



# Israel's Energy Industry Electrifying sustainable energy solutions



Next Generation Oasis



# The Global Energy Challenge

The use of energy has always been key to the development of human society, enabling mankind to control and adapt to its environment for centuries. Throughout history, civilizations have risen and prospered based on their access to energy, and the world, as a whole, has become increasingly dependent on this scarce resource for the essential needs of agriculture, transportation, technology and communications.

Today, however, humanity is faced with a rapidly growing and looming energy challenge. The resource that has proven to be a catalyst for historic global change has also brought with it a range of complications. The rising use of fossil fuels, steady climate change, the dependence on foreign oil, and the risk of reaching peak oil points are only a few amongst the mass of potential issues this energy challenge will present in the coming years. These challenges already impact health, agriculture, the economy and international relations and conflicts.

Humanity will need to utilize all of its creativity and technological innovation to answer these rising energy needs. In turn, this challenge also presents a huge market and business opportunity for those companies that can provide real, relevant and outstanding sustainable energy solutions.

# Sustainable energy industry fast facts:

1

Renewable forms of energy have contributed 14% of the growth in global power generation over the past three years.

2

World primary energy consumption - oil, natural gas, coal, and nuclear energy - fell by 1.1% in 2009, indicating a rise in sustainable energy use.

3

Solar energy demand has grown at about 30% per annum over the past 15 years (hydrocarbon energy demand typically grows between 0-2% per annum).

4

The projected global clean energy investment in 2017 will be \$254.5 billion.

5

Only 1.7% of the world's total energy supply is provided by sustainable sources such as solar, wind, geothermal, etc.

"It is not an exaggeration to say that the future of human prosperity hinges on finding a way of supplying the world's growing energy needs in a way that does not irreparably harm the environment. Until recently, it looked as if we had plenty of time to meet that challenge. No longer."

Organization for Economic Cooperation and Development, International Energy Agency "World Energy Outlook" report 2008



Smart solutions to global challenges



# Creating a "Next Generation Oasis"

What do we imagine when we think of the word "oasis"? Walking, exhausted and thirsty, in a harsh desert and suddenly coming upon a green haven with flowing sweet water. This oasis provides our most basic, most crucial needs; without it, we could not survive.

The "Next Generation Oasis" is the oasis mankind will create to enable humanity to thrive in the wide range of natural geographies and climates. Reaching far beyond past mystical connotations, this oasis represents humanity's advanced abilities to provide sustainable solutions to a variety of environmental challenges.





## A history of turning desert into oasis

Since its foundation in 1948, Israel has placed great emphasis on conserving energy wherever possible, developing innovative, alternative and sustainable solutions to combat the nation's lack of natural resources. Ranging from its decades-long use of solar thermal energy, to its development of unique bio-fuels, the country has consistently turned its natural disadvantages around, achieving great success and demonstrating expertise and knowledge in the field of sustainable energy. Energy sustainability has been a national priority in Israel since day one, and this emphasis has proven itself in one of the world's most emergent and well-crafted energy systems.

The Israeli sustainable energy industry is today considered a global pioneer thanks to breakthrough technological innovations in the fields of solar and geothermal, as well as bio-mass, wind and wave energy.

- Israel serves as the base to over 100 start-ups in the sustainable energy sector.
- Solar water heaters are used in over 90% of Israeli homes.
- Israel houses one of the world's largest solar energy dishes at the Ben-Gurion National Solar Energy Center.
- The Israeli Public Utility Authority and National Infrastructures Ministry have established feed-in tariffs for the development of solar and wind power technology, encouraging major investment and innovation into these fields.
- As of October 2010, a consortium of leading Israeli companies, investors and academic institutions began to develop and operate a brand new technology center for sustainable energy in the south of the country.
- Israel is currently embarking on programs that will enable it to integrate alternative energy systems and implement energy efficiency technologies to meet its climate change challenges.

"20 years ago, when I was a member of the US House of Representatives, I made my first visit to Israel, and I was charmed by your growth in development and application of solar technologies. It seemed to be a step with vision, and it's incredible that it was done by the country to create an infrastructure to enable the private market to concentrate on renewable energy. The know-how accumulated since then in the renewable energy industry is one of the best I know of in the world."

Tom Ridge, 2010, Former U.S. Secretary of Homeland Security and Current CEO of Ridge Global

Research with a vision





# A culture of technology & determination

Energy is not Israel's only scarce resource. Since its inception, the country has faced a variety of difficulties emanating from its limited natural assets and numerous political and geographical challenges. To overcome these hurdles, Israel has always relied on its most valuable asset – the human resource.

Despite its challenges, Israel's innovative population has achieved considerable success due to the emphasis placed on education, academia and technology by the country's government and society. Moreover, Israelis are widely and deservedly perceived as being driven by a creative entrepreneurial spirit. This spirit and the incredible human resource it drives have enabled Israel to develop considerable expertise in the various fields of energy conservation.

Areas of expertise of Israeli companies in the sustainable energy arena include:

- Solar Thermal
- Wind/Turbine
- Photovoltaic Systems
- Energy Crops
- Biomass
- Energy Efficiency

# Israeli energy expertise



With no fossil fuel resources of its own and a desire to limit foreign oil imports, Israel has long worked to harness one of its most abundant resources, the sun, in order to produce electric power. In turn, various Israeli commercial entities have developed innovative uses of photovoltaic solar energy technology. While the technology is still improving, commercial use within the country has already been established, with installation of photovoltaic cells on the rooftops of private homes relatively common.

Additional examples of innovative Israeli products, technologies and efforts in this developing field include:

#### **Unique Reflector Dish Design**

In conjunction with the Ben-Gurion National Solar Energy Center, an Israeli firm has been developing a new system that would make use of a 10 m<sup>2</sup> reflector dish, along with mirrors and lenses, to magnify and focus the rays of the sun. This new development in photovoltaic technology could produce 1,000 times the energy that standard flat panels produce, dropping the cost of solar energy to that of fossil fuels and natural gas.

#### **The Weizmann Institute SolarPower Tower**

The tower, developed by the illustrious academic institution, contains a field of 64 large, multi-faceted mirrors (heliostats) which can track the movement of the sun independently and reflect its light onto selected target areas. It also contains a unique optical reflector through which one megawatt of concentrated sunlight can be beamed down onto a ground target, enabling groundbreaking research and expansion of the photovoltaic technology industry.

#### **Solar-on-Water Power Generation**

An Israeli company has developed a viable alternative to land-based solar technology through the creation of a floating concentrating photovoltaic (F-CPV) system. The system features a modular design that supports power output ranging from several kilowatts to dozens of megawatts, and can dramatically lower the cost of energy production to a level far below national feed-in tariffs.

#### **Photovoltaic Glass Units**

This unique technology, pioneered by an Israeli firm, essentially transforms conventional notions of building integrated photovoltaics by providing effective energy generation and efficiency in modern and adaptable glass designs.

#### **Solar Power Harvesting System**

An Israeli firm has developed a unique and cutting edge distributed solar power harvesting system. The technology, comprised of a power optimizer integrated into each module, a highly reliable DC-AC PV inverter, and a web-based monitoring application, effectively removes known system constraints across the photovoltaic energy space and enables cost-efficient production of clean, grid-ready energy.





Solar thermal technology, the utilization of the sun's energy to actively heat water, capitalizes on the vast power of the sun to provide a new sustainable energy resource. Israel has considerable history and expertise in the field, making use of it for decades following Dr. Zvi Tabor's 1953 prototype of the Israeli solar water heater. Since that time, numerous Israeli innovations have increased solar thermal energy efficiency and made it readily available to the industrial and commercial sectors almost year round, regardless of climate, after only a few hours of sunlight.

Solar Thermal Technology

Examples of Israeli governmental, academic and commercial involvement in this field include:

#### **Forced Circulation Systems & Thermosiphon Solar Heating Technology**

An international, Israeli-based company has developed a flexible set of systems that use electrical pumps, valves, and controllers to circulate water or other heat-transfer fluids. The technology can supply heated water to several large tanks, making it suitable for hotels, swimming pools and other commercial applications. The firm has also developed a streamlined system that uses natural water circulation to provide hot water for domestic locations after only a few hours of sunlight.

#### **Cutting Edge Solar Collectors and Heaters**

These Israeli-designed solar collectors and water heaters make use of novel and innovative materials such as copper and resilient epoxy coating, guaranteeing clean water, long lasting resistance to corrosion and unmatched levels of efficiency.

#### **The Solar-Hybrid Power Generation Unit**

This technology, a product of 20 years of R&D work and cooperation between an Israeli firm and the Weizmann Institute of Science, presents a new optical and mechanical dish concept that delivers heat to a special receiver and generates power through the use of solar base units (100 kWe each); these units can be strung together to create a larger power plant. When the available sunlight is not sufficient, the system can also operate on alternative fuel sources, guaranteeing uninterrupted power supply around the clock.

#### **Modular Solar Power Solutions**

An Israeli company has developed a large-scale solar power system comprised of modular, small-scale base units which can be strung together to form a utility-scale off-grid power plant. The technology includes a solar tower with a field of tracking heliostats that generate 100 kW of electricity and 170 kW of heat each 24 hours a day. Furthermore, it enables each base unit to be located independently, providing great flexibility in finding suitable installation sites, improved reliability and the benefits of scalability.

#### **The Solel Success Story:**

Solel Solar Systems and its \$418 million dollar acquisition by Siemens AG is an impressive Israeli success story. The company's unique technology, which enables the efficient conversion of solar thermal energy into clean electricity, has made the firm a world leader in the field of thermo-solar energy solutions, and its success is highly indicative of Israel's considerable effort and achievement in the field of sustainable energy.



## Energy Crops

Energy crops are purpose grown agricultural products, such as sugar beet, straw, or sugar cane, that are used in biomass fuel production. Through a combination of computational genomics, molecular biology and advanced breeding methods, Israel has become a leader in this field, continuously searching for plant species that can aid or serve in mass bio-fuel production.

Israeli developments in this field include:

### **Oilseed Crop Bio-Diesel**

The Agricultural Research Organization (ARO) has been researching techniques for enhancing the production of bio-diesel from castor beans, which are drought resistant and have high prospects for oil content utilization.

### **Bio-Diesel Enzyme Catalysts**

These particular enzymes, discovered and developed by an Israeli firm, can act as catalysts for reactions between ethanol and methanol, resulting in cheaper and more cost-effective bio-diesel production.

### **Algae Fuel Sources**

An Israeli firm has developed a unique technology for producing bio-diesel and bio-ethanol from algae. Utilizing flue gas from coal burning power stations for algae cultivation, the process allows CO<sub>2</sub> emissions to be reused and filtered to aquaculture pools to nurture algae growth. Instead of being released, the recycled CO<sub>2</sub> allows the algae to produce concentrations of more than a million times its natural concentration in ocean water, maximizing its energy potential.

### **Novel Gene Discovery Platform**

This technological platform provides computational gene and promoter discovery capabilities, as well as model and target plant transformation capabilities, to enable rapid discovery and validation of genes, promoters and molecular markers correlated with energy crop production.

### **Jatropha Oil Cultivation**

An Israeli firm has produced vegetable oil from the vigorous, drought-resistant Jatropha plant as raw material for the synthesis of bio-diesel. The plant, which is inedible by animals or humans, produces oils that can grow on barren, eroded lands, under harsh climatic conditions, making it an ideal source for bio-diesel production.



Biomass is a renewable alternative to fossil fuel that is derived from readily available organic materials such as wood, waste and alcohol fuels. Converted to other usable forms of energy like methane gas, or transportation fuels like ethanol and bio-diesel, these otherwise largely unusable materials can do anything from power homes and industrial facilities to provide fuel for vehicles. The Israeli government and various commercial organizations have taken great steps to expand this burgeoning field, promoting research as well as developing facilities and environmental solutions which make use of the unique resource.

Breakthrough efforts by the Israeli government and commercial sector in the field of bio-mass include:

#### **Solid Waste Biomass Research**

An Israeli company has been exploring the option of using solid waste as a source of energy through biomass solutions. The firm has already designed

special reactors for the production of bio-gases from such material, and has invested considerable resources into achieving efficient conversion of organic waste into other forms of usable energy.

#### **Biomass Steam Production Facility**

In 2006, an international Israeli-based company opened the nation's first biomass steam facility. The facility generates steam for industrial use by burning wood chips from tree trimmings, cutting operation costs by 25% and replacing a system of steam boilers that operated on carbon monoxide-emitting fossil fuels.

#### **Cell Wall Modulation Platform**

This Israeli developed technology, which has evolved from cellulose binding domains (CBDs), uses these and other proteins to accelerate plant growth, improve fiber properties and enhance the digestibility of fibers to release more sugar for ethanol production.



## Energy Efficiency

Due both to the country's reliance on imported fuels, as well as the desire to avoid adverse environmental effects, energy efficiency has long been considered an Israeli national priority. For decades, Israeli governmental, academic and commercial organizations have cooperated to educate the population about energy conservation and produce novel energy solutions in this field, resulting in a wide variety of technologies and innovations geared to improve efficiency in both the domestic and industrial sectors.

Examples of Israeli governmental and commercial involvement in this field include:

### **Voltage Regulation and Control Technology**

This unique technology is geared to maximize energy efficiency, allowing for energy savings and CO<sub>2</sub> reduction in both outdoor and indoor commercial lighting and industrial motor applications.

### **High Intensity Discharge Electronic Ballasts**

This technology, focused on energy-efficient lighting, is not only environmentally friendly, but enables users to cut lighting energy bills by 65%, dramatically lower maintenance costs by up to 50%, and reduce the number of light fixtures needing installation and maintenance.

### **Cutting-Edge Smart Power Grid Systems**

Leveraging high-tech techniques from the IT, communications and power electronic sectors, an Israeli company has developed highly integrated smart grid power systems. The technology, which makes use of pluggable units and web-connected applications, will maximize cost cutting for utilities and customers, and is geared to provide a truly scalable energy control solution.

### **Innovative Smart Grid Data Distribution Technology**

An Israel-based international communications company has further imported smart power grid systems by using broadband connectivity solutions to collect and transfer data from various meters. Such smart grids optimize electrical production, rendering environmentally damaging production at inefficient and "dirty" power plants redundant.

### **Lighting Energy Controller Systems**

This novel technology enables municipalities, corporations and private users to maximize energy efficiency both in indoor and outdoor lighting. By installing the systems next to electric distribution panels, users can control the voltage supplied to lighting currents, operate lights more efficiently, and reduce maintenance and costs.



With winds blowing from the Mediterranean Sea to the vast plateaus of the Arava Desert, Israel is the perfect setting for harnessing the natural power of the wind. Although the country's wind power has yet to reach full capacity, the national government and various commercial entities have made significant gains in the field, developing new technologies and solutions to capitalize on the emerging resource. Moreover, the construction of new wind farms is expected to provide a total of 25% of Israel's sustainable energy by 2020.

Examples of Israeli governmental and commercial involvement in this field include:

#### **Voltage Regulation Solutions Technology**

In response to the country's irregular and largely unpredictable wind speeds, an Israel company has developed this technology to monitor and respond, in real-time, to alterations in rotor shaft rotation speed, assuring stable voltage output even when changes in wind speeds cause the turbine generator's RPMs to fluctuate.

#### **Composite Material Wind Turbines**

These newly designed rotors can be produced from light, flexible and inexpensive cloth sheets made out of composite materials, enabling the reduction of kW installed costs to half and the shortening of return of investment time to 3-4 years.

#### **Breakthrough Wind Turbine Gearbox Designs**

These variable speed turbines, built around a fully-mechanical, variable speed drivetrain, significantly improve power generation efficiency and reliability and reduce the cost of energy by as much as 20%.

#### **Small Wind Turbines for Grid and Off-Grid Locations**

These Israeli-designed small wind turbines, modeled according to aerodynamic principles, provide competitive and cost effective power solutions for numerous off-grid (utility independent) and grid-connected (in parallel to utility power lines) applications. Furthermore, due to its exceptional performance and reliable operation, this technology produces a faster return on investment than other turbine alternatives.

#### **Cutting Edge Wind Tunnel Research**

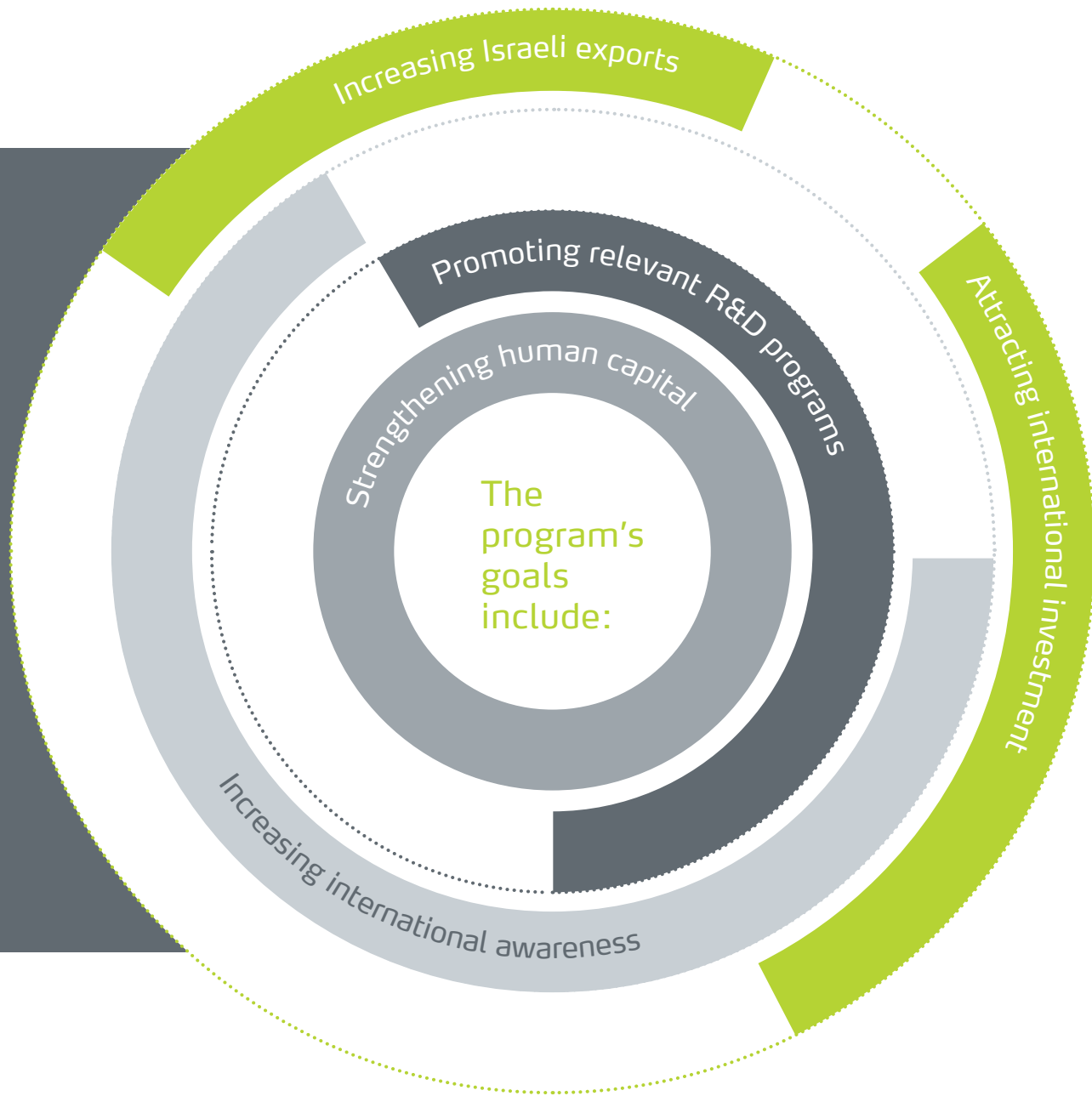
For over two years, the engineering staff of one of Israel's largest aerospace firms has made use of its field expertise and wind tunnel, used to test models of planes and the operation of high-powered engines, to improve wind turbines currently on the market.



Israel NewTech

# Government support for Israel's growing industries

Israeli NewTech was founded on the belief that the Israeli water and sustainable energy sectors have the talent and capability to be strong growth industries for the country, and to play an important part in establishing the "Next Generation Oasis" for the world's rising needs. This pioneering national program is led by the Ministry of Industry, Trade and Labor, and is supported by a number of additional Israeli government agencies. Israel NewTech helps to advance the water and sustainable energy sectors by supporting academia and research, encouraging implementation in the local market, and by helping Israeli companies succeed in the international arena.



Find out how Israel NewTech can help you locate the ideal partner in Israel for your energy needs. Israel NewTech regularly promotes visits to Israel by international companies in the energy industry, and presentations abroad by representatives of Israeli companies, as well as maintains a constant presence in all relevant international conferences and trade shows.

**For more information, including a company directory, please visit our website:**  
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