

IEA-Advanced Motor Fuels ANNUAL REPORT 2015



ISRAEL

Israel

Introduction

Until recently, Israel was an energy-poor country that relied almost entirely on imports of primary energy commodities. Despite discoveries of natural gas from off-shore fields, the main challenge associated with decreasing dependency on oil imports remains how to implement alternative fuels in the transportation sector.

In 2015, the consumption of fuels for transportation in Israel had grown at 8% in comparison to 2014, with consumption reaching approximately 2.8 million tons of gasoline and a similar amount of diesel. Table 1 presents details on the vehicle fleet in Israel in 2015.

Table 1 Fuel and Vehicle Use in Israel in 2015

Parameter	Gasoline	Diesel					Jet Fuel
Type of Vehicle	Mainly Private Vehicles	Light-duty Trucks	Medium- and Heavy-duty Trucks	Buses	Private Vehicles, Minibuses, Taxis, and Other	Trains	Jet Planes
No. of vehicles	2,500,000	245,000	82,000	18,000	100,000	Not specified	Not specified
Current usage of fuel (%)	43	14.0	11	6.6	9.4	1	15

Policies and Legislation

The Fuel Choices Initiative, approved by the Cabinet of the Government of Israel in January 2013, is a 10-year Government program managed under the Prime Minister's Office. The program is dedicated to reducing the world's dependency on oil for transport and supporting alternative fuels in transportation. The Israeli Government's objective is to turn the country into a center of knowledge and industry of alternative fuel technologies by supporting the development and implementation of the next generation of alternative technologies. This program is being implemented with the cooperation of several vehicle manufacturers that support the increased use of alternative fuel technologies in the transportation sector in Israel.

The Fuel Choices Initiative encourages lowering dependence on crude oil for transportation for energy security, economic, and environmental reasons. It sets ambitious targets for Israel: cut the use of oil for transportation by 30% by 2020 and by 60% by 2025, as compared with currently projected

“business as usual” oil consumption. The targets are based on a bottom-up analysis of the various Israeli transportation market sectors, under the assumption that any solution must be economically viable for the end user as well as the economy.

The alternative fuels being promoted are compressed natural gas (CNG, mainly for heavy-duty trucks and buses), methanol blends (for cars, starting with a 15% blend and advancing later to higher blends), and electric mobility (mainly for buses, mass transit solutions, and dedicated fleet solutions). The Fuel Choices Initiative also aims to implement projects, in the longer term, that use biofuels from second- and third-generation nonedible crops (developed in Israel), and a process of waste-to-energy conversion.

More information about this program can be found at <http://www.fuelchoicesinitiative.com/>.

Activities pursued by the Israeli Government for the local market include the following:

- Establish regulations for new type of fuels (E10, M15).
- Establish pilot projects for methanol (in cooperation with Fiat Chrysler Automobiles [FCA]), Pilot E-Bus, and Super-capacitor based Electric Urban Public Transportation.
- Implement Green Tax 3. (As a supportive policy to integrate alternative fuels, Israel has formulated a tax policy called “Green Tax 3” that taxes fuels according to their environmental externalities.)
- Switch major users to alternative fuels.
- Enact regulations to subsidize the purchase of transport vehicles using natural gas as a motor fuel.
- Establish grants and a safety net for the construction of CNG fuelling stations.
- Set up joint projects with municipalities.
- Conduct workshops and conferences.
- Support other types of transportation. (The Ministry of Transportation in Israel initiated a plan to reduce private transport by 20% by 2030 with respect to business as usual and trends as of 2015. As part of making public transport more efficient, currently in Israel, a transport information system is deployed that provides an efficient bus-customer relationship.

Implementation: Use of Advanced Motor Fuels

Main achievements thus far:

Four research centers:

- Solar Fuels I-Core. Challenge: Generate clean, efficient energy from renewable sources (<http://www.i-core.org.il/Alternative-Energy-Sources>).
- Israel National Research Center for Electrochemical Propulsion (INREP). Challenge: Improve energy storage and integration into mobility platforms (<http://www.inrep.co.il/>).
- Agro - Energy Research (Vulcani Center). Challenge: Generate clean, efficient energy from renewable sources.
- Institute for Innovation in Transportation.
 - ✓ National center together with Tel Aviv University.
 - ✓ Multidisciplinary.
 - ✓ Research agreements with international institutes (Massachusetts Institute of Technology [MIT] Media lab and others).
 - ✓ Partnership with industry.
 - ✓ Accelerator for pre-seed ideas.
- Research grants (involving a total of 190 groups of researchers).
- \$100 million Co-Invest Fund.
- 21 pilot projects — Ministry of Energy demonstration funds.
- Ecomotion Community. The Community is focused on innovative smart transportation technology and is made up of 2,000 entrepreneurs and more than 250 startups (a list of the startups can be found at http://www.fuelchoicesinitiative.com/files/PDF/Companies_Directory_Fuel_Choices_Initiative_A4.pdf).

Natural Gas and Synthetic Fuels for the Domestic Market

Recent findings on off-shore natural gas fields are turning Israel into a leading regional energy supplier. In order to fulfill the economic and energetic potential of its natural gas resources, the Israeli Government is building a long-term strategy and policies for increasing the use of gas in Israel.

One of the main targets of the Government is increasing the use of natural gas and natural-gas-based synthetic fuels in the Israeli transportation sector. This target, backed by Government policies and regulations, is expected to generate significant investments and vibrant business activity in the growing local market. Companies and investors that will enter this new and innovative alternative energy sector will also lead in the growing global natural gas sector.

The Ministry of Energy and Water Resources acts to implement fuels based on natural gas — namely, CNG, gas-to liquid (GTL, drop-in) fuels, and methanol. The Ministry conducts well-to-wheel (WTW) projects and is involved in all technical, regulatory, and economic aspects. The task is supported by a number of pilot and demonstration projects in this field and by a techno-economical study of these fuels and their relevance to the Israeli market. The extensive analysis has considered all relevant segments of the supply chain, including the production, transportation, and consumption of the fuels by end users, as well as the required infrastructure. An executive summary of the analysis can be found at <http://energy.gov.il/Subjects/EGOilReplacement/Documents/ORcng.pdf>.

CNG

The regulatory status of CNG is relatively established. The Israeli mandatory requirements (IMRs) for motor vehicles are compatible with the European requirements, regulations, and documentation as specified in the European Community Whole Vehicle Type Approval (ECWVTA) certificate. These requirements can be found at http://he.mot.gov.il/index.php?option=com_content&view=category&id=183&Itemid=358.

Other mandatory requirements, laws, and standards for natural gas and CNG can be uploaded from the website of the Ministry of National Infrastructure, Energy and Water Resources at <http://energy.gov.il/English/Subjects/Natural%20Gas/Pages/GxmsMniNGLobby.aspx>:

- The Gas (Safety and Licensing) Law, 5749-1989
- The Natural Gas Sector Law, 5762-2002
- Industrial Gas Installation Directive – Natural Gas Authority (NGA)
- Compressed Natural Gas Directive – NGA

The following standards can be purchased from the website of the Standards Institution of Israel (SII) at www.sii.org.il:

- Automotive natural gas: SI 6119
- CNG fuelling stations for vehicles: SI 6236

Methanol

Methanol, a fuel that could be produced from a variety of feedstocks, is already used in different percentages in China. Both the United States and Australia are currently looking into methanol as an automotive fuel, because it can be produced from low-cost natural gas.

Israel began looking into methanol as a strategic transportation fuel due to the fact that it can be produced from domestic natural gas and has significant

economic viability. In addition, an economic study carried out under the Ministry of Energy, Water and Resources shows high economic feasibility in high methanol percentages. Therefore, a part of Israel's strategic plan is to implement a fuel with high methanol percentages in dedicated flex fuel vehicles (FFVs) into the Israeli market.

During 2012–2015, the Government of Israel supported and closely monitored a field trial of M15 (15% methanol and 85% gasoline) in Israel. The field trial included an examination of the fuel and vehicle side (laboratory tests of the fuel stability, engine performance on test-bench, road tests, and vehicle-generated emissions), as well as examination of the infrastructure.

After collecting and analyzing the data from this pilot, it was concluded that although there are very few and small modifications needed, M15 could not be used as a drop-in fuel in all existing gasoline-operated vehicles with no changes or adaptations of the vehicle. As mentioned previously, since there is a clear economic advantage for the consumer at high methanol concentrations, high methanol percentages in FFVs are being targeted.

FCA car manufacturers showed interest in the results of the pilot. However, they stated that targeting FFVs directly is a high risk for them in terms of technological risk management, and indicated the necessity of M15 as an intermediate step.

Accordingly, the Ministry of National Infrastructure, Energy and Water Resources, is supporting another pilot project “Adaption of FCA Vehicles to Run on Methanol Blends.” The main product of the study will be a detailed report describing the changes that have to be made to the vehicles, if any, in order to authorize them for M15 according to FCA standards. This milestone is the first in a series of milestones that would lead FCA in the development of cars using a high percentage of methanol, in accordance with the vision outlined by the Fuel Choices Initiative under the Prime Minister’s office.

To realize this task, the Government initiated the creation of a national standard for M15 fuel — automotive gasoline: a methanol-gasoline (petrol) fuel blend composed of 85% unleaded gasoline (petrol) and 15% methanol (M15).

GTL Fuels

Since 2012, the Ministry has studied the potential benefits of developing GTL plants in Israel for producing liquid synthetic fuels (gasoline and diesel) from natural gas.

The main strengths of GTL are as follows:

- Energy security and diversity. GTL makes up the highest percentage of oil substitutes. The ability to rely on self-produced fuels greatly diminishes the risk and dependencies associated with relying on imported oil.
- Use of existing infrastructure. The fuel can be used without requiring any modifications to existing infrastructure, vehicles, or driving habits.
- Other uses. The GTL process allows the production of various distillates, such as kerosene and petrochemical products, that hedge demand risks.
- Export potential. An increasing demand in Europe and elsewhere may result in export markets for hedging local demand.
- Economics. The techno-economic analysis has shown that the economic viability of developing a GTL plant is highly attractive, especially if the plant is configured such that it can be integrated with existing refineries. Capital costs are estimated to range from \$60,000 to \$100,000 US per barrel of daily production, depending on plant configuration, with the higher estimated cost reflecting the expense of a stand-alone facility.

In June 2014, The Ministry of National Infrastructure, Energy and Water Resources of Israel published an invitation to submit standpoints, information, and expressions of interest regarding the possibility of building and operating a GTL (natural gas to liquid fuels) facility in Israel. Only a few technology owners and engineering companies responded to this Request for Information (RFI); the Israeli Government is currently considering its next steps, perhaps through a pre-feasibility study for specific technologies in specific locations.

Electric Vehicle and Energy Storage Cluster

The electric vehicle (EV) and Energy Storage Cluster emerged from decades of academic and applied research in the fields of electrochemistry and electric engineering; from the development and production of special energy applications for use in the defense and biomedical sectors; from world-class, innovative information and communication technology industries; and from a local business culture that supports entrepreneurship and innovation.

Israel has pioneering startup and technological companies that have entered the world of EVs and energy storage, offering innovative solutions and products for transforming electric transportation into an economically and technologically viable alternative. Companies in the cluster develop and produce improved batteries; new types of fuel cells, super-capacitors and

metal-air batteries; grid and battery management systems; EV infrastructure solutions; and managed EV charging systems.

The Israeli Government has taken steps to incentivize a local market for implementing EV technologies and infrastructures and is offering large tax benefits and regulatory support. The Israeli business environment for EV technologies and infrastructures and the Government incentives are creating a local ecosystem that supports the expansion of companies into global markets.

Engines, Composite Materials, and Other Technologies

Thanks to advanced academic and applied research and defense-related developments in diverse technological fields and also to the local entrepreneurial spirit, many Israeli companies and startups are providing various solutions to help vehicles reduce oil consumption. Creative companies are developing new engines; efficient power train technologies; and new, composite light materials.

Biofuels and Energy Agriculture Cluster

The Biofuels and Energy Agriculture cluster emerged from decades of academic and applied research in the fields of biotech, agriculture, and chemistry; from world leading agro-tech and agro-industry; and from advanced biotech industries.

Israeli startups and technology companies are at the forefront of biofuel and agricultural research and development and are considered world leaders on multiple fronts. New types of fuel and biomass crops, as well as algae technologies, are being developed; better methods for breeding, cultivating, and irrigating energy crops are positioning energy production at the forefront of the next generation of agriculture; and innovative processes and catalysts for converting feedstock and waste into fuels are about to change the economics of biofuels.

Leading Israeli agricultural companies are starting to work on global agricultural projects, introducing their knowledge and experience and improving crop yields. Because of its small size, the local Israeli market is focusing on promoting second- and third-generation locally produced biofuels, and through that effort, giving its companies and investors a global competitive edge.

Outlook

Figure 1 shows where the market is expected to go.

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currently projected business as usual oil consumption. The targets are based on a bottom-up analysis of the various Israeli transportation market sectors, under the assumption that any solution must be economically viable for the end user as well as the economy.

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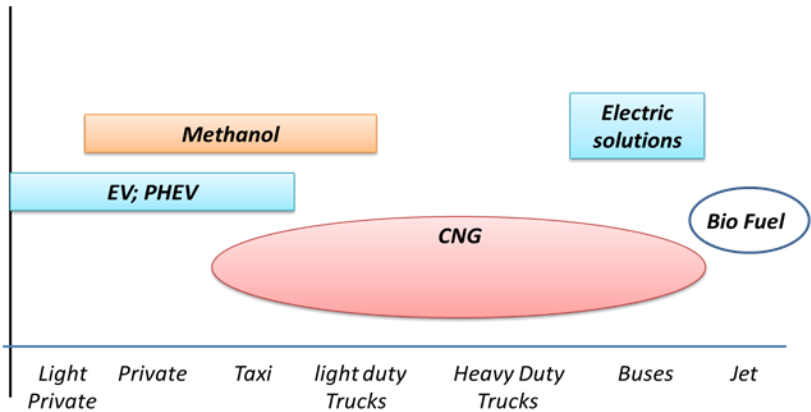


Fig. 1 Market Trends for Advanced Motor Fuels in Israel

AMF TCP Success Stories

Participation in the AMF TCP has given Israel greater access to the most relevant and up-to-date information and research on alternatives to traditional transport fuels. Leveraging this international expertise has helped Israel build its national research capabilities in support of its current and projected strategies.