

Lead Phase-Out Training for the Democratic People's Republic of Korea

A training workshop on phasing out leaded additives from gasoline was held 24 – 26 January 2011 in Pyongyang for 35 participants from a variety of ministries and institutes. The participants also learned about several other key transport issues and the related recommendations (listed below) that, if implemented, will provide the Democratic People's Republic of Korea (DPRK) with a sound basis for environmentally and socially sustainable transport.

The Transport Unit staff member provided 5 presentations: 1) a general overview of transport issues and an introduction to the work of UNEP's Transport Unit; 2) fuel quality issues, specifically unleaded, low Sulphur fuel; 3) cleaner, more efficient vehicles, with an introduction to the Global Fuel Economy Initiative; 4) public and non-motorised transport; and 5) suggested recommendations. There was a presentation from DPRK providing information on the public transport systems in place, road design criteria used and other basic information. Through discussions, a number of informational points were provided:

- There is a small amount of leaded fuel for high quality cars. The rest of the fuel (coloured differently) has no additives and is a problem. Octane was the favourite topic in the workshop;
- The lead level in leaded fuel is between 0.3 – 1.0g/kg. Participants mentioned they are using the China standard (TEL between 0.8 – 1.0g/kg and Sulphur between 0.1 – 0.15%);
- They want to develop their own Octane additives and produce them in-country, as it is expensive to import;
- There are 2 refineries (one on each coast) and they import from Russia and China, with some refining done in-country. The capacity and design of the refineries is unknown;
- It is unknown how much is refined in-country and how much is imported as a final product;
- The government has banned the importation of second hand vehicles, and only new vehicles are imported to replace phased-out older vehicles;
- There is local assembling of cars using imported Fiat parts, and locally produced trucks, tractors and trains;
- The number of cars has been increasing over the past couple of years;
- Polluting cars are not issued licenses. Under the Environmental Protection Law, cars that emit Black Carbon are banned;
- Older, coal burning military trucks are still in use to transport people and goods, especially in the countryside;
- There are air quality standards for PM10 and SO₂, but no air quality measuring equipment;
- There are currently no vehicle emission standards, but they are trying to develop emission reduction devices. Participant agreed that they could use the China fuel and vehicle standards as a basis from which to modify and adapt to Korea;
- The Academy of Sciences is researching into physical methods to improve fuel efficiency, including a technology that uses electromagnetic coils (?) to break fuel into smaller particles so more burns;
- There is apparently a policy to encourage public transport through investment in trams and metros, and advertisement to promote them. Guidelines on road construction include EIA, sidewalks and green belts around the road.

On the third day, the participants developed recommendations in break-out groups and then discussed an action plan. The recommendations that were particularly important for the participants are: phase out leaded fuel; find affordable alternatives to raise the Octane level; set vehicle emission standards, possibly using the China standards as a model; develop a train (or possibly a Bus Rapid Transit) to connect the satellite cities and suburbs to the city centre (the current buses and trolleys aren't enough to meet

demand); provide protected bike lanes as part of the road design standard; raise awareness about these issues; and promote public transport.

Recommendations 1 and 2 look at fuel issues; recommendations 3 and 4 cover vehicles. 'First Stage' recommendations cover the priority issues that provide the platform for the second stage. In addition, some of the vehicle standards require a certain fuel quality; for example the Catalytic Converter, an important emission control device, needs unleaded fuel.

Recommendations 5 and 6 look at the public and non-motorised modes of transport; these are important modes in DPRK and should not be neglected in the transport plan. Pyongyang has very good examples of public and non-motorised transport, and the majority of people walk, bike and / or take the bus. However, the use of private vehicles has increased noticeably over the past couple years; if not managed carefully, the number of vehicles will continue to increase, leading to congestion, pollution and increased fuel consumption. Therefore, in addition to cleaning up fuels and vehicles, attention must be given to expand, improve and promote public transport and increase bike lanes, so that people continue using these cleaner, more sustainable types of transport.

1. Cleaning up Fuels: First Stage

- 1.1 Phase out leaded gasoline, in recognition of its highly toxic nature and its long lasting impacts on human health, particularly on the mental development of children; in addition, lead destroys the ability of the Catalytic Converter to remove up to 90% of harmful emissions
- 1.2 Legislate unleaded gasoline as the standard
- 1.3 Invite a fuels / refinery expert to visit the refineries and provide guidance on additives, improving fuel quality and upgrading the refinery
- 1.4 Develop a road map to phase down Sulphur levels in fuel, in recognition of its negative impacts on human health (cardiovascular, respiratory and cancer diseases), buildings and vehicle engines (increases maintenance costs; damages newer engines and emission control devices)
- 1.5 For locally refined fuel: develop a refinery investment plan, in order to meet Euro (or China) 4 equivalent standards within the shortest timeframe possible; decrease Sulphur levels to 50ppm in one step (this is more cost effective) and include other key fuel quality parameters when designing the upgrade, such as higher octane, lower benzene and aromatics etc
- 1.6 For imported fuel: import Euro 4 equivalent fuel

2. Cleaning up Fuels: Second Stage

- 2.1 Establish a fuel quality monitoring system to maintain and enforce regulations of standards

3. Vehicle Standards: First Stage

- 3.1 Require all new gasoline vehicles to have a functioning Catalytic Converter, in order to maximise the emission reduction potential provided by going unleaded
- 3.2 Adopt the highest Euro / China emission standards possible for new and imported second-hand vehicles, based on the fuel quality available, and tighten the vehicle standards as fuel quality improves to ensure the greatest emissions controls with the most advanced technologies:
 - 3.2.1. At 500 PPM Sulphur levels in fuels: All new vehicles to meet Euro 2 emission standards
 - 3.2.2. At 50 PPM Sulphur levels in fuels: All new (including imported second hand) vehicles to meet Euro 4 emission standards
- 3.3 Ban 2-stroke vehicle engines in motorcycles and 3-wheelers, as these are very high emission engines

4. Vehicle Standards: Second Stage

- 4.1 Set age limits for imported second-hand vehicles
- 4.2 Mandate regular inspections, ensuring that the vehicles within the country and vehicles being imported meet ever-tightening standards with regards to age, emissions, fuel efficiency and / or technology (such as catalytic converters) etc
- 4.3 Adopt a fuel economy policy to promote fuel efficient vehicles, using various tools including the use of lower tax levels for more efficient vehicles, labelling system etc

5. Maintain and increase use of public transport

- 5.1 Expand and improve the network of public transport, using the highest vehicle standards that are appropriate for the fuel quality available; this can also include electric trolley buses that are on Alternating Current, rather than the older Direct Current buses being used now
- 5.2 Promote public transport among the public
- 5.3 Develop a train or Bus Rapid Transit system along main routes to connect satellite cities / suburban areas to the city centre

6. Increase infrastructure for non-motorised transport

- 6.1 Legislate that all road related projects provide funds and space for infrastructure for non-motorised transport (sidewalks, protected bike lanes, bike racks etc)
- 6.2 Put in protected bike lanes on current roads
- 6.3 Ensure this infrastructure links with the public transport system, in order to promote both systems and to maintain the current high usage rates of these modes
- 6.4 Create efficient linkages between non-motorised transport, public transport and individual motorized transport to improve efficiency of urban mobility
- 6.5 Increase use of non-motorised transport for areas such as the city centre through pedestrian-only zones, car-free zones, parking fees etc

Action Plan for the Democratic People's Republic of Korea

The workshop participants discussed the outline for an action plan to study the recommendations and then implement them. Critical to any further activities is a clear understanding of the fuel and refinery situation in the country.

First step: Report for the Assessment of the Transport System in N Korea

Time frame: 3 months (30 April 2011), with an initial draft prepared by early March

The report should first provide some background information about growth of urban centres, what is the current population and projected growth etc. Then the report will have a section for each of the topics below. Each of the following sections should describe the current status, provide any relevant data, describe what is needed in terms of capacity or standards etc, and indicate any information gaps. The information can be collected in Pyongyang through the ministries and institutes listed, to provide a general picture of the situation.

Fuels Section

Sources of information: the Ministry of Chemical Industry, the National Standards Institute, and the Ministry of Foreign Trade. Questions to answer include:

- What is the current fuel quality: Sulphur level, Octane, lead level etc;
- Where does the fuel come from;
- How much fuel is refined in DPRK;
- How much fuel is imported as a final product;
- How much fuel has lead additives;
- What is the octane level of the unleaded fuel;
- What is the current design and capacity (quantity and quality of fuel) of the refineries;
- Are there any plans to upgrade refineries.

Vehicles Section

Sources of information: the Central Bureau for Statistics, Ministry of Foreign Trade, Ministry of Machinery Industry, and Ministry of Public Security (for vehicle registration).

- What agency keeps records of vehicle registrations;
- What has been the growth of the vehicle population over the past 5 years;
- What standards or restrictions exist for vehicles;
- How many vehicles are imported and how many are produced locally.

Public Transport Section

Source of information: the Municipal authority and Ministry of Road and Marine Transport.

- Who looks after public transport to set standards, fund expansion, promote use, set ticket prices etc;
- What upgrades are needed for the current system in terms of number, type and quality of public transport vehicles to meet demand;
- What activities are needed to promote public and non-motorised transport.

City Planning Section

Source of information: the Ministry of Municipal Management, Ministry of Land and Environment Protection, Land Planning Institute, and Environment and Development Centre.

- How to promote measures that encourage public and non-motorised transport: car-free zones in the city, pedestrian only zones, park and ride, develop a biking network through protected bike lanes on existing and new roads, reserve one lane on the wider roads for buses only, parking fees etc;
- What are the current road design standards.

Legislation Section

What is the current legislation for the above sections and what changes need to be done to meet the vision / goals? The assessment should identify in each section the key ministry that will draft legislation to present to the Cabinet.

Second step: Draft Legislation

Based on the report, draft the outlines for legislation / standards for fuel quality, vehicle emissions, vehicle efficiency, road designs (to include bike lanes, reserved bus lanes) and public transport. Then each of the relevant ministries can propose legislation related to their work, based on this assessment, and give to the Cabinet and then the People's Supreme Assembly to approve.

Time frame: Various. For fuel quality and vehicle emission standards, this can be done in 2 – 3 months, using the Chinese standards as a template.

Third step: Proposals for various projects related to these issues

Based on the assessment and approved legislation, ministries can prepare proposals for implementation of the recommendations. For the Transport Unit of UNEP, the priority will be phasing out lead, so a proposal will look at a reasonable time frame, what support is needed and what expertise is required. The second priority is development of fuel quality and vehicle emission standards. These can be based on the Chinese standards for now.

ANNEX I

After the first day of the workshop, participants had a number of specific questions that were written down for response on the second day:

1. Is there any measuring data for the amount of lead in the blood in accordance with the number of vehicles per km² and the amount of lead in fuel?
2. Is it possible to raise the octane level up to 85 – 90 by adding MTBE? If it is not possible, they're saying that the damage to environment and loss of economy is much greater than the loss of economy in case of using TEL, because the low quality of fuel causes the knocking phenomenon. What do you think of that?
3. Is it possible to produce gasoline with octane more than 88 when improving the quality of fuel? (I think they are referring to upgrade of refinery). Is there any data on that?
4. Would you explain the efficiency of MTBE comparing it with TEL? What is the rate of increasing octane according to the rate of additive? (I think they were referring to the volume required of each additive compared to the impact)
5. What is the cost of constructing an MTBE production facility with 1,000t/year capacity? Is it possible to transfer technology with low cost? Is there any technical data on that (advanced MTBE production data)? (They were worried about the cost of importing additives, and want to make their own – there is research going on for this purpose)
6. TEL was used in the fuels for airplanes. If they don't use this, what alternatives are they using?

During the workshop, participants requested further relevant information:

- Get information and technical research data on antifreeze, increasing efficiency of combustion, and raising octane and cetane numbers
- Examples of emission standards (specifically China standards and the methodology to prepare them) and environmental laws
- How to increase awareness about public transport
- How to model air pollution dispersal as part of an EIA for road construction
- The method of preparing emission standard (procedure, principal, technical method, calculation method, case studies)
- The method of preparing air environment standard, fuel standard, vehicle standard (case studies)
- Technical data on diffusion prediction of air pollutants from transport emission, model of pollution concentration calculation (case studies, simulation)
- Data on additives which raise octane number (since 2000)
 - Organic metal compounds (below 400°C in volatility)
 - Amine or aromatic amine compounds
 - Ethers including MTBE, ETBE, tertiary amyl methyl ethers, etc)
 - High polymer compounds
- Data on additives which raise cetane number (since 2000)
 - Peroxide compounds
 - Organic metal compounds
- Data on additives which reduce diesel coagulation

- Organic germanium compounds (source country: Japan, German, etc)
 - Amine/amide /imide compounds
 - Polymer/mixed polymer compounds
 - Dispersion reagent of paraffin
- Technical data on methanol fuel
- Data on antioxidants (since 2000)
- Data on inert metal compounds
- Data on biomass fuel, methanol fuel, other substitute fuels