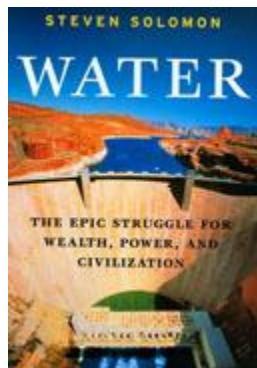




## Water: The Epic Struggle for Wealth, Power, and Civilization

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### Introduction

**JOANNE MYERS:** Good afternoon. I'm Joanne Myers, Director of Public Affairs Programs, and on behalf of the Carnegie Council, I would like to thank you for joining us.

Today we are very pleased to welcome veteran journalist Steven Solomon to our program. Mr. Solomon has written for *The New York Times*, *BusinessWeek*, *The Economist*, *Forbes*, and *Esquire*. Additionally, he has appeared on CNBC, NPR's *Talk of the Nation*, Bloomberg TV, and other news shows. His earlier book, [Confidence Game](#), presciently warned about the increasing dangers in the volatile global financial system. This afternoon Mr. Solomon will be discussing his latest work, [Water: The Epic Struggle for Wealth, Power, and Civilization](#).

Water has always been a precious commodity, but for those who find it in short supply, its value is becoming even more apparent day by day. In fact, many of you may have been hearing or reading about how water is the new oil. It's true that water, like oil, is critical to the global economy. However, unlike oil, there is no substitute. Water has been and is the most important driver of human development.

In *Water: The Epic Struggle for Wealth, Power, and Civilization*, Mr. Solomon writes about the role of water in world history. He tells us that water has always been of great importance and has simply returned to the primacy it held from the earliest of times. He explains how water, once made navigable, manageable, and potable, became pivotal to the rise and fall of great civilizations and their achievements. He gives examples, from Mesopotamia, the Roman Empire, Medieval China, and Islam's Golden Age, to Europe's rise, the steam-powered Industrial Revolution, and to America, to show how water has always played an essential role in advancing human aspirations and the prosperity of nations.

Today supplies of water—at least the clean, easily accessible sort—are coming under enormous strain. Fresh-water scarcity due to the needs of a growing global population, climate change, and mismanagement, particularly in poor countries, where industrialization is contaminating rivers and aquifers, has become one of the 21st century's looming challenges. With the demands of a world population soaring towards 9 billion by 2050 and only 2.5 percent of water on earth being fresh, the challenges are enormous. As several reports have indicated, water consumption needs are doubling every 20 years. If we stay on our current course, we will outstrip nature's sustainable supply of accessible fresh water.

As the quest for water drives new political, economic, and environmental realities across the globe, it is very likely that water famine could outstrip food famine, even causing future wars. We have already seen how genocide, disease, and civil warfare have increased as water-starved, overpopulated areas of Africa, Asia, and the Middle East fight for this precious resource.

While the scenario of an impending global water crisis is pretty bleak, you may ask how the issues came to be and whether there is a solution. Although there is no one-size-fits-all, there are several things that can be done. To find out just what can be accomplished, please join me in welcoming our guest today, Steven Solomon.

Thank you for coming.

### Remarks

**STEVEN SOLOMON:** Thank you, Joanne, and thank you for the excellent introduction. I can throw out half of my speech.

Thank all of you for coming and taking time from your busy schedules to contemplate that precious clear liquid that many of us carry around with us every day in little personal bottles. And what would we do if we didn't have it?

The topic I'm going to discuss is the greatest crisis that most Americans are only beginning to hear about, and that is global fresh-water scarcity. In fact, I do argue in this book that water is overtaking oil as human society's scarcest critical resource. If you want to think of an analogy, just as oil transformed the history of the 20th century, I think fresh water is already beginning to shape the geopolitics, the economics, the environment, domestic politics, and the quality of our everyday life in the 21st century. It's even more important because it is so indispensable. You can't drink oil, and you can't grow food with it.

What is happening essentially is that under the duress of rising population and the voracious demands of our industrial society that has been using water at twice the rate of population growth, and also a lot of our own inefficient water practices, more and more nations around the world are outstripping their available sustainable supply of fresh water. By that I mean the finite amount of water that continually self-renews, through the natural process of evaporation and precipitation, to replenish the rivers and the lakes and the shallow groundwaters that have been the source of water for all human history. Our ecosystems are getting depleted, and we are starting to run dry for many key economic uses and for human uses, in agriculture, industry, and energy production.

Given our current practices and technologies in more and more parts of the world, there is simply not enough available to replenish the water ecosystems for the world's 6.5 billion today, much less the 9 billion we're becoming, many of those meat eaters as well and enjoying middle-class diets, which even use more water than the absolute increase in population growth. As a result, global society is polarizing into what you might think of as water-haves and have-not societies.

We always try to look back to our Founding Fathers in times of stress for wisdom. I think [Ben Franklin](#) puts it pretty nicely. He says, "When the well is empty, we learn the worth of water." Well, the global well is starting to go dry, and we're all starting to learn the worth of water.

I would like to start our exploration on the frontlines of one place in the world water crisis. That would be Pakistan, where Secretary of State [Hillary Clinton](#) made a rather tumultuous visit in October 2009. Behind all the headlines that that generated, she was repeatedly beseeched by Pakistani leaders about Pakistan's impending water and food crisis. Of course, she paid close attention to that, not just because of Pakistan being a critical ally in the Afghan war and the war on terrorism, but because Pakistan is a nuclear-armed, Taliban-besieged, politically fractious state that would be, really, our ultimate failed-state nightmare, I think, if that state should fall apart.

Water is one of the pressure points on that state. To meet the necessities of its growing population, which has actually quintupled since independence in 1947 and is expected to grow another 30 percent, to 225 million, within about 15 years, Pakistan is in desperate need of revitalizing its very badly decaying irrigation and drainage system. It has the largest contiguous irrigation system in the world, about ten times the size of Massachusetts. It's also running short on hydropower, and the storage capacity of its lifeline river, the Indus, has only 30 days' storage against, let's say, an unforeseen drought. It's rather terrifying. The United States or Australia has about 30 times more storage against that kind of an event. [Aswan Dam](#), when it's full, can hold two years.

It has relied heavily on pumping groundwater for its agriculture. It has been over-pumping the groundwater beyond its replenishable rates by nature, and its groundwater tables are now falling to levels that are hitting quality and quantity limits. At the same time, its surface irrigation on the Indus is also badly over-tapped, causing many of the problems of salination as well.

The Indus itself, like many other rivers around the world—70 or so of the major rivers—is so badly overdrawn that it no longer reaches the deltas. And this is true in the Colorado, it's true in the Rio Grande, it's true on the Nile and the Yellow River as well. They no longer really reach their deltas to replenish them. Those have been fertile areas both for food and for biodiversity throughout history.

But now there is a special problem on top of this one, and that is this: 50 percent of the water from the Indus River comes from glaciers up in the Himalayas, and these Himalayan glaciers have been melting at an extraordinarily fast rate. The predictions now are that it's going to lose one-third of its flow in the next 15 to 20 years, at the same time that its population is going to be growing and it has all these other very serious, formidable problems to deal with.

On top of that, the shortages that it currently faces have already set off internal schisms between the [Sindhis](#) in the South, who feel that the Punjabis in the North are taking too much of the water. It gets pretty complicated,

because next door, of course, is India, and India is where the Indus actually passes through before it arrives in Pakistan. They have fought three wars over the years, and there are ongoing disputes in the Kashmir, as we know. They believe, somewhat paranoiacally—but who knows?—that India has designs to withhold water, use it as a part of the diplomatic pressure points against them, to prevent it from entering Pakistan, if and when the situation arises.

There was a very recent summit that the United States, in fact, helped to facilitate between the two prime ministers, ostensibly to get past the problem of bombing in Mumbai by the terrorists who originated in Pakistan. A fair portion of that meeting was spent, from Pakistan's standpoint, accusing India of violating the 1960 [Indus River Treaty](#) by building some hydropower dams on some of the tributaries that lead into the Indus and feed the Indus. This Indus River Treaty is considered by many to be one of the great achievements of holding off water wars in this region of the world, but almost everybody now believes it is in drastic need of a renewal.

Pakistan is also highly suspicious of India's aid for damming in Afghanistan. Afghanistan provides 20 percent of the water to the Indus River. When the Americans leave eventually, I think they don't want to find themselves surrounded by India and its allies able to control the water valves.

India, of course, has its own very severe water and food and energy shortage crises—in fact, in many ways, worse than Pakistan's—that it is trying to mitigate. It has drilled something like 22 million tube wells since 1975 to feed its population growth. Many of these wells are now going dry. On top of that, they also suffer from the erratic swings of the monsoons for rain-fed agriculture, which are getting worse with climate change. It's not only very possible, it is almost a sure thing that India will be one of those countries that no longer will be able to feed itself in the next number of years and will become a major grain importer. This is going to change the dynamics of world food trade markets for everybody in the world and be a major source of concern.

Of course, the United States has been alarmed and concerned about Pakistan for some time, and its stability, and was very much alarmed in April of 2009, when, as some of you may have noticed, the Taliban broke out of the northwestern provinces and entered into [Buner](#) and put it within 25 miles of this giant [Tarbela Dam](#) on the Indus. It's sort of like the Hoover Dam, if you thought of losing the Hoover, or the Aswan Dam, for example, in Egypt. Any damage to that dam would cripple Pakistan's hydropower, agriculture, and, obviously, any control over it would give enormous strategic leverage to the Taliban.

Hillary Clinton and the State Department, of course, did respond to Pakistan's concerns. We have just recently passed a [\\$7.5 billion, five-year aid package](#). The largest and most urgent part of that, I want all of you to be aware, was addressed to those water issues of irrigation, hydropower, and storage. They have also, of course, been trying to facilitate as much as possible the India-Pakistan dialogue on water security.

This is going to leverage other greater capital investments that the Pakistanis have, of course, but whether this is going to be enough for Pakistan, a country where 60 percent of the people make a living as farmers, to get by the destabilizing pressures from this food crisis is anybody's guess.

But there's one bit of encouraging news in this. Maybe it seems obvious to people. For the first time, global water scarcity is being recognized as a vital objective of U.S. national security interests and is being integrated into the highest-level processes at the State Department. Just on March 22, World Water Day, Hillary Clinton gave a [speech](#) that signaled, in fact, this. I had been speaking to the State Department before that, and the process has been ongoing for some time. But they do, in fact, get it, which is a very important point. Fresh-water scarcity is emerging as one of the key driving fulcrums of world geopolitics and creating a whole new calculus of strategic challenges for policymakers.

One of those, of course, is related to climate change. When you think of water, you should think of climate change at the same time, because climate change is really the water crisis in hyperdrive.

Climate change wreaks most of its damage by creating things like unpredictable and extreme floods, droughts, melting glaciers. What do they do? They overwhelm water infrastructures that have been built up over the years both for harnessing the advantages of water and protecting us against its destructive aspects.

People who think about water also recognize that water and energy are totally interconnected with one another. Most people are a little surprised to realize that the largest number of withdrawals for water in the United States—and, in fact, most industrialized countries—is not for agriculture; it is for energy, for mostly cooling thermoelectric power plants. Now, most of that water goes back into the river, hopefully at the right temperature that they took it out at and in clean form. But we actually face limitations, even in our own country, on the number of power plants that we are able to build just because of the volumes of water that have to be taken out of the rivers.

Fresh-water scarcity is the chief reason why 3.5 billion people are expected to live in countries, including India,

Pakistan, and possibly China, that will not be able to feed themselves in the next 20 years. We have never had a situation in the world like that. Volatile food prices are extremely worrisome in the heavily food import-dependent Middle East. It currently imports 50 percent of its food. It's going to be rising to 70 percent as water availability there per person falls by 50 percent itself over the next two generations.

Saudi Arabia has been making news. It finally gave up this rather foolhardy policy of pumping dry its non-replenishable aquifer in the desert to become self-sufficient in wheat—in fact, exporting that wheat—because the aquifer is just giving out and it won't be there anymore. Instead, they are leasing cropland in places like Sudan, Ethiopia, Pakistan. Some of these are not the most propitious places or are they going to be the most reliable, also for water shortage and other reasons. But we are beginning to see around the world countries beginning to look to guarantee their food supplies. Food security, which, of course, is on the [Obama](#) Administration's agenda, is starting to take place, with or without us. It's happening.

Throughout history, as documented in this book, nations that have been unable to grow or reliably import inexpensive enough food have often destabilized and sometimes collapsed. Some of those failing states, such as water-famished Yemen and Somalia, have been fertile ground for international terrorist groups—Yemen most recently with the attempted Christmas bombing in Detroit, from the al Qaeda group that has taken root in that country. Of course, Somalia has piracy on the shipping lanes, which is a real problem.

The fact that Israel gets two-thirds of its water supply from lands that it won in the [Six-Day War](#), which itself was partly triggered by disputes over control of Jordan River water, and that a third of its water comes from the West Bank aquifer that it shares with Palestinians, in a four-to-one sharing ratio in Israel's favor—just enough for the Palestinians to drink, but not do much else with—is one of those additional grievances that is underlying the Middle East peace process. The Arabs often accuse the Israelis of stealing their water.

There are a billion people in this world that lack access to safe drinking water and 2.6 billion don't have basic sanitation. This is more than just a humanitarian tragedy. It also poses contagious health risks that do not stop at borders, and it is a massive problem for economic development. Both are tragically visible inside Haiti, for those of you who look closely at those stories.

I was, myself, in Kenya laying about two miles of water pipes, from a well to a waterless village. It alleviated the people from having to walk two to three hours every day—a lot of them were children, giving up a lot of their schooldays, women as well, who could no longer do productive work—to fetch water, which is very heavy. It weighs eight and a third pounds per gallon. You have to have at least—they say at least, minimum, 13 to be healthy. They don't have that amount. They might get four or five gallons, if they're lucky, for each one of them. But you can imagine carrying 200 pounds of water every day for that distance? It's a heartbreaking waste of personal and human capital when you see that, and when you know that it can be solved so easily.

There are dislocations from the water shocks, like the floods and the mudslides and the droughts, that are overwhelming existing water infrastructures and have already driven millions of people from rural farms in India, Bangladesh, Syria, Iraq, and Yemen, often pouring into cities that don't have enough water themselves and then become very combustible. We are expected to have 150 million what some people call climate-change refugees—I like to think of them as water refugees, because it's water that is driving them—within a decade.

As water runs scarce and populations surge, we have this problem of how to keep the peace on the 263 shared river basins and countless shared but invisible groundwater resources that are also diminishing, in trying to come up with positive-sum incentives for people to cooperate in these regions, as they have pretty much, remarkably, up to this point in time.

We also have a problem that there are upriver states that, in some cases, in particular need to be engaged. Two of them to keep in mind are Turkey, which is really the Mideast's new water superpower, among other things—the headwaters of both the Tigris and the Euphrates rise in Turkey. It has other water resources as well, but through the Euphrates it dictates the flows that go down to Syria and Iraq. Iraq, which in the 1960s got the lion's share of the water, today gets about 15 percent of that. Several times Syria and Iraq, most recently in the fall, have gone hand-in-glove to the Turks to try to allow more water to flow. But that river is dammed up 150 percent—they have projects on the board for 150 percent of the water that's in the Euphrates. Well, obviously, that's impossible. The Turks are making those decisions unilaterally at this point in time.

The other country to keep an eye on is China. China controls the Tibetan Plateau. Almost all of Asia's main rivers rise in that region. They are, of course, in a breakneck race for economic growth. They are building dams on those rivers. Ten, 15, 20 years from now, I think we are going to be hearing similar stories about the [Mekong](#) and the [Salween](#) running short.

Are these countries going to cooperate or not? Turkey and China were two of three countries that voted against the [1997 UN convention](#), not yet in effect, that said that upriver states should behave in such a way that they

don't harm downriver states. They just don't like it. The third one, by the way, is Burundi, on the Nile, that has aspirations that I think they are not going to be able to achieve.

But I will point out—maybe we can get to it in some of the questions, the details on Egypt, like Iraq in the 1960s, has been in the anomalous situation of being a downriver state that has been able to have the lion's share of the water. That is ahistorical, and now that dams are being built in Ethiopia and Sudan and very poor countries, they are in negotiations that will—they hope to preserve what they have, but their populations are rising very fast, too. That's a very scary situation as well.

I would also just say that the corporate leaders in Davos, at the World Economic Forum, recently addressed this issue. They raised the concern about these [food bubbles](#)—that is, all this groundwater that is being used for producing food in India and Pakistan, in particular, but we are doing it in the United States in the Central Valley, and the North China Plain is also going dry. When they hit bottom, those food bubbles are going to burst, and it's going to be very ugly.

They are afraid, however, about another thing, really, more than anything else. They are worried that, increasingly, insufficient quantity and quality of water is going to disrupt transnational corporate supply chains and is also going to promote nationalist and anti-market backlashes that will disrupt this predictable, welcoming environment that the businesses need to operate, and which the world is going to need, frankly, in a free world trading system, if we are going to be able to meet the needs of the 3.6 billion people who are going to live in countries that can't feed themselves.

It's true, I do believe, that water scarcity may be rising to prominence in the 21st century, but it is not exactly true that it is becoming more important than oil, as much as it's reasserting, as you said, what has always been its primacy as the most critical, indispensable resource.

I'm going to skip over something here that I would like to get to, maybe in the question-and-answer period. I just want you all to think about how much water you think you personally consume each day. We'll come back to that question if we get a minute. I think you're going to be surprised by the answer. It will underline very clearly the importance of water for almost everything that we do.

In every age of history, the prosperity of every society has depended on how well it has controlled and harnessed its water resources for productive uses and protected against its destructive aspects.

Invariably, if you think about them, the great waterworks of history have been among the epic challenges of their age, and when breakthroughs have been made, they have been associated with turning points of civilization and with the rise and also the decline of great states when they fail. Just think of the agricultural revolution at the start of world history in Egypt, in the Nile, Mesopotamia, the Indus. These folks got control of these rivers for large-scale irrigation and managed to harness the manpower that's required to do that and began to build civilization.

Think of our own age. What's the seminal invention of the [Industrial Revolution](#)? The steam engine. It's water in another form, applied to industry.

Rome obviously had its aqueducts that allowed a city to grow to the size of 1 million, which may not seem like a lot of people, but it was an amazing number of people in those days because cities were death traps, frankly, because there was not enough clean water and sanitation.

Think of the canals that have had a role in history. The [Grand Canal](#) in China—1,000 miles long, early seventh century. It unified southern and northern China and was the springboard to what became that remarkable age of Chinese civilization in the Middle Ages.

We have in our own era had the Erie Canal—I think many of us in this room understand the importance that had in the United States—the Suez Canal, the Panama Canal.

Then you fast-forward to the thing that really transformed our Far West. Our arid Far West needed irrigation on a large scale to be able to utilize its resources. The great breakthrough came with the Hoover Dam. The multipurpose dams that brought irrigation, hydropower, flood control were immediately replicated around the world in remarkable fashion. There are now 45,000 giant dams around the world, half of them in China, including the largest at [Three Gorges](#).

These also were one of the facilitators of the [Green Revolution](#). The Green Revolution required an intensive amount of water to go along with the fertilizer and hybridization of the crops. This is what allowed the world population to grow to such an enormous amount without the horrors that we have seen in world history when water resources have been out of line with population levels. Usually it adjusts by starvation and pretty miserable

things.

But, of course, that brings us full circle. The success of each era creates the challenges of the next era. It's the 6.5 billion people, rising to 9 billion, with prosperity, and the way that we use water today that is creating the basic problem today.

I won't go into the details of it here because we are running out of time, but I will close on this point. The water crisis is presenting us, really, with two great challenges. One is a water ecosystem crisis. Many of our vital water ecosystems—now, for the very first time, we need to think about them as requiring water themselves to be able to continue to be sustainable. I mentioned the rivers depleting. I have talked about groundwater depleting. Our wetlands are gone. The glaciers are melting.

Without paying attention and figuring out how to manage the ecosystems themselves, we are going to be in a tough spot. We may get through, but it's going to be tough. There have been, really, four uses for water in world history. But ecosystem management now is the fifth new critical resource. This has to be managed at the same time that we think about our world society polarizing increasingly into the water haves and have-nots.

There really are different types of water have-nots that we can address in the question-and-answer period. Man has two choices about how to deal with these. The best one is to use our existing water resources in a much more productive manner. But that requires political upheavals that so far few have been willing to undertake. The other is to try to buy time and hope for some kind of technology or other kind of organizational innovation to come around that will bail us out. The greatest hopes are [desalination](#), genetically modified food—more crops for fewer drops—and recycling.

In the meantime, what are we doing? We are over-pumping that groundwater as it goes down to the bottom. In some places, like China, they are building massive canals, aqueducts—big versions of what we have in California—that take water from where we think we have more of it and move it to where we know it's short. China has the [south-to-north water-diversion projects](#) going, which are probably the largest water projects on earth at the current time.

But in the end, they don't solve the problem, because even in those other regions they run out as well.

So on that note, I'll open it up to questions. Thank you very much.

## Questions and Answers

**QUESTION:** It's not by accident that your name is Solomon. You have undertaken a major, major issue, and we thank you for it.

I was waiting for what came up only in your last sentence, which is, what can we do about it, especially in our technology-focused age, when there are technologies such as desalination that could be used so much more widely?

Would you be a little optimistic for us and go into some of the solutions?

**STEVEN SOLOMON:** I was going to conclude with why the future may not look like the past. We have avoided war, so that's optimistic—for the most part. But on the desalination question or some of the other technologies, desalination is a great technology that's coming into its own. Its costs have come down dramatically. There is great progress being made on the reverse osmosis process, the filters and such. It still has limitations. It still is a fossil fuel-powered technology. Okay, when you're short of water, you don't care, but it does have a tradeoff with climate change and other problems. When the water comes onshore, it still has to be pumped, and pumping water is a very energy-intensive operation. It has to be moved somewhere.

So it's only being used, really, in the most critical of situations at the current time.

But the good news is—Israel is one of the most progressive countries, actually, when it comes to water use, as is Australia, I will add—they are building five big desal plants that will add 50 percent to their water supply by 2020, it's projected. It will produce more water than they are taking out of the West Bank aquifer, so if the world decides they wish to trade that water for peace with the Palestinians, that's a deal that I think we can do. So that's there.

There has been progress on genetically modified crops as well.

But the problem is the timing of this. Even if you had the big breakthroughs in desalination tomorrow, the build-out from such a tiny base would be probably pretty long. I can tell you, there's a lot of money on the

sidelines waiting to rush in. That's not going to be the problem. But the organizational problems, the things that are keeping these billion people—why do a billion people not have safe drinking water in the world today? It's not a technical problem. It's an organizational problem. Those aren't going to vanish with a breakthrough in desalination.

So I have my doubts that the timing is going to work out well, that you are going to be able to build out fast enough whatever breakthroughs might come down the pike to be able to meet the needs as water begins to run short in some of these critical places.

**QUESTION:** You mentioned that Israel and Australia have relatively progressive policies on water management. I'm wondering if you could give us a snapshot of some of the policies there that would be translatable to the United States, given that we have so many regional differences here.

**STEVEN SOLOMON:** We do indeed. Let me just take, first of all, what Australia has done, which is a fairly remarkable thing. The [Murray-Darling Basin](#) is one of the most arid areas and has faced an extreme drought for a long period of time. It is actually, as I understand it, somewhat analogous to the way that water—it grew up similar to the western portion of the United States, actually, so it's a good analogy. There the government moved very aggressively, tore up the old water rights rules, and created from the ground up a system where the government itself would purchase enough water for the ecosystem, and the rest of it became open for bidding. They today have a trading system, a functioning market trading system, where you can buy water rights for the available amounts of water that are in that river. It's done over mobile telephone. It took them a long time to get all the kinks out of it.

But they went through in the last ten years or so a situation where they lost something like 70 percent of the water that they had had previously. That's remarkable. They are still producing the same amount of food that they did before. It's different food. They are not exporting rice, unfortunately, to Malaysia or Singapore. But they came through that very efficiently. It's sophisticated. Because of the irrigation, that puts salts back in the water. You can also trade for—if people are planting trees that take salt out of the ground, they trade the rights, because you have to pay for the pollution as well.

Israel, on the other hand, has been doing several things. About 70 percent of its wastewater is now not treated up to potable levels, but is kept as greywater and is then shipped down to the farms, because you can use that kind of water for agriculture. They have basically a dual piping system in the country, which is very efficient. Of course, they pioneered the drip irrigation techniques long ago.

They have also, very interestingly, been moving, just like Australia, to trying to improve the productivity of their farming by actually raising the cost of water to the farmers, which is the thing that we will not do in this country today, and most places will not do. They are beginning to phase out some of their agriculture. They realize they have to rely on the trading system. They just can't have self-sufficiency in food. They recognize that. And they are an industrialized society, so they have other means to earn the revenues to pay for those imports.

Those are a few of the things that they have done. But for the United States—I have to tell you, we are sitting on an economic resource in this country that we don't even recognize. We are a water-wealthy country. We don't have the population problems that a lot of other parts of the world do. We have an industrial base that's very potent. We have institutional order that allows us, if we put our minds to it, to increase the productivity of our own water use very much more dramatically than has happened through the pollution regulations. That's the way we have done it so far.

We could become and should become, both for our own economic advantage and also to be able to provide the food, the industrial goods, and other water-intensive energy products that the world is going to need desperately in the next 20 years—as a matter of foreign policy, we would increase our leverage in the world if we were able to provide that stability to many of these countries.

But we are just not even thinking about it. It's not even on most people's radar.

**QUESTION:** About ten years ago or more, I read about a very imaginative project which involved towing an iceberg from Antarctica to Saudi Arabia. I actually met two summers ago a Texan who had a camp up in Canada who was involved in this project, but I didn't have a chance to ask him why it wasn't repeated and what the economics were. Could you comment on that, please?

The second question is, where is the most effective research into desalination occurring in the world?

**STEVEN SOLOMON:** The answer to the first question—the honest answer—is, I don't really know the true answer, but I do know that all those projects have been abandoned. They had [Medusa Bags](#) that were going to carry plastic bags and were going to float those down. None of them really panned out. And the fact that there

was a Texan involved doesn't surprise me, because they have been thinking about these big, massive water-moving schemes across the United States for decades to try to get water down into Texas.

The second one is, there's a lot going on. Southern California has launched some big projects. I mentioned Israel. Cyprus has some things. Singapore has some very state-of-the-art desalination plants. A lot of big companies are working in this area. A great consolidation, actually, took place, where the 3Ms and the GEs and all the others were buying up all the little, small, creative companies. They are working very much on the membrane technology. That's really where a lot of the action is there.

So there are a lot of people working on it. It's not going to fail because people are ignoring it.

**QUESTION:** The figure you gave of shooting for 50 percent of Israel's water supply from desalination I think is fascinating. Can you tell us what power they are using to do that?

As a supplement to that, has there been any thought of having nuclear plants associated with desalination plants?

What is Israel using for their power source? Is it oil?

**STEVEN SOLOMON:** It is fossil fuel. I'm not sure if it's gas. I think it's a gas form, but I'm not 100 percent sure on that. I would have to research that and get back to you on that.

As for nuclear, again I'm not sure of the answer. Certainly people have thought about it. But nuclear has not been exactly the most popular technology in some parts of the world recently. I have not heard that too much with regard to desal.

**QUESTION:** I was curious about your remark that the United States is such a water-wealthy nation. Everything I read talks about our aquifers depleting, the [Ogallala](#) out in the Midwest, terrible droughts and the parched Southwest perennially, the great waste of water which this country is embarked on. I wonder what your prediction is over the next few decades.

**STEVEN SOLOMON:** We have approximately, of accessible, reliable water, something on the order of 8 percent of the world's water and we have only 4 percent of the population—five times more per capita than China, for example, and more than that for India, which I think is a seven-to-one ratio. The fact that we do, in fact, waste a lot of the water, as you mentioned, is part of our problem. Some of it, of course, is also polluted as well.

The usage questions—pipes leak. We know that. The problem here is that we have never put an economic value on the water itself. Even the delivery of the water—think about what goes into it. You have to collect the water. You have to pre-filter it, send it down in the pipes. It takes energy. Then you have to treat the wastewater before it goes out. It's a big, involved process. Almost nobody in the world actually charges a sufficient amount even to keep up the pipes, much less for the actual cost of the water.

On top of that most of it goes to agriculture that is very uneconomically productive, relatively speaking. But you have to eat. Some subsidies are inevitable in this process. But you really want it to encourage the agriculture that's going to use it in a much more efficient manner.

I'll give you one statistic, just this one thing. In the United States, between 1900 and 1975, our water use grew three times faster than population. This was a normal historic trend. Today, as I said, in the world the situation is, it's twice as fast as world population. But from 1975 to the current day, our water use in this country has not only plateaued, it has actually declined a little bit. Our population has gone up 30 percent in the meantime, and our GDP has not suffered either. There has been an enormous increase in water productivity.

Why did that happen? The thing that happened that stands out is that that is associated with the period that we put in the [Clean Water Act](#). Suddenly there was an effective cost put on the water use for those to whom it applied. It did not apply to agribusinesses, for the most part. It applies to thermoelectric plants, to industry, to what we call point sources and to some cities. Those, being markets, responded the way businesses are going to respond. They said, "If we're going to have to put back this water into the environment in the same way we took it out, we're going to try to figure out technologies to use less of it, to find better technologies to use it so that it's not so costly."

So there has been a great productivity increase in this country. Let's say that is a 30 percent increase. You could probably easily double—go to 100 percent, if you could put these rules on the agribusinesses. The cities themselves are expected, even in California, in the new bill that they are working on out there, to increase by 20 to 30 percent—just in the cities, which have already done a lot—the recycling technologies, which is actually one of the better technologies.



**QUESTIONER:** [Not at microphone]

**STEVEN SOLOMON:** The recycling of water. In other words, the wastewater that we produce is actually very clean. In fact, I think the astronauts drink purified wastewater themselves. We can drink it. In fact, in [Windhoek](#), in Africa, they actually do. But in most places they put it back into the ground and then pull it out again, just because toilet to tap doesn't seem so appealing.

But it works. Again, these same membrane technologies we were talking about before in desal are also being applied in making progress in this area.

There is an awful lot that can be done. But you have to start by getting the market engaged in the process of using water efficiently, and also within a framework that says that maintaining the ecosystem has a cost.

I have been going around saying that you really need to do two things. You have to deregulate some of the more egregious politically subsidized uses of water, both on the supply side and on the pollution side. At the same time, you put in a golden rule that says everybody has to return water to the environment in the same clean condition you took it out in, so the next guy has the same fair use of it that you did. It's sort of fair play. Obviously this is really hard to get to and there are a lot of complications and all of that. But as a general principle, it would engage market forces on the side of a clean environment and using water efficiently. It would be great.

**QUESTION:** Do you know of any examples of multilateral or bilateral treaties covering the right of one state to divert waters or overuse waters upriver?

**STEVEN SOLOMON:** Oh, yes.

**QUESTIONER:** Or any decisions of international tribunals that set forth principles on this?

**STEVEN SOLOMON:** Tribunals I'm not sure of.

There has been great work done on this. For all the predictions of water wars and all of that, there has been far more cooperation around the world. There are many rivers that have basin agreements amongst them on water sharing. The [Mekong has had one](#), without China, for a long time. Imminently we're expecting one on the Nile. I won't go into the history there, but that would be a breakthrough. There are dozens of those.

The thing that makes them work is that when you cooperate on a river, it should be a positive-sum game. You should be able to get more resources out of the river than each person going on their own and grabbing what they can. That happens because—where do you put storage? For example, we have Aswan Dam, stored in a terrible place. They lose 12 percent of the water in the river just because of evaporation. When the British controlled the whole region, they were going to put it up in the highlands, where there was much less evaporation.

Sometimes you want to clean up swamps that maybe also divert water and resources.

So by cooperating—and not only that, people in this field say that water, rather than becoming a source of conflict, actually becomes one of those things that rivals find themselves able to agree upon and then expand into other areas of agreement, finding common grounds in negotiations between them.

I don't think it has yet reached the level of law at an international level. I have spoken an awful lot to the World Bank people that have done a lot of work in negotiating these [agreements that are active on the Nile](#).

**QUESTION:** A great point on the cooperation that you just mentioned. For example, regarding the Great Lakes, there is a great [project between eight U.S. states and two Canadian provinces](#) to make an effort to prevent diversions and to manage water quality.

But I have a question on the market mechanisms point you brought up earlier. As opposed to other commodities, like soybeans, oranges, or corn, water is essential for human sustenance. In economic terms, it's the ultimate public good. So does it make any sense to make a commodity out of water—to privatize it, in other words?

**STEVEN SOLOMON:** That's not necessarily privatizing it. The government still owns it, in most cases.

But the way to go forward is this. I think the most enlightened way to think about it—that's a good point you make—is what some people call the three Es. It should be three things at once: an economic good, if you will, used efficiently; water for the ecosystem itself; and equity, social equity.

The way that you make this work in practice, I think, if you could negotiate good contracts, is that you should have tiered pricing, meaning that for the lowest amount of usage—let's say the 13 gallons that people believe is

the minimum that we all need to have a good quality of life—it can be free. It can be free or one dollar, something everybody could afford. As the volumes move up in terms of usage, the price goes up, to encourage efficiencies, rather than encouraging waste.

For example, today in California, we are working on grandfathered water rights that go to agribusinesses that got the water when the original irrigation systems were put in. They call it a use-it-or-lose-it kind of law out there, where if they don't use all the water that was allocated to them, or their grandparents or great-grandparents, they lose the right to it, and it goes down to somebody else. So they just flood their fields, regardless. It's inefficient use of that water. They flood it away. The guys who come right after them in water rights, who sometimes get the water and sometimes don't get the water, are very efficient users of the water, because they sometimes don't get enough. They are the ones who are leading the cause.

But the logic is crazy. It's inverted.

So the answer to the question is, you have to protect the basic human right—I do think, if there is a physical right to any physical good, it should be water. And 13 gallons would not strain anybody's reservoirs. That's not hard—even more than that. I think in Europe they use 50 to 60 per household, maybe a little more. We use 150. We don't even need that much. But we could pay more. If you want to use 150, let us pay a little more. But then when you get to the big-volume users, the price goes up.

The problem has been, where this has occurred in other countries where there have been problems, like in Bolivia and elsewhere, that either the contracts were made badly and the prices went up for poor people beyond what they could afford or the governments were inept or corrupt, and the businesses, frankly, were very shortsighted. It all led to political backlashes that got them kicked out of the countries anyway.

It's organization.

**QUESTION:** I just want to follow up a little bit on the last question on these agreements that have been made, as you said, more on a cooperative basis. They seem to be flowing through economic channels of the World Bank or regional institutions. At the same time, with 263 of these shared basins, there seems to be an opportunity for some level of preventive diplomacy, looking forward in terms of foreign policy. Do you think, given your research and what you know of these agreements that have worked, it's better that it is really channeled through the economic organizations and, in a sense, as economic policy, rather than going down the channels of the international political UN convention route?

We have done a little bit of work with parliamentarians in South Asia on water management and also in the Caucasus and the Aegean. Those succeeded because it was focused on the economic shared growth concept rather than looking at it in terms of politics and diplomacy.

I just wonder where you think this is headed or should head.

**STEVEN SOLOMON:** It's a big question. It's not one that I researched very thoroughly, so take my answer for what it's worth. It's just an opinion.

You did mention that I did another book—and it will be influenced by that, too—on international economic policymaking in the area of finance. I saw how the world worked a little bit in those areas.

I guess I have a bit of a cynical view. I do think that countries ultimately act in what they generally perceive to be their best interests. Sometimes passions overrule their best interests. But you do want to find something where everybody sees that there is something in it for them economically.

If you can do it locally and regionally, that's the best, obviously, because you know all the details, and every water situation is different. There's no cookie cutter for any of these problems. If you do it through World Bank mediation—the World Bank used to control the financial strings. That was its lever. They have lost that lever today. China is financing 220 dams, approximately, around the world right now, including ones in Ethiopia and Sudan that the World Bank would not have financed earlier because Egypt would have objected to it, and would not have done these three Es.

So there's a bit of an unruly aspect to this.

On the other side, that's good, because sometimes, frankly, the World Bank and some of the international institutions are very stultifying institutions. Brazil has been going on its own and has done great things, actually, outside of what were sort of considered the best practices of the day by the multilaterals.

That's sort of a jumbled answer. I just think that different levels have to start working on it. The State

Department, for the first time, is engaged. Harvard has the former head of the World Bank up there, and they are focusing on a number of these countries as well. They are bringing together some resources that can work on some of the technical problems.

There are very deep social problems in each one of these water issues. Equity issues are very profound. When they build a dam, for example, people are moved out. It upsets the social structures in societies. If you upset the local community social structures, these projects don't work. So there is a whole level of complication.

I think the more people that are focusing on it and aware of it, bringing attention to it, it gives you a higher chance of success.

**JOANNE MYERS:** I thank you very much. Before we conclude, you just have to tell us, how many gallons of water do we consume every day?

**STEVEN SOLOMON:** That's right. Thank you for reminding me. It's 1,000 gallons. You're forgetting the food you eat and all the water that went into the food you eat. If you eat a hamburger, by itself it's 700 or 800 gallons. So if you're a meat eater, it's a big number. The shirt on your back—700 gallons for a T-shirt. A little computer chip? That's 2,000 gallons of ultra-purified water to make that tiny little chip. And industries are huge users of water.

So you realize that when you begin to think of it, water is really a big deal in everything that we do.

**JOANNE MYERS:** On that note, I thank you very much for joining us.

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