

April 6, 2011

To: Professor Ruth Arnon, President, Israel Academy of Sciences

From: Amos Nur, Chairman; Marlan Downey, Martin Landro, Harold Vinegar,
The Israel Academy of Sciences and Humanities Special Committee

**Re: Report on an academic infrastructure for the Mediterranean EEZ and oil
and gas related research and education in Israel**

Introduction

1. The Committee's Mandate

Following the letter from the President of the Israel Academy of Sciences and Humanities (below), the committee met in Jerusalem March 29 - April 1. It first invited a number of stakeholders – from the Hebrew University in Jerusalem, University of Haifa, Ben-Gurion University of the Negev, the Israel Geological Survey, Tel Aviv University, the Oil Commissioner, and Technion to a) understand the current teaching and research activities that are relevant to the EEZ and oil and gas in Israel; and b) understand their respective plans and proposals for the future. We evaluated their inputs relevant to the three points listed in the letter from the President of the IAS and decided on a list of recommendations.

2. Letter from the President of the IAS

Dear Prof. Nur,

I hereby appoint you to head The Israel Academy of Sciences and Humanities Special Committee on establishing an academic infrastructure for Mediterranean EEZ and oil and gas related research and education. The other members of the Committee are: Prof. Marlan Downey, Prof. Martin Landrø and Dr. Harold Vinegar.

The objectives of this Committee are to evaluate the existing academic infrastructure in Israel and its potential needs, and to recommend courses of action on the national level in regard to the following subjects:

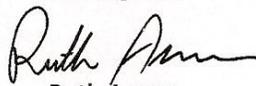
1. The extent of recruitment and areas of expertise of new faculty members, to be enlisted by the various academic institutions of Israel, in these particular fields.
2. Research infrastructure to be established and enhanced in the academic institutions of Israel, to facilitate state of the art research.
3. Practical mechanisms of academic-industrial-governmental cooperative operation.

The Academy will request every academic institution in Israel to assist you fully in fulfilling these tasks.

I would greatly appreciate it if at the end of your discussions you will provide us with a report and recommendations, and I look forward to meeting you during your stay in Jerusalem.

Many thanks in advance for your kind assistance.

Best regards,


Ruth Arnon

3. History: 30-Year Decline

Oil and gas exploration in Israel was started in the 1940's during the British mandate. When the State of Israel was formed and the British left, Israel formed a set of national oil companies (e.g. the Israel National Oil Co. in 1958) which were state-run until they became private in 1985. During this time there were 410 wells drilled, consisting of 288 wildcats and 122 development wells, almost all onshore. A total of three small oil fields and five gas fields were discovered in Israel with a total of 70 million barrels of oil equivalent. Today oil production from those fields is less than 100 bbls/day, while Israel imports about 270,000 bbls/day.

The disappointing record of onshore exploration led to the privatization of the national oil companies in 1985 and a dramatic decrease in exploration activity.

Over the next twenty five years Israel experienced a steady decline in experienced oil and gas professionals as they retired and were not replaced. The oil and gas infrastructure was also not maintained: today there are only fifty-year old drilling rigs, a single wireline logging truck with 1980-era equipment, no active core and fluids analysis laboratories, etc. Because of geopolitical reasons, no major oil or oil service companies were active in Israel, which has seriously delayed oil exploration in the country.

As oil industry jobs were not available, academic interest in petroleum engineering and petroleum geology declined as well. Today there are very few academic faculty in Israel with any oil and gas experience. None of the Israeli universities offers a graduate degree in oil and gas related areas.

4. Gas and Oil Potential in Israel

As it turns out now, Israel has major gas and oil potential in two geographic locations:

- 1) Offshore Israel where there are major gas finds in Tamar and Leviathan totaling 25 TCF. There is some evidence of offshore Israel having light oil resources as well, suggesting that wells to be drilled in the next few years may result in oil discoveries. This will require deeper offshore drilling.
- 2) Onshore Israel, where the Cretaceous source rocks have not matured, Israel has enormous in situ oil shale potential, with over 250 billion barrels in-place resource. Israel's in situ oil shale quality and quantity is one of the best in the world.

There is potential synergy between Israel's offshore gas and its onshore oil shale, because natural gas is the best heating source needed for shale oil production. Stranded offshore gas, uneconomical to produce by itself, may become economic when used for conversion to shale oil. The two industries could be co-developed to make Israel completely self-dependent on both gas and oil.

The large oil and gas potential of Israel will provide long term support for many decades of oil and gas industry and academia in Israel.

5. Current Status of Technology

Israel's technical competence in petroleum technology is thirty years out-of-date in university and government groups. Regarding the offshore resources, the committee determined that none of the groups interviewed has a sufficiently up-to-date understanding of oil and gas exploration models. Israel is much too dependent on foreign industry consultants and doesn't have sufficient internal oil and gas expertise to check their work. Noble Energy knows how to find and develop hydrocarbons in Israel, but Israel does not!

Although the Petroleum Commission has access to data from the operators, this data is confidential indefinitely outside the Petroleum Commission, and the Commission appears understaffed to utilize the data itself. For example, no quantitative government estimates of the oil and gas volumes expected from source rocks in the offshore have been made. Consequently, major uncertainties remain as to the source of the discovered gas. Presently, Israel lacks a singular governmental body to receive and analyze confidential data from the operators. This is important to provide the government (and the nation) with a rigorous understanding of the future oil and gas potential and environmental and engineering risks associated with production.

6. Needs and Gaps

The committee feels that the hydrocarbon energy potential of Israel is much greater than is commonly understood. We therefore consider that the potential of Israel's oil and gas resources is too large and too significant to be managed and reviewed only by external consultants.

Short term:

- Skilled Israeli oil and gas professionals are needed to review and monitor drilling and environmental and safety plans provided by the operators.
- Skilled Israeli oil and gas professionals are needed to oversee, and when needed, manage the offshore current and future discoveries and production. Specifically needed are drilling engineers, reservoir and production engineers, petroleum geologists and geophysicists.
- It is imperative to initiate as soon as possible Israeli academic petroleum education programs to begin to supply a stream of professionals needed within 2-3 years.

Long term:

- Provide continuously updated projections of hydrocarbon energy supply made by petroleum professionals for national planning.
- We recommend establishing a governmental entity to perform long term planning of energy operations in Israel. This could be an arm of the Council of Economic Advisors. It should be staffed by petroleum and other energy professionals.
- We suggest the establishment of at least 2, possibly 3, mutually complementary academic centers of excellence that will provide Israel with world class training, teaching and research in petroleum-related disciplines as detail below.

7. Recommendations

Academic-

Short term

- Establish petroleum programs for graduate and undergraduate students.
- Arrange courses by visiting professionals.
- Send students for advanced graduate training abroad.

Long term

- Establish research programs tailored to Israel's offshore oil and gas exploration and development and marine sciences in general.
- Enhance professional training and research tailored to onshore oil shales.
- Participate in international research projects.

8. Roles of universities to meet the needs

Following our meetings with representatives of the various interested groups, we suggest establishing - in a staged fashion over time – up to 3 **Academic Centers of Excellence:**

- a. Given the importance of the offshore gas discoveries and the size of the area in the eastern Mediterranean that Israel has rights over we recommend the establishment right away of a center comprising Technion and University of Haifa (possibly with the addition of the Institute of Oceanography in Haifa) focusing on petroleum engineering, petroleum geophysics and marine science. The Technion team has provided the committee with a detailed vision and plan for their energy-related teaching and research, and the University of Haifa has already provided 12 faculty positions for their marine science and resources program. Both have complete institutional backing and commitment and have already outlined the ways they will work together as a center. Furthermore most, if not all, developed nations have at least one university-based marine sciences or ocean sciences research and teaching program. The University of Haifa is Israel's only such program (which began to evolve only very recently).

- b. A center comprising BGU, GSI and Hebrew University located on the Beer-Sheva campus focusing on unconventional oil shale and land environmental science. This center should be established once the groups involved have developed the specifics of their planned programs. For example: who will lead this center, what new faculty positions will be required or envisioned, what new courses will be developed, and how the collaboration amongst the partner institutions will be managed.
- c. Consider eventually establishing a center located on the Givat Ram campus comprising Hebrew University, GSI, and BGU focusing on petroleum geology and geochemistry. From the discussions we had with personnel from HU and the GSI it became obvious that although interest exists they do not have a plan as yet, that leadership is not in place as yet, and a definition of what new and innovative research activities they intend to undertake is not defined.

OTHER UNIVERSITIES OR RESEARCH INSTITUTES OR INDIVIDUALS FROM OTHER INSTITUTIONS SHOULD BE ENCOURAGED TO PARTICIPATE.

9. Roles of Government to Meet the Needs

- Approval of the undergraduate study programs by MALAG.
- Funding each center at approximately 4-5 MM\$ per year for a 5-year duration.
- Require that each center form a technical/scientific external review committee consisting of top professionals.
- Explore ways to enhance availability of well and seismic data acquired by the operators to the appropriate research teams.

10. VISION OF THE NEXT 5 YEARS AND BEYOND (SHORT TERM, LONG TERM)

- Provide tax incentives and seed money that encourages development of Israeli petroleum service companies.
- Incentivize all centers to develop high tech exploration and production methods that could be commercialized worldwide.

