U.S. Department of Energy

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India Trip Report (January 15-24, 2002)

U.S. Participants:
Mr. Ira Dorfman, President, Dorfman & O'Neal
Prof. Henry Frisz, Bronx Community College, representing the National Alternative Fuels Training Consortium
Ms. Marcy Rood, Deputy Director, National Clean Cities Program, U.S. Department of Energy

Hosts:
Sugato Sen, Society of Indian Auto Manufacturers (SIAM)
Von Millard and Balakrishnan, U.S. Asian Environmental Partnership (US AEP)

Background:

In 1981, Delhi had just over 500,000 vehicles. In 2000 the vehicle population grew to around 3 million, with two thirds of the vehicles two and three wheelers. Also, more than 10,000 buses ply the roads in Delhi. To curb vehicular pollution, the Supreme Court of Delhi mandated the use of alternative fuels, such as compressed natural gas (CNG) and liquefied petroleum gas (LPG) in all commercial vehicles. In just the past fourteen months, more than 50,000 natural gas vehicles are now operational. LPG vehicles are currently being used in demonstration projects only. The government is also now mandating five percent blend of ethanol in gasoline.

The network of CNG stations is also quite impressive although technical and safety issues abound. As of January 2002, 87 stations exist, including 20 mother stations, 15 daughter booster stations, 36 daughter stations and 16 online stations. By March 2002, 94 stations should be operational with another 31 planned for completion in the near future. Existing compression capacity is 4.6 lakh kg/day and average sale is 3.7 lakh kg/day. CNG is 40% cheaper than diesel and 68% cheaper than gasoline.

Some stations have terrific signage that showcases to the public the benefits of CNG.

Areas of Need:

Unfortunately, some of the technology utilized has been proven unsafe or unreliable through past American experience. Also, lines for the CNG fuel can sometimes wind through the streets for miles. Waits of 3-4 hours to fuel are common. On average a vehicle is only getting a fill of 2000 PSI. This is due to both technical design inadequacies and a calculated decision to reduce operating pressures after a handful of highly-publicized vehicle explosions.

Future supply of natural gas to meet the growing number of vehicles is a concern although gas industry officials express optimism about increased future supply of CNG through successful offshore gas well exploration and expansion of pipeline capacity.

Conversions are an ongoing problem. Kits provide questionable environmental benefit and integration of systems are poorly engineered. As a result, safety concerns about these installations are considerable. For example, brackets were observed to be loosely mounted on steel cylinders, resulting in observable abrasion damage to the cylinder walls.

Training of technicians appears to be lacking. Only Tata and Ashok Leyland, the two Indian original-equipment CNG bus manufacturers, are training mechanics on CNG buses. But training is currently only offered once and is not on-going. While Delhi

Transport Corporation (DTC) assured our delegation during a maintenance facility tour that all specified maintenance is performed according to manufacturer specifications, observed conditions of the buses suggest that current maintenance and inspection is inadequate.

Inspection of cylinders is currently not conducted other than on Delhi Transport Corporation (DTC) Buses, and even here best practices appear lacking. The development of safety standards is a must. Private bus operators are developing their own procedures without regard to safety – such as shutting off cylinders and then reopening them as needed. (Ashok Leyland is now producing CNG buses with roof-mounted tanks on low-floor buses, although most of the current rolling stock has the cylinders mounted under the chassis, another source of concern.)

Natural gas is only odorized in some area, such as gas lines that are also serving residential customers. In buses, there are 72 joints to check for gas leaks. Obviously, odorized gas would help to detect leaks and cut down on the cost of leak detector equipment, which often isn't being used. However, leak detection sensors are a secondary issue – bus designs must be upgraded. With the use of industry-approved connectors, most of the leak concerns will be mitigated.

Also, government officials remain skeptical of the benefits of CNG and are being fed misinformation by the detractors. For instance, the Chief Minister of Delhi, Sheila Dikshit, said on two occasions during our visit that it is imperative to understand the health impacts of CNG – as if to say that the health benefits of CNG have not already been quantified. Also, detractors are spreading rumors that CNG vehicles emit more ultra fine particles than diesel. She seems to have bought into these arguments and states that she is afraid that CNG will cause serious illnesses. The Centre for Science and Environment (CSE) in New Delhi is really the only voice of reason in this debate. More scientific data must be introduced from other reputable sources to assist CSE in arguing public policy issues. Also, real over the road emission testing of CNG vehicles is needed. At the same time, many acknowledge that air pollution has improved dramatically in Delhi since the CNG buses were introduced.

The needs identified for CNG also apply to LPG. The only difference is that with LPG the U.S. Department of Energy still has the opportunity to address station design, vehicle integration and standards issues BEFORE a large-scale program is launched. The government has mandated the introduction of LPG as a transportation fuel and ordered domestic oil companies to open 250 LPG fueling sites. Assistance in sanctioning proper LPG kits manufacturers is necessary and the training of technicians must be offered as the program grows.

Steps to Provide Assistance:

1) Training: One of the goals of the trip was to launch a train-the-trainer program with the Society of Indian Auto Manufacturers (SIAM). On January 18, 2002, the National Alternative Fuels Training Consortium (NATFC) of the U.S., SIAM and the DTC signed a Memorandum of Understanding "to encourage cooperation among the three institutions to work for setting up a National Alternative Fuels Training Institute in India." The Chief Minister of Delhi witnessed the signing. DOE's Clean Cities International Program has provided $85k to NATFC to transfer materials and send trainers to Delhi, India.

SIAM will be the lead organization in organizing the following courses:

1) CNG Cylinder Inspection Course—1 or 2 days in length
2) Train the Trainer on CNG—5 days in length
3) General Awareness on CNG/LPG for Government Officials—1 day in length
4) Train the Trainer on LPG—4 days in length

Based on priorities, SIAM will offer the course to government officials in the Spring 02, followed by the train the trainer and cylinder inspection courses in early Fall 02. DTC will offer classroom and shop space for the training. Technicians working on buses, taxis and auto rickshaws will be targeted for the train the trainer courses on CNG. Inspectors of the Transport Department of Delhi and DTC will be trained on CNG cylinder inspections.

Everyone agrees that training is a critical need. However, based on the many issues identified above, the resources that NATFC bring to the table are only capable of addressing a few of the training and assessment needs – mostly in the technician and operator training areas. When it comes to system assessments, standards development and service station design, other experts are required to address these needs.

2) Delhi Clean Cities: Another goal of the trip was to launch the idea of a Delhi Clean Cities coalition. One of the benefits of a grassroots coalition is that all interested stakeholders come to the table to discuss problems and work on solutions in building a sustainable and safe alternative fuels program. Training is one such program that can be guided by the coalition. Stakeholders identified during the trip: SIAM, DTC, Transport Department of Delhi, Winrock International, Gas Authority of India, Ltd., Association of State Road Transport Undertaking, Maruti, Society of Automotive Engineers—Northern India Section, Centre for Science and Environment, TATA Engineering, Ashok Leyland, Bharat Petroleum Corporation, Cummins India Ltd., Confederation of Indian Industry, and Indraprastha Gas Ltd.

Stakeholders yet to be identified include private bus operators and taxi associations. Also, appropriate Federal agencies should be encouraged to join.

3) Technical Information Exchange: The third goal was to identify key individuals who should be a part of the Clean Cities International and Gas Technology Institute's Reverse Technology Tour to be held in October 2002 in conjunction with the International

Natural Gas Vehicle Conference. With the help of U.S. Asian Environmental Partnership (US AEP), Clean Cities International is now prepared to organize this tour.

Also, Clean Cities International has asked US AEP to help bring three individuals to Oklahoma City to the National Clean Cities Conference in May 2002.

Meetings and Additional Outcomes of Trip:

In addition to the U.S. delegation speaking at the "Seminar & Panel Discussion on Alternate Energy Driven Vehicles" and attending the "International Workshop on High Capacity Bus Systems" at the 6th Annual Indian Auto Expo, the following meetings were conducted:

1) S. Behuria, Director of Marketing and I. Srinivas Rao, Chief Manager of Supply & Logistics, Bharat Petroleum Corporation, Ltd.

Bharat Petroleum has been mandated by the government to build 42 LPG stations in six Indian cities and 5-6 stations in Delhi. None have been built to date and only company cars have been converted.

Opportunities exist for U.S. station equipment manufacturers and conversion kit companies. Training was also discussed. DOE should also talk to Ford/GM about OEM LPG vehicles. (Mr. Dorfman to follow-up with World LPG Association.)

2) Sudam Maitra, Maruti UDYOG Limited; R.B. Madhekar, SAE Secretary—Northern India Section; and A.D. Sindwani, SAE—Northern India Section

The U.S. delegation explained initiatives in India. Mr. Maitra arranged for us to visit a large Maruti manufacturing facility.

3) Mr. Nandi, Mr. Gandi and Sugato Sen, Society of Indian Auto Manufacturers

The delegation worked on the details of implementing the MOU. See above. SIAM is responsible for developing a list of questions that can be used to facilitate the development and modification of training modules. (Prof. Frisz to follow-up.)

4) Staff of Transport Department, Government of NCT of Delhi. (Mr. Anand Khullar, Additional Director, was unavailable due to a death in the family.)

This agency is responsible for inspecting vehicles. Only 10 inspectors are employed to inspect the nearly 3 million light-duty vehicles plying the streets of Delhi. They have not been trained on CNG. Staff members were eager for training.

5) Tarun Das, Director General and V Raghuraman, Senior Advisor—Energy Confederation of Indian Industry (CII)

SIAM members are also part of CII. CII agreed with the necessity of training in this area. CII will be meeting with Secretary of Energy in February and will possibly meet with Ms. Rood. CII has a lobbyist in Washington and is a powerful stakeholder.

6) Ted MacDonald, EPA

EPA is funding an inspection and maintenance pilot program and helping with emission modeling. It is possible to tie the training programs together.
EPA supports the MOU.

7) Shyamala Abeyratne, President and Saroj Mishra, Sr. Program Officer, Winrock International India

Winrock is promoting large-scale ethanol production and use in India. The government is mandating five percent ethanol blends, in which they need to produce 400 ml to meet demand. Ethanol is currently made from molasses. Winrock has gathered key state officials together at several workshops. They would make an excellent stakeholder in the Delhi Clean Cities coalition and have numerous contacts in the various states, which can be useful as the CNG/LPG programs grow outside of Delhi.

8) A.S. Lakra, Director, Association of State Road Transport Undertakings

This association is comprised of 67 Transport Corporations around India. They provide professional development and training to their members. They also have 500 bus vendors as members and they develop certification of parts and monitor performance. They operate the Central Institute of Road Transport where they train managers and engineers. It is also a testing facility. They will have an annual conference in late March-April and would like materials on CNG and a possible speaker. (Ms. Rood to follow-up)

9) Rajeev Khanna, General Manager and Santosh Kumar, General Manager (Training), Gas Authority of India (GAIL) and A.K. De, Managing Director, Indraprashta Gas Limited

A.K. De is responsible for the CNG stations in operation. They had many technical questions, such as CNG station design and technology upgradation, natural gas quality, CNG filling system, development of safety standards, and are in need of training and information. A list of needs was given to the delegation.
(Ms. Rood/Mr. Dorfman to follow-up…Mr. De is a prime candidate to attend Clean Cities Conference and Reverse Technology Tour.)
The U.S. delegation visited a Mother, Daughter and Daughter Booster station.

10) Visited a DTC Bus Depot—services Ashok Leyland buses.

Classroom and service areas are available for training. More than 50 people attended and listened to Prof. Frisz in earnest. Seven bus fires have occurred and leaks are of utmost concern.

11) Anumita Roychowdhury, Centre for Science and Environment

Centre for Science and Environment is the lead NGO that pushed for a CNG vehicle mandate in Delhi. The delegation exchanged information and gained support for the initiatives. Concern was expressed that Delhi already has a lot of institutes so a coordinated effort is important.

12) R.K. Jaiswal, Senior Manager of TATA Engineering and Debabrata Chakraborty, Cummins Power Systems India Ltd.

More than 1600 technicians have been trained and 1200 TATA drivers have been trained. However, Mr. Jaiswal expressed concern for establishing a training program that is on-going. TATA is willing to provide the trainers for the train-the-trainer course. They have trained drivers how to refuel but drivers are not assigned to buses. 14 stations have been authorized to provide parts for the CNG buses. Currently, there is no facility for maintenance on privately owned buses.
Cummins will begin to sell lean-burning CNG engines in India. Three parts will be shipped from the U.S. to India to be assembled into the CNG engine.

Rob Adams, a consultant for DOE's domestic Clean Cities Program, was hired by TATA to examine quality control issues and safety of TATA's buses.
(Mr. Dorfman has already followed up with Mr. Adams and now has a better understanding of the consulting work that he performed on behalf of TATA.)

13) Maruti Plant Tour—The plant is capable of producing 500,000 vehicles annually. They produce a CNG van and will be developing a LPG sedan. They are interested in quality control. (Dorfman to follow-up.)

14) Ron Sissem of Louis Berger Group, Greenhouse Gas Pollution Prevention Project
Mr. Sissem is spearheading a transportation planning project in Hyderbad, India. This past fall three delegates visited the Transtar manufacturing facility in Denver, where they manufacture CNG/hybrid buses. Officials in Hyderbad would like to demonstrate LPG/hybrid technology. (Ms. Rood to follow-up with Denver coalition)