DMRC

Delhi Metro - Green Initiative

Conference of Parties (CoP) - 22

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Executive Director/ Electrical
DMRC

Contents

Transport System-Scenario

- Transport sector is a key driver of economic and social development of any country. This sector is also a major energy consumer and significantly contributes toward Green House Gases (GHG) emission.
- For sustainable development of any country, technical capacity of transport planning and transport technology has to be efficiently used for making the sector viable as well as sustainable.
- Transport planning policy and investment decision should be based on three sustainable development dimensions – social development, environmental development & climate impact and economic growth & future life cycle analysis.
- For all sustainable transport planning, effort with a appropriate balance development of transport mode, integration of the transport modes such as long distance train, Metro's, bus , last mile connectivity such as battery operated rickshaw, auto rickshaw, taxi, etc.

Delhi Metro at a Glance

- Delhi Metro Journey from drawing board to reality was a long process.
- Keeping in view the increasing population of Delhi and the road scenario based on the study of Central Road Research Institution (CRRI). Govt. of NCT Delhi & Govt. of India thought of a prospective plan for future transport system of the capital, a multi model transport was planned.
- Master Plan was made for Delhi Metro expansion, covering 421 kms by 2021 in four Phases.

1995	DMRC was registered on 3rd May 1995 under the Companies Act, 1956 with equal equity participation of the Government of the National Capital Territory of Delhi (GNCTD) and the Central Government to implement the construction and operation of a world- class Mass Rapid Transport System (MRTS).
1998	Work on the Delhi Metro Project started on October 1st , 1998.
2002	The First section of the Delhi Metro (Shahdara-Tis Hazari) was opened for the public on December 25th 2002.
Today	Delhi Metro operates in 213 km having 160 stations .
Phase-III	Total length 160 km comprising of 109 stations which are under construction & likely to be completed in next one year including 15 stations commissioned as on date. DMRC Phase-III also covers Ghaziabad & Faridabad corridors of Delhi-NCR. Over & above this, DMRC is also constructing Noida-Greater Noida Section of NCR as a part of its Phase-III.
Phase-IV	Being planned for 95.86 km having 75 stations to be completed by 2021.

Green House Gas Foot Print

- Though apparently it was very obvious that metro system is much more energy efficient & will reduce the carbon footprint to the great extent. And at the time of planning of the metro, it was estimated that the energy consumption will account for approximately 40% of the total working expenses.
- The initial planning of Metro Stations and the Rolling Stock was done such that the Metro system being introduced by Delhi Metro is sustainable and the foot print of carbon is as low as possible.
- Study by CRRI New Delhi captured the environmental & social atmosphere of Delhi Metro that the number of vehicle that will get off road will be of the order of 4 lakh and an annual reduction in pollutants will be 6 lakh (approx.) tones, and annual reduction in the road accidents will be of the order of almost 1000 per year.

Cond…

Green House Gas Foot Print

Cond…

- Delhi Metro has been registered under Clean Development Mechanism (CDM) with UNFCCC for installing low green house gas emitting Rolling Stock with regenerative braking technology in metro system under the Project I'd :1351.
- This Rolling Stock was estimated to reduce the carbon foot print of almost 41000 tones of CO_2 per year.
- Till date Delhi Metro has earned 2,20,000 carbon emission reduction (CERs) from this project.
- Delhi Metro again registered with UNFCCC under Project I'd : 4463 (Metro Delhi, India) for use of metro with respect to other modes of transport. Over seven years of crediting period, commencing from June 2011, average annual emission reduction has been estimated approx 5.3 lakh tones of CO_2. So far, Delhi Metro has earned one million Carbon Emission Reductions (CERs) form this project.

Green House Gas Foot Print

Cond…

- MRTS has also been registered for Programme of Activity (PoA) Project No. 9863. The project has potential to generate more than 6 lakhs CERs annually just from DMRC Phase-III operations. Upcoming Metro projects across India can avail benefits of CDM through DMRC's MRTS PoA.
- Delhi Metro has been registered with prestigious Gold Standard foundation also for adopting energy saving measures in stations of Phase-II over Phase-I stations under the Project I'd: 10300000001684. Average annual GHG emission reduction has been estimated approx 7 thousand tones of CO2. So far, Delhi Metro has earned 12.8 thousand Carbon Emission Reductions (CERs) form this project.

Energy Scenario in DMRC

- Annual energy consumption of Delhi Metro is of the order of 734 million units out of which traction energy consumption is 474 units and auxiliary consumption is 260 million units.
- The electrical load of underground stations is of the order of 1500 kW and of elevated stations is 200 kW.
- The electrical load of a 6 coach train is 3000 kW.
- Delhi Metro has taken lot of energy initiative right from design to construction as well as in operation & maintenance such as;
  - Adoption of 25kV Traction system – reduction of equipment sizing and lesser energy loss due to higher voltage.
  - Higher COP (≥6.4) Chiller are being used.
  - Light weight Coach made of Stainless Steel thereby reduction in train tare weight.
  - Regenerating feature in Rolling Stock.
  - Massive use of LED lighting in Train as well as stations.

Cond…

Energy Conservation

Cond…

- In normal train operation, tunnel is cooled by piston effect by taking fresh air from the atmosphere at rear station and exhausting the heat generated by the train before entering to the next station to the atmosphere through vent shaft.
- Tunnels are not air-conditioned but stations are air-conditioned. Therefore reduction in air-conditioning load.
- Open system of air-conditioning during winter (15th November to 15th March). Chiller is not used, only AHUs are run by taking fresh air from outside & rejecting the heat in atmosphere.
- Closed system of air-conditioning of stations during summer (16th March to 14th November), when outside temperature is 45-50 °C.

Cond…

Energy Conservation

Cond…

- CO_2 monitoring in station area.
- Extensive use of Variable Frequency Drives (VFDs) in Pumps, AHUs, TEFs & FAF.
- Use of solar power by putting solar PV on the roof top of elevated stations, all depots and parking areas.
- Live controlling and monitoring of all the auxiliary load through building management system (BMS) at stations and at Operational Control Centre (OCC) as well.

Green Initiative-Under Way

- Initially, no green/sustainable rating system to assess the operational Metros and Metros being constructed was available across the world.
- In 2013, DMRC took initiative to make a green metro rating system for the stations, Depot & RSS with IGBC when IGBC & USGBC were partners.
- DMRC in collaboration with IGBC launched the first green rating system exclusively for metros under construction in Sept. 2014.
- Since August 2015, DMRC is also working with USGBC for drafting green guidelines to rate the existing metro system. This rating system is likely to be launched by the end of 2016.

Cond…

Green Initiative

Cond…

- All under construction phase-III metro stations, depots & RSS are being designed & constructed, complied with the highest green rating system i.e. **"Platinum"**.
- 15 stations & 3 RSS of Phase-IIII which have been commissioned so far have already been rated with IGBC **"Platinum"**.
- Our corporate office-Metro Bhawan has also been rated GREEN by USGBC under their Dynamic Plaque rating system.
- Till date 7.3 MWp of solar power has already been installed in Metro network with a target to install 50 MWp of Solar Power.

Project /Station Name– ITO

Station showing Landscaping with Native Plants & High SRI paving

Solar Panel at the rooftop of ITO Station (Underground)

LED lighting Inside the station & low height ticket counter desgined for differently abled

Escalator equipped with VVVF Drives

Project /Station Name and Line – Mandi House
Station showing Native Plant landscaping & high SRI Paving

MRTS Movement In India & DMRC

On favorable operation of Delhi Metro, other city has asked to Delhi Metro for Making Detailed Project Report of Metro .

Metro Project in India Delhi Metro is turn-key consultant for;

Jaipur Metro Project,

Kochi Metro Project,

Noida-Grater Noida Project,

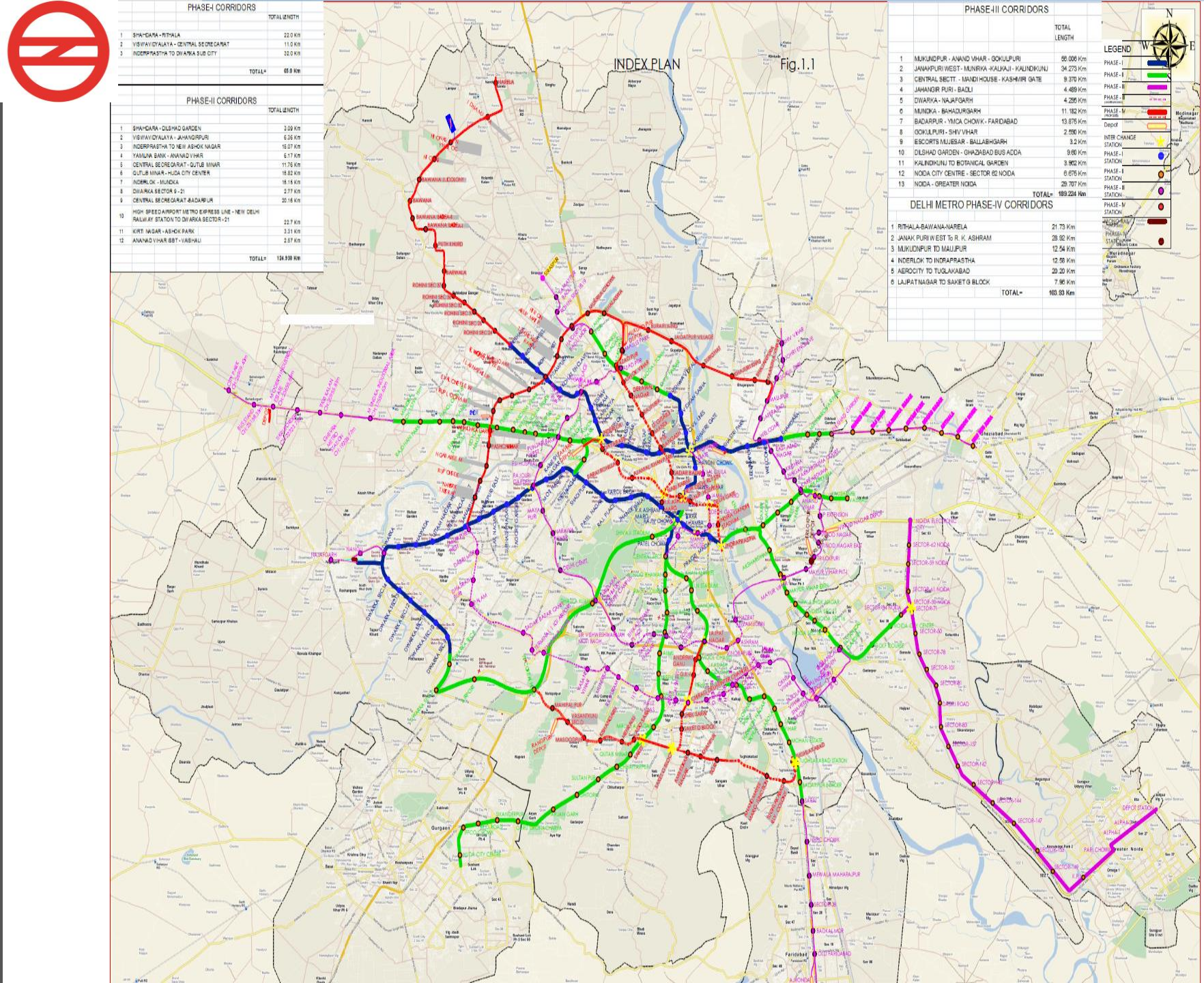
Vijayawada Metro Project &

Mumbai Metro Project

Consultancy Assignments

Lucknow Metro, Ahmedabad Metro, Nagpur Metro, Pune Metro, Vishakhapatnam Metro, Kerala Light Metro Projects, Jakarta Metro, Mauritius Metro, Raipur Regional Rapid Transit System Pre-feasibility Study, Amritsar Metro Traffic Feasibility Study, High speed rail of kochi.

In addition to above Delhi Metro has provide consultancy service to Dhaka Metro, Jakarta Metro.



DMRC Energy Management Policy

DELHI METRO RAIL CORPORATION LIMITED
दिल्ली मेट्रो रेल कॉर्पोरेशन लिमिटेड

ऊर्जा प्रबंधन नीति 2015

दिल्ली मेट्रो रेल कॉर्पोरेशन लिमिटेड दिल्ली राज्य एवं राष्ट्रीय राजधानी क्षेत्र में स्वच्छ और आरामदायक सार्वजनिक रेल परिवहन प्रणाली उपलब्ध कराने और परिवहन उद्योग में सभी परिवहन साधनों की अपेक्षा न्यूनतम ऊर्जा खपत करने वाली मेट्रो बनने के लिए वचनबद्ध है।

1. ऊर्जा की खपत, उसके उपयोग और ऊर्जा की बचत से संबंधित सभी संगत विधानों और उससे संबंधित जरूरतों का अनुपालन सुनिश्चित करना।
2. नवीकरणीय ऊर्जा स्रोतों के उपयोग जहां तक यह आर्थिक दृष्टिकोण से व्यावहारिक हो, को प्रोत्साहित करना ।
3. ऊर्जा की खपत के मापदंड तय करना।
4. ऊर्जा की खपत का सदुपयोग करना और ग्रीन हाउस गैसों को कम करना।
5. समय समय पर समीक्षा कर ऊर्जा की खपत पर निगरानी रखना, इसे नियंत्रित करना और एक कारगर ऊर्जा प्रबंधन प्रणाली द्वारा ऊर्जा की खपत में सुधार लाना।
6. न्यूनतम लागत पर बिजली प्राप्त करना।
7. कर्मचारियों में ऊर्जा संरक्षण के बारे में जागरूकता पैदा करना।

"दिल्ली मेट्रो रेल कॉर्पोरेशन लिमिटेड ऊर्जा संरक्षण के लिए वचनबद्ध है।"

ऊर्जा संरक्षण दिवस
दिनांक: 14.12.2015
स्थान: नई दिल्ली

मंगू सिंह
प्रबंध निदेशक

Energy Management Policy 2015

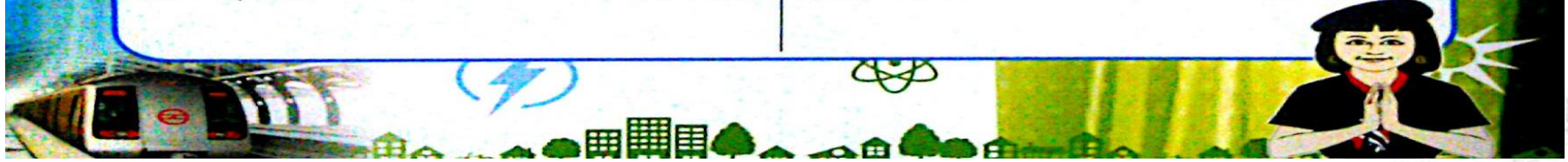
DELHI METRO RAIL CORPORATION Ltd. is committed to provide clean and comfortable public transport network in the state of Delhi & NCR and to be the lowest energy consumer in the Transportation sector on likewise basis.

1. Assuring compliance of all relevant legislation and other requirements related to energy consumption, its use and Energy efficiency.
2. Encourage use of renewable energy sources to the extent it is economically viable.
3. Benchmark energy consumption.
4. Optimize energy consumption and reduce green house gases.
5. Control & Monitor Energy consumption by periodic review and improve energy performance through an effective Energy Management System.
6. To obtain Power at minimum cost.
7. Create awareness about Energy Conservation amongst the employees.

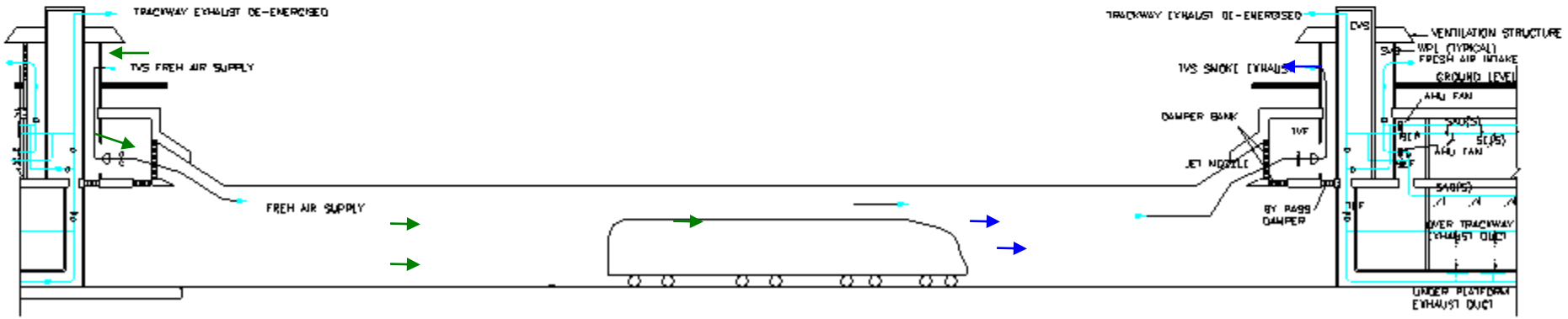
"Delhi Metro Rail Corporation Ltd. is committed to energy conservation."

Energy Conservation Day
Date: 14.12.2015
Place: New Delhi

Mangu Singh
Managing Director



Congested Mode Operation

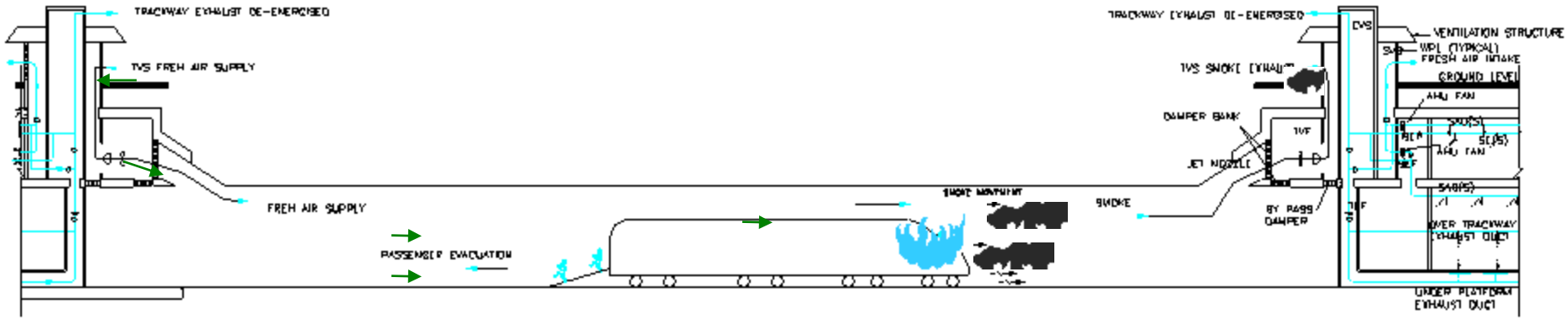


Fresh or Cool Air

Hot Air

Hot Smoke

Emergency Mode Operation in Tunnel



Fresh Outside Air

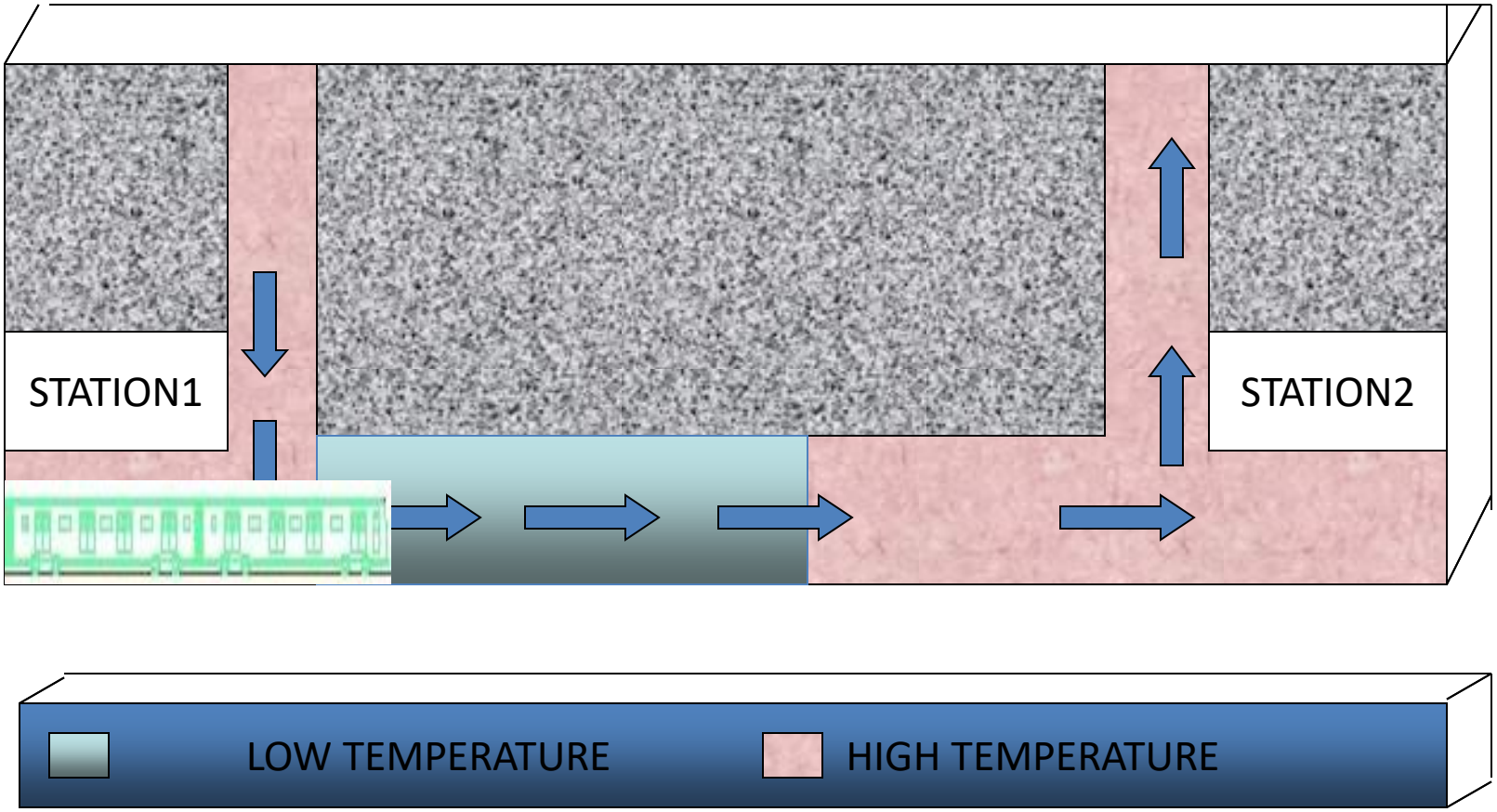
Hot Smoke

Thank You
for
Giving me an opportunity
for sharing my views

DELHI METRO
मेरा मेट्रो

Normal Operation

- **PISTON EFFECT**



Normal Operation

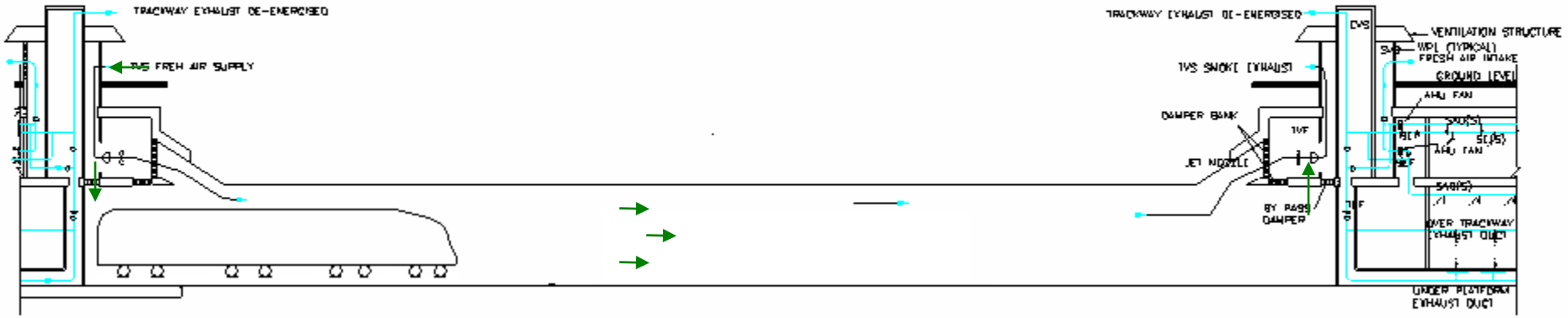
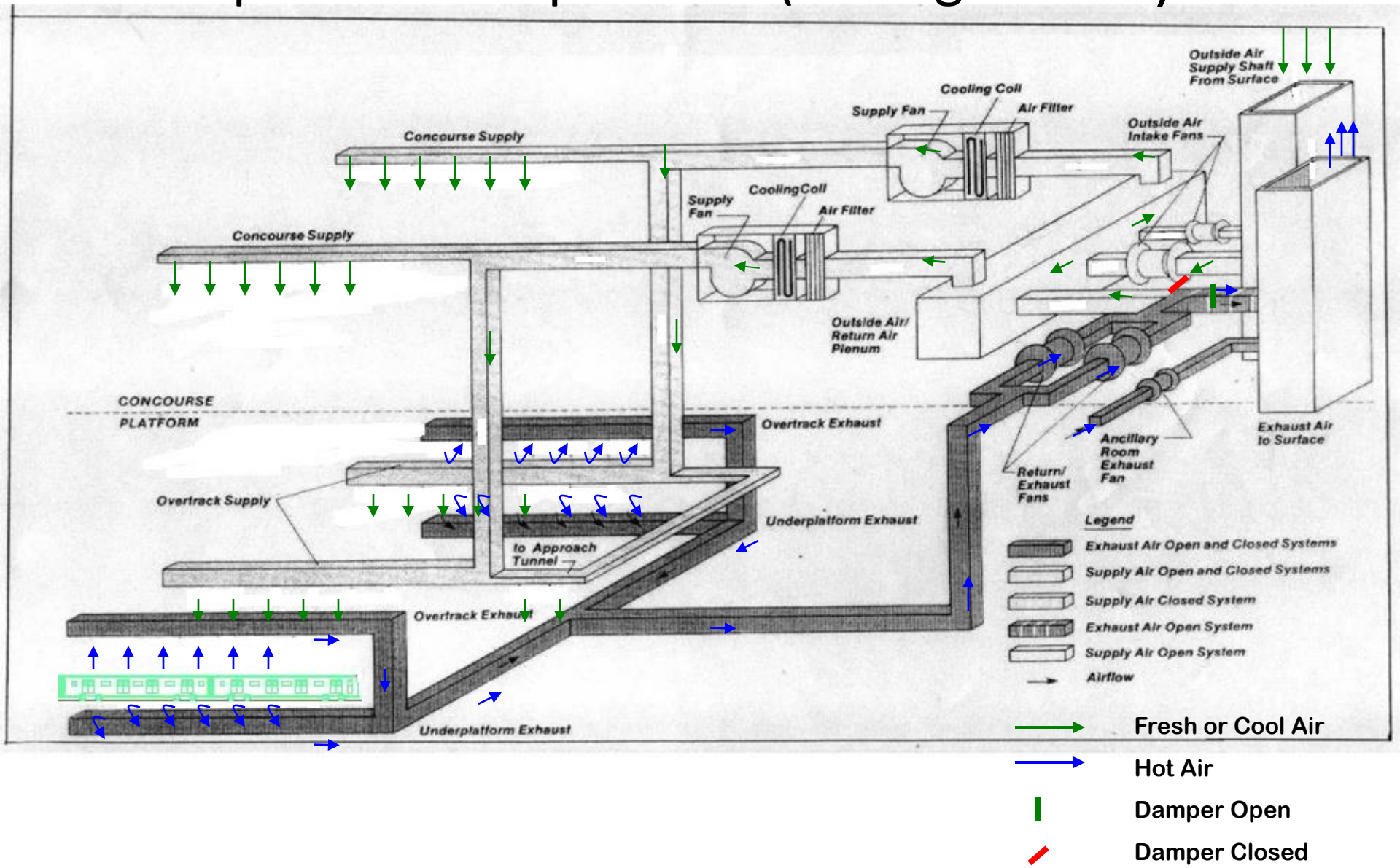


FIGURE 3

Open Mode Operation (During Winter)



Close-Mode operation of ECS (During Summer /Monsoon)