



חברת החשמל  
Israel Electric

# Methanol – Gaining Twice: Improving Both the Quality of Air as well as Providing a Reliable Electricity Supply

The houses of the city of Eilat and the clear blue waters of the Red Sea reveal themselves towards the end of the long Arava highway. The bay of Eilat is spread out before you in full splendor and your heart bursts. In this southern city, an exciting daily routine takes place, requiring a strong and robust electricity infrastructure. According to the Israel Electric Corporation [IEC], the average demand for electricity of an Eilat residence is 18% higher than that of a residence in the rest of the country. This is a considerable gap. In the small power station located near the city, one small industrial gas turbine and two diesel-fueled turbo-jet gas turbines generate electricity. The conversion of the power station to generation by methanol will contribute significantly to the improvement of Eilat's air quality and will maintain the reliability of the electricity supply to the city.

In 1965, IEC constructed a power station with an installed capacity of 6 MW in Eilat together with the first desalination plant of this type built in Israel. This power station operated for about 15 years, and was shut down in 1980. At the same time, due to Eilat's fast rate of development, gas turbine power stations and switching stations were built to improve the reliability of the electricity supply both to the city's residents and those of the Arava. In its early years, Eilat was an "electricity island" and it was only in the 1960s that the city was connected to the national electricity grid by the 110 KW high-voltage line. The peak local consumption in that period reached 5-6 MW. Presently, the generation capacity of the Eilat gas turbine power station stands at approximately 100 MW [a 16-fold increase in less than five decades].

Today, electricity to Eilat is supplied via two external high-voltage electricity lines from the center of the country. Due to Eilat's accelerated development in the last years, it has become ever more difficult for these lines to provide for the increasing demand. In order to meet the quality indexes and reliable electricity supply to which IEC has committed itself, the generation system and electricity supply to the city must be upgraded. To meet these requirements, the Company has been promoting the construction of an additional high-voltage line to reinforce and increase the transmission capacity to the city from the national grid. Erecting the line involves burying it in the Ramon Crater and this work will only be completed in 2016. Until then, the Company is forced to operate the turbo-jet/industrial gas turbines near the city during peak hours. Diesel oil is considered a relatively clean environmentally-friendly fuel compared to heavy fuel-oil and coal, but still pollutes more than natural gas. The Ministry of Environmental Protection understands the need for a reliable electricity supply to the city, especially due to the prevailing severe weather and the scope of the tourism trade. As a result, the Ministry has made an exception and permitted the operation of the diesel-fueled gas turbines, located in the desert areas near the city, for short periods, but for no more than 300 hours per year – a total that does not meet the demand. This authorization was granted to IEC by the Ministry of Environmental Protection even though the emissions of the diesel-fueled gas turbines are higher than those permitted in the regulations and may affect the air quality of the residents. As a consequence, the Ministry of Environmental Protection and its Minister supports the methanol-fueled operation of the Eilat gas turbines.

**Yaacov [Yasha] Hain, IEC's Deputy President and CEO**, who is leading the project, explains that the Ministry of Environmental Protection, aware of the environmental advantages in burning methanol, will permit gas turbine operation for longer periods of time, up to 2,000 hours a year – almost seven times more than permitted today, with diesel-fueled electricity generation.

## The Joint Initiative between IEC and Dor Chemicals

Dor Chemicals, the sole importer of methanol to Israel, began promoting the construction of a 500,000 tons-per-year methanol plant in Israel. As a result, explains Hain, IEC decided, as part of its environmental research and development activity in its Strategic Plan for Sustainable Development, to look into the implementation of methanol as an alternative to diesel to fuel the turbo-jet gas turbines, due to it being a significant emission-reducing fuel, and thus contributing to the improvement of the environment. These benefits must also be added to the fact that the cost of methanol per energy unit is somewhat lower than diesel.

**Mordechai [Modi] Reshef**, the Northern Region Gas Turbines engineer responsible for the operation of the diesel-fueled turbo-jet gas power stations was appointed to head the project. Dr. Moshe Keren, Deputy Department Manager of the Business Development Unit in the IEC Engineering Projects Division was appointed to assess the initiative aspect and the economic viability of the project.

The methanol initiative was established to study the implementation of methanol over varying periods of time. In the short term, the possibility of replacing diesel, as in the case of Eilat, where methanol is planned to be used until completion of the high-voltage power line work to improve the electricity supply capacity; in the long term, the possibility of exporting technology to convert diesel-fueled gas turbine power stations to methanol-fueled power stations.

## Methanol – A Fuel with Advantages

### Economic Advantages

Methanol is a synthetic alcohol and not a mined mineral. Therefore, it is clean from foreign materials and can be considered a noble fuel. "As for its market price", explains Dr. Keren, "methanol can be regarded as a commodity [its price is determined in the futures stock exchanges]". Methanol's world price is not influenced by fluctuations in the oil price. Methanol can be produced from a number of raw materials, such as: coal, natural gas, RDF, and oil distillates. Its price tends to be stable and should there be an increase in the tariff of one of the raw materials used to produce it, its variety of sources enables producers to use an alternative cheaper raw material, and thus minimizes the effect of the price increase. Lately, due to the increase of methanol production in China, its price has fallen and it is lower than diesel. This fact makes the use of methanol viable compared

to diesel, considering that double the quantity of methanol compared with diesel is required to produce the same caloric value.

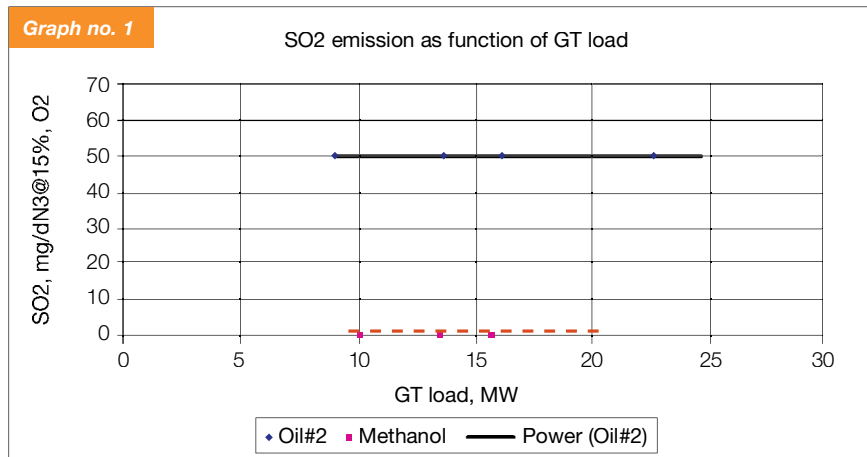
### Conveying Advantages

The conducting of natural gas to the power stations is by pipelines, but for the conveyance to be worthwhile, the quantity of natural gas must be large enough to justify the laying of pipelines. Therefore, in places that energy consumption does not justify laying of pipelines, there arises a need for other energy sources. A known alternative to gas piping is the use of Liquefied Natural Gas [LNG]. Converting natural gas to liquid reduces its volume by about 1,000 and enables easier transport. Nevertheless, to liquefy natural gas, there is a need to cool and store it in containers at ultra-low temperatures of minus 160°C. Storing and conducting LNG becomes a special challenge. Methanol provides an effective alternative solution in this aspect as well, as it is a liquid that can be stored and transported at room temperature, i.e. there is no need to cool it to extreme temperatures as is required to convert LNG.



Yaacov [Yasha] Hain, IEC's Deputy President and CEO

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### Environmental Advantages

In the main environmental indexes and according to the Clean-Air Law of 2008, the emission indexes from burning methanol are much better than those from burning diesel. "It is no wonder that the Ministry of Environmental Protection and its Minister support the joint venture between IEC and Dor Chemical", states Engineer Reshef.

Methanol's undisputed advantage is that it does not contain sulfur, so that when burned, there are no sulfur dioxide [SO<sub>2</sub>] emissions, [see graph no. 1]. More important is the fact that methanol combusts at a significantly lower temperature than diesel, resulting in an 80% decrease in nitrogen oxide [NO<sub>x</sub>] emissions [see graph no. 2]. The index for particulates, emitted into the air during the methanol burning process, compared to diesel, is much better and the air-borne particulate quantity is almost nil [see graph no. 3].

These advantages make methanol a very environmentally-friendly fuel as far as air quality is concerned, and places it in very good standing compared to diesel, which in turn was considered a friendly fuel compared with other fuels, such as heavy fuel-oil.

### Occupational Health and Safety above All

This initiative is a first in which methanol is to be used as a raw material for electricity generation. For this reason, the constant emphasis on safety and health regulations in the workplace, customary at the IEC, is doubly important, as Engineer Reshef explains.

According to the law and before the Eilat methanol initiative was decided upon, a risk

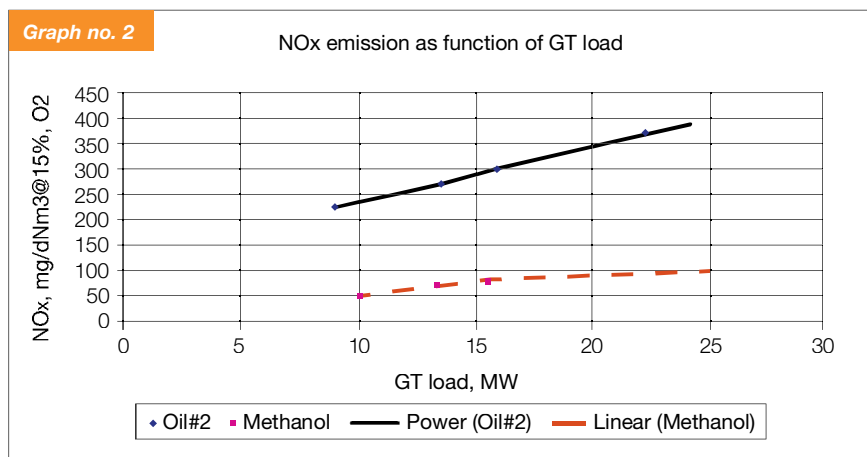
evaluation analysis was executed and risk calculations for the different scenarios were carried out, such as burning of a methanol vessel, the container cracking, and a methanol leak, in various meteorological conditions. The risk circle did not exceed the area of the site in any of these scenarios.

Special safety precautions will be taken when adapting the diesel-storage vessel to methanol [2,000 cubic meter volume]. The dike (spill retainers) around the container will be hermetically sealed to prevent permeation into the ground in the event of leakage. In addition, a special floating ceiling will be installed in the container designated to prevent the evaporation of methanol into the environment. The installed fire-extinguishing equipment will be upgraded so that in the event of fire, a special alcohol-resistant foam will be ejected to blanket and stifle the flames within seconds.

Methanol must be handled skillfully. The drivers of the container trucks, the workers responsible for unloading the methanol at the generation site, and the workers responsible for storage in the location, will all undergo special training to learn how to handle this material and how to behave in an emergency. The fire-extinguishing array on site will be upgraded and exercises will be carried out with the Eilat-Eilat Fire Fighting Regional Association to practice and maintain the expertise and awareness needed.

As the gas turbine site is situated west of Eilat, the container trucks will arrive at the generation site directly from Road 12, without any need to enter the city.

As part of upgrading the electricity generation layout that operates the gas turbines with methanol, a new state-of-the-art control system will be installed at the site. This system



will monitor the methanol-fueled electricity generation process continuously. In case of a fault of any type, the flow of methanol to the turbines will be stopped immediately and if required, fire-extinguishers will be operated automatically.

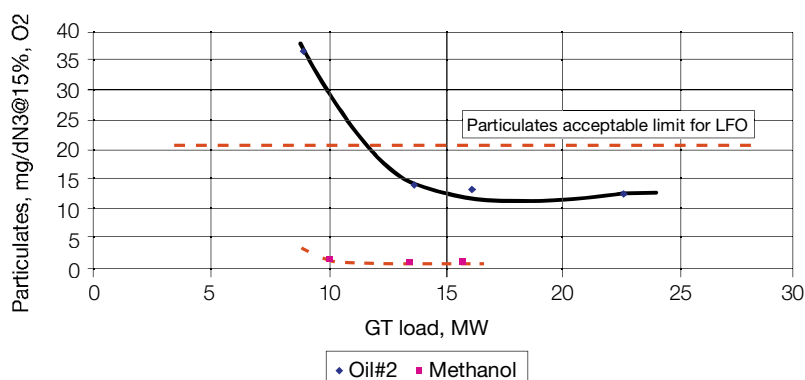
## The Export Potential

It is not always economic to transfer natural gas over long distances and at times, it is also not possible for practical and technical reasons. Therefore, in quite a few electricity-generation facilities throughout the world, in distant or isolated locations [e.g. islands], electricity is generated by fuels such as diesel or heavy fuel-oil. Having heard of the methanol initiative, currently being promoted by IEC and Dor Chemicals and beginning to pave its way throughout the world, many industrial companies the world over are beginning to follow this development closely.

According to Dr. Keren's assessment, the planned conversion technology for the turbo-jet gas turbines is new, but promising, so that the probability of the initiative's success is high. Consequentially, the joint partnership of this project between IEC and Dor Chemicals can become leverage for the initiative and can market the know-how [technical and regulatory] accumulated from conversion of the power stations fueled by diesel or similar fuel to modify them to use environmentally-friendly methanol as a fuel. This contributes to the importance of the initiative and transforms it into a stepping stone for the establishment of a leading novel technology.

Graph no. 3

Particulates emission as function of GT load



## Opening the Doors to Visitors

Due to the world's interest in the methanol initiative, delegations from all over the globe are expected to arrive in Eilat in the near future to study the initiative and its business potential. During the Eilat-Eilat Conference, and also following it, the participants and representatives of other businesses can visit the site located in Eilat and be suitably impressed.

In the future, after the completion of the methanol generation facility and its production from local natural gas, it may also become a source of Israeli export.

**Visits may be coordinated with Engineer Reshef, the Project Manager: 972-57-7625878.**



Methanol connection

## IEC Policy for Environmental Protection\*

- Integrating environmental considerations in all company activities and decision-making.
- Designing and operating facilities with emphasis on continuous reduction of environmental impact, taking into account principles of sustainability, while adopting the best proven and economic technologies.
- Adopting advanced proven technological covenants/agreements, even when laws and regulations do not exist.
- Intelligent use of raw materials and natural resources: land, air, water, and fuels.
- Reducing and recycling of garbage and by-products.
- Integrating landscaping considerations, both spatial and environmental, in planning new facilities and maintenance of existing plants.
- Maintaining an open and transparent dialog with the public, regarding plans with an environmental impact.
- Reducing greenhouse gases, in the spirit of international treaties in which Israel plays a part, by increasing efficiency of power stations, increasing fuels and environmentally-friendly energy sources, and encouraging electricity saving.
- Joint activity with environmental groups (state, public, international) including participating in environmental studies, developing and promoting advanced technologies.
- Implementing environmental values in the organization's culture, increasing environmental awareness and commitment by company workers, and integrating environmental issues in community activity.

\* IEC Environmental Report for 2011; July 2012; p. 7.