Regional Seminar on: “Enabling Policies for Financing Energy Efficiency Investments”

Policy Reforms to Promote Energy Efficiency in the Transportation Sector in Egypt

By Dr. Hamed Korkor

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Introduction: Importance of the Transport Sector in Egypt and the Need for Promoting Energy Efficiency

- One of the main drivers for social and economic development. Meanwhile, it is one of the major energy consuming and pollutants emission sectors which represent:
  - 25% of total final energy demand.
  - 46% of total petroleum energy consumption
  - 26% of total CO2 emissions by all economic sectors.

- High growth of both gasoline and diesel consumption (5% and 5.3% annually during the last three decades) and the increase of their imports (1.2 and 4.9 million tons during 2012/2013 respectively).

- Contribute to the drastic increase of total petroleum energy subsidy that reached more than LE 128 billion (USD 18 billion) in 2012/2013. Transport sector represent 45% of total petroleum energy subsidy (more than USD 8 billion).

Unless effective energy efficiency measures and policy reforms have to be taken that situation is expected to be worsen.
# Transport Sector Main Characteristics


<table>
<thead>
<tr>
<th>Year</th>
<th>Road</th>
<th>Railways</th>
<th>River</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(billion passengers-km)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981/1982</td>
<td>47449</td>
<td>17903</td>
<td>7</td>
<td>65359</td>
</tr>
<tr>
<td>1991/1992</td>
<td>77494</td>
<td>46517</td>
<td>12</td>
<td>124023</td>
</tr>
<tr>
<td>2001/2002</td>
<td>112815</td>
<td>39083</td>
<td>15</td>
<td>151914</td>
</tr>
<tr>
<td>2011/2012</td>
<td>180340 (68%)</td>
<td>83730 (32%)</td>
<td>24 (0%)</td>
<td>264094 (100%)</td>
</tr>
<tr>
<td>Average Annual Growth Rate (%)</td>
<td>4.6%</td>
<td>5.3%</td>
<td>4.2%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Road</th>
<th>Railways</th>
<th>River</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(billion ton-km)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981/1982</td>
<td>13890</td>
<td>2307</td>
<td>2114</td>
<td>18311</td>
</tr>
<tr>
<td>1991/1992</td>
<td>26261</td>
<td>3229</td>
<td>1761</td>
<td>31251</td>
</tr>
<tr>
<td>2001/2002</td>
<td>40605</td>
<td>4188</td>
<td>3712</td>
<td>48505</td>
</tr>
<tr>
<td>2011/2012</td>
<td>58776 (86%)</td>
<td>6280 (9%)</td>
<td>3277 (5%)</td>
<td>68333 (100%)</td>
</tr>
<tr>
<td>Average annual Growth rate (%)</td>
<td>4.9%</td>
<td>3.4%</td>
<td>1.5%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

Source: Central Agency for Public Mobilization & Statistics (CAPMAS) & State Information Service Annual Books.

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## Transport activity is relaying mainly on roads for both passengers and freight transport.

### Road Transport:
- Road network of a total length of more than 121 thousand km.
- Total number of vehicles has increased from 1.1 million in 1990 to 6.6 million in 2012 with an average annual growth rate of 8.8%.
- **Private cars represent 49.3%**, taxi 4.7%, buses 1.6%, trucks 14.4%, tractors 0.3% and motorcycles 2.6% with other types representing the reminder.
- **About 56.2% of total vehicles fleet exist in GCR and Alexandria.**
- **About 26% of total vehicles fleet of age of more than 27 years old and 25% of more than 17 years** which result in the inefficient use of fuel and higher rates of pollutants emission.
Transport Sector Main Characteristics

**Railways Transport:**
- The second oldest railway system worldwide after the British railways.
- The establishment of the first line that connects Cairo to Alexandria started in 1851 and becomes in operation by the year 1854.
- There are 28 railway lines extends for more than 10 thousands kilometres.
- The lack of effective plans for the development of the railways system and infrastructure coupled with poor maintenance and the lack of the necessary investments resulted in a very low performance and share of passengers and freight transport as mentioned before.

**River Transport:**
- River navigation lines extends for 3136 km.
- There are 44 river ports with storage capacity of 1.2 million tons of freight.
- Most of the ports are connected to the main roads and only two connected to the railways system.
- Molasses, petroleum products, phosphates and stones are the main freight transported by the river representing more than 80% of total river transport freight.
- The decline share of passengers and freight river transport could be attributed to:
  - Absence of the government subsidy and support to river transport activities,
  - Lack of the government role and coordination in assigning specific volumes of freight to different transport modes including river transport,
  - Lack of proper maintenance, adequate development and modernization of river transport infrastructure.
### Energy Consumption and GHGs Emission by Transport Sector

**期间 (1981/1982-2012/2013) 运输部门：**

- **汽油消耗** 增加，从1981/1982年的1.3百万吨增加到2012/2013年的6.1百万吨，平均年增长率约为5%。
- **柴油消耗** 增加，从1981/1982年的1.7百万吨增加到2012/2013年的8.5百万吨，平均年增长率约为5.2%。
- **GHGs排放** 估计为49.4百万吨的CO₂，2012/2013年占所有部门总排放的26%，另外还有2.1百万吨的CH₄和0.4百万吨的N₂O。
- **总石油能源消耗** 增加，从1981/1982年的3.8百万吨增加到2012/2013年的16.6百万吨，平均年增长率约为5%。

### Table 2: Transport sector petroleum energy consumption (1981/1982-2012/2013) - (‘000 tons)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>1349</td>
<td>2041</td>
<td>2386</td>
<td>6079</td>
<td>5%</td>
</tr>
<tr>
<td>Turbine</td>
<td>337</td>
<td>453</td>
<td>402</td>
<td>590</td>
<td>1.8%</td>
</tr>
<tr>
<td>Gas oil</td>
<td>1740</td>
<td>2908</td>
<td>5284</td>
<td>8462</td>
<td>5.2%</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>103</td>
<td>155</td>
<td>750</td>
<td>279</td>
<td>3.3%</td>
</tr>
<tr>
<td>Others</td>
<td>227</td>
<td>215</td>
<td>1099</td>
<td>820</td>
<td>4.2%</td>
</tr>
<tr>
<td>Total Petroleum Products</td>
<td>3756</td>
<td>5772</td>
<td>9921</td>
<td>16230</td>
<td>4.8%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0</td>
<td>0</td>
<td>244</td>
<td>400</td>
<td>5%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>3756</td>
<td>5772</td>
<td>10165</td>
<td>16630</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

来源：EGPC & EGAS.
Transport Sector Main Challenges

- **Limited capacity of existing public transport** fleet in addition to its inconvenient and lack of appropriate maintenance that led to the switch of a significant volume of passengers to private cars. A similar switch of freight transport had also occurred from railways and river transport to road transport, mainly trucks.

- **Traffic congestion** that causes severe negative economic and environmental impacts.

- **High rate of accidents** that account for more than 1000 deaths and 4000 injuries yearly.

- **High energy consumption levels** by the sector which reflect the inefficient use of energy and the need for more reform of existing and implemented energy efficiency policies and measures.

- **High levels of air and noise pollution**.

- **Inadequate financial resources**.
The current paper highlights some of the most important energy policy reforms that have been performed in the transport sector in Egypt during the last few decades in order to develop and promote energy efficiency and air quality improvements projects.

Particular emphasis has been made to policy reforms and projects eligible to attract energy efficiency investments and make it bankable among of which are:

- The Greater Cairo Region (GCR) Old Vehicles Scrapping and Recycling Program (OVSRP),
- The utilization of Compressed Natural Gas (CNG) as a fuel for vehicles, and
- Cairo Metro.

The analysis made focused on defining the economic, social and environmental impacts and benefits of implementing the previous mentioned policies, particularly for the OVSRP including estimates of expected fuel saving and reduction in GHGs emissions.
Old Vehicle Scraping and Recycling Program (OVSRP)
Old Vehicle Scraping and Recycling Program (OVSRP)

- One of the main problems which contribute to the inefficient use of energy in the transport sector in Egypt and consequently the increase of pollutant emissions is the existence of significant number of old vehicles which characterized by low efficiency engines and poor maintenance.
- The main problem associated to old vehicles is their frequent breakdown which causes traffic jams and bottlenecks and in turn increase fuel consumption and emission of GHGs.

**Program Main objectives:**

- Reduce GHGs emissions through the scrapping and replacement of old vehicles.
- Create an effective tool that can help the enforcement of traffic law number 121 of the year 2008 which states “mass transport vehicles of age of more than 20 years old are not eligible for new operating licenses or license renewal”.
  According to the law, the mass transport vehicles include taxis, microbuses, trailer trucks, and buses.
- Implement the program as one of the United Nation Framework Convention on Climate Change (UNFCCC) CDM projects in order to make use of the generated carbon credits to strength its economic viability.
Old Vehicle Scraping and Recycling Program (OVSRP)

Program Main Features and Characteristics:

- Considered as the first UNFCCC’s transport-based implemented CDM project worldwide which is financially supported by the World Bank Carbon Fund.
- Based on Public Private Partnership (PPP) which means that costs, benefits and risks are shared between different stakeholders.
- The GCR’s taxies are considered as the main target for the first phase of program implementation.
- Consequent phases will consider other old mass transport vehicles such as microbuses, trucks and buses and will cover other regions.
- According to the OVSRP design document total taxi fleet in GCR account for 86 thousand of which 58% of an age of more than 22 years old, 24% of an age of more than 32 years and 7% of an age of more than 37 years.
- The average specific fuel consumption of new taxi vehicles estimated at 9.4 liters per 100 km compared to 13.2 liters per 100 km for old taxi vehicles which means fuel consumption saving and consequently reduction of pollutants emissions by about 29%.
The program comprises several stakeholders including the Ministry of Finance (MoF), the Ministry of Interior (MoI), 2 local banks, 5 vehicles manufacturing companies, an insurance company, an advertising company, old vehicles owners, the Clean Development Mechanism Awareness and Promotion Unit (CDM AP) which affiliated to the Ministry of Environment, and the World Bank Carbon Finance Unit.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Main Duties and Responsibilities</th>
</tr>
</thead>
</table>
| The Ministry of Finance (MoF) | • Coordinate and manage all program activities.  
• Provides vehicles owners with payments for surrendered eligible vehicles.  
• Ensuring that obsolete old taxies are scrapped according to the prevailing environmental regulations and standards in order to avoid their re-use or part of them.  
• Bear new vehicles sales tax on behalf of vehicle’s owners.  
• Exempts customs on imported components of vehicles.  
• Guarantees given loans from banks against default in selected cases.  
• Working with the World Bank Carbon Finance Unit to leverage carbon finance to support the development of a recycling facility that would ensure scrapped vehicles are permanently taken off the roads. |
| The Ministry of Interior (MoI) | • Providing land for processing/scraping and recycling sites, as well as managing vehicle inspection and new vehicle licensing.  
• Provides security and monitoring services for processing, scrapping and recycling sites. |
| The Ministry of Environment (MoE), EEAA and the CDM Awareness and Promotion Unit | • Program development and monitoring as CDM project including issuing letter of approval of the program and its participation in achieving sustainable development.  
• Program supervision from environment perspective.  
• Giving environmental approval for participating private sector entity to operate the scraping and recycling facility. |
| The World Bank Carbon Finance Unit | • Working with the Ministry of Finance to leverage carbon finance to support the development of a recycling facility that would ensure scrapped vehicles are permanently taken off the roads.  
• Securing partners willing to buy carbon credits |
| The banks | • Provide low-interest loans to eligible vehicle owners. |
| The Vehicles Manufacturing Companies or Auto Dealers (Lada, Sperenza, Hyundai, Chevrolet Lanos, and Peugot). | • Prepare vehicles for mass transport use (e.g. install meters and paint exteriors).  
• Provide up to 3 year warranty on vehicles.  
• Provide the necessary routine maintenance.  
• Guarantee loans against default as they repossess the vehicles and pays the loans to the bank.  
• Buying old taxi licenses. |
| Insurance Companies | • Providing insurance for the new vehicles. |
| Advertising Firms | • Using taxis as advertising space, to help reduce owners’ payments. |
| Representatives for processing/scraping sites | • Monitor the process for scraping old taxies.
The program design is based on classifying and grouping a specific number of Component Project Activities (CPA) as a project.

Each of the CPA is extended for a 10 years period.

Therefore, the program is designed to include a cluster of sub-projects as follows:

- **The original OVSRP**: which contains 11 CPA.

  - **Additional projects** that could be added by the MoF during the 28 years registration period of the original GCR OVSRP. Additional projects which are under studying and consideration include:
    - **The Expansion of GCR OVSRP** to include other regions (e.g. Alexandria, Delta, etc.).
    - **Old Microbuses Scrapping Project**: include 64 thousand private microbuses of an age of more than 20 years.
    - **Old Buses Scrapping Project**: include the scrapping and recycling of about 1100 old buses and 613 old minibuses owned by Cairo Transport Authority (CTA). The proposed vehicles are expected to be replaced by new diesel hybrid, CNG, and EURO III diesel vehicles.
OVSRP – Implementation Procedure

1. **The Ministry of Finance (MoF)** to announce the implementation of a new phase of the **program** and define participating banks and vehicles manufacturing companies.

2. Old vehicles owners willing to participate apply for the program at one of the participating banks and complete all the necessary documents.

3. Banks to inform eligible old vehicles owners applied to the program within 5 working days about their approval on providing them with commercial loans of a maximum LE 70 thousands for each taxi (locally assembled brands) over 60 installments (5 years).

4. Banks and old vehicles owners agree upon the type and price of the new car and loan conditions.

5. Banks to inform participating vehicles manufacturing companies or suppliers on their approval for giving loans for old vehicles owners within 5 working days.

6. Old vehicles owners to deliver their old vehicles at the scrapping and recycling site.

7. Representative of the MoI to issue certificate for scraping old vehicles at vehicles scraping and recycling site located 20 km to the west of Cairo center on Cairo - Alexandria desert road.

8. Representative of the MoF to take the necessary actions for paying LE 5000 to participating banks to be deducted from the new vehicle cost for the benefit of each old vehicle owner.

9. Old vehicles owners get the new car from vehicles manufacturing companies and take the necessary actions for getting their license through the MoI representative at the vehicles scrapping and recycling site.
Total Cost of the Program: estimated at **US$ 620 million (LE 3.5 billion)** during its duration, the period (2009-2018).

<table>
<thead>
<tr>
<th>No. of vehicles</th>
<th>Per vehicles ($)</th>
<th>Total ('000 US $)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Government subsidy per vehicle</td>
<td>49 000</td>
<td>911</td>
<td>44.64</td>
</tr>
<tr>
<td>Tax and custom waivers *</td>
<td>2674</td>
<td>131.03</td>
<td>21.1</td>
</tr>
<tr>
<td>Vehicle price after discounts</td>
<td>8833</td>
<td>432.82</td>
<td>69.8</td>
</tr>
<tr>
<td>Annual program coordination &amp; monitoring *</td>
<td>0.05</td>
<td>1.17</td>
<td>0</td>
</tr>
<tr>
<td>Recycling site preparation **</td>
<td>11.70</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td><strong>Total estimated project cost</strong></td>
<td>620.24</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

* Based on US$1=5.61 EGP (Egyptian pounds)
** World Bank (2010). Carbon Finance Assessment Memorandum (CFAM)
Source: UNFCCC (2009), Egypt Vehicle Scrapping and Recycling Program, CDM SSC-POA-DD, Ver. 01, Oct. 6 '09.

Energy Efficiency Potential:
- As previously mentioned, the program design is based on classifying and grouping a specific number of Component Project Activities (CPA) as a project with each of the CPA extended for a 10 years period.
- Total **number of scrapped and recycled vehicles** through the program implementation during the period (April 2009 to the end of 2013) accounted for more than **49 thousand vehicles**.
- Consequently, **total fuel saving and GHGs emissions reduction** estimated at about **0.6 million tons of oil equivalent** and **1.7 million tons of CO2e** over 10 year’s period.
OVSRP Policy Design Consideration
(Drivers for Implementation Success)

A. The Characteristics of Program Design and Set up:

- **The well set up and design** of the program through a combination of outreach, financial and economic incentives and market organization.

- **The design of the program as a PPP** and the success in building up strong and effective partnership between different stakeholders.

- **Maintaining a degree of flexibility** that allow for periodical changes to be made on the program.

- The utilization of **one-stop-shop approach** that help old vehicles owners to scarp, recycle old vehicles, get loans for purchasing new and fuel-efficient ones in addition to insurance and licenses, etc. all in one site with a very simple, effective and transparent steps and approach. Therefore, high levels of program participation rates have been achieved.

- **Careful program planning**, close monitoring in addition to partners meeting before program implementation which proves to be essential for ensuring better coordination among different stakeholders, keeping detailed records for project activities through its database, and performing random surveys to estimate fuel saving and GHGs emissions reduction.
B. The Package of Incentives Provided by Different Stakeholders:

- The MoF provides a grant of LE 5000 for each scraped vehicle, bear the costs of scrapped vehicles, sales tax for new vehicles, custom duties fees for the components of new manufactured vehicles, and provide the necessary guarantee for loans from local banks.

- Local Banks provide loans for old taxi owners to purchase new vehicles of a maximum LE 70 thousands for 60 installments over 5 years period with an interest rate of 7.5% compared to 9% as prevailing market interest rate.

- Vehicles Manufacturing Companies and Suppliers offer lower prices for new vehicles (25%-30% less than market price), provide spare parts and the maintenance for new vehicles at reduced cost (a discount of 30% is given to spare parts).

- The Insurance Company provides insurance against theft, fire, and accidents at an interest rate of 3.25% compared to 6.25% as prevailing market interest rate.

- The Advertising Agency that has an exclusive right to advertize on new vehicles pay a monthly advertising cost of LE 550 for 5 year period for the benefit of taxi vehicles owners.
OVSRP – Economic, Social and Environmental Benefits

- **Reduction in traffic jams** and consequently the economic losses associated to it,
- **Providing more new job opportunities** (10500 as direct jobs and 1000 as indirect jobs with generated net daily income of about LE 85 for each new job),
- **Raising the income of taxi owners by about 40% and taxi drivers by 100%** through the creation of additional vehicles operation shifts and reduction of vehicles fuel consumption and maintenance costs (each taxi owner is expected to get an average monthly income of LE 1500 compared to LE 900 for the old taxi). As a result life conditions for taxi drivers and owners will improve,
- **Providing opportunities for the establishment of new Small and Medium Enterprises (SMEs).**
- **Revenue from the generated CERs** during the program period is expected to range from USD 15.8–27.8 million which will be utilized for supporting program cost [based on the project duration as a CDM project for 28 years (2009-2037) and assuming program market price of USD 11 per each CER generated till 2013 and of USD 6 per CER after 2013].
- **Business development of participating stakeholders** such as vehicles manufacturing companies and banks (gained profits by participating banks will result in increased availability of investments funds),
- **Improve air quality** and hence the Egyptian citizen’s life and health conditions,
- **Upgrade taxi fleet** in addition to public transport buses and microbuses in later phases of program implementation. **upgrading urban transport will directly affect economic development in terms of reduced commuting time, increased productivity, and income generated from tourism.**
OVSRP – Economic, Social and Environmental Benefits

- **Enhance the capabilities, skills and knowledge of existing staff** of program stakeholders such as banks on different aspects and approaches relevant to attracting investment and the implementation of programs and projects for climate change mitigation, air quality improvement and sustainable environmental management, and more importantly the formulation of a cost effective financing mechanism that could be used as a model for attracting and allocating necessary finance and investments for similar programs and projects in the transport sector and in other economic sectors.

- An **annual fuel subsidy saving** of about LE 399 million will be gained as a result of the operation of new efficient vehicles and the retrofit of significant portion of it to run using CNG.

- Moreover, based on the results achieved through the implementation of the various phases of the program, **additional expected energy savings and reduction in GHGs as a result of program expansion have been assessed**. In performing that assessment the following assumptions have been made:
  - Total number of eligible old taxis vehicles to be scrapped and replaced by new vehicles estimated at 225 thousand by the end of the year 2018,
  - An average annual fuel saving of 1.2 ton per vehicle and average annual GHGs reduction of about 3.4 ton of CO$_2$e per taxi.

The assessment resulted in an expected gasoline consumption savings of about 1 million ton during the period (2013-2018) and GHGs reduction of 2.8 million ton of CO$_2$e during the same period.
The challenges and barriers which exist and might negatively affect the program effectiveness, sustainability and replications in the future include the following:

- Failure of some stakeholder such as advertising agency and taxi vehicles owners to fulfill their commitments,
- Rapid growth of the program which created increased service demand that was not expected by maintenance companies,
- Culture differences of taxi vehicles owners who are used to make their vehicles maintenance service at local maintenances shops,
- Degree of coordination among different stakeholders, and
- Waiting times for getting new vehicles.
- Political instability and economic growth decline.
The Utilization of Compressed Natural Gas (CNG) as a Fuel for Vehicles
During the period (1992-1996), two demonstration projects have been implemented in two of the petroleum sector companies. The first project comprised the construction of 2 CNG fast filling stations to serve 30 dedicated CNG buses. The second project comprised the construction of 3 CNG fast filling stations and the conversion of 150 of the company vehicles to run on both CNG and gasoline.

Currently there are six operating CNG companies four of which are established with international oil companies (BP, ENI, Shell, and Total) and two are private companies.

Two companies (CARGAS and GasTec) have a CNG market share of 96% of total number of CNG vehicles and 87% of total natural gas sales (end of 2013).

The Egyptian Natural Gas Holding Company (EGAS) plays the role of the regulator to NGVs market.

By the end of March 2014, total number of NGVs account for more than 200 thousand fuelled by CNG through 173 fuelling stations.

About 62% of converted vehicles are located in Cairo, Giza and Alexandria governorates.

About 62% of converted vehicles are located in Cairo, Giza and Alexandria governorates.

Taxi vehicles represent about 73% of total converted vehicles to CNG compared to 18% for private cars and only about 1% for each of buses and pickup vehicles.

During the period (1997/1998-2012/2013) total natural gas consumption by vehicles estimated at 3.5 million tons which means liquid fuel saving of about 3.8 of gasoline (4.2 mtoe) and consequently estimated cumulative CO2 emissions reduction during the same period of about 2.3 million tons.
In order to encourage car owners to use CNG, the MoP in collaboration with local banks and the CNG operating companies developed the Smart Card program.

The Smart Card program allows car owners to get the necessary loans to convert their vehicles to CNG from one of the local banks and pay the conversion cost which is LE 5000 to 6000, in the form of monthly installments with favorable interest rate.

### Procedure for Converting Vehicles to Use CNG:

- Any car owner who want to convert his/her car can contact any of the NGVs operating companies and fill a simplified questionnaire that contains some personal information in addition to his/her approval to join the smart card program.
- The bank transfer the total cost of conversion to NGVs operating company and issue the smart card to vehicle owner who use it each time he fuel his car with CNG.
- The car owner has to pay 0.90 LE/M3 of CNG (equivalent to the price of gasoline 80) until he pay back the total cost of conversion then he start to pay the cost of CNG (0.45 LE/M3) and enjoy the price differential between both fuels.
The monthly savings to car owner range between LE 200 to 3300 per month depending on the type of gasoline replaced by CNG and the millage travelled.

Due to the higher costs associated to the construction of CNG fueling stations and natural gas pipelines the ministry of Petroleum supply natural gas to CNG operating companies at a price of LE 0.14/M3 while they sell it at LE 0.45/M3 leaving about LE 0.31/M3 of CNG sales to cover both investment and operating costs.

### Economical Benefits (Saving) to Car Owners

<table>
<thead>
<tr>
<th>Gasoline Daily Average Consumption</th>
<th>Value of Monthly Consumption of Gas in LE (0.45 LE/M3)</th>
<th>Monthly Saving in case of Utilizing Gas (in LE) instead of gasoline 90 (1.75 LE/Liter)</th>
<th>instead of gasoline 92 (1.85 LE/Liter)</th>
<th>instead of gasoline 95 (5.85 LE/Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>61</td>
<td>201</td>
<td>216</td>
<td>816</td>
</tr>
<tr>
<td>10</td>
<td>123</td>
<td>402</td>
<td>432</td>
<td>1632</td>
</tr>
<tr>
<td>15</td>
<td>184</td>
<td>603</td>
<td>648</td>
<td>2448</td>
</tr>
<tr>
<td>20</td>
<td>245</td>
<td>805</td>
<td>865</td>
<td>3265</td>
</tr>
</tbody>
</table>
The remarkable progress and development of NGV market in Egypt could be attributed to several important market drivers which include:

- The availability of significant natural gas resources and the existence of a reliable, efficient and expandable natural gas network that covers most of the inhibited areas of the country,
- The prevailing fuels pricing scheme makes natural gas the fuel of choice for vehicles, (currently, the price of CNG is LE 0.45/M³ which represent 50% of gasoline 80 price, 26% of gasoline 90 price, 24% of gasoline 92 price, 8% of gasoline 95 price and 41% of diesel price),
- The success of the MoP to keep balance between numbers of converted vehicles and CNG fuelling stations
- The formulation of a CNG policy committee (responsible for giving approvals for the establishment of CNG operating companies, monitoring the development of NGVs market, recommending and adopting the appropriate policies and measures to achieve CNG industry targets and objectives),
- The formulation of a CNG committee within EGAS with mandates and responsibilities including monitoring the performance of the CNG operating companies and the development of the CNG market, proposing the necessary norms and standards, giving approvals for the establishment of new conversion centers and the construction of new CNG fueling stations.
- The development of the smart card system as an effective financing mechanism for converting vehicles to CNG,
- Performing awareness and promotion campaigns for the utilization of CNG as a fuel for vehicles,
- Local manufacture of CNG compressor, dispensers and storage through SAFE Egypt CNG Company.
The Utilization of CNG as a Fuel for Vehicles

Barriers and Challenges

**The technical and operational barriers and challenges** include:

- Low efficiency of some existing vehicles fleet engines,
- Extra weight and reduced vehicle trunk space caused by CNG cylinder,
- Inadequate participation of vehicles manufacturing companies in the national program for vehicles conversion,
- Lengthy procedures for getting approvals for the construction and operation of CNG fueling stations and conversion centers,
- Access to natural gas network, waiting time at CNG refueling stations,
- Land space availability, prevailing standards and safety regulations; and awareness.

**The economic barriers and challenges** include:

- The relatively high cost of conversion kits and CNG fueling stations that account for LE (5000-6000) thousand and LE 7 million respectively,
- Encountered problems facing the implementation of the “Smart Card system” such as operation outage of smart cards machines in some of the CNG fueling stations and delays of paying loans installments associated to the cost of vehicles conversion for some vehicles owners to lending commercial banks.

**The environmental barriers and challenges** include:

- The current prevailing environmental law, number 4 for 1994, sets some limits for vehicles pollutants emissions. However, the law does not cover all pollutants such as NOx and SOx and is not practically enforced to a large extent.
Cairo Metro

- Is the first in Africa and the Middle East and the greatest implemented project in Egypt in the 20th century.
- Considered as a good example of the importance of public transport in achieving energy savings and pollutants emissions reduction in large and crowded cities like Cairo.
- Transportation trips in GCR are expected to increase from 25.2 million /day currently to 33 million /day in 2022 (an increase of 7.8 million trip/day ) which is expected to be accommodated by Cairo Metro System.
- The National Tunnels Authority (NAT) is the entity responsible for the construction and operation of Cairo Metro. Since its establishment in 1983, several metro lines have been constructed and becomes in operation in GCR.
Cairo Metro
Energy Saving and Pollutants Emissions Reduction

- Average specific energy consumption of lines 1 & 2 estimated at about 8.8 thousand kwh/million passengers.km (about 1.8 toe/million passengers.km).
- Assuming average specific energy consumption of private cars of about 37.5 toe/million passengers.km.
- Therefore, fuel saving as a result of utilizing Cairo Metro instead of private cars estimated at about 35.7 toe/million passengers.km.
- Therefore, total fuel savings and CO2 emissions reduction estimated at 32 mtoe and 90 million tons of CO2 during the period (1989-2021) respectively.
Cairo Metro
Socioeconomic and Environmental Impacts

- The construction of metro lines characterized by being very high capital intensive projects. Therefore, attracting the necessary and appropriate investment for their financing becomes a great challenge.
- The success of implementing the first line of Cairo metro in addition to its economic, social and environmental benefits encouraged both national and international investors and financing firms to participate in financing the rest of metro lines.

<table>
<thead>
<tr>
<th>Line / Phase</th>
<th>Opening Date</th>
<th>Length (Km)</th>
<th>Investment (LE billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Line 1 (Helwan-el Marg)</strong></td>
<td>Start operation:1987</td>
<td>44.3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fully operation:1989</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line 2 (Shobra El Kheima - El Mounib)</strong></td>
<td>Start operation:1995</td>
<td>21.6</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Fully operation:2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line 3 (Imbaba - Cairo Airport):</strong></td>
<td></td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td>Phase 1 (Attaba- Abbassia)</td>
<td>2012</td>
<td>4.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Phase 2 (Abbassia- Haroun Station in Heliopolies)</td>
<td>April 2014</td>
<td>7.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Phase 3 (Attaba- Sphinx Square - Imbaba)</td>
<td>October 2015</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Phase 4 (Haroun Station – Cairo Airport)</td>
<td></td>
<td>13.8</td>
<td>12</td>
</tr>
<tr>
<td><strong>Line 4 (October-Oasis Highway - Police Academy)</strong></td>
<td>October 2020</td>
<td>37</td>
<td>10.4 (phase 1)</td>
</tr>
<tr>
<td>Development of Lines 1 &amp; 2</td>
<td></td>
<td></td>
<td>2.7</td>
</tr>
</tbody>
</table>

- Financing firms include EIB, AFD, JICA, EC, etc. in addition to the Egyptian Government.
Cairo Metro
Socioeconomic and Environmental Impacts

- Performed studies to assess the socioeconomic and environmental impacts of Cairo metro reveals several positive impacts which include:
  - The generation of more economic returns or value added as a result of reduction of surface trips of different modes of transport, improvements in traffic jams and congestions, etc.
  - The creation of more jobs. As an example, 3500 people worked in the first phase of line 3.
  - The improvements of life style of communities around metro lines,
  - The development of the national industry and the leverage of its efficiency and competitiveness,
  - Renewing all public utilities networks surrounding metro lines areas,
  - Fuel saving and reduction of pollutants emissions,
Cairo Metro
Barriers and Challenges

- Huge capital investment needed,
- The economic, social and environmental negative impacts occurred during construction,
- Need for qualified personnel and the acquisition of most up to date technologies and knowhow necessary for the construction and the operation of metro lines, etc.
Conclusions

- The transport sector plays a vital role in achieving economic and social development in Egypt. However, it is one of the main energy consuming sectors and pollutants emitters.

- The high growth of population and travel demand for both passengers and freight transport in addition to the existence of significant number of old vehicles and poor and inconvenient public transport systems resulted in transport sector sever problems that include traffic jams, commuting time increase, inefficient fuel consumption, more pollutants emission, high rate of accidents, etc.

- Unless effective energy efficiency and policy reforms measures have to be taken, that situation is expected to get worsen.

- The government of Egypt started since few decades taking the necessary energy efficiency and air quality improvements policy reforms that include the development of public transport systems such as Cairo Metro, the utilization of CNG as a fuel for vehicles, scrapping of old vehicles OVSRP, etc.

- The implementation of the previous mentioned programs and policy reforms resulted in considerable **energy savings and pollutants emission reduction** in addition to positive economic and social benefits gain.
Conclusions

- The success of implementing the previous mentioned programs and projects could be attributed to the following main drivers:
  - Their design and set up as a PPP and the success in building up strong and effective partnership among different stakeholders.
  - The provision of cost effective financial mechanisms and economic incentives packages that helped overcome high upfront investment cost barriers.
  - Maintaining a degree of flexibility that allow for periodical changes to be made on programs implementation procedures.
  - Carful programs planning and close monitoring which proves to be essential for ensuring better coordination among different stakeholders.

- The implementation of such programs and projects helped not only proving their success, raising interest and confidence for implementing further similar projects but also the need for **getting the necessary political support** for their implementation.

- In spite of the success that has been achieved for such projects and programs, several **challenges and barriers** exist that might negatively affect its effectiveness and possible sustainability and replications in the future.

- **Lessons learned** from programs implementation proved good potential for its replication in countries with similar transport system and economic characteristics as the case of Egypt.
Recommendations

**Importance to:**

- Create positive incentives on the whole value chain of similar programs in order to encourage behavioral changes towards Energy Efficiency (EE) improvements in the transport sector and attract the necessary investments for their materialization,

- Have a strong and solid cooperation among different stakeholders.

- Have a strong political support combined with remarkable success of implementing similar EE programs and projects.

- Perform pilot projects to allow better understanding and appropriate design of EE programs, assist information and outreach to be targeted and build up the necessary and effective partnership for its execution.

- Have a well defined scope and effective approach for EE programs implementation in order to get their components carefully worked out.

- Perform and conduct awareness campaigns.
Thank for Your Attention

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