sources of data were used to chalk out historical background, build up review of research studies undertaken on motor vehicles including auto-rickshaws and highlighting the distinctive features of two-stroke and four-stroke engines. The major source was Internet. Thus different websites were visited to

gather the information that was subsequently computed. The brochures circulated by different manufacturers were also helpful.

## **5.2. Primary Data**

The primary data were collected from different stakeholders and affectees. Appropriate questionnaire were developed to take the responses of the officials/members of the following parties:

1. Transport Department, Government of the Punjab Lahore.
2. Environmental Protection Department (EPD), Government of the Punjab
3. Institute of public Health, Birdwood Road Lahore
4. Representative manufactures of two stroke auto-rickshaws and four – stroke CNG rickshaws
5. Auto-Rickshaw Dealers Association Lahore
6. The Punjab Rickshaw Drivers Association
7. Representative rickshaw drivers who responded for the pre-test of the questionnaire and some rickshaw drivers driving 4-stroke CNG rickshaws in Delhi and NOIDA, India.
8. Bank of Punjab, LDA Plaza, Egerton Road Lahore.

The data were gathered keeping in view a broader perspective of the problem that included the aspects to which this article will lead to. As the data were in significant quantity to answer some primary questions of immediate interest from the policy and governance point of view, the detailed survey of rickshaw drivers that is yet in progress is not included for discussion.

## **5.3. Interpretation of Data**

The data gathered from the secondary and primary sources were computed and interpreted and results were compiled as descriptive research. The general strategy for data interpretation involved the computation and comparison of responses from different respondents to conclude as researcher's opinion or conclusion. If necessary the primary and secondary data information was also combined to draw certain conclusions.

# **6. RESULTS AND DISCUSSION**

## **6.1. The Components of Rickshaw Exhausts and Damages They Cause**

The major components of rickshaw exhaust include all the components that are included in the exhausts of the vehicles in general because all the vehicles use the same fuel mainly Gasoline. The main difference, of course, is that their exhausts are relatively more damaging as they are equipped with 2-stroke oil engines that cannot burn the fuel completely as a result of which the pollutants are released in higher concentrations that are more damaging. For example, rickshaws emit more smoke that contains both coarse and fine carbon and other particulates. Thus, here it may be appropriate to describe the components of vehicular exhausts in general.

A Report from Dublin, Ireland has described the major components of vehicular exhausts such as Smoke, Sulfur Dioxide, Lead, Nitrogen Oxides, and Other pollutants e.g. Carbon Monoxide, Hydrocarbons, and Ozone<sup>24</sup>. The outline briefing is given in Exhibit 1<sup>25-31</sup>.

Apart from the information computed in Exhibit 1, there are also the combined secondary effects of pollutants that are even more dangerous than the primary effects. For example, NO<sub>x</sub> combine with VOCs and also form harmful ground-level ozone in presence of heat and sunlight that may cause lung damage, chest pain, coughing, nausea, throat irritation, and congestion ( ). Similarly, damaging ground-level ozone comes from the oxidative degradation of VOCs present in solvents. It is also reduced as a result of reactions between chemicals produced by burning coal, gasoline, and other fuels and chemicals found in paints and hair sprays(). Acid rain is harmful to vegetation and tends to change chemical composition of water, and renders it potentially unfit as habitat for all bacteria excluding acid-tolerants.

A recent study funded by the National Institute of Environmental Health Sciences, USA has reported that the elderly have higher risk for cardiovascular and respiratory diseases from fine particle pollution<sup>32</sup>.

## **6.2. Distinction between 2-Stroke and 4-Stroke Engines**

It was surprising that most of the respondents were not clear about the difference between 2stroke and 4-stroke engines. Some of them even confused number of cylinders with the number of strokes. Frankly speaking, we in the capacity of researchers were also not very clear about this difference. Thus, it was thought necessary to probe into the literature concerning this aspect and place our clarifications on record for the future guidance of the concerned circles. Requisite concepts are compiled below.

Both 2-stroke and 4-stroke engines are seen on the roads today. The major point of distinction between 2-stroke and 4-stroke engines is that the 2-stroke cycle is completed in two stages only called Compression and Exhaust, while the 4-stroke cycle is completed in four stages that are Intake, Compression, Power/Ignition and Exhaust. . Each stroke corresponds to one full stroke of the piston. Thus, the complete cycle of 2-stroke translates into one revolution and of 4-stroke into two revolutions of the crankshaft to complete the cycle.

**6.2.1: Advantages of 2-Sroke Over 4-Stroke Engines:** The two-stroke engines qualify for different important applications because two-stroke engines have some important advantages over four-stroke engines that are described later:

- Two-stroke engines have one cylinder and do not have valves. Thus, they have a simple construction that lowers their weight, while 4-stroke engines are equipped with four cylinders and a multi-valve system and thus have a complex construction and are heavy weight.

**Exhibit 1**  
**Outline briefing of vehicle exhaust pollutants**<sup>24-33</sup>

<b>Pollutant</b>	<b>Symbol or Formula</b>	<b>Source</b>	<b>Description: Impact/Diseases Caused</b>
<b>Particulate Matter (PM) including PM<sub>10</sub> that is less than 10 microns in size.</b>	C & M-Oxides	Vehicle burning diesel fuels	Respiratory disease, lung damage. They reduce visibility and cause breathing problems and permanent lung damage. Smoke, dust, and vapors can remain suspended for extended periods and thus cause continuous damages.
<b>Sulfur Dioxide</b>	SO <sub>2</sub>	Diesel, Mobil oil	Major contributor to smog and acid rain Major collaborator of ozone in smog formation.
<b>Ozone</b>	O <sub>3</sub>	Formed as a result of oxidative breakdown of VOCs and reactions of SO <sub>2</sub>	Respiratory tract, chest pain & persistent cough, affect the ability to take a deep breath, and an increase susceptibility to lung infection Ozone in stratosphere filters UV rays (harmful to humans). Ozone can also damage vegetation and reduce visibility
<b>Lead</b>	Pb	Pb (C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> in fuels	Nervous damage & learning behavior Averse effects in young children
<b>Nitrogen Oxides</b>	NO <sub>x</sub>	Fuels such as gasoline and coal	High: smog harms humans (breathing difficulty) asthmatics, coughs in children, general illness of respiratory system Major contributors to O <sub>3</sub> -(smog) and acid rain NO <sub>x</sub> reacts with (VOCs) to form smog
<b>Carbon Monoxide</b>	CO	Incomplete burning of fuels	Low:: dizziness, headaches, and fatigue High: Fatal Combines with blood cells to inhibit O-transport
<b>Carbon Dioxide</b>	CO <sub>2</sub>	End product of combustion	Toxicity, increased breathing rate, unconsciousness It is a greenhouse gas
<b>Chlorofluorocarbons</b>	(CFCs)	Refrigerators ACs & other	Skin & breast cancer Rise to damage ozone layer
<b>Volatile Organic Compounds</b>	VOCs	Gasoline; other fuels and fuel production	Vehicle emissions are an important source of VOCs Produce vapors easily at room temperature. VOCs include (the principal dry cleaning solvent).

- Two-stroke engines produce about twice as much power as compared to 4-stroke engines due to ignition in every revolution.
- Two-stroke engines can work in any orientation. A standard four-stroke engine may have problems with oil flow unless it is upright, and solving this problem can add complexity to the engine.
- Two-stroke engines are less expensive to manufacture as compared to 4-stroke engines.
- Two-stroke engines exhibit a greater power-to-weight ratio as compared to many 4-stroke engine designs.
- Two-stroke emits less oxides of nitrogen as compared to 4-stroke rickshaws but of course they emit much more carbon as compared to 4-stroke<sup>34</sup>.

**6.2.2: Disadvantages of the 2-Stroke Over 4-Stroke Engines:** The disadvantages are as follows:

- The life span of 2-stroke engines is less than that of 4-stroke engines. This is due to lack of a dedicated lubrication system that translates into faster wear and tear of the parts of a two-stroke engine.
- Two-stroke engine oil is expensive, as its 4 ounces of it per gallon of gasoline. This means burning of about a gallon of oil every 1,000 miles, if a two-stroke engine is used in a car.
- They do not use fuel efficiently, while 4-stroke engines use fuel more efficiently. This means getting fewer miles per gallon.
- Two-stroke engines, being not equipped with a system of valves, are not provided with an external lubricating system to lubricate its components. Thus, the lubricating oil is mixed with gasoline or other fuel to lubricate the inside engine machinery. Thus, the lubricating oil is also burns along with the fuel. It, being carbon rich does not undergo complete combustion and exhausts un-burnt carbon as smoke. This does not happen in 4-stroke engines as no oil is mixed with the fuels.
- Two-stroke engines are a notorious source of pollution. The pollution comes from two sources: Combustion of the oil and periodic leakage of fuel. The combustion of oil makes all 2-stroke engines smoky to some extent, and a badly worn out 2-stroke engine can emit huge clouds of oily smoke. When a new charge of air/fuel is loaded into the combustion chamber, a part of it leaks through the exhaust port.
- Due to injecting high pressure CNG single cylinder 2-stroke engines and subsequent ignition of all the fuel, the two stroke CNG-engines have been claimed to heat up. On the other hand, the pressure and amount of CNG is distributed between four cylinders in 4-stroke engines and they spark fuel at half rate. Thus, they do not heat up on road.

### **6.3. Responses towards Justification of the Ban**

In our computations, there was almost a complete consensus on imposing the ban as all the parties accepted that the two-stroke engine rickshaws, being source of injurious air pollutants to human and animal health, were contrary to the national health security. The major point made in favor particularly by the manufacturers for total justification of the ban was that the two-stroke rickshaw technology is obsolete and two-strokes have been banned all over the World. Moreover, these rickshaws have lived their life. Being very old, they are highly noisy, and emit poisonous pollutants such as CO, carbon dioxide, oxides of nitrogen, sulfur dioxide, particulates such as PM10, PM 2.5, etc.

The only opponents were the rickshaw divers that were scheduled for the pre-test of the survey questionnaire. Almost none of them voted in favor; reflecting a biased and briefed opinion. The major question they raised was “Why we first? Why not diesel based buses, etc?” Although, at this stage, a small part of the universe does not represent the community as a whole, it is an alarm that they may provide the same responses in bulk in the elaborated survey. One logical conclusion that can be drawn at this stage is that if they are in a mood to deny the universal facts then they are unconscious of the consequences of the harm expected from the two-stroke engine rickshaws to the environment. Thus, Government of the Punjab will have to launch a special campaign to train them for their transformation into conscious citizens ready to fulfill their social obligations.

In spite of the existence of big consensus on justification of the ban, almost all affectees including rickshaw manufacturers and dealers strongly disagreed with the modus operandi on different bases. They also added that the grace period was less than due.

As far as the gravity of the pollution is concerned, most of the respondents said that that they were all against pollution and believe that the problem should be solved through a mutual consensus.

The major advocates were the Rickshaw Dealers Association. Its members offered highest number of points to support their arguments. These points made by its office holders have been conveyed below while reporting responses on different dimensions of the problem.

#### **6.4. Growth of Rickshaws in Lahore, Pakistan and Punjab**

Our recent enquiry reveals that the number of rickshaws in Pakistan and also in Punjab is a matter of controversy. The major and so far considered authentic source may be Pakistan Economic Survey 2004 and Pakistan Economic Survey 2005. The other sources of information are the press reports and interviews of the representatives of the concerned parties conducted by us.

**6.4.1. Lahore Level:** Lahore has a lion's share in rickshaw population of Pakistan. The number of rickshaws running on the roads of Lahore is 60,000 as per registration by the Lahore District Registration Authority. There is no disagreement on this figure. The Rickshaw Dealers Association, of course, told us that the total number of rickshaws in Lahore is around 100,000. The additional 40,000 include rickshaws registered in other districts and unregistered rickshaws. Some rickshaws registered in Lahore are also running in other cities of the Punjab. Of course, current number of rickshaws in Lahore may be 60,000 as balance may be assumed to have shifted to other cities of the Punjab.

**6.4.2. Pakistan Level:** According to a report presented in Hanoi Conference in 2001<sup>23</sup>, the three Wheelers were introduced in Pakistan in late 1960s. After three decades, their number rose to 43,000 per estimate of 1991. It more than doubled in 2000 and rose to 94,000. The rickshaws, being "Short Distance" and "Limited Person Carrier", these were initially designed with 2-Stroke Engines. There has been no change in the design of the auto-rickshaws over the last 4 decades.

A journalistic report published in "Jang", the number of registered rickshaws in Pakistan which were mere 50,862 in the year 1990 that differs from the above report significantly, crossed the level of 1, 30,488 by end of 2004<sup>2</sup>. Their number has more than doubled, while motorcycles and scooters have increased seven-fold over the past 20 years. The majority of these rickshaws, which got registered during the last one decade, were in Punjab only, as NWFP, Balochistan and Sindh governments had already banned the registration of new 2-stroke rickshaws<sup>3</sup>.

**6.4.3. Punjab Level:** According to the figure cited by EPD, Punjab, there are about 200,000 vehicles running on two-stroke engines in the province<sup>4</sup>. Per information from the Transport Department, Government of the Punjab, out of the above figure, there are 100,000 two-stroke rickshaws, the major component of which that is 60,000 are running on the roads of Lahore.

## **6.5. Number of Rickshaw Drivers and Others Affected in Lahore**

Both Government Departments and the rickshaw manufacturers told us that the number of affectees in this context was 60,000. The Rickshaw Dealers Association refuted this figure strongly on the basis that no can be behind the wheels for 24 hours. Thus, the members argued that there are a minimum of 120,000 drivers in Lahore if one driver is assumed to occupy and operate rickshaw for 12 hours in spite of the fact that normal man hours per day are 8.

The Association members were of the view that banning of two-stroke has not only affected 120,000 rickshaw drivers but has affected indirectly 1,200,000 souls that are indirectly associated with the rickshaw business. These include Kharadias, Oil and LPG-gas Dealers, Body Makers, Mechanics/ Mistris, Rickshaw Dealers, Investors, Hood Makers, Rixin Dealers, Welders, Spare Parts

Dealers, Manufacturers of Rickshaws and Spare Parts, Dentors and Painters associated with engine, body and chassasis, etc.

Here, it may not be out of place to mention the impact on the labor engaged in rickshaw manufacturing factories. One of the companies said that they had to retrench their labor by 60 % temporarily. As they were authorized by the government to manufacture CNG rickshaws, they were quite hopeful to recall workers within an-year time. Some manufacturers gave the general remarks that the affected workers will switch over to new technology after a little shop-floor training, and worst come worst, they being technical hand can join any technical workshop for repairs. After taking into consideration the convincing points made by the manufacturers and government officials, we dropped their detailed survey for the study of impact of ban on their socio-economic status.

#### **6.6. Number of Rickshaw Owners in Lahore and Rent Charged by Them**

Both Government Departments and the rickshaw manufacturers told us that there are some big players in rickshaw business who own even more than 500 rickshaws per head. This information was strongly rebutted by members of Rickshaw Dealers Association. The interviewees said that the maximum number of rickshaws owned by a person may be 10 to 15. The rickshaw drivers also gave the same figure. Some said that maximum was around 50 but none endorsed a figure 500 or above. Some rickshaw drivers, of course, said that the dealers bought even around 1000 rickshaws from factories and handed over to individual drivers to pay back in installments.

There was, of course, a consensus on amount of rent charged by the owners. The average rent being charged per rickshaw for twenty four hours as told by the Association was Rs 130. When compared to (100 +150), the figure from other sources, there does not seem to be much difference.

We were also told that most of the rickshaw drivers are driving rickshaws on rent.

#### **6.7. Substitution of 2-Stroke by 4-Stroke CNG Rickshaws**

We were impressed by the confidence expressed by government departments that are determined to control the situation created by the ban. The Transport Department has enlisted a couple of pioneers in rickshaw manufacture and has encouraged a large number of new entrants to produce 4-stroke CNG rickshaws to meet the demand within an adequate span of time. So was also the hope of EPD Punjab. Unfortunately, the picture presented by affectees was highly deplorable, rather it was gloomy. The Association claimed that Government of Punjab has not yet been able to bring more than 300 substitutes on road. Even these have badly failed. So much so that Bank of the Punjab has stopped issuing loans on rickshaws on the basis that newly manufactured so called 4-stroke CNG rickshaws have totally failed on the road. The reasons of their failure are as follows:

- The Department of Transport and others including even new manufacturers does not understand the technology well and it has not bothered to involve those who are insiders. The result is that they have fitted only one cylinder in the engine for total pressure of CNG (32Kg) that should have been distributed in four cylinders as it does in cars at the rate of 8Kg per cylinder for smooth ignition and combustion.
- The equipment in the CNG rickshaws is substandard whose make is Chinese. For example, its timing chain is 1/10 th of 2- stroke, carburetor is also not up to the mark.
- CNG 4-stroke rickshaws are more expensive than 2-stroke rickshaws for different reasons: 1) Its spare parts, in the first instance, are not available. If these are available, they are very expensive. For example, the price of the clutch wire fitted in two-stroke rickshaws was Rs 5, while that of CNG 4-stroke rickshaw is Rs 250. Similarly, the clutch box of 2-stroke rickshaw costs only Rs 60 to 70 while that of CNG 4-stroke rickshaw costs Rs 3,000. Another example may be the piston of two-stroke that costs Rs 200 while that of 4-stroke costs Rs 2,500. Moreover, the four stroke engine can be overhauled in Rs 600 to 700, while that of four stroke demand Rs 5,000 to 6,000 for overhauling.
- This is unfortunate that no dealer, technician or mechanical engineer was consulted and those who were involved were not aware of the in depth technology.

We partly agree with the first reasons advocated by the affectees as our first impression about the stakeholders was that most of them were not clear about the difference between two stroke and 4-stroke technology. Per recall, the only personage that could tell us a little bit of difference was the Manager WEPA, Lahore. That is why we had to clear concepts about this distinction from our research based on secondary data. We do not agree with the third reason because none including manufacturer, drivers in India and Pakistan endorsed it. The prices of substitutes were overstated rather exaggerated, For example, the price of the clutch wire told by the tellers was between 18 to 35 rupees. The lack of standard in Chinese products due to overproduction can be acceded to in the light of many other products whose performance is sub-standard. An important example in this context is electrical fittings. About last reason, the claim of government departments constitutes the opposite. They say that we have taken the expert advice at every step forward.

The major argument that members of Association offered was that due to this failure the Bank of Punjab has stopped issuing loans to CNG rickshaw buyers. This could be verified by contacting different branches of the Bank. The one that will better illustrate is located in LDA Plaza.

Our experience of exchanging ideas with Indian rickshaw drivers also did not present an encouraging picture. Most of them did not interpret substitutes as successful vehicles. They also endorsed that these get heated when moving uphill. They also said that the old rickshaws were more powerful than the new rickshaws. Although the substitution in India is almost complete, we are not hopeful about its effectiveness in Pakistan and feel that confidence expressed by government

departments is in reality “Overconfidence”. This is evident from their number on road encountered by common man.

Although, all the manufacturers claimed that their products are successful with one cylinder. The use of four cylinders is most appropriate but that will also necessitate the elaborate engine of four wheelers. The only Company that claimed success was the producer of WEPS. They claimed that their rickshaws are successful with the use of two cylinders. This Company is yet in the primary stage in new transaction. Let us see how it fares in future.

### **6.8: Available Options to Two Stroke Rickshaws**

There were major options before the controlling departments: Conversion of 2-stroke to 4-stroke CNG rickshaws and manufacture of new 4-stroke rickshaws. Government of the Punjab totally discarded the first option with verbal interpretation that the conversion is not economical. The same were the views of some new entrants in rickshaw manufacture in tune with the government policy. When they were asked if there was a sanction of some formal study behind this argument of negative economics, answer was “Yes” but where the study was lying and who did it?, had no answers..

The association members were of the view that the conversion of two stroke to 4-stroke was possible within two hours per rickshaw with an investment of Rs 20,000 to 22,000. If the subsidy that is being paid to the Bank is paid to the rickshaw owners, the same could be accomplished without any problem. If the calculations are done on 60,000 basis, the government is prepared to invest Rs 8.6 billion national money on manufacture of four stroke rickshaws. The same can be managed in Rs 1.3 billion and a saving of 7.3 billion is visibly possible but Government is not trying to understand the idea and it is after big national wastage. One of the companies “Tiger” has actually converted at the above price that is Rs 22,000. When it was declared in the Court of Law, the Chief Minister’s Secretariat instructed to start action against the Company. There was the likelihood that factory of the company may be sealed. On this basis the Association has lodged a petition in Lahore High Court.

We also feel that both options should have been techno-economically evaluated before resolving in favor of new manufacture only. After sorting out alternatives, the choice should have been for the most appropriate. The Government of the Punjab should have kept in mind that scrapping 60,000 to 100,000 rickshaws means big sum of money that could be saved. One of the manufacturers told us that they are considering conversion and have a plan to start it after a few months. Of course, they admitted that technology was new and conversion may be possible in Rs 60,000 to Rs70,000.

### **6.9. Effect of Ban on Rickshaw Manufacturing Companies**

The Rickshaw Dealers Association claimed that about 12 to 13 companies involved in two stroke rickshaw manufacture have closed after the ban. They

could not survive due to lack of capital and shifting to new technology. Most of these companies were in Lahore. Of course, some had their head offices in other cities of Pakistan. These companies were Eagle Rickshaws, Ghorri Rickshaws, Eagle Rickshaws, Super Star, Excel Car, Shaheen Rickshaws, Super Star (Lahore and Hyderabad), Wicky Master, Sitara Rickshaws, Shan Car, Sunghat Car, Kamal Car, etc. The average labor force in these companies was 100 to 150. If average taken is 125, then it will in all be 1300. If the labor of survivors is included, total number of workers comes out to be 2,000. This figure was provided to us also by the Department of Transport.

One of the companies said that their investment and overhead almost doubled with the Ban and thus it was very difficult for financially weak companies to survive.

#### **6.10. Effectiveness of Financing Scheme of Punjab Government**

The Chief Minister of Punjab has sanctioned Rs 20,000 out of the Green Fund as subsidy paid to the Bank, The rickshaw buyer will deposit Rs 24,000 and Bank will sanction a loan of Rs 100,000. This makes the overall price of rickshaw as Rs 144,000. The installment to be paid by the buyer will be Rs 33, 00 per month. The interest will be paid by the Government.

The Association members were of the view that had Government paid subsidy to the rickshaw driver/owner instead of paying it to the Bank and conversion permitted, the matter would have crystallized with a meager investment of Rs 60,000×20,000 = Rs 1,200,000,000 or 1.2 Billion. This argument has an appeal if it is techno-economically proved that the conversion leads to technological sound product and is economically viable with a sanction of formal study behind it.

Here, it may be appropriate to narrate the information gathered from one of the rickshaw drivers. He told us that he had the impression per announcement that he will be able to get new rickshaw on installment if he makes arrangements for Rs 23,000. He was successful in this exercise but when he contacted the Bank, he was told that including the taxes, he had to pay Rs 45,000 that was not able to manage. He spent his saved money in routine needs and was left without a rickshaw. He also complained that those who purchase rickshaws on cash are on top priority. Very few are successful in purchase of rickshaws on installment.

#### **6.11: Corruption at Different Levels**

The dealers were of the view that corruption was involved at different levels in different departments. The most torture-some example that can be given here is that of the Lahore District Registration Department that registered about 12 to 15 thousand two stroke rickshaws after the date of Ban Notification that is 22-12-2004. The two stroke rickshaws against these registrations are yet being sold. If

justice is done, it will be clear that the government officials have not worked hard consistently and honestly.

This label requires a formal enquiry and we reserve our comments on this issue.

## **CONCLUDING REMARKS**

In our opinion, in spite of the long history of attempts of Punjab Government to control environment since early 1990s and inadequate responses of rickshaw drivers, dealers and manufacturers that make the major cause of failure of the control agencies through implementation of long acting Pakistan Environment Protection Policy, we conclude with the following remarks:

1. The decision taken by the Punjab Government was under the pressure of the decision of Supreme Court of Pakistan as otherwise it had to face the contempt of court.
2. The ban was imposed without the sanction of a systematic techno-economic study that should have clearly crystallized out what would be its impact on the socio-economic status of rickshaw drivers, rickshaw manufacturing labor and all others aligned to rickshaw business that collectively make a highly significant number worth attention of experts of Pakistan.
3. The ban was imposed on the basis of vehicular air pollution policy templates of other countries particularly of India without taking into consideration the fact that no systematic study seems to have been carried out in these countries. Anyhow, our recent observation during our visit to India reveals that Indians apparently seem to have been successful in shifting not only from two stroke to four stroke CNG auto-rickshaws but also have affected this change in other vehicles such as buses, trucks, etc, in a short span time since 2002. On the contrary, we have achieved very little on this front and chances of success in future also are not bright. The basic cause of this difference is that our conditions are very different from India. For example, barring our comparable nuclear capability India is far ahead of us in routine technologies. Moreover, it is now equipped with well developed business, financial, economic and social institutions that are striving to achieve leadership at the global level. Above all the temperament of Pakistani rickshaw drivers is different from Indian rickshaw drivers. Our assessment about Indian rickshaw drivers says that even they have not mentally accepted this change.
4. This is unfortunate that we do not prepare the nation psychologically before implementing a change through some new policy. This is endorsed by taking any example from any other sector. The same is the case over here. There were some sincere group briefing efforts by the official of EPD and Punjab Department of Transport but no arrangement were made to convince rickshaw drivers that air pollution from 2 stroke rickshaws was not only injurious to the environment but also to their own children. We, in our pre-test activity, attempted to convince them on these lines and the results highly positive.

5. The proceedings of ban on bigger vehicles such as buses, trucks, etc, should have been started at the same time as that provides big reference to the rickshaw divers to argue against the ban.

**In spite of the pitfalls highlighted above, we give big credit to Government of the Punjab that it has succeeded in managing almost complete consensus on the necessity of imposing the ban to keep the Lahore environment clean.**

Now, the question is what next? Our enquiry leads to the juncture where we can resolve to look into the implications of banning 2-stroke engine auto rickshaws on the following lines:

- Evaluation of alternative options such as conversion of two stroke rickshaws to four stroke CNG rickshaws, manufacture of new 4-stroke CNG rickshaws, substitution of rickshaws by taxis, etc and sorting out what is in the best interest of the nation and in that of the public at large
- The assessment of benefits and costs of the ban on two-stroke engine rickshaws to bring to light the correct status of the government decision of imposing ban.
- Studying the impact of ban on the socio-economic status of the rickshaw drivers of Lahore.

Side by side, the studies on these lines may be undertaken on the transformation of large size vehicles from diesel to CNG based vehicles.

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## APPENDIX 1 (Support material, not for publication)

### Two Stroke Engine

The two-stroke engines are commonly found in low-power devices such as lawn and garden equipment, auto-rickshaws, pick-ups, etc. The construction of a two-stroke engine is as shown in Fig.1

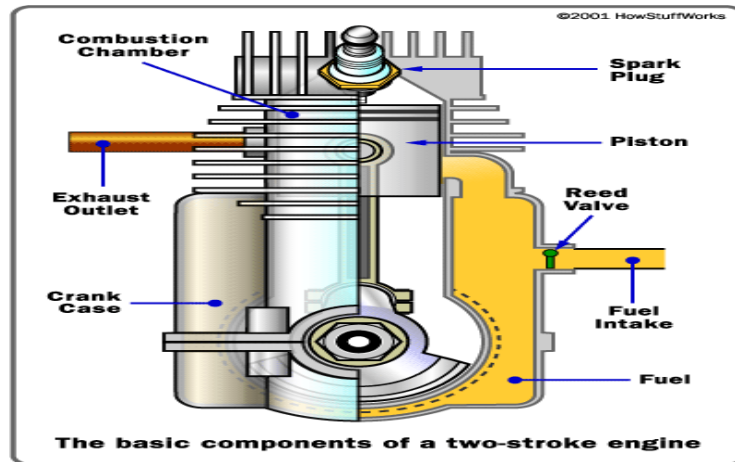


Fig.1: Construction of two-stroke engine (Transferred from Ref 33)

The two stroke engine consists of a cylinder fitted with a piston that in turn is connected to a crank in a crank case as shown in Fig.1. It has a reed valve for fuel intake and an exhaust outlet (Fig.1).

The cycle is explained below.

**Combustion Stroke:** To describe the cycle, let us start from the point where the sparkplug fires the mixture of fuel and as a result air in the cylinder is compressed. The mixture explodes as a result of ignition. The explosion causes expansion of gases that pushes the piston downward. The downward motion of the piston compresses the air/fuel mixture in the crankcase. The stroke ends when the piston reaches the bottom of the cylinder. At this juncture, the exhaust port is uncovered. Most of the exhaust gases in the cylinder are pushed out under the pressure built in the cylinder.

As the piston finally moves up, the intake port is uncovered. The piston's movement has pressurized the mixture in the crankcase, so it rushes into the cylinder, displacing the remaining exhaust gases and filling the cylinder with a fresh charge of fuel, as shown in Fig. 2.

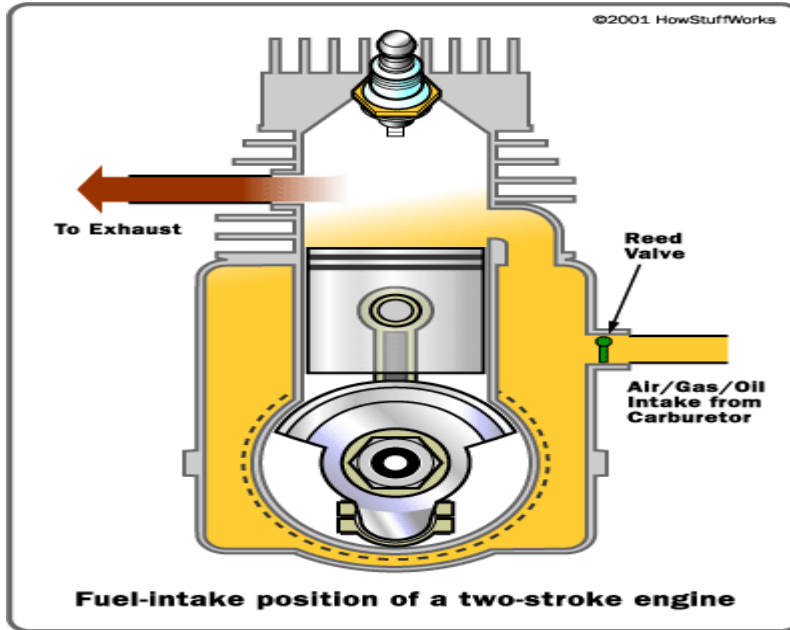


Fig.2: Ending of Combustion stroke an initiation of compression stroke  
(Transferred from Ref 33)

**Compression Stroke:** The momentum built in the crankshaft starts driving the piston back toward to the spark plug. It presses the air/fuel mixture in the cylinder which is compressed as a result of which a vacuum is created in the crankcase. The vacuum opens the reed valve to suck air/fuel/oil mixture from the carburetor. As the piston reaches the end of the compression stroke, the spark plug ignites it to initiate the combustion stroke again. The cycle is repeated again and again fires again to repeat the cycle.

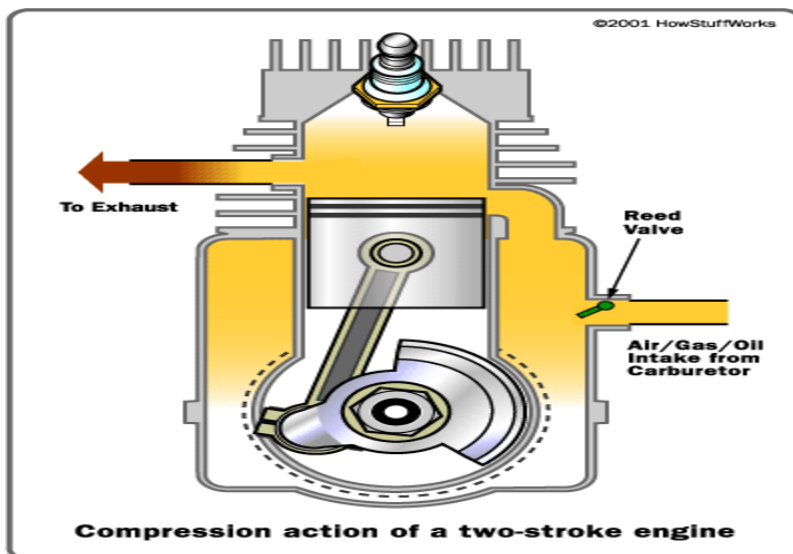


Fig. 3: The completion of the compression stroke and initiation of combustion stroke (Transferred from Ref 33)

### **Four Stroke Engine**

The construction of the 4-stroke engine and its cycle in 4 strokes is shown in Fig.4. It consists of a cylinder fitted with a piston that is further connected with a crank shaft. The crankshaft turns the gears of the device that turns wheels of a vehicle. The system is further equipped with a few valves as shown in Fig.4 and functions as explained in different strokes. It is also fitted with an electrical starter that helps to initiate the process:

The stages involved are illustrated below.

**Intake:** In this first step, the piston (Fig 4) starts moving down, as a result of which the fuel inlet valve (poppet valve) mechanically opens by the turning of the crank-shaft, and thus draws a fresh charge of vaporized fuel-air mixture. The exhaust valve is kept shut by a spring. As the piston reaches the bottom, the valve closes.

**Compression:** The piston moves up by the force of the turning crankshaft whose flywheel Fig. 4: Construction and cycle of four-stroke engine momentum drives the piston upward. When it reaches the top, the air-gas mixture is compressed and thus the valve is forced shut by the increased gaseous pressure inside the cylinder

**Power:** The electric circuit connected with the spark plug turns on. There is an explosion in the cylinder on top of the piston that causes gaseous expansion as a result of which, the piston moves downward. The force associated with the downward motion turns the crank-shaft around.

**Exhaust:** At the end of the power stroke, the exhaust valve is opened by a cam-lifter mechanism. The upward movement of the piston pushes exhaust products compose of gases, smoke, etc, out of the cylinder through an open valve.

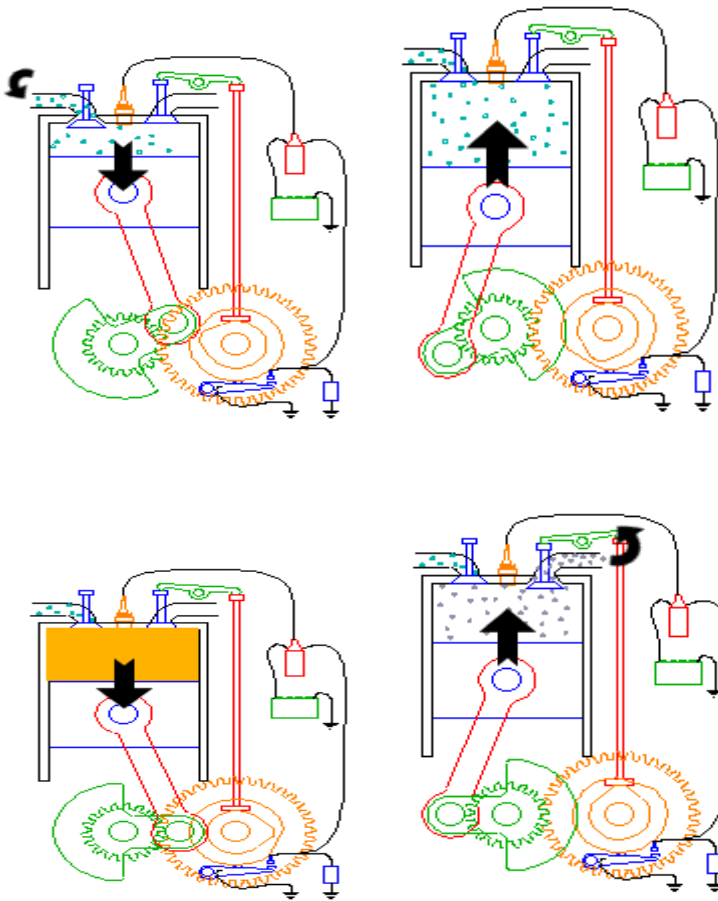


Fig. 4: Construction and cycle of four-stroke engine.

The cycle repeats again and again. Usually, one cylinder is involved in the complete cycle. The number of cylinders increases with the increase in the power of the vehicle. The use of four cylinders is very common in cars. Different power vehicles have different mechanical arrangements to control the devices.

The two stroke engine technically differs from the four stroke engine as follows:

- In a two-stroke engine the crankcase serves as a pressurizing chamber to force air-fuel mixture into the cylinder. Thus, it can't hold thick oil. Instead, the oil is mixed with the gas to lubricate the crankshaft, connecting rod and cylinder walls, etc. In the four-stroke engine, on the other hand, the crankcase is completely separate from the combustion chamber. Thus, it can be filled with heavy oil to lubricate the crankshaft bearings, the bearings on either end of the piston's connecting rod and the cylinder walls.
- In a two-stroke engine, there is the combustion chamber on its one side while on its other side is the crank case. The piston compresses the air-fuel mixture and captures the energy released by the ignition of the fuel. The

piston on the other side in the crankcase creates a vacuum to suck in air-fuel mixture from the carburetor through the reed valve and then pressurizes the crankcase so that air/fuel mixture is forced into the combustion chamber. The four-stroke accomplishes all these functions in the cylinder through a system of valves.

- The sides of the piston in 2- stroke engine act like valves that cover and uncover the intake and exhaust ports drilled into the side of the cylinder wall. The valves in the four stroke engine are independent of the piston and thus function separately.