



Sustainable- Integral Solutions for Energy and Water (With the Use of a Lot of Hot Air)

Written by Prof. Dan Zaslavsky



Horizon Research Publishing, USA

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(With the Use of a Lot of Hot Air)**

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Introduction

This book is the result of learning formally, of doing a lot of research, of trying to apply solutions to the problems of energy, water, and agrotechnical needs. Functioning as a professor in the leading technological institute in Israel and functioning in different tasks such as the chairman of the "Israeli national commission for research and development" and finally asked to advise the ARS the agricultural research service of the US the Netherlands government and more. (see attached brief C.V., page 336). My work led to hundreds of articles in scientific journals, of over 250 reports on different projects. As an example, part III of the book describes the revolutionary technology to produce electricity using hot and dry air (the "Energy Towers") which could supply over 16 times the electricity produced globally and at half the cost or less, the full description around this subject amounts to nearly 30 volumes of reports and early design in several countries. The present book did not mean to bring all the detailed mathematical searches, performance of measurements, material use etc. It does not bring the hundreds of references which are so common in scientific and technological journal publication.

My aim in this book was first of all to draw the full picture of problems involved. One cannot do an effective work to look for solutions without having a wide and far reaching view of the subjects. There are too many controls of authorities completely not balanced with responsibilities. A lot of technical work and scientific spending go on with not enough continuous control or professional checking. The process involved can be compared to the climbing of a tree and deciding where to turn and reach the right leaf. This is a long and complicated path. Too often at the need of coming close to realizing an aim of doing, decision is made without checking carefully all the turns even when the decision is made by professionals. It is far worse when the decision is made by politicians.

Very often, the wrong questions are asked. The decision makers are motivated by egoistic trends not even having the ability to listen and even worse, in not being able to admit a mistake.

I hope the readers will be forgiving for repeating of subjects in the different chapters. The large volume and huge variety of subjects drove me to reemphasize some items. Especially that the many readers will skip parts and will not learn by heart the different sayings.

The Main Parts of the Book

Summary

Part I. Technological dreams around on the "Dead Sea" and where did it lead us to.

Part II. There is a need to come out of the fossil fuel age. However, the reasoning, and path chosen is often wrong.

Part III. Energy Towers - A sustainable solution for energy and water by utilizing hot and dry air without the need for a solar collector.

Part IV. Solving the water problems and interaction with energy supply.

Part V. Epilogue - What have we solved and what we did not.

Table of Content

Title	Page
Summary.....	1
S.1. The Original Aims of Writing this Report	1
S.2. The Dreams about the Dead Sea.....	4
S.3. Have the Dreams been Realized?	6
S.4. So What Has Come Out Instead of the Dreams on the Solar Ponds?	7
S.5. An Approach to Research and Development	9
S.6. What are the Two New Basic Problems That Popped Up in The Energy and Water Fields?	11
S.7. What Are the Presently Available Methods to Replace Fossil Fuels?.....	14
S.8. The Wrong Methods and the Needed Yardsticks	16
S.9. How come photovoltaic's is so heavily subsidized and what should be done to reduce the damages of mismanagement.	18
S.10. The Direct Energy Cost and Indirect Costs on Environmental Damages, Human Health and Strategic Problems Almost Treble the Costs.	18
S.11. The Cost of the Energy Affects a lot of Other Costs.....	18
S.12. Having found such solutions to the energy we would be able to increase the water supply even tenfold and more.....	19
S.13. Having so much water even in the arid areas could we assure the supply of agro-technical products for a much larger population and make it evenly distributed to the different nations?	19
S.14. Where is Our Society Moving to?	19
Key Words	21

Part I. Technological Dreams on the Dead Sea and Where Did It Lead Us to

A Personal Note	24
1.1. Basic Terms and History of the Two Seas Canal	32
1.1.1. How the Two Seas Canal was born? Was it by defining a problem, or was it a prejudice about some possible solutions or some kind of a psychological phenomenon?	32
1.1.2. Possible Targets Mentioned in Relation to the Two Seas Canal, for Better or for Worse	53
1.1.3. Summing Up Past Negations of the Two Seas Canal after thorough Techno-economical Studies	60
1.1.4. The Basic Logics of Solving the Three Major Environmental Problems	71
1.1.5. Is There Any Justification to Continue with the Two Seas Canal? And, Are There Some Targets that are still to be Followed?	72
1.2. The Right Approach Suggested for the Above Specific Aims	73
1.2.1. Water Resources	73
1.2.2. Sources of Energy	77
1.3. Some Alternative Projects	78
1.3.1. A Brief List	78
1.3.2. The Northern Alternative	79
1.3.3. The Southern Alternative	81
1.3.4. Mixing the Ocean Water	81
1.4. Some Finalizing Notes	82
1.5. The Task of the World Bank and Some Israeli Functions	83

Part II. The Need to Come Out of the Fossil Fuel Age

2.1. Introduction	88
2.2. Climatic Changes	95
2.3. Are There Other Reasons to Leave the Fuel Age and What Should Be the Criteria for a New Technology?	105
2.3.1. The Reason We Left the Stone Age	105
2.3.2. The Real Reasons We Should Consider Moving to Renewable Energy Sources and Leave the Fossil Fuel Age	109
2.4. Alternative Ways to Reduce Our Dependence on Fossil Fuel	126
2.4.1. Source Groups	126
2.4.2. Efficient use of Energy	129
2.4.3. The Use of the Fruits of the Sun	133
2.4.4. Other Fruits of the Sun	137
2.4.5. The Use of Solar Radiation for Heat	138
2.4.6. In Summary Up to Here	139
2.4.7. Solar Energy Technology for Massive Supply of Electricity	140
2.4.8. There Is Another Form of Solar Energy for Electricity Called "Solar Chimneys"	143
2.4.9. The Energy Efficiency and Economy of Hydrogen Fuel Cells Remain Unproven as of a Usable Value for Massive Electricity Supply	143
2.4.10. There Are Several Other Sources That Are Not Exactly of the Same Type	144
2.4.11. Conclusion about Replacing the Use of Fossil Fuel	147
2.5. A Copied Appendix Criticizing the IPCC 5 th Report on the Global Warming	148
2.6. Key Findings by Chapter	151

**Part III. Energy Towers - For Producing Electricity and Desalinated
Water without a Solar Collector, by using Hot and Dry Air**

Executive Summary.....	162
3.1. Background.....	172
3.1.1. A Brief History	172
3.1.2. Underlying Principles of "Energy Towers" Technology.....	174
3.1.3. Project Considerations and Review	175
3.1.4. Reviews of the Concept in the Scientific and Technologic Literature.....	184
3.1.5. Some Technical Details	191
3.1.6. The Electricity Costs	206
3.1.7. The Source of Energy and Estimated Potential	210
3.1.8. Pumped Storage and Base Load	223
3.1.9. Different Parts of the System.....	225
3.2. The Economy.....	236
3.3. Fringe Benefits and By-products	241
3.3.1. Pumped Storage.....	241
3.3.2. Replaced Costs and Overall Environmental Contribution.....	242
3.3.3. Desalination.....	242
3.3.4. Prevention of Salinity in Large Irrigation Projects.....	246
3.3.5. Aquaculture	248
3.3.6. Cooling of Thermal Power Units.....	251
3.3.7. Pre-cooling of Compressed Air for Gas Turbines Operation.....	251
3.3.8. More Energy Recovery and Optimization.....	251
3.3.9. Growing Crops to Replace Gasoline and Diesel Fuel for Transportation.....	252
3.3.10. Reduction in Fuel Imports	252
3.3.11. Compliance with Limits for Power Use and Kyoto Protocol	252
3.3.12. Possible Future Environmental Contribution	253
3.3.13. Protection against Price Fluctuations.....	254
3.3.14. Avoiding the Need for Strategic Reserves and Other Strategic Expenses	254
3.3.15. Industry and Export	255
3.3.16. Natural Gas for Transportation.....	255
3.3.17. Cooling of the Globe Beyond Just Reducing the Amount of the Greenhouse Gasses	255
3.3.18. Positive Feedback Increases the Performance of the Energy Towers When the Air Warms Up	255
3.3.19. Technological Improvements to "Energy Towers"	255
3.3.20. Summary of Added Benefits.....	255
3.4. Environmental Problems & Gains	256
3.5. Is There a Need for a Pilot Plant and What is the Design Stage?	259
3.6. Some Organizational Notes	263
3.7. List of Terms.....	263
3.8. List of Figures.....	265
3.9. List of Tables	267

Part IV. Solving the Water Problems and Interaction with Energy Supply

4.1. Introduction and What Is Needed for Sustainable and Cheap Water Supply? 270

 4.1.1. The Necessary Components of Water Supply..... 276

 4.1.2. The Major Components of the Rain 281

 4.1.3. Extra Rain..... 287

4.2. Methods for Sea Water Desalination 290

 4.2.1. Interrelation with Renewable Energy Sources..... 290

 4.2.2. Desalination and "Energy Towers" 294

 4.2.3. A New Revolutionary Desalination Method – "Mabua"..... 296

 4.2.4. Energy Recovery from Desalination..... 298

 4.2.5. Choosing the Spot Where to Desalinate. 298

4.3. Ground Water Pollution 298

 4.3.1. The Basic Problems 298

 4.3.2. Irrigation with Sewage Water - Is It a Worth While Thing to Do? 306

 4.3.3. Reuse of Sewage Water, How Should It Be Done? 308

 4.3.4. The Questions Remaining Are: What is the Cost of Bringing the Sewage
 Water to Drinking Water Quality. Is It at All Practical? 310

 4.3.5. Why the Irrigation with Sewage Water is So Expensive Compared with the
 Desalination and Bringing Them First to Drinking Water Quality? 311

4.4. A Couple of Examples for the Right Type of Projects 314

 4.4.1. A Land Cleaning System 314

 4.4.2. The Northern Alternative for Handling a Combination of Problems all over
 the Country (See Also Part I of this Book.) 316

 4.4.3. Some Projects That Should Be Disallowed 318

Part V. Epilogue - What Have We Solved and What We Didn't

5.1. What are the Real Questions? 320

 5.1.1. In Part II of This Book We Have Tried to Ask the Questions..... 320

 5.1.2. Just as an Illustration, How the Present Approach Is Worse Than Irrelevant 321

 5.1.3. The Use of the Term "Sustainable" Is Not Really Well Defined 323

 5.1.4. Once We Get Rid of the Fossil Fuel Due to the 7-8 Reasons 324

5.2. Energy Sources 324

5.3. What Did We Manage to Achieve in the Field of Water Use..... 327

5.4. What other Basic Supply Actions are Still to be Solved in Order to Widen the Limits
 of the Global Supply Capacity to a Growing Population? 330

5.5. What are the Ultimate Solutions? 332

About the Author 336

Summary

S.1. The Original Aims of Writing this Report

I have been asked by UNESCO to describe a new technology of producing electricity without the need to use fossil fuel. The energy source in this case was hot and dry air supplied down to two arid belts, one north of the equator and one south of it. The supply is by the so called "**Hadley Cell Circulation**". My development was basically a machine to produce a down draft wind by water spray for cooling the dry air. This process is enclosed inside a tall and large diameter vertical constructed shaft. It has been given by us the name "**Energy Towers**". We use the fruits of the solar radiation.

UNESCO has considered it as an important contribution to the human knowledge and has asked me to add it to an existing collection of about 500 titles that they have claimed that they already composed into their important cultural project. At least this is what they have said.

The "Energy Towers" method has been proven to supply electricity at the lowest known cost (2-6.5 cents per kWh) in the widest range of conditions between the best sites to the poorest ones. The lowest level of conditions was arbitrarily fixed by being ready to pay not more than 6.5 cents per kWh with 10% interest rate and certain dimensions (1200x400 meters shaft 80 meters above sea level and 40 kilometers north of the Red Sea near Eilat).

Global mapping has shown that the potential is to supply within these limits over 16 times the present global electricity supply (of the year 2010). About 40 countries have these very useful conditions. Moreover, it has been discovered that the use of the "Energy Tower" itself for producing electricity, there are 13 material, tangible byproducts of a potential added net income of 4-14 cents per kWh. In addition there are about 10 qualitative added values of environmental nature, economical values, strategic values and even cultural values. In the case that the first full scale power station starts working it may have a revolutionary effect not only on the energy and water problems. In all probability it will be a significant weapon to overcome terrorism supported now mainly by Islamic oil merchants. I hope it would lead us into a new age. I have felt that it is of an utmost importance to bring in this story with the widest view and the longest perspective involving the very complex system to take into consideration how come till now we could not manage realizing practically the revolutionary method. I was convinced that the description and explanation of our failures have a very high value, or else we may miss some of the main points.

I have felt that in the process of searching for this solution, extremely important lessons should be learned and can definitely be learned involving

the human society management, good and bad doing as far as research and development are involved as well as the procedure of design and performance of developments.

The very significant meaning is in four terms:

- One is the issue of coming out of the fossil fuel age, not necessarily as a result of the real or not real warming up due to gases like the CO₂ gases or similar ones. The first popular effort is that we should look for a sustainable technology. And sustainable is translated by mistake as renewable. Being from a renewable source is essential, however, certainly this is insufficient.
- The second target is to extend the limits of our global sustainable support in most of the physical meanings of which energy supply is first. But then comes also water supply, last but not least, is the food offer and other agro-technical supplies. It is very doubtful that we shall be able to fulfill this last one in the same proportion as the electric power and water supply. Any act which is undertaken now that would hurt this aim should be avoided.
- The third contribution is in the possibility to overcome some very backward cultural segments of the human society and in our case seeing now an ever increasing huge income and ability to spend a very important cause of happiness, probably by far the most. The human spending is probably the best rough yardstick of our demand from our global service capacity. This idea should have influenced our efforts for changes. It cannot go on to have as the main and even the single aspiration to increase the G.N.P (Gross National Product)
- The most general measures of being sustainable is using a renewable source and at a low enough cost. The most fundamental human aspiration nowadays is to have a high income and to leave longer, and these lead almost by definition to the opposite – to a large spending which by definition increases the demand on our globe, even beyond its capability to renovate. The distribution of the G.N.P. is another very important factor to be more specific. During the last 300 years the human society increased tenfold (from seven hundred millions to seven billions). This means that in the future, if the human society will continue to grow at the same rate, we shall exceed the demand from the globe to provide us with our needs in a sustainable way at the same proportion but in a very inefficient way. We therefore must redefine our ideals. The technical ideas brought here will not necessarily solve this problem. At most it will delay the disaster and give us another couple of hundreds years chance to change some things in our culture and public management.

I have arrived to these solutions described here not just by a chance. Getting disappointed from other attempts, I have analyzed the right principles involved:

- Looking for a renewable source is essential, but definitely not sufficient.
- However, in order to become sustainable it must have a low overall cost, because the cost is the main measure of the environmental load on our globe, being the real necessary spending or just gained funds for the fun to waste money. Another way to demand that is to estimate how much energy has to be spent in order to produce a power station compared with the amount it is anticipated to supply to the human community. Wind turbine, would return the energy that was needed to install them and maintain them, within few months. Photo-voltaic plates would need much longer production period to return the energy that was needed for the installation and maintenance. For a long time such return could hardly ever be achieved.
- The fruits of the sun are intuitively promising, at least part of them, and we have enumerated several of them. However, this rightfully chosen, though somewhat intuitive direction gave birth, among others, to the idea of the "Energy Tower".
- Next, it became obvious to me that one of the major other targets is to use the interaction with the solution of water problems.
- Most important, I did not find a common language with the public administrators and not even with environmental economists. It is important to clarify the obstacles in the human society behavior and the clerical management. We are experiencing decisions by non professional and often dishonest decision persons. The very mechanism of design and performance of technical projects is such that it leads to non- reasonable doings. There is no balance between the authorities and the responsibilities etc. In my experience the highest damages in every measure come from the wrong doings systems.

The rest came out and keeps on leading to more and more advantages. Some very important ones came out the last couple of years and it seems that it is leading to a whole new thinking framework. We have also to have some very important lessons about research and development and avoid in the future some very serious misbehavior in project developments.

There was a wide range of problems to be solved and to use reliable procedures in several disciplines, in order to bring the new technology to the stage where it could be realized in practice. Moreover, it was necessary to demonstrate a high enough level of reliability. The handling of these problems failures and successes can serve as another important part of the lessons of the human knowledge. This will be

described in some of the chapters (mainly Part I, Part III and IV).

However it seems to me that there are several outstanding aspects to be learned from the experience in developing the "Energy Towers". They seem to be almost as important as the new technology itself. Describing interwoven activities over 30 years of work I have been involved in the energy fields and the water fields.

- How does one arrive to such a result?
- What are the real yardsticks to evaluate the alternatives?
- What is the difference between "renewable" and "sustainable" and to what does really a "green" energy means? Are these some new religions or well defined technical criteria? The definition of word "green" is often self-contradicting.
- Why does it take such a long time before anything is done?
- What is the reason, who is to be blamed for an irrational decision making and very bad management?
- What is the rate of success in research and development? Do heavy subsidy and mass production really lead to a better end result?
- Can a small pilot help us? When is it useful and when not?
- What are the other involved aims and how our main target interacts with other existential activities.
- ETC.

S.2. The Dreams about the Dead Sea

There have been, basically, three dreams about the Dead Sea.

- **One dream** was the utilization of salts in the sea for different purposes. This dream has been realized to a great extent by the Israeli "Dead Sea Works" Ltd. producing among others potassium chloride, magnesium, bromide and calcium chloride. There are, however, many serious questions to be answered about the future of this project and the environmental problems involved. The transfer of the Dead Sea works to private ownership actually killed almost any serious research and development and any care about environmental problems and the very future of this industry.
- **The second dream** was to use the head difference between the Mediterranean Sea and The Dead Sea which used to be over 360 meters to produce electricity by hydro-electric water fall to the Dead Sea (which is the lowest lying site on the globe.). – We have waked up from this dream when we have found that the total energy that could be produced did not reach even the increase in demand for electricity In Israel in half a year. It was far too expensive by a factor of nearly 10 and it would have been involved with destructive environmental problems which would be terrible as far as destroying the Dead Sea works of

the first dream. And nobody had any idea of how one can overcome it. Unfortunately this idea of transferring water from the ocean to the Dead sea was never left and despite being found, at least seven or eight times, to be not recommendable, to use a very mild expression. Worse and worse alternatives were brought up and eventually even forgetting what was the aim to start with. From gaining some hydro-power for which we have very attractive alternatives, it became something to "save the Dead Sea" (from what? It is possibly doing just the opposite) and to desalinate water near the Dead Sea coast. In the end it became "the Peace valley" by a leader who looked "like a Pharaoh trying to build himself a pyramid". Now, the latest, someone talks about building a "pilot" to the full scale foolishness, not meeting any of the rules that lead to the idea of using a pilot. The handling of this second dream through all its stages demonstrates very brightly some of the most common errors in managing engineering projects by politicians or by other types. It could serve as a teaching model for it. Is it motivated by ignorance? Is it helped by a corruptive motivation or by inefficient management? I may state that we were sleeping far too long and waked up of our dreams a little too late. However, some are still dreaming or hallucinating or may be putting up their face as if they are dreaming. The dreamers of this subject caused an unbelievable damage in fighting any other solution for the energy and water problems. Every wise initiative in these fields was considered very dangerous enemy to the corrupt or sick dreamers.

- **A third dream**, relatively late one, was to build the so called "**Solar Ponds**" where water solution was layered with heavier solutions at the bottom and density reduces gradually with the elevation. The solar radiation then warms up the whole water profile but solution density gradient prevents an upward heat transmission by convection. Thus, the bottom layer becomes very hot, even boiling. This heat source can be used for different purposes and even to produce electricity. If we could have a way to perform it over the whole surface of the Dead Sea we could have provided nearly one third of the electricity needed in Israel. We have done it both in ponds built on the ground and one pond floating in the middle of the sea. However, the efficiency of solar to electricity was a small fraction of one per cent. With all our efforts we could not do better. The whole thing was very far from economic justification. Moreover, the environmental problem was unsolvable to the point that even the solar pond itself could not have been built and operated without bringing billions of cubic meters of fresh water produced by desalinating ocean water first. However such operation gradually dilutes the heavy salty water. Also, contrary to the second dream this one led, while not fulfilling the hopes in our

dreams, to three extremely attractive alternatives. It is very important to learn how this difference occurs. The three outcomes are the ability to build a power station around geothermal sources; a solar collector of the highest efficiency of 60% and the lowest costs of about 2 cents per kWh heat; and last but not least, the most important outcome, the "Energy Towers" which is the main subject for this book (part III) which led also UNESCO to ask me for writing it. Most of the materials involved have been written long before their suggestion. Unfortunately the cooperation with UNESCO could not have been continued when they were leading to skip most of the main significant messages.

- We have to note that as time passed several other functions were related to the Dead Sea. Among them archeological fascinating material and history which is closely related to the very creative stages of the Jewish and Christian tradition including the famous "Dead Sea Scrolls". In recent years it has been found that the Dead Sea climate, water and mud, have very valuable health treatment values of special sufferings.

S.3. Have the Dreams been Realized?

- The first dream of utilizing industrially the chemicals has been a great success. However, as I have mentioned, since the Dead Sea Works (DSW) was given to private owners, no significant advance was made. Moreover, some great ideas that could have brought many to the DSW and solve some of the main problems and provide new industrial targets– were rejected by the management of the plant, in spite of the favorable opinions of the engineers. The management was led by a very short sighted lust for money. They would not spend for research and development even one part in a thousand of their profit. This can serve as a very significant model of how a rich national credit was turned into a very high profit which in turn was used mainly for short sighted personal financial profits for a very small fraction of the population and thus it is practically gradually wasted and placing a useless load on our globe. This is one of the interesting developments of the human society rules of behavior which at present appreciate and even sanctification almost solely the value of net national global income and eventually a personal one.
- Israel has an outstanding record of using the developed credit for research and development and future creating and further increasing useful credit. Being the chairman of the national commission for research and development and testing 4 major subjects, in all four, Israel has gained over 50 dollars for every dollar invested in research and development. It is unfortunate that in the last couple of decades there is a consistent increase of

private preachment and less and less relative social and cultural progress. Some give it the nickname "piggish capitalism". The chances of making a success in an individual research subject are not much better than 1:10. It is therefore essential that the state would intervene, acting like an Insurance company. The trouble is that the treasury ministry clerks reduced the government funds for research almost to one tenth of what it was before.

- The second dream of using the hydro-electric potential was rejected at least seven times, unanimously, by all experts and each time the name was changed and some politicians and ignorant or corrupt engineers looking for easy profits made worse and worse proposals. The last proposal with the largest number of completely unexplainable elements was to build a "pilot plant" for a canal from the Red Sea to the Dead Sea ("Red Dead canal") and use the head difference in order to desalinate water by a station near the Dead Sea and give it a name the "Peace Valley". It had at least three devastating environmental problems and possibly more; It needs a large power station run by fuel in order to operate the system , and the cost of desalinated water many times more expensive compared with other straight forward and immediately erected methods. The main target changed and claimed is "to save the Dead Sea" and in addition house over three million inhabitants along the "Arava valley" – unbelievable. Why to build a pilot of the project where it has been proved that definitely with no doubt the whole idea is absolutely idiotic and will lead to at least three terrible environmental problems and create product ten times and more too expensive. Despite all that the World Bank took it and it was obvious by just looking on their terms of reference for their work that nothing good would come out of it. And sure enough, their result was the worst ever seen in every possible term.
- The Last Dream of the solar ponds failed but as I said, gave birth to three extremely successful newly born ideas, one of which is the central subject of this report. (In part III)

S.4. So What Has Come Out Instead of the Dreams on the Solar Ponds?

- a. A solar collector for heat of the highest efficiency obtained so far, reaching 60% by "Arel-energy" Ltd. And now "Tigi" Ltd. Tests by two leading institutes in Germany and Switzerland have shown that using these collectors could help saving in Europe about 30% of the fuel use. The developers were led mainly by the need they had for a large volume of hot water for a production process. Being the neighbors of "Ormat" Ltd who worked on the "solar pond", they felt they can do much better. For a much smaller cost. They have arrived at 60% efficiency instead of 16% solar to

heat. At present it is the most efficient solar collector and of a very attractive cost effectiveness ratio and has received a global first price. The estimated cost is about 2 cents per kWh heat supplied. The area needed to produce one million kWh of used heat per year is about 800 square meters. Compared with 12000-17000 for photovoltaic cells and a cost far more than tenfold for solar chimneys producing an upward air flow from a solar collector and motivating turbines. The developers of this new collector demonstrated also the very efficient way to use the high temperature for cooling. I believe also that before long it will be used also for small desalination units by distillation.

- b. The utilization of geothermal sources for electricity was made possible by constructing a steam turbine operated by steam made of some organic liquid that boils at a temperature much lower than 100 centigrade. This was obtained by "Ormat" who was working on the original dream of the "solar ponds". They have already realized power stations of this type around 550 mega-watts. Recently it has been reported that Ormat agreed to further increase this output. The global potential is not exactly known and it is impossible to eliminate the second law of thermodynamics and have a much higher efficiency.
- c. The "Energy Towers" which are the main target of part III of this report and has been considered in UNESCO as an important addition to the human society knowhow was born also as a result of the failure of the solar ponds and after reviewing more and more other methods to supply energy without using fuel and if possible also avoid the need for a solar collector. I was working with "Ormat" on the solar ponds and managed to reduce the necessary investment to about one third of what it has been before I went in. However the fundamental failure of the idea because of the still relatively high cost per effective energy use, led me into a search. An almost straight forward analysis led me to the "Energy Towers" in trying first of all to use the fruits of the sun without a need for a solar collector for electricity; avoiding the cost and the limitations inflicted by the second law of thermodynamics; possibly finding a natural storage like in hydro power; and prove a continuous large scale supply.
- d. However one cannot overlook also some real problems with the Dead Sea and other problems in power supply, water supply, Salinization processes, and deterioration of the Jordan River environment, lowering of the Dead Sea water surface by almost one meter a year, opening of pits or sink holes and structural destructions due to lowering of the drainage level.
- e. I have suggested 4 rational acts to be taken in order to solve these problems

and some more with an extremely attractive economy and no added environmental problems.

- f. Till now it was impossible to get the administration to come up with consistent approach, overall plan and logically sound decisions. It seems that an impossible division of authorities and completely unbalanced responsibility with the authority are some of the main reasons for this condition. Another one is a procedure of decision making that makes it almost impossible, in principle, to come up with logical results. Some of these suggestions will be described in the following. The review of water and energy problems and solutions serve as very meaningful examples. This discussion is at least as important as the water and energy uses themselves

S.5. An Approach to Research and Development

In doing research on the outcome of research and development in Israel I have found several very important conclusions (being the chairman of the Israeli national commission for research and development 2004-2007) which were also proven in viewing the above items.

1. There are Three Main Levels of Research, Very Roughly Defined
 - 1.1. The first one has to do with some learning process, early Measurements of a new nature, and rarely any convincing well documented and application with a high probability to be commercially successful. It is mostly covered by second and third degree academic students. Here are very low chances to get it on if it would depend on high level company managers. Many of the research funds live with the illusion that they devote the funds only to the higher levels and they would grant their funds only if you can make an impression as if you bring in a revolution. However this basic first stage is essential. Without it there will not be created the higher ones.
 - 1.2. The second level has to do already with projects with some more probable chances for commercial benefits. At this level there is also hardly any use in asking for high management administrator's judgment and decision or asking stagnantly educated economists.
 - 1.3. The upper level has to do with some projects of concrete chances for commercial applications. It is mostly covered by commercial companies, not necessarily private ones.
2. A very rough estimate of the size of the investments in the three levels of the R&D is 1/4 in the lowest level, 1/4 in the second level and 1/2 in the upper, third commercial level. Research which I have ordered from the Neman Institute in

the Technion, has shown that in order to compete economically with the OECD countries we would have to invest in research altogether about 4% of the economical activity. This means 1% to the first stage, about another one percent for the second stage and 2% for the third one.

The chance for success in the upper two levels is still very low. It could come down to as little as 1:10 and even 1:20. This means, among others that the government or some contributing funds must get involved in funding the research and development in a large scale. Its weight is like that of the essential need for an insurance company for health or for security. Individuals cannot be ready alone for such events. There are other services that we consider to be the government responsibility if it is to be performed efficiently and sufficiently. There are even some ideas that cannot be sold commercially because of its very wide ranges of contribution where exact boundaries cannot even be defined. The most attractive idea to eliminate all drought effects in the eastern end of the Mediterranean Sea (described in part IV of the book) is an example.

3. However, if we behave reasonably then even research on ideas of the First – lowest level that had no specific commercial targets or those of the second and third level who failed, could be very valuable in the general progress of learning. In fact, without the first level it is very doubtful that anything significant will happen in the upper levels. Still, the overall results are that for every dollar invested in research and development we have earned way over 50 dollars. (Theoretical work by Economists specialized in the field have found profit for every dollar Invested 20-50 times larger gain.) This has been found true in all 4 fields of vital subjects that have been reviewed for our commission following my request. Energy was one of them and so was also water and the profit has been found more than 50 dollars for every dollar invested. However thing occurs only on the average out of many well managed projects.
4. Misconduct and bad management could easily waste huge sums of Money and waste a very long time before renovation would be used. I shall not enumerate here in details all the flaws in this management work.

There are several rules to be watched in order to prevent irrational conductance as in our case in the Dead Sea dreams and in all the other items of trying to solve the energy and water problems. A large part of the book is devoted to warn us from such errors.

1. One thing can be proven mathematically to be a real superstition. That is spending huge sums of money in producing, subsidizing and selling large masses of a useless product and assumes that it will promise any eventual economical success. The very fact that only one out of 20 is successful

means that 19 out of twenty fail despite a high investment. As an example in 2008 photo-voltaic cells for electricity were subsidized globally by 550 billion dollars and this has been going on for over a decade! Still the cost of electricity was 10 fold too expensive compared with other proven alternatives. The method cannot be considered "green" or "sustainable". In mid-2012 the secretary of energy in the US prof. Chue declared that the photovoltaic plates will not become economical unless we find a way to reduce its cost by a factor of 4. This is after two decades of supporting by the fuel companies. In my opinion even this is not sufficient. I am sure that if the huge sums would have been spent on rational and honest research good results could have taken place. The big question in this case is what was really the aim of those that subsidized the Photo-voltaic cells? There is more than suspicion that they really wanted to prevent real progress by buying the scientists and the decision makers.

2. Interestingly, a general design of a project in its first stage cost typically 0.5% of the project cost. The overall detailed design and project inspection comes close to 5% of the project cost. An amazing patronizing of some economists and political decision makers take the authorities of "not allowing the spending for preliminary design unless a positive decision has been taken first to execute the project". There are great similarities between the systematic approach in choosing the research path and do research. Many of the errors we could report on in the following demonstrate it well. Very often having a very attractive path of design would lead us to resolve specific obstacles in the design by doing research. This has characterized many of the problems I had to face- a mixture of design efforts and technical and scientific research. While the dreams about the Dead Sea changed two very dramatic changes occurred in the fields of energy and water. They affected all the efforts our group had to go through. They are described in sections II and IV of this book.

S.6. What are the Two New Basic Problems That Popped Up in The Energy and Water Fields?

The first problem was the global warming issue. Once the Intergovernmental Panel about Climate Change – (IPCC) through the U.N. with some cooperating supporters raised this issue as the most important problem human society is going to face. It is caused, so they insist to say, by people burning fuel and adding carbon dioxide as it is called "a greenhouse gas", into the air. As a backing to their paradigm they have also invented the so called "Kyoto protocol" supposedly to overcome this problem. It is in fact "a permit to sin if you pay for it".

The second problem was the decision of the large oil companies to subsidize very heavily the photo-voltaic technology, knowing that it is not going to really solve the energy problems, not in the near future; they have continued to subsidize the fossil oil using a small part of their profits. Both were intended to buy the decision makers and even the scientists.

These two problems have been discussed in part II of this report. It seems that they have served the biggest enemies against real progress. One is amazed to find out that even fossil fuel is subsidized by fuel companies and interested governments politicians. A very fundamental change recently took place by the discovery of oil and natural gas in many countries that reduced dramatically the threats by the old corrupt fuel salesmen.

Basic questions which are very popular and most often asked.

- Is the problem really of global warming?
- Is the reason for it is really greenhouse gasses?
- Is it really man made?
- Are the effects of global warming going to be really as bad as they say?
- Can we avoid it? Can we or should we make very expensive efforts to recapture the greenhouse gasses?
- Is the Kyoto protocol a real useful method – to pay for the production of the greenhouse gasses and get credit to keep on burning fuel by using elsewhere energy from renewable sources?

The answers to these questions by serious and honest people are to a great extent negative and even very strongly so! The IPCC people (Intergovernmental Panel of Climatic Change) are even being blamed for dishonesty or at least non scientific publications. **However, even much more important, we have shown that these are not at all necessarily the relevant questions**

Some of the real problems are in keeping on the use of fossil fuels?

1. The finite reserves of fuel even after much more has been discovered. All it gives us is a little longer time to reduce our dependence on fossil fuel.
2. Danger for tipping prices once we come again to the more far possibility to use the fuel. We have also shown some 8 very strong reasons why we should, anyhow, come out of the fossil fuel age.
3. Fluctuation of prices where the variance affect heavily the Gross domestic product. It reduces it. This could be proved mathematically.
4. Large scale atmospheric pollution leading to lower solar radiation, acid rain, effects on vegetative and living creatures activities
5. Affecting the health of people and especially children causing also a very high rate of deaths.

6. The need to have long terms enforcing fuel supply agreements and economic and political difficulty involved.
7. A need for stored reserves with high costs
8. Very high spending for military defense involved and pay for strategic partners.

Some of these stated problems add up to the result that the actual real cost of using fossil fuel is tripled by what is called "Externalities".

As an example the need to ask the right question: why did human society leave the Stone Age?

- Is it because we ran out of stones?
- Did stones become expensive?
- Is using stones damaging the environment?
- Is there a religious dictation not to use them?

None of these!!!

We left the Stone Age because we have found much better and diversified technologies!

- Ceramics
- Glass
- Metals
- Cement using lime and volcanic ash (leading to "Portland cement")

One can ask a very similar question, why we stopped living in houses made of clay mud or clay mud with straw reinforcement.

We can show that there are 7-8 very sound reasons to leave the fossil fuel age that does not necessarily have anything to do with global warming. There are definitely other reasons involved with the solar activity and the global position.

We can also show that there are several technologies that can allow us right away to reduce the use of fossil fuels. These methods are cheaper and are from renewable sources. They can thus be sustainable and they are of a large enough volume to serve us significantly starting practically immediately. (See parts II and III of this book)

Despite the fact that while I have served as the chief scientist of the ministry of energy and supported the company that tried to use the oil shales in Israel and we have learned how to use a potential estimated to be about 200 billion dollars, I have come to the conclusion that we should find a technology of energy supply preferably from a renewable source and without the need for a solar collector. The use of a renewable source is a necessary condition but definitely not sufficient. It could be from a renewable source and still not necessarily sustainable. One first additional condition to be in order to become sustainable is to have a low enough

cost. This is as the cost is a very close measure for the waste of energy involved with the installation and operation. Another demand is that it will not be intermittent without a cheap and efficient way to store energy. The "power factor" should be as close as possible to a full unity. For example the photovoltaic technology had a power factor not higher than 20% (without adding an effective and cheap storage method). It can then be proven that not a penny will be saved in the building common power stations and that maximum gain could not exceed 20% of fuel cost. Another demand is that the technology should not need a large land area. Photovoltaic technology requires at least 70 times the area of other technologies. A very important yard stick is how long will take the return of energy produced by this method to cover up the energy that has been needed to establish and operate the supply technology. As an example, how could we consider photo-voltaic cells as sustainable if it could hardly return the energy that was necessary in order to produce them, install them and operate them along the whole life off their installation.

I must state that I am aware about a development that would lower the cost of the Photo-Voltaic installation to one third and where the efficiency of turning solar radiation to electricity reached already twice the one used till now and may very well trippled. These two improve considerably the benefits of the P.V system. Many efforts to develop cheap and efficient energy storage would help also to the justification of using the P.V. We have found a new approach that could contribute a new set of storage elements. It has not reached the stage of giving it wide publicity. Interestingly those trying to sell P.V. prevent the support of the new development.

S.7. What Are the Presently Available Methods to Replace Fossil Fuels?

S.7.1. Improved Efficiency

There is a long list of electricity production and use, in heat supply and use, in cooling, in transportation, in agriculture, in water supply, in irrigation and in industrial uses. The saving can be larger were the energy use is higher and this is more in the countries with the higher average income. In Europe it is at least 20% with 5 years or less the investment return period. In the US it could be even over 50% energy saving This can be simply proven as the gross domestic energy use per capita in the US is twice higher than in most European countries and the electricity used per capita is about 14000 kWh per year compared with about 6000 per capita in Europe. This is despite the fact that the real standard of living is almost the same. This situation leads us to a one of the most important conclusions. As long as the main measure for success is earning more money and being able to spend more, the human society carries itself to its end on this globe in a more significant rate. No wonder then that public financial managers consider research and development and humanities as a waste of money. They know nothing else. This has been my experience when serving as the chairman of the national committee for research and development.

S.7.2. The use of waste for electricity and heat

It could reach 10% of the electricity and more, with several very important and valuable byproducts such as: Recycling in four separate piles: glass, ferrous metals and non-ferrous metals and finally plastic materials; Preventing 15-25% greenhouse gasses (Assuming that it is really a serious problem); Preventing one of the worse groundwater pollutants; Saving land area; Reducing traffic load; And finally, provide one of the tools to conform the energy supply curve to the demand. Replacing fossil fuel.

S.7.3. Modern solar collector for heat with over 60% efficiency

This method developed by "TIGI" Ltd, could reach in Europe 30% fuel saving, and somewhat less in Israel.

S.7.4. The fruits of the sun- wind energy

It could provide in the order of 20% of the electricity with no need for subsidies. And much more even, with small subsidy. And in getting turbines installation off shore.

S.7.5. The fruit of the sun – hydro-power

This highly used technology could provide, overall, 6-7 percent of electricity globally, and none at all in Israel. Advanced ideas developed by me indicate a possibility to increase several times the output in part of the existing sites.

S.7.6. The fruit of the sun- bio-fuel

This item varies very much from country to country. However, once we solve the water shortage problem and especially in arid non cultivated land at present, we could practically replace the fossil fuel supply for transportation. There are however still two fundamental questions to be answered. Can we do it without hurting the traditional agriculture and the difficulty to supply the agrotechnical fruits with limited size of free land and growing population? The second question is still whether the energy needed to produce the crop and its preparation for use, do not exceed the energy provided by it? All examples I have considered have shown that there is no economical justification. There is also the idea of extending the capturing of the greenhouse gasses which would be very expensive and only hurt the agro-technical fruits by reducing the availability of carbon dioxide for photosynthesis which provides naturally a positive feedback to the agrotechnical supply shortage.

These items 1-6 add up to 50-60% of the fuel replacement, and possibly more and it can be applied immediately. It is far more important than the big discovery of new fuel sources mainly in the form of natural gas.

S.7.7. The fruit of the sun-The "Energy Towers" which utilize hot and dry air

This technology is described in detail in part III of this book. It proves by global mapping that it could provide 16-20 times the global electricity supply (of the year 2010) at costs between 2 and 6.5 cents per kWh. We have discovered 13 solid – tangible byproducts the benefits of which add up to 4-14 cents per kWh extra net present value profits.

This subject is the main important achievement that this report is presenting. Desalinating sea water at half the cost is one of the 13 additional benefits of this project.

S.7.8. There is still a very important need to conform the supply curve to the demand.

There are several Methods to do it. Some of the suggested technologies have it built in (like the above "Energy towers").

Notably, this target is essential to reduce the Energy costs and to make It possible to use to a large scale intermittent energy source Like wind energy or solar energy for electricity.

In summary, we have shown that there is a way to come out of the fossil fuel age and that it is quite worthwhile economically. We do not have to carry a debate with the IPCC teams. And their unproven paradigms about the global warming due to greenhouse gases. By realizing our recommendation we easily reach their irrational dream without any damage and no need for the idiotic "Kyoto protocol", which has been signed by most countries and has not been performed except to a very small claimed declaration.

However, we cannot be proud on overcoming the control of the fossil fuel subsidies distributors both to their main marketing of fuel and to the theoretical far away replacement – the photovoltaics. This prevents really our expectation for a more rational questioners and decision makers to take over.

S.8. The Wrong Methods and the Needed Yardsticks

There is a long list of confusing ideas. The testing is in using the following yard sticks:

S.8.1. The investment per average kilo-watt or cost of kWh Production or supply and not for installed kilowatt.

S.8.2. The length of production life needed to cover the Energy needed to produce, erect and maintain the Installation.

S.8.3. The area needed to produce a certain amount of Energy (say square meters per million kWh per year).

S.8.4. Useful byproducts and useful feedbacks.

S.8.5. Avoidance of damaging byproducts.

Just for illustration the **photovoltaic cells** still cost when I have prepared the first draft of this book about ten times more per kWh compared with the standard technologies using fossil fuel and far more compared with some methods mentioned above in items 1-7. It is still 4 fold more expensive a several years later and still not more than a wishful claim. There is no doubt that the amount of energy demand to produce erect and maintain the technology is more or less proportional to the cost. Even an extra profit eventually goes for someone's extra spending that always involve energy spending. **It amounts that Photovoltaic cells in their lifetime will barely supply this creation energy.** There are also very high possibilities, that fossil fuel crisis will come down. Thus it is not a "green" energy. It is not "sustainable". It does not solve anything for mass energy supply. It has no positive byproducts (possibly with the exception of a very poor addition of waste heat.). All this is after several decades research and while in almost 7 years with the typical global subsidy given was over half a trillion dollars per year. This is unbelievable because this subsidy alone amounts to nearly 4 cent per kWh for all the electricity used over the globe and nearly 50 cents per kWh for the photo-voltaic cells... Now, the area needed to produce a million kWh per year in a very sunny area is about 12000 square meters or more (the latest report in Israel is of 17000 square meters). This is while wind turbines need only 100 square meters and "Energy Towers" need only 250 square meters. Etc. The photo-voltaic cells are using a "renewable" energy source. However, it is not at all a "sustainable" method. The average daily production by photo-voltaic cell is only about 20% of what it would produce with full sun 24 hours a day. This is called the "Load Factor". The real average cost of the cell is then the installed capacity divided by the load factor if the installed plate has been claimed to cost even one dollar per watt the relevant cost is 5 dollars per average watt. This is while at us only about 2.5 dollars for common power station run by coal and a similar cost per average watt of Solar Tower. There are still two other serious limits to the Photo-voltaic cells.

Fuel cells are very efficient in producing electricity using hydrogen as a source and the only by product is pure water. (There are some other possibilities of this type.) However one needs electricity to produce first the hydrogen from water and then one needs some way to produce the electricity to do it and then a way to store the hydrogen. So what did we save? Nothing. We simply wasted energy on these transformations and a lot of money and remained at the same basic problem we have started with.

And there is such a long list of methods that much is wasted on them and the worst thing is that they keep the real solutions away.

Sea waves, sea tides and ocean currents should be disallowed to be used for energy collection because with eliminating them we would pay heavily for not

getting a great amount of energy, and as a result reducing the rains, kill the ocean water population by preventing oxygen supply by the sea water mixing and by preventing nutrients supply.

Other crazy ideas.

- Put wind turbines on the road sides to use the wind caused by passing cars.
- Burying piezoelectric crystal under the road asphalt to be activated by passing cars

S.9. How come photovoltaic's is so heavily subsidized and what should be done to reduce the damages of mismanagement.

- Is it ignorance?
 - Is it corruption by fuel companies that tie the hands of research people and decision makers because they know this will not endanger their profits.

I know of several ideas to remove the obstacles from the photovoltaics by trying to overcome the following:

- Reduce the cost of the photovoltaic plates
- Improve the efficiency of turning solar radiation to electricity
- Find a way to overcome the intermittency of the supply and trying to fit it to the demand.

The group involved had already some preliminary tested ideas for the first two. I have been asked to be their consultant and especially help in providing the solution for the third problem. The work on the Energy Towers and desalination methods lead also to some ideas in this direction.

S.10. The Direct Energy Cost and Indirect Costs on Environmental Damages, Human Health and Strategic Problems Almost Treble the Costs.

S.11. The Cost of the Energy Affects a lot of Other Costs.

- An important example is water production and transportation.
- Another important item is in industrial products.

However, at the same time a smart planning of the products could help solving problems such as conforming the supply curve to the demand. This is one of the critical items in saving costs and in making the use of solar energy and wind energy which are intermittent.

Water desalination is another example of this adaptation where we can desalinate in summer when there is a lot of sun and water need and stop during other months when there is a higher demand for energy and less demand for water.

S.12. Having found such solutions to the energy we would be able to increase the water supply even tenfold and more.

Cheaper water production will be shown. It could serve as another way to reduce the intermittency of energy supply by water storage. We have shown two methods to get very much water at about one tenth of the cost of sea water desalination by reverse osmosis. We have also shown a broader look at the water problem where we have 8 different sources of water pollution. Eliminating them could provide us with huge amounts of drinking quality water at a very low cost. We suggest a wider view of solving the water problems in part IV of the book.

S.13. Having so much water even in the arid areas could we assure the supply of agro-technical products for a much larger population and make it evenly distributed to the different nations?

This is still very much in doubt.

S.14. Where is Our Society Moving to?

The major motivations are:

- To increase the gross domestic product. However if we increase the GDP, are we going simply to spend more?
- What are the private personal dreams? To earn more? Are we going simply to spend more?
- May be we hope to increase the credit that will enable us to initiate, to learn and investigate. What for? For eventual spending personally more? Or participate in spending in national ambitions? Could my neighbors do the same? And what about other nation? And once we make this progress is it possible that there is no way to avoid increasing the demand from the renewable capacity of our globe?
- It seems that at this end of viewing the sustainability of the human society on the globe with the limited resources we have to rethink the rules of behavior of the human society. We shall have to reconsider and extend the human values that have been expressed in the bible in the Ten Commandments and then discussed and revised for thousands of years and led to our democratic regime and liberal society. More thinking is necessary. Furthermore, who is a chosen person or which is a chosen nation. Is it a person or a society or a nation which is worthy to be given a lot or which is devoted to give a lot? Unless we change that, I am not sure we can assure the existence of the human society in general or our grandchildren in particular.

It seems that at least some of the arbitrary UN checked Paradigms and very damaging errors in research and in project development infected led the Unesco people. Many of the above subjects which it is considered so important and fundamentally needed for analysis like the change in the size of the human society and the length of human life met impatience by Unesco. There was a growing number of unexplainable rejections to my drafts which urged me to keep away.

The book draft has been presented to UNESCO. They returned remarks which smelled with political positions that asked to keep out my attempt to criticize certain policies which have affected very badly the handling of the combined problems of energy, water and agrotechnical products. They have also asked to keep the book at about one tenth of the volume I have actually put in it in order to identify the systematic problems and the public management. So, this book has not received the approval of Unesco. I hope you will find an interest in it. I shall be glad to receive opinions raised criticism and proposals.

Key Words

Summary

ENERGY TOWERS, Sustainable, down draft wind, Dead sea, desert, fruit of the sun , renewable energy , water supply, Mediterranean sea dead sea canal, climate change, warming , greenhouse gas, water supply fossil fuel, solar ponds.

Part I. Technological dreams on the Dead Sea and where did it lead us to.

Dead Sea, Mediterranean Sea- Dead Sea canal, Red Sea –Dead Sea canal, Solar Ponds, project failures, new ideas, solar collector for heat, geothermal power station, down draft wind machine, Energy Tower.

Part II. The Need to Come Out of the Fossil Fuel Age

Climate warming, greenhouse gas, coming out of the fossil fuel age, environmental disturbance, externalities, possible alternatives, renewable energy sources, energy efficiency, fruits of the sun, photovoltaic cells, wind power, waste, solar collector, fuel prices, price fluctuations, cost of defense, Sustainable, green, renewable.

Part III. Energy Towers for Producing Electricity and Desalinated Water Without a Solar Collector by Using Hot and Dry Air

Desert, Hadley cell circulation, wind shear, microburst, The fruit of the sun, Energy Tower, Wind producing machine, sustainable technology, Cheapest energy source. Small land area, 13 byproducts, half cost desalination, energy storage, positive feedback to global warming, Preparatory work, global mapping.

Part IV. Solving the Water Problems

Rain, groundwater, Aquifers, water storage, runoff mechanism, Erosion mechanism, water accumulation, concave soil surface, new desalination method, enhanced rain, Sea warming, groundwater pollution, Polluting sources, sewage water, damages by sewage irrigation, sewage water recycling, recommended water projects.

Part V. Epilogue

Agrotechnological supply, sustainable energy supply, Sustainable water supply, insufficient agro technical supply, human values, necessary changes, adapt the globe to the human society, adapt the society to the global limitations.

About the Author

Prof. Zaslavsky has been a full professor in the Faculty of Agricultural Engineering since 1971 and was Dean in the years 1993 and 1994. Between the years 1983-1985, he served as the Chief Scientist of the Ministry of Energy and Infrastructure. He was the Water Commissioner for the State of Israel between the years 1991 and 1993. His research has dealt with a variety of issues concerning water and energy, including solar ponds, surface and subsurface hydrology, renewable energy using solar hot water units and wind turbines, water management policy, desalinization, etc. Prof. Zaslavsky has worked with other researchers and has patented several inventions. A method and apparatus for disposal of salt and brine wastes, a solar collector for air heating and a device for controlled release of fertilizers, are some of his inventions.

For the past 15 years, he has focused on a project named "Energy Towers" which in all probability will create a revolution in energy production. The "Energy Towers" project is based on a novel technology which produces renewable electric power from hot and dry desert air. It entails the construction of a "wind-generating machine" - a hollow tower with openings at the top and bottom, without the need for a solar collector. Atomized water is sprayed at the top of the tower and, as in a natural wind shear, it cools the air immediately below, raises its density and causes it to drop quickly. On its decent to the tower base opening, the air rushes through a surrounding circle of turbines which drive electric generators. The "Energy Towers" technology provides an enormous source of renewable and absolutely clean electricity at a cost less than that of fuel-generated electricity. It is an ideal solution for the main environmental threat to the globe today - air pollution caused by SO₂, NO_x, and by the greenhouse effect of carbon dioxide gas.

In association with the "Energy Towers", a technology for sea water desalination was developed requiring less than half the investment associated with the best alternative method and about 2/3 of the energy outlay.

C.V. - Short Version



Prof. Emeritus Dan Zaslavsky

Personal

Date & place of birth: May 12, 1931, Kibbutz Givat Brenner, Israel-(Tel Aviv "Hadsa" hospital)

Citizenship: Israeli

Marital status: Married to Aviva (Rabinovitch) - son Amos and daughters Michal (Sofer) and Ruth (Biger) (seven grandchildren)

Mailing address: Faculty of Civil and Environmental Engineering, Technion--Israel Institute of Technology, Technion City, Haifa 32000, Israel

Home address: Nehemia str. 22 haifa Israel 32294

Languages: Hebrew and English - reading, writing and speaking

Early professional experiences Mapping, Land surveying, field construction
Roads drainage etc.

Academic degrees

B.Sc.: 1954 Civil Eng. Hydr. Option, Technion--Israel Institute of Technology, Haifa, Israel

1955 Civil Eng. Diploma, Technion--Israel Institute of Technology, Haifa, Israel

M.Sc.: 1957 Hydraulic Eng. and Soil Eng., Technion--Israel Institute of Technology, Haifa, Israel

Ph.D.:1960 Soil Physics, Iowa State University, Ames, Iowa, U.S.A.

Academic & Administrative Positions

Full Professor, since 1970 Full Professor at the Faculty of Agricultural Eng., Technion--Israel Institute of Technology, Haifa, Israel

Special consultant 1967-1968

Agricultural Res. Serv., U.S. Dept. of Agriculture, Hydrograph Laboratory
 (1).review and change all soil & water research Programs in 13 national centers;
 (2). Total revisions of Hydrological theory of forming runoff and erosion)

1977 Guest Professor

Agricultural U., Wageningen, the Netherlands Special course on new approach to surface hydrology and consultant to the Dutch Ministry of Agriculture

1983-1985 Chief Scientist Ministry of Energy

1984 Deputy Director General Ministry of Energy

1983-1985 Member of Board of Directors of Israel Electric Corporation; Binominal Science Foundation, U.S. - Israel, National Council for R&D etc.

1983-1985 Chief Scientist - Belfer Foundation

1991-1993 Full time consultants to the Ministry of Agriculture for Energy Water Policy and Water Commissioner for the State of Israel

1991-1993 Israeli Water Commissioners

Dean 1993-1994 Faculty of Agricultural Engineering, Technion

2004 – 2007 Chairman of the Israeli National Council for Research and Development (Israeli president nomination)

Military service: first mobilizations May 15 1948.-No. 43444-War off independence

1969-1983 Commander (Lieutant Colonel) of “TACHASH” Reserve Unit (know-how for the Israeli Armored forces)

(Mixed partial reserve service and full time participation in 5 wars)

Consulting work *Has been served as a professional consultant to “Tahal” - Water Planning for Israel and many companies in Israel and abroad.*

Graduate students guide

M.Sc. - 32 graduates
Ph.D. - 15 graduates
Secondary adviser to many others

Original papers in professional scientific journals	over 90
Technical reports	over 280
Books	3
Patents	11

Prizes and etc.

Several prizes, including –"Karl Emil Hilgard Hydraulic Prize by The American Society of civil Engineers for the best work in 1982".

- Many invited lectures

- Honorary chair for agricultural Eng.

March 2014- Honorary prize for life product in water, granted by "Agam" The Israeli common society of all water organizations

Special task

President of disciplinary Court of the academic staff

1999

Professor Emeritus.



Summary

Part I. Technological dreams around on the "Dead Sea" and where did it lead us to.

Part II. There is a need to come out of the fossil fuel age. However, the reasoning, and path chosen is often wrong.

Part III. Energy Towers-A sustainable solution for energy and water by utilizing hot and dry air without the need for a solar collector.

Part IV. Solving the water problems and interaction with energy supply.

Part V. Epilogue- What have we solved and what we did not.



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