

A Letter to the Young People of the World



The Goddess of Clean Energy

A Bold New Education
for the 21st Century

John Slade

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Title in Norwegian: Et brev til verdens unge

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ISBN 978-1-893617-69-8
ISBN 978-1-893617-70-4

John Slade Bøker
Moerveien 4
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Picture credits at end of book.

A deep “Thank you!”
to

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Tor Larsen

Helena Hegstad Diamantis

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Liudmila Mikhaylyukova

Abeer Yaseen

Åshild Maria Eftevåg

Jakob Larsen

Turid McAdam

Amund Eriksen

Janicke Idland

Akersborg Rotary Klubb, Oslo

Peace Research Institute of Oslo

Golden Mountain Restaurant, Oslo

Ås Train Station Kafé



The next generation.

**Autumn Semester—the Problem
Spring Semester—the Solution**

Student Research

Speakers from the Real World

A Global Online Library

A Weaving of Schools

A Global Generation Growing Up Together

Clean Energy, Prosperity, Democracy, and Peace

The Renaissance of the 21st Century

Introduction

If we clear away the unrelenting noise, if we clear away the smoke of a dozen wars, if we clear away for one evening the urgent demands waiting for us tomorrow . . . we can discover that we stand together before one of the most important decisions that people have ever faced on their long human journey.

Yes, we have a choice, between unprecedented catastrophe, and unprecedented progress. We *can* make the right choice, if we see who we are, and how ready we are to make the decision which will guide us for at least a century.

Young people of the world, you are the first global generation in human history.

You have unprecedented systems of communication.

You have, more than any generation before you, an unprecedented awareness of the world as a planet on which life has flourished for eons, and on which life is seriously threatened today.

And you have, in every country around the world, an unprecedented determination to build a better world. You no longer ignore somebody else's war somewhere on the other side of the planet, but ache in your heart for the day when peace will finally come.

You have the ability to free yourselves from the shackles of the 20th century—the poverty, the pollution, the plunder, the racism, the wars—and to build a future that calls upon the *best* that is within us.

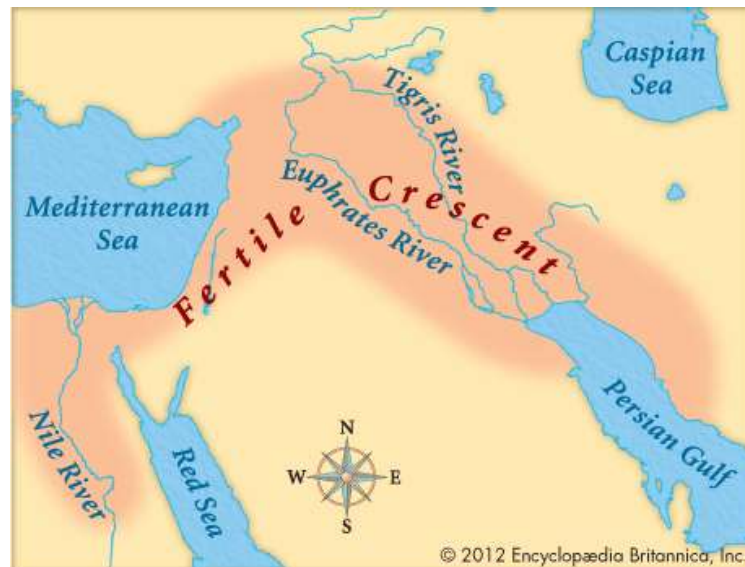
Yes, you can build the Renaissance of the 21st century.

Chapter One

The Arctic Ice Cap

Let's take a look at two events which have occurred within the past three million years. These two events may at first seem distantly related—or entirely unrelated—but the relationship between a geophysical phenomenon and our long human journey is crucial to our future survival.

Three million years ago, our human ancestors walked upright on the plains of eastern Africa, where they made tools from stones and mastered the uses of fire. Eventually, they migrated north into what is now the Middle East, and thence west into Europe and east into Asia. They steadily evolved—the fossil skulls which we find today show an increase in the size of their brains—and thus they turned their attention from hunting and gathering what food they could find . . . to growing a unprecedented range of food themselves.



Between two rivers, progress blossomed.

In one particular region, where two major rivers—fed by the snow and ice in the mountains of Turkey—flowed down onto a broad plain, our ancestors developed irrigation, drawing water from the rivers into a growing network of canals. They also domesticated both plants and animals, and thus grew a surplus of food. This reliable abundance of food enabled them to turn their attention to other things beyond mere

survival. Because they stored increasing quantities of wheat—the large seeds could be kept in baskets during dry periods, then planted when the rains returned—they needed a system of writing to keep track of annual harvests. The first writers in human history were not poets, nor historians, but accountants who kept track of wheat, barley, flax, peas and lentils, as well as cows, goats, sheep and pigs.

The people who lived in the Fertile Crescent did not stop with agricultural abundance and writing. They built cities of increasing size and complexity. They developed a code of law to keep the growing populations under control. They traded with other people who arrived in caravans from the west (Europe) and from the east (Asia). And they invented the wheel. It seems that the more they did, the more they could do; progress became a concept in their daily lives.

The Fertile Crescent—which encompassed the modern states of Egypt, Palestine, Israel, Jordan, Cyprus (a nearby island in the Mediterranean), Lebanon, Syria, and Iraq, along with parts of southern Turkey and western Iran—became the Cradle of Civilization, blessed with rivers fed by snow and ice in the mountains, blessed by abundant sunshine, blessed by land rich with nutrients, and blessed, especially, with people who developed a system of mathematics which not only helped them in their business transactions . . . but enabled them to track the movements of the sun and the moon and the stars.

These extraordinary people, with their ever-evolving cultures, were aided by the stable climate of the Holocene, a geological epoch which began about 12,000 years ago, at the end of the last ice age. The great sheets of ice which had covered northern Europe and Asia had melted, leaving remnants of ice high in the mountains. The world was still cold enough that snow could replenish this ice, winter after winter, and yet the world was warm enough that the ice could melt, summer after summer, to feed the great rivers flowing down to the plains.

Domesticated plants and animals from the Fertile Crescent made their way into the world. Writing and mathematics and codes of law made their way into the world. The fruits of a Golden Age—marred by unrelenting wars—became the foundation of our modern world today. The torch was passed from Babylon to Athens, to Rome, until, many chapters later in the record of human history, people today grow their wheat, and shear their sheep, and hire accountants to keep electronic business records, and argue cases in court, and point their rockets toward the stars. The early flute, made from a reed, and the early drums, made from animal skins stretched over a gourd, have become a symphony orchestra. The early letters,

made with a sharp stick on the damp surface of a tablet of clay, have become the great libraries of the world. Progress is as much a part of our daily lives as our morning cup of coffee.

* * * * *

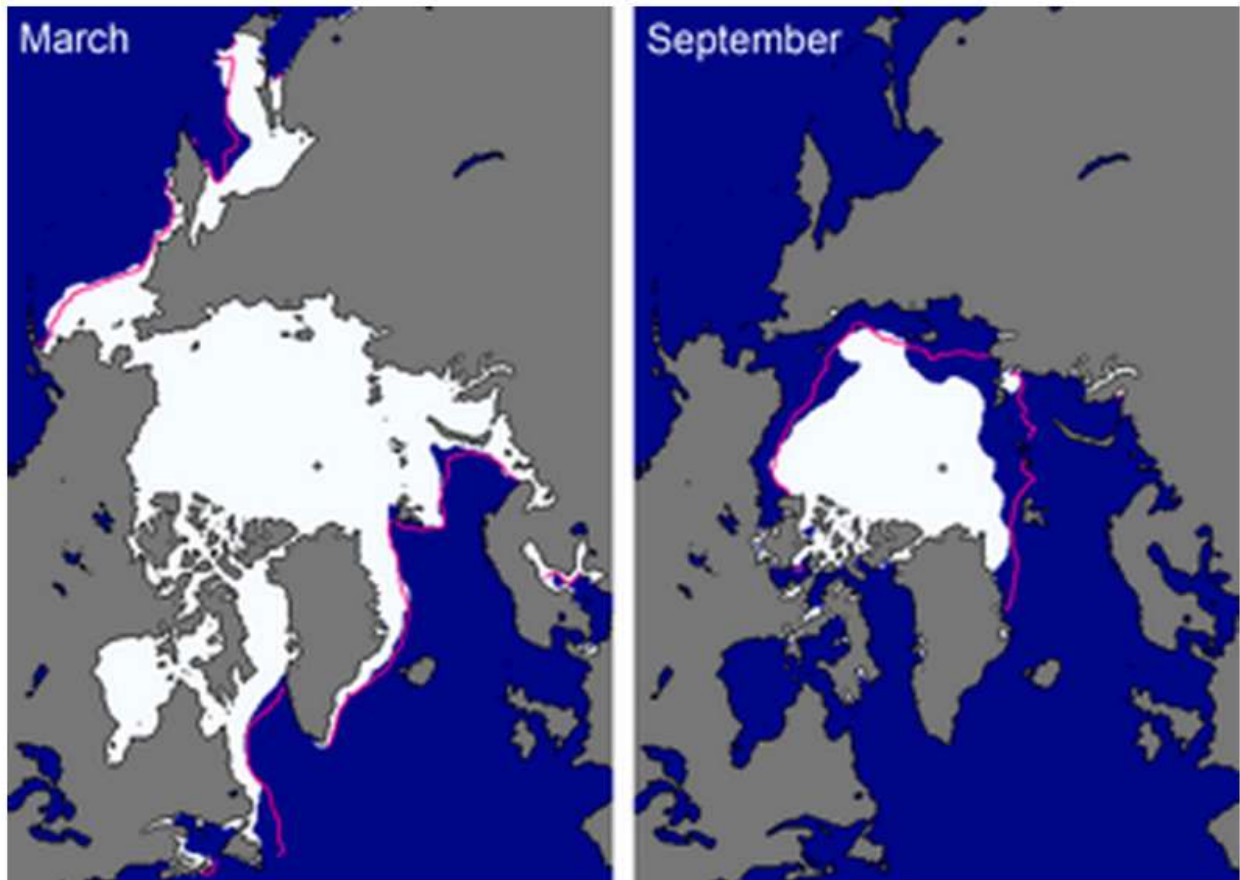
During the same three million years of human development, something else was happening in the world. Planet Earth has always experienced extended periods of warming and cooling, caused by various factors such as the wobble of its axis or the gravitational pull of distant planets in the solar system. About three million years ago, Earth became cool enough that a curved cap of ice formed at the top of the planet, where it floated on the Arctic Ocean.¹



The Arctic ice cap, ringed by northern lights.

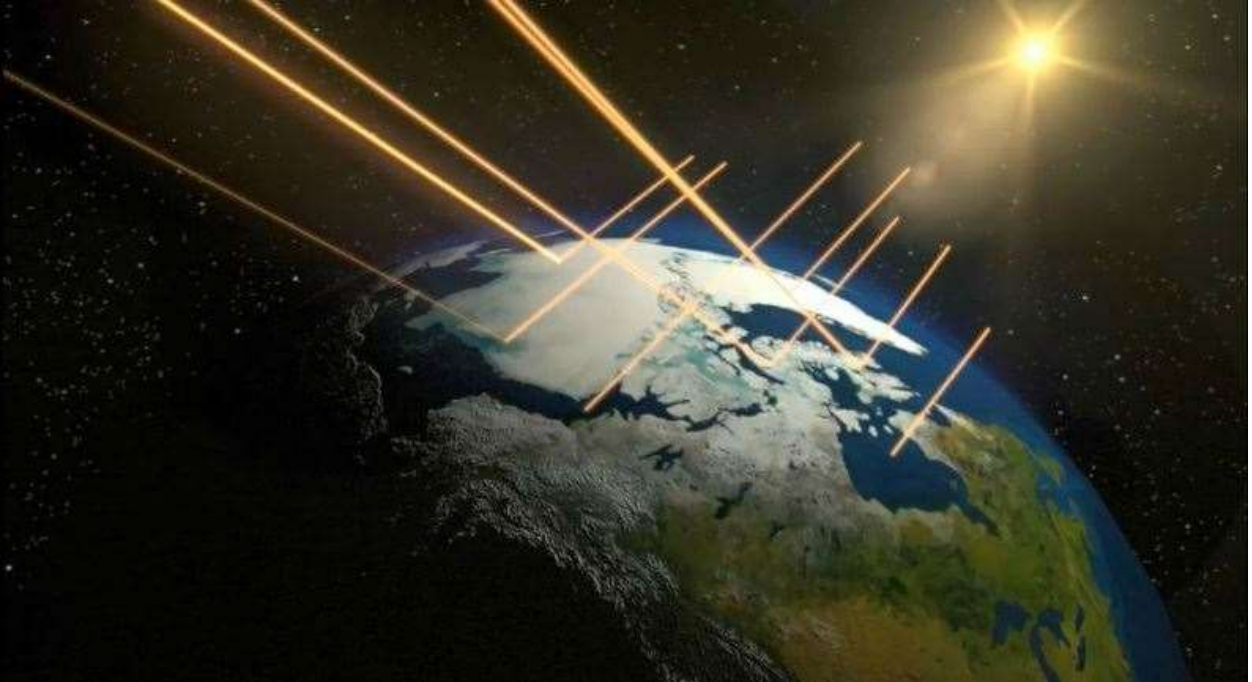
During the Arctic winter, when Earth's axis pointed away from the sun and the top of the planet was dark, the cap of ice expanded until it reached the northern coastlines of Asia, North America, and Europe. During the Arctic summer, when

Earth's axis pointed toward the sun and the top of the planet was brightly lit all day and all night, the cap of ice shrank, exposing the open water of the Arctic Ocean to the warming sunshine.



Arctic sea ice in 2013; winter maximum in March, summer minimum in September.
The dot represents the North Pole.

The Arctic ice cap, a thin sheet of white ice and snow, *reflected* about 90% of the sunlight back into space. The open water of the Arctic Ocean, wrapped around the edges of the ice cap, *absorbed* about 90% of the sunlight. The reflective ice cap has helped to maintain fairly stable temperatures on planet Earth for three million years, by reflecting sunlight which otherwise would have warmed the Arctic Ocean, and thus the planet itself.



The Arctic ice has long reflected light from the sun, keeping the Earth cool.
But now the huge curved sheet of ice is melting.

Like the Holocene, the geological epoch which has provided the Fertile Crescent (as well as the rest of the world) with a stable climate for twelve thousand years, the Arctic ice cap has provided the planet with a balance of temperatures—neither too hot nor too cold—for three million years, during the period of our long human journey.

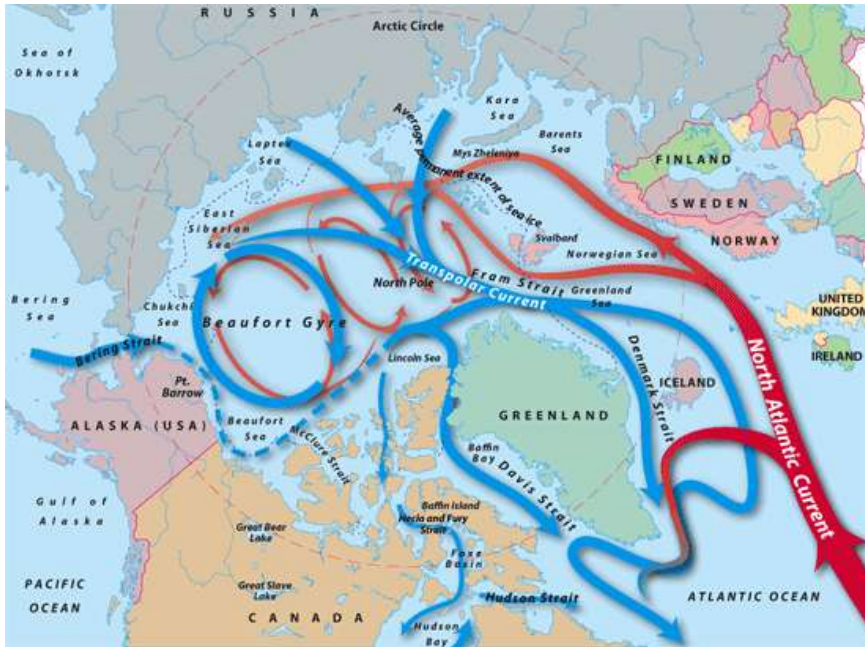
But now, as you know, the Arctic ice cap is melting. It no longer reaches as far south during the dark winters, and shrinks more and more to the north during the sunlit summers, thus exposing more and more open ocean water to the warming rays of the sun. As the Arctic Ocean becomes increasingly warm, it melts the sheet of ice—only a few meters thick—from underneath, so that the ice cap is not only reduced in surface area, but becomes thinner, and more delicate, as well.

The more the ice cap shrinks, the warmer the ocean becomes. And the warmer the ocean becomes, the more it melts the ice from underneath and the more the ice cap shrinks. The entire process accelerates, as we have seen with satellite surveillance since 1979.

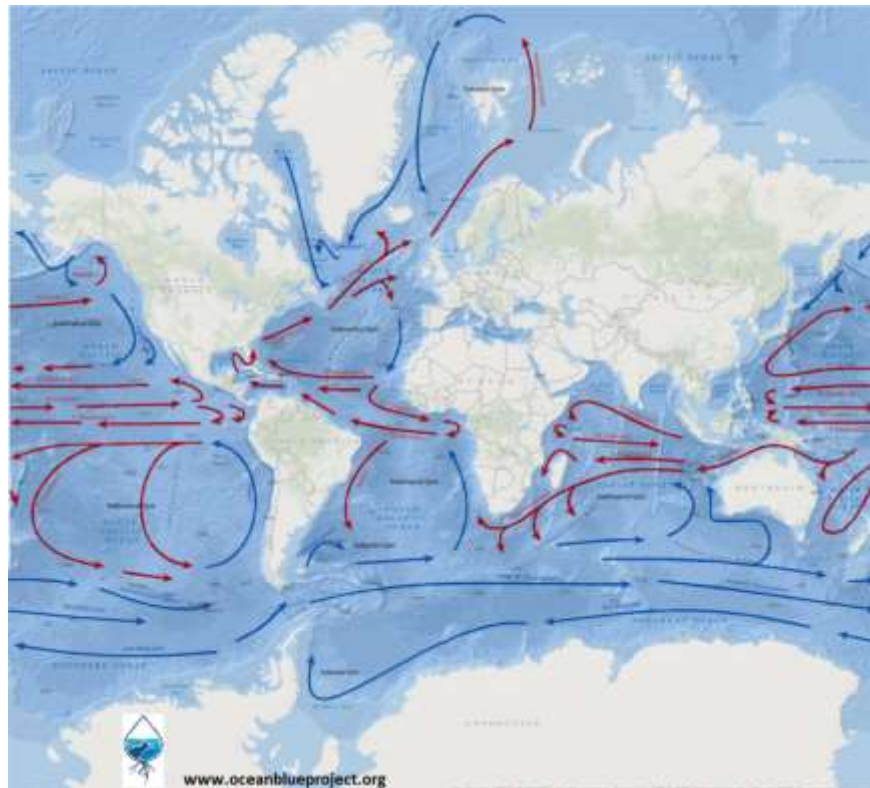


The shrinking of the Arctic ice cap,
from summer of 1979 to summer of 2012.

Several currents pass through the Arctic Ocean, including the northern portion of the Gulf Stream (called the North Atlantic Drift as it reaches the top of the planet). These currents—becoming colder and thus *more dense*, as well as saltier (from the evaporation of surface water) and thus *more dense*—sink at the top of the planet and continue their courses like great rivers flowing at various depths, all the way down to the floor of the ocean basin. As the Arctic Ocean warms, the currents flowing through it pick up increasing amounts of unnatural heat, then carry that heat on their journeys around the planet.



Currents flowing through the Arctic.



Currents flow like giant rivers around the planet.
Red on the surface, blue down deep.

Two centuries of manmade pollution have wrapped our planet with an ever thickening blanket of carbon dioxide and methane. Much of the heat in our warming atmosphere has been absorbed by the oceans, which initiated the shrinking of the Arctic ice cap. Now as the ice cap shrinks, uncovering more and more open water, geological factors combine with our pollution to warm the Earth further still.

The domino effect has begun: it has already reached the tundra, where the permafrost—a vestige from the last ice age—is now thawing. The thawing layer of subterranean ice is already releasing increasing amounts of methane, produced by bacteria from the decay of ancient plants long buried beneath the permafrost. The methane adds to the blanket of greenhouse gases wrapped around the planet . . . and again the process accelerates.



Ancient ice, now melting beneath the tundra.
Beneath the ice are planetary amounts of methane.

How long before the Arctic ice cap has shrunk to half of its original size?

It already has.

How long before the ice cap disappears entirely?

We don't know.

How warm will the Arctic Ocean become, when it is no longer capped by the protective ice?

We don't know.

How much unnatural heat will the ocean currents which pass through the Arctic Ocean carry around the planet, on the surface and deep below?

We don't know.

How much methane lies trapped beneath the permafrost, waiting to be released into the atmosphere?

We don't know.

How warm will planet Earth become with the release of planetary amounts of methane?

We don't know.

And this is just the beginning. There are more dominoes than we even know about. The warmer the atmosphere above the Arctic Ocean, the weaker the jet streams; the weaker the jet streams, the more wildly will our weather fluctuate.

The warmer the oceans, the more powerful the hurricanes.

The warmer the atmosphere, the more moisture it can carry, and thus the more rain it can release, creating unprecedented floods.

And drought? In twenty years, "drought" will be the most frequent word on the front pages of electronic newspapers around the world. The great rivers of the planet, no longer fed by melting ice and snow in the mountains, will become troughs of mud.

And on and on. Climate change is coming like a freight train, and we are all standing right on the tracks.



Precious life on a perfect planet.

Chapter Two

Nuclear Weapons in the Arctic

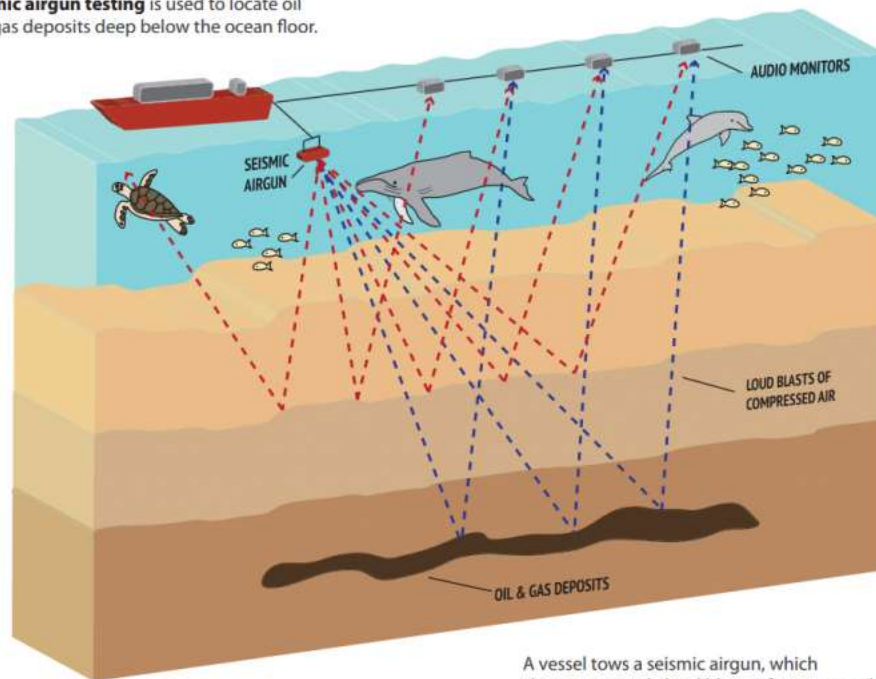
But there is something more. Something that very few of us have thought about.

A multitude of oil companies, from a multitude of countries, are making plans to drill for oil in the Arctic. Huge supplies of this valuable resource are waiting to be tapped. Fortunes are waiting to be made.

Oil companies reassure us that they will not spill any oil in the Arctic. Even if that were true, so many other dangers await us. We need to ask the Big Questions about drilling for oil in the Arctic. We especially need to ask them in our schools.

How do oil companies search for oil beneath the bottom of the sea? By blasting “sonic cannons” towed by ships. A shock wave of sound goes from the surface down to the bottom and penetrates the terrain beneath the bottom, then bounces up again, where the wave is read by instruments which produce a sonogram of the bottom, indicating where oil might be found.

Seismic airgun testing is used to locate oil and gas deposits deep below the ocean floor.



A vessel tows a seismic airgun, which shoots extremely loud blasts of compressed air through the ocean and miles under the seafloor, **every ten seconds, 24 hours a day, for days to weeks on end.**

A sonic cannon devastates marine life as it searches for oil.

These shock waves will bounce back and impact the bottom of the Arctic ice cap, battering it, cracking it, potentially shattering it. Once the ice is cracked, the warming water of the Arctic Ocean rises up into these cracks, melting the ice from *within*. The process of melting accelerates even more. The polar bears will soon be walking on mush. The layer of algae covering the bottom of the ice cap will be destroyed, and thus the foundation of the Arctic food chain will be destroyed.

The shock waves are massively intrusive to the life in the seas. Imagine someone exploding sticks of dynamite in your living room ever ten seconds, for hours and days and weeks at a time. Whales and dolphins, which rely on their underwater sounds to communicate, become disoriented. Large groups of whales which have washed up on beaches show bleeding in their inner ears, and extensive damage to their internal organs, where the shock waves have ripped through the soft tissues. Fish navigate with the help of sensors along the sides of their bodies; these sensors are devastated by the blast of sonic cannons. Research has shown that tiny creatures with fragile calcium shells—krill and pteropods—are shattered by the shock waves. Again, a major part of the marine food chain is destroyed.



Behold the fragile floating snail, the pteropod.
(You can say the p if you want to.)

What about the delicate eggs, and the tiny, delicate hatchlings which continue the miracle of life in the seas? Shattered by shock waves.

Yes, the research on the effects of sonic cannons is limited . . . because the oil companies never bothered to do the research.

* * * * *

Extracting oil from the Arctic requires a sequence of industrial stages. The oil companies first explore for oil with their sonic cannons. Then they build the enormous platforms. They drill for the elusive oil. They pump the oil up to the surface. And then they transport the oil in giant ships to distant refineries.

The oil companies will all, theoretically, work within their “zones”: Norway has a zone, Russia has a zone, the United States has a zone, and so on.

A century of evidence shows us that oil vessels are closely guarded by military vessels. Take a look at the Persian Gulf as a classic example. Why did the American Congress recently vote a record military budget, \$700 billion, for a huge increase in military development? Is Washington worried about Poland? About Syria? About China? No, Washington is getting ready to meet the Russian military development in the Arctic. Russia is already increasing its submarine fleet at two northern bases, near Arkhangelsk and near Murmansk. Much of this military preparation is focused on Arctic oil.

Thus we will soon find ourselves with powerful military fleets from a multitude of countries—both surface ships and submarines—prowling the Arctic Ocean at the top of our planet. These ships will carry both “conventional” weapons as well as nuclear weapons.

Imagine an American aircraft carrier patrolling the American zone of the Arctic, as well as a Russian aircraft carrier patrolling the Russian zone (which they now claim reaches all the way to the North Pole). What sort of missiles are under the wings of the planes on the decks of those carriers? We will not know, because that is a military secret.

What sort of missiles will the submarines carry? Long-range missiles with nuclear warheads, able to reach Saint Petersburg and Moscow, able to reach New York and Washington, able to reach the NATO airfield in Bodø, Norway, in a matter of minutes.

Remember, many of these military vessels will be sailing close to Norway’s northern shore. Hammerfest will have a front seat view of oil ships and naval ships going back and forth, day and night. Nukes and oil, nukes and oil.



Perhaps the final battleground on planet Earth.

If you visit the Peace Research Institute of Oslo (PRIO) at Hausmanns gate 3, you can find in the library a monthly journal called **Jane's Intelligence Review**. This journal keeps track of weapons developments in countries around the world. On the cover of the September 2017 issue, you will see a striking illustration of two

submarines in the gray-green waters beneath the Arctic ice cap. The title of the enclosed article: “Pole Positioning: Ice melt risks Arctic military competition”.

Already in September of 2017 (the month of the election in Norway, in which voters agreed to drill for oil in the Arctic), **Jane’s** is warning us about the next war in a long series of wars caused by oil. Which may also be World War Three. Which may also be the final war on planet Earth.

A quick reminder: the Arctic ice cap has covered the top of our planet for three million years. Because the thin, curved sheet of ice reflects 90% of the sun’s radiation, it has kept the Arctic Ocean consistently cold, and thus has stabilized temperatures on planet Earth. Now as the ice cap melts, the ocean is increasingly exposed to sunlight, and thus becomes warmer and warmer. The warming ocean melts the sheet of ice from below, at an accelerating rate.

Sonic cannons will batter the ice cap. A growing number of ice breakers, Russian, Canadian, Norwegian, American, will cut the ice cap into pieces. Submarines which surface from beneath the ice cap will further weaken the ice.

Sheets of ice break off and drift. What happens to oil rigs pumping oil when a sheet of ice, blown by a strong wind, with a surface area of over a hundred square kilometers, comes sweeping toward those oil rigs? It crushes them, and oil now leaks from a dozen broken wells. What happens if this disaster occurs in January, during the darkness of the polar night? At forty degrees below freezing.

What happens if an oil spill in one zone pollutes the waters of another zone? Do the Russians want American vessels helping to clean up an oil spill along the Russian coast, when the American vessels are suspected (as they will be) of spying on Russian submarine ports?

If America becomes involved in a military conflict with Russia, and then calls upon Norway, as a member of NATO, to support American warships against Russian warships, what will be Norway’s response?

As the ice cap melts—or is battered into pieces which quickly melt—the Arctic Ocean becomes warmer and warmer, because it absorbs the sunlight shining on the top of the planet. What sort of storms will become increasingly common in the Arctic? Hurricanes are born at sea, powered by the heat from the oceans. (The **light energy** from the sun becomes **thermal energy** when the sunlight penetrates the oceans, and then that heat energy rises in droplets of evaporation from the surface of

the oceans, and becomes the **kinetic energy** of the winds in a hurricane.) The warmer the ocean, the more powerful the storm.

Imagine an unprecedented storm in the Arctic, during the Arctic winter night, blowing military vessels and oil vessels out of their zones. Giant sheets of ice crush hundreds of oil rigs. Huge ships transporting oil crash on the long Russian coast; they burst open and release immense amounts of oil. Ships crash on the rocky Norwegian coast, spilling oil into the archipelagos and fjords. Rescue efforts and clean-up efforts are utterly impossible until the storm slowly dies.

What sort of future do the young people of the world now face?



The next generation.

If, as the result of a frozen switch, a dead radio, an impulsive, blundering politician, one nuclear missile is launched by mistake, even a small one—and it explodes with a fiery mushroom cloud over Siberia—the entire world immediately goes on nuclear alert. Aircraft carriers in the Persian Gulf, destroyers in the Mediterranean Sea, submarines off the coast of China, are on full alert. NATO's missile systems in Poland, Estonia, Latvia, Lithuania—Russia's historic nightmare—are on full alert. What is happening in the nuclear silos in Russia? In Montana? What is happening in Israel? What is happening in Pakistan and India? In China? In North Korea?

In 2017, planet Earth, the only planet on which life is known to exist, is also the home of 14,900 nuclear weapons . . . insanely dangerous weapons which threaten the future existence of life itself. The United States today has 6,800 nuclear weapons in scattered locations around the world. Russia has 7,000 nuclear weapons. 1,800 of the combined American and Russian nuclear weapons are now on high-alert status; they can be launched within minutes.

Seven other countries also possess nuclear weapons in a state of readiness: Great Britain (215 warheads), France (300), China (270), India (110-120), Pakistan (120-130), Israel (80), North Korea (less than 10).²

Total: 14,900 nuclear weapons which are maintained by a variety of governments in various states of readiness. These weapons are as much a part of your daily life as your morning cup of coffee.

The Arctic—that dark, cold, mysterious place about which we know so little—may well become the final battleground on planet Earth. Our greed for the profits from oil—despite the great challenges of climate change—may well trigger our final suicidal madness.



Global warming, final chapter.

Is that what we want?

Young people of the world, is that what you want?

These are the questions that we need to ask . . . before we go seeking for more petrodollars in the Arctic.

Chapter Three

The Good News

That's the bad news. Now let's turn our attention to the good news.

For the first time in human history, people around the world are beginning to work together to harness the sun and the wind. Two great benefits are produced by this unprecedented cooperation. First, clean energy is gradually replacing the filthy energy which has polluted the planet for over two hundred years. And second, equally important, people from different countries, different cultures, are learning to work together as they build wind farms and solar farms, and the international grids. As we learn how to build a better wind turbine, so we learn—by working with colleagues from around the planet—how to work with each other.

In the old days, it was *my* oil company, based in *my* country, even though I might be stealing the oil from *your* country. (Of course, I needed an army to do it.) Although clean energy companies are based in various countries, they work more and more with companies and colleagues from around the world. Nobody is stealing someone else's wind, someone else's sunshine. And armies—sorry, boys—become more and more a relic of the past.



Harvesting the sun.

These are the two key components that could launch the Renaissance of the 21st century. They are **clean energy**, spawning a growing multitude of benefits around the planet, and **intelligent cooperation**, enabling us to build a growing network of education, and prosperity, and democracy . . . and peace.

So we have a choice: between unprecedented catastrophe, and unprecedented progress.

As the Arctic ice cap melts, we can send our ships to the open waters of the north to drill for more oil, knowing that right behind the oil vessels from a dozen different countries . . . will sail fleets of military ships from a dozen different countries, protecting the “national interests” of those countries. The Arctic Ocean will become a very crowded place.

Ironic, isn't it, that Russia and America, the two cold war adversaries, are now very much alike in their resistance to progress toward the clean energy future. The oligarchs and the oil boys cling to their oil, to their profits, while the rest of the world moves forward. Russia has zero offshore wind turbines, and very few onshore turbines. The United States has a growing number of onshore turbines, built primarily by foreign countries, and only five offshore turbines, built in France and installed by a Norwegian ship. Yes, the Neanderthals still live in Washington and Moscow, while *Homo sapiens* has set his sights on a world of hope, a world of progress, a world of peace.

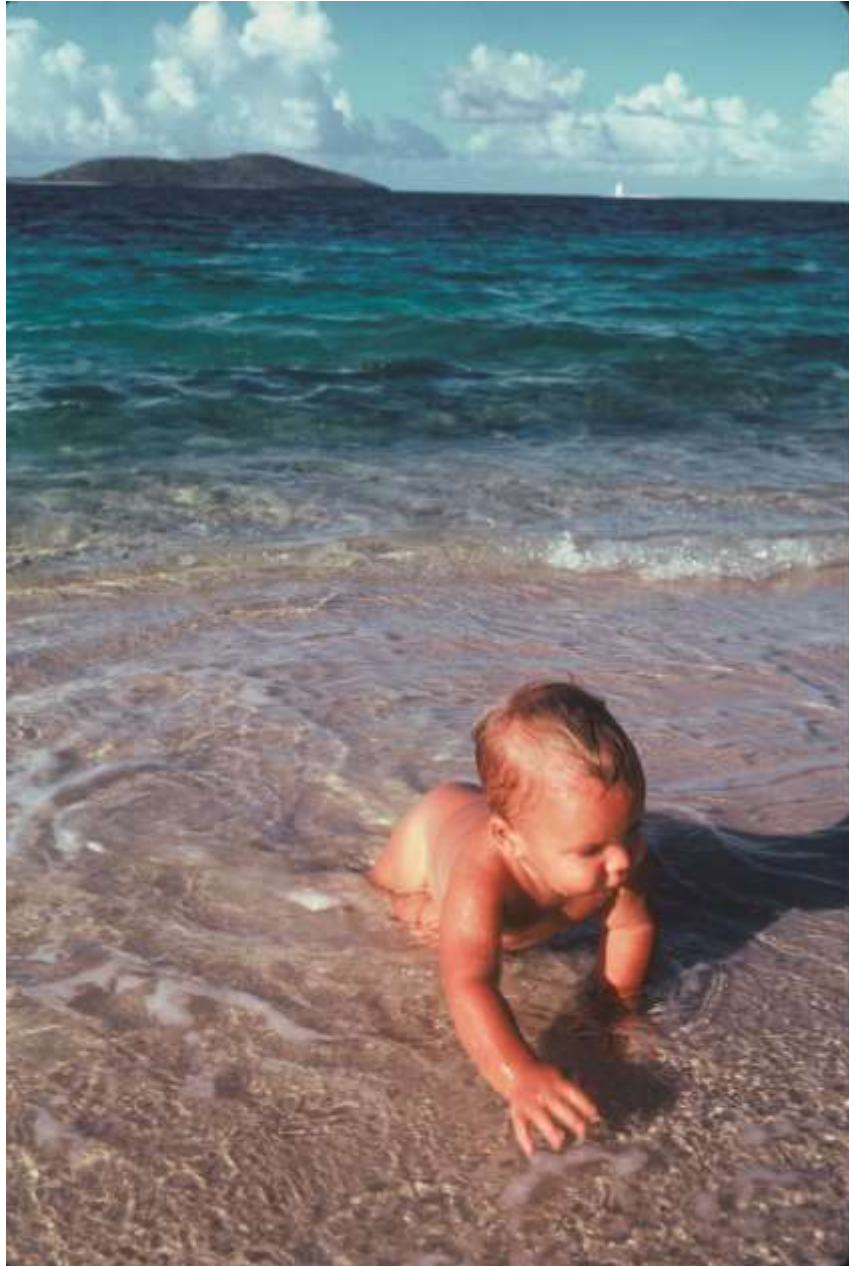


Putting together the components of peace.

The wind has been waiting for a long, long time to fly the kite of every kid around the world.

And the sun has been waiting for a long, long time to shine on the uplifted face of every kid around the world.

And we, on our human journey of three million years, have been waiting for a long, long time to finally decide—helping along the process of “natural selection”—to nurture the *best* that is within us.



To nurture the *best* that is within us.

Chapter Four

A Gaping Hole in our System of Education

As a teacher of English in several countries, several cultures, I kept encountering the early effects of climate change. When I taught on the Caribbean island of St. Croix for four years, I would often go snorkeling with friends at the Buck Island reef, a horseshoe of coral that wrapped around the eastern (upstream) end of a small island. As an underwater park, the reef—with its colorful fish, graceful turtles, hidden lobsters, evil-looking moray eels, and small squids that moved in formation—was protected from any sort of fishing. But no legal restrictions could protect the coral itself from a sea that was becoming warmer, and more acidic. The pointed prongs of staghorn coral, and the broad arms of elkhorn coral, both rusty orange, were turning chalky white.

Yes, the tourist boats kept coming, so that people could watch a turtle glide past them with slowly flapping flippers—a moment they would never forget—but those of us who visited the reef month after month knew that the coral was dying.



The next generation.

Hatching leatherback turtles on a beach on St. Croix.

* * * * *

I later traded the sunny beaches and crystal-clear waters of the Caribbean for two years on the tundra, above the Arctic Circle in northern Norway. I remember the day when I was late leaving my house for the ten minute walk to the college, where I had an eight o'clock class. It was a cold morning in November. The sun, which in a few weeks would disappear completely, had not yet peeked over the southern horizon. I put on my down jacket and wool hat, pulled on my thick gloves, grabbed my books in one hand and a cup of coffee in the other, then hurried out the door.

Half way to the college, I paused to take a sip of coffee . . . and discovered that it was a frozen black plug in my cup. Above me, the green ribbons of the northern lights were still rippling among bright stars in the night sky. My hot coffee had frozen in less than two minutes in the deep cold of a polar night.

When I showed my Sami students the cup of frozen coffee, they laughed at me, this American from that other world down south.



Two of my vibrant Sami students,
Ailli Biirita and Atle Johannes.

The Sami are the reindeer people of northern Scandinavia and northwest Russia. I was teaching English at the Sami College in Kautokeino, in the center of the vast tundra in northern Norway. My students were twenty young adults who were working as teachers, and who were taking my class to improve their English. As it turned out, I learned as much from the Sami as they learned from me.

Living in the far north, they experienced the early effects of climate change long before people further south even noticed. The reindeer migrate twice a year, in the autumn from their summer feeding grounds to their winter habitat, and in the spring from their winter feeding grounds to their summer habitat. For thousands of years, the Sami and their reindeer have moved back and forth between the mountains and the sea. They depend on certain snow conditions, and stream conditions, and coastal conditions to be stable.

In the month of April, as my students explained to me, the cold dry snow is deep. The springtime sun, which has reappeared after two months of darkness, melts the snow surface, turning it into a wet slush. After the sun sets, the night becomes extremely cold, so that the slush freezes, forming a thick, strong crust of rugged ice. The reindeer can walk on this ice, and thus the spring migration takes place at night; during the warm days, the reindeer sleep, as do their Sami herders. (Three-quarters of my Sami students disappeared during the month of April to help their families with the spring migration, never mind my classroom schedule and exams.)

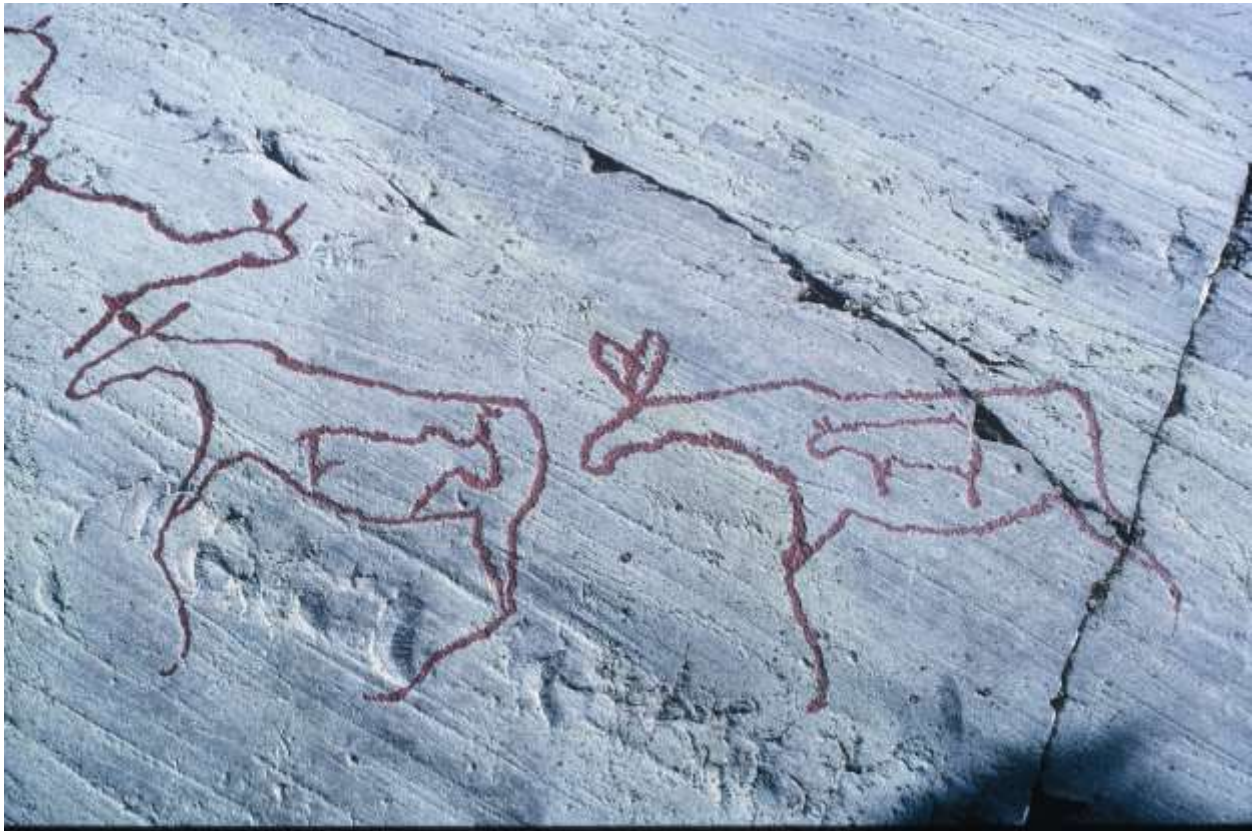
But what happens when spring comes a week or two early? What happens when temperatures are warmer than normal? What happens when the crust cracks and crumbles beneath the hooves of a thousand reindeer?

The reindeer calves are born in the spring. They have no trouble walking on the crust as they follow the herd during the cold nights. But what if the crust is unfrozen slush, and the snow beneath is a meter deep? What if a stream coming down the mountain, which for thousands of years has been a tiny trickle of water from melting snow, is now a torrent of water from snow melting weeks too early? If the calves try to cross the stream, they can be washed away, while the Sami herder watches helplessly.

The Sami also taught me that although people at climate conferences in the south speak of limiting the temperature rise to two degrees Celsius, that can mean six degrees or more in the Arctic north. As the Arctic ice cap melts, and the sun shines on the entire surface of the Arctic Ocean for the first time in three million years, no one knows how warm the ocean will become. The winds blowing across the ocean will become warmer; these winds blow across the northern portions of the continents which

wrap around the ocean, warming the tundra. What will happen when the winds stay warmer than zero degrees—the freezing point—during an entire winter? The snow will come down as rain. On a cold night, the rain will freeze as a crust of ice covering the moss which the reindeer eat. If the reindeer cannot break through that ice with their hooves, they will starve.

No one knows how long the Sami have been living in harmony with their reindeer on the tundra. We can only guess that as the glaciers retreated at the end of the last ice age, twelve thousand years ago, the reindeer moved north, and the Sami moved with them. These people do not need computer simulated climate models to know what is happening in their country.



Rock carvings of pregnant reindeer,
in northern Norway, from roughly six thousand years ago.

The Sami speak an ancient language. When my students greeted me in the morning with “Buorre beaivvi, Joavvna,” they spoke words older than Latin, older than ancient Greek.

Perhaps, when they with increasing insistence demand that we listen to them when they speak about the strange, unpredictable weather which threatens not only their reindeer but their entire culture . . . we people from the south might set aside our ignorance and our arrogance and listen to them with the respect which they deserve.

* * * * *

I later traded nights of cross-country skiing on the frozen Kautokeino River beneath a full moon when the deep Arctic cold—forty degrees below zero—allowed us to stop for no longer than a minute before we had to get moving again . . . for the relative comfort of living beside the sea (although still north of the Arctic Circle). I taught Business English at the College of Bodø, near the shore of one of Norway's famed fjords. The Gulf Stream, flowing from south to north along Norway's coast, keeps both the sea and the fjords from freezing during the winter. The winds off the sea warmed the coastal areas, so that while we still had cold dry snow in the mountains behind Bodø, we never developed—as can happen on the tundra—an ice cream headache just from breathing.

The College of Bodø has several departments, including the excellent Department of Fisheries, where I began to do research on the northern marine world which was now my new home. I lived not in the busy town of Bodø, nor in an apartment complex near the college, but in the tiny village of Hopen, further up the fjord, where twenty houses stood in a cluster above the shore of a small bay. My home, not more than thirty meters from the lapping waves of the fjord, was a genuine log house, well over a century old, with a wood-burning cast iron stove, kitchen utensils handed down through the generations, and an outhouse with cracks in the walls so wide that the January wind would leave a dusting of snow on the seat.

Two elderly gentlemen lived nearby, one in Hopen within calling distance, and one in a forest of stunted Arctic birch trees where, on a certain winter morning, Magnus and his wife awoke to discover that their house was entirely surrounded by a herd of reindeer. (They took pictures out the windows.) Both Odd and Magnus had been fishermen on the northern seas; Magnus still had a small boat, which he sailed alone, setting his nets out on Saltfjorden, never mind the driving rain.

These two fishermen augmented my research at the Department of Fisheries by visiting me in my log home and having a cup of coffee with me (Odd would hold a cube of sugar between his teeth and drink his coffee through the dwindling cube) while they talked about fishing and the sea in the old days. As Magnus said about the

diminishing populations of fish, “Folks won’t know what they’ve done to the sea . . . until they don’t have anything left to eat but rocks.”



Magnus bringing home the catch.

After listening to Odd’s stories about frozen dawns and sudden storms, I decided to visit the Lofoten—an arm of islands which reaches southwest from the Norwegian coast far out to sea—during the winter cod season of February to April. A ship sails from Bodø to the Lofoten town of Svolvær, then a bus follows a winding road through the mountains and over a gracefully arching bridge to the fabled fishing village of Henningsvær, built on a cluster of small islands beneath a wall of towering jagged mountains.



Over the bridge to magical Henningsvær

I lived on one of the small islands, where I was able to stand on the wharf of the codfish factory and talk with the fishermen who came on their boats every afternoon to deliver their catch. They had spent decades out on the sea, and had witnessed the unpredictable weather, the shifting of the currents, the unusual birds. Again and again they told me that they were not sure exactly what was happening, but things were definitely different.



Henningsvær Harbor, between two long slender islands,
beneath a towering wall of mountains.



Delivering the cod to the wharf.



Harvesting the codfish.

* * * * *

I came to the conclusion that though teaching English was important, what my students *really* needed to learn about was the growing threat of climate change. And they also needed to learn about the many benefits of clean energy. For if we are going to examine the Problem, then we must as well examine the Solution.

So I took a bold step: I contacted the Vestas wind turbine company in Denmark and asked if I might visit their factory, to learn what these wind turbines were all about. Vestas not only invited me to visit, but set up an interview with the CEO, the company's top executive, who spent an hour and a half over coffee and Danish rolls explaining to me the history of his company . . . and his vision for the future.



Harvesting the wind.

This wonderful gentlemen introduced me to a newly hired engineer who was about to make a tour of the various Vestas factories and research labs. The two of us spent three days driving around western Denmark—I marveled at the bike paths that ran parallel to the highway from one town to the next—visiting what I began to appreciate as the early stages of a powerful new Renaissance. In one giant factory building, we stood at the tip of a wind turbine blade that was over fifty meters long. Looking down the full length of the blade, I could see the same graceful curves that I had seen in an eagle’s wing feather. This blade, manufactured to spin on an offshore wind turbine, would spend at least twenty years catching the briny wind blowing over the sea . . . so that the energy in the wind could be transformed into the clean energy of electricity.

We had lunch in a company cafeteria where a delegation of about twenty-five people from China was eating at long tables with their colleagues from Denmark. A small Scandinavian country was teaming up with a giant Asian country. Yes, here was an early step that could take them, and the rest of the world, on an exciting journey through the decades of the 21st century.

* * * * *

Having visited the Vestas world headquarters, I took another bold step and introduced myself to the Danish manager of a work site in northern New York State where Vestas was setting up 195 new wind turbines on a windy plateau at the eastern (downwind) end of Lake Ontario. Speaking Danish while I spoke Norwegian, Sven welcomed me to join the work crew and handed me a hardhat and yellow vest.



Standing in front of a giant hub.

I had my camera and zoom lens with me, so I was able to take portraits of the guys as they readied the blades to be lifted by an enormous crane up into the sky, where the blades were connected to the hub of the nacelle. I discovered that many of the workers were Native Americans, who specialized in wind turbine construction. One of them called me over and told me to grab hold of the long rope which several men were holding as if engaged in a tug of war. The rope reached up to the tip of a blade; the men steadied the blade while the crane lifted it. Gripping the rope, I could feel a strong vibration, for the eagle feather was already catching the wind, and trembling with eagerness to go to work.



Up on the deck of the nacelle.
Your intrepid author does *not* like heights.

* * * * *

I decided to take the next step: the teacher would become an author. I would no longer stand at the front of a classroom filled with twenty-five students, teaching them how to write a three-page essay with footnotes and bibliography. Instead, I would reach out with a special sort of book to young people around the world, encouraging them to rise up to the great challenges which they were soon to inherit.

I would weave the facts which I gathered from intensive international research into a vibrant story—a novel—in which most of the characters were young people from many countries, many cultures. They look with their young eyes at the impending catastrophe which adults are about to dump into their laps. And they decide . . . to leave behind the wreckage of the 20th century, and to build a far better world in the 21st.

As I wrote these books—about a teenage Sami girl growing up on the tundra, about a teenage Norwegian boy growing up in Henningsvær, about a teenage girl from Syria speaking to us from her dusty tent in a refugee camp, about an American veteran

who returns from the war in Iraq to his farm in Illinois, about a teenage girl living in the Maldiv Islands who watches the rising sea level slowly swallow her home—I visited various schools to meet my potential readers. I talked with the students about climate change, the Problem, and clean energy, the Solution. And I learned, again and again, that most of the schools had a limited number of courses in Environmental Studies, courses which were taken by a limited number of students. Or, the schools had no courses at all, but bits and pieces of Environmental Studies which were tacked on to a biology class, or a geology class.

A high school or college student could easily study a full range of courses for four years and then graduate . . . without ever spending five minutes considering the climate catastrophes which were going to batter her for the rest of her life.

There is a gaping hole in our educational system, a willful ignorance which puts us all at enormous risk.

So the teacher who had become an author now turned his attention (with a great sigh) away from the stories which he loved to write, and instead took up his pen to write a description of two academic courses which we urgently need, in classrooms around the world.

These are not courses taught by one teacher, in which students read one textbook, in preparation for a final exam. These are courses of an entirely different sort, designed to a great extent by the students themselves. These are courses which rely far more on individual research than on the ponderous chapters of some outdated textbook. These are courses which do not lead to an exam and a grade and credits on a transcript, but to a genuine sense of *purpose* in life. These courses can lead as well to a great job, and potentially, to a lifelong career.

Young people of the world, the time has come for you to cast off the shackles of the 20th century, and to build *your own* magnificent 21st century.

I have taught in classrooms from California to New York, from the sunny Caribbean to the frozen tundra, from a small school in Henningsvær to the great universities of Saint Petersburg and Arkhangelsk, Russia . . . and I know from that long and rich career that the students of the world are entirely capable of working *together* as they no longer take baby steps, but long, bold strides, toward building a far better world.



The next generation.

Chapter Five

Climate Change, the Problem

The young people of the world have the right to know the full truth about the dangers of climate change. They have the right to know what sort of world they will live in, as they raise their children, as they pursue their careers.

The *worst* way for them to learn the full truth about climate change is to wait for somebody to teach it to them. We have already spent over four decades—from the early 1970s, when scientists first began to focus their attention on strange events in our weather, to the present day—ignoring climate change, denying climate change, lying about climate change, and slowly—finally—admitting that maybe climate change is real. (The first Earth Day was on April 22, 1970, almost fifty years ago.)

The best way for young people to learn the full truth about climate change is to do the research themselves, and then to share that research with their fellow students around the world. Scientists will be very glad to share nearly fifty years of professional research with a motivated generation who will listen to them. Satellites first began to photograph the seasonal changes in the Arctic ice cap in 1979; those pictures do not lie.

Thus a course on climate change must include *intensive student research*. The students will learn how to ask the right questions; how to dig deeper, and deeper; how to evaluate what they learn; and how to share their knowledge with the other members of their generation . . . with the other members of their global team.

All right, then. Let's get started.

We need a full, serious course during the autumn semester on **Climate Change, the Problem**. The scope of the course should extend from local environmental conditions to events around the world. Students need to think in terms of the entire planet, and of the entire 21st century (at least).

The teacher should have a good general background in the science of climate change, as well as—equally important—the ability to guide the students in their own research.

The students and teacher, working together, will invite a broad range of **speakers** to address the class and engage in discussions. These speakers might include:

Local farmers, who have followed weather patterns for decades, and who know how drought, or floods, can affect their crops.

Local fishermen, who know firsthand the changes taking place in the lakes or the sea.

Local foresters, who have closely monitored the health of a forest or wetland.

Indigenous people who have lived close to the land for generations.

A professional meteorologist, who reports on the weather at a local radio or television station.

The town mayor, who is responsible for preparing the community for the extreme weather that may come in the future.

Health professionals, who may suddenly be called upon to deal with a heat wave, with injuries from wildfires, or with new diseases in the region, such as malaria.

A local car dealer, who can explain why, out of the 500 cars on his lot, only a small number are hybrid or electric.

Students are welcome to use their ingenuity as they develop a list of invited speakers. The main goal is to listen to the voices of people who have been working in the real world, and to engage in vibrant discussions with them.

Students must be able to extend their research beyond local speakers. They will therefore work with their colleagues around the world to set up a **global online library** of books, articles and videos which focus on climate change. This library will be constantly growing as new materials—both professional and the result of student research—are added, in a multitude of languages.

Students will be able to watch a twenty-minute film in which a Sami reindeer herder speaks about the changing climate on the tundra. (The film could have subtitles in several languages.)

A film could present a scientist speaking at an international climate conference on the threat of rising sea levels to coastal cities and island nations.

A film made by students in Ethiopia could document the drought in their village.

Films made by students in various locations could document drought and wildfires in California, Russian Siberia, and southern Europe.

Professional research institutions around the world can contribute articles on Arctic research, glacier research, snowfall, rainfall, water tables, and monster hurricanes.

Companies which specialize in flood control can showcase their products.

Wildlife experts can contribute articles and photography about the threat of climate change to Siberian tigers, African elephants, and Alaskan grizzly bears.

Students in a small high school in Nepal will have access to an online library which reaches out to the entire world, enabling them to study climate change in the communities of the Andes Mountains of Peru, the Sierra Nevada Mountains of California, and the Alps of Switzerland.

Students in a remote school in the Amazon rainforest in Brazil will be able to study deforestation in a dozen locations around the planet. They will develop a global perspective on the problems which plague them at home.

Now comes one of the most exciting features of this innovative course on Climate Change—the Problem.

It is called: **Weaving the Schools Together**. Students around the world will create an *online directory of their schools*, so that students in Nepal can contact students in Peru and California and Switzerland, enabling them to share their research on vanishing glaciers, vanishing water supplies.

Students in Brazil can learn from students from a dozen other schools about deforestation, the devastation to wildlife, mudslides, poverty, and the threat to local cultures.

Students researching the drought and wildfires in California can link up with students researching the drought and wildfires on the Russian tundra. As they learn from each other, as they get to know each other, as they talk with each other on skype, as they share their photography, and perhaps as they share their favorite music, the kids in California and the kids in Russia are learning—in addition to all that they learn about climate change—that they *are* able to communicate, they *are* able to work together, they *are* able to share their very different perspectives on a problem which threatens their future, and the future of planet Earth.

All the crap between Washington and Moscow becomes less and less real, while the friendships among students, and the genuine research, and the search for workable solutions, become increasingly real.

Thus, while we are weaving the schools together—grade schools, high schools, colleges and universities—we are also weaving together a global generation. For the first time in human history, an international generation can grow up together as they examine and attempt to solve the local problems and great planetary challenges which they will face as working adults. The American students and the Russian students will learn that what is important is *not* who has the most nuclear weapons in their arsenals, but instead, which clean energy technologies they could share to develop their transportation systems.

Yes, we will learn about all the complex details of climate change, but we will also learn to view our world with an entirely new perspective: one based on a willingness to learn from each other, to help each other, to share with each other.

As students develop a growing list of global contacts, they also develop a *unifying purpose*: **We, together, will build a better world.**

Already, we are building the foundation of the Renaissance of the 21st century.

But wait. There is a group of young people who are not attending schools, who are not sitting at their familiar desks, who are not waiting for the bell to ring so that class can begin. Today, around the world, there are thousands, hundreds of thousands, even million of refugees, wasting the days and months and years of their lives in refugee camps. Children grow up without schools, or with poorly equipped schools, where teachers appear for a month or two and then vanish.



Moria refugee camp, Lesbos Island, Greece

The challenge to educate young refugees is enormous, and yet . . . young refugees have enormous potential. Many of them have been driven from their land by drought, or by battles over water. They have seen the ravages of climate change already, and thus they bring their own important perspective. Their voices should be heard. They too want to be a part of the global generation which will Build a Better World.



One tiny light of human habitation,
embraced by the mountains,
and blessed by the heavens.

Toward the end of the autumn semester, students around the planet will write a three-page report summarizing their research project. They will also make a five-minute presentation to their classmates, speaking from the front of the classroom about

their research, their findings, and their conclusions. Students thus build their writing skills and their speaking skills, and . . . they develop their confidence.

Perhaps as well, they have found a new *purpose* in their lives. Before, they were more or less aware that certain monsters were lurking out there in the world, but what could they themselves do about the polar bears who were running out of ice, or the fishermen who were running out of fish? Most young people—most people in general—feel helpless when faced with such enormous problems. Especially when the giant oil companies and their puppet politicians are spending great sums of money to block any progress.

But now, as students listen to their classmates speak about not only the polar bears which live on the ice, but the algae that lives on the bottom surface of the ice, and the tiny creatures called krill and pteropods which eat the algae, and the fish, and even whales, which eat the krill and pteropods, the students are learning that they *can* learn about the monsters, they *can* design their own class to make it more effective and more exciting, they *can* form a team able to rise to the urgent challenges. Yes, they *can* fight back, rather than wait and wait, with a vague dread in their gut, for the next hurricane, the next tornado, the next flood to come crashing through their world.

True, the adults have made this mess, and they have been dilly-dallying for a long time without really cleaning it up. The young people will inherit this mess, simply because they were born into a world of filthy oil and filthy coal and hideous, unbelievably stupid fracking. But by cleaning up the mess themselves, young people can form a team, a team which moves from **Climate Change, the Problem to Clean Energy, the Solution**.

How nice to wake up in the morning with a real sense of *purpose*.



“What do you think about all this climate change stuff?
Is it because those idiots keep burning coal and oil?”

“Naw, I blame it on the cows and their methane.”

Chapter Six

Clean Energy, the Solution

We need a full, serious course during the spring semester on **Clean Energy, the Solution**. We have spent the autumn semester learning about the bad news; now we are going to spend the magnificent spring semester learning about the good news.

Once again, the students and the teacher, working together, will invite a broad range of speakers to address the class and engage in discussions. These speakers might include:

A clean energy entrepreneur, who has launched a company that installs solar panels on the rooftops of homes and businesses. What compelled him to leave his job as a lower level architect in a large firm, where he designed windows and doors, so that he could set up his own business and harness the power of the sun?

A farmer, who has a dozen wind turbines spinning in his corn field, or wheat field, or dairy cattle pasture, installed and maintained by an energy company which leases a small circle of land for each turbine. The farmer doesn't have to do a darn thing except stand out on his porch with his morning cup of coffee while he watches the spinning blades of his turbines. Each turbine pays him between \$8,000 and \$10,000 a year, so that he can pay off his loan to the bank (he bought a new harvester), send his kids to college, and keep the family farm in the family, forever.

Nobody loves wind turbines more than the farmers of the world, because by harnessing the power of the wind—by *harvesting* the wind, as some farmers like to say—they provide themselves and their families with something which they love almost as much as a good steady rain: peace of mind for the future.

An economist, who will explain to the students that the wind industry is creating thousands of new jobs, more and more jobs every year, in countries all around the world. She will explain to the students that the solar industry is creating even more jobs than wind. She will also tell them that the clean energy industry, more than most industries, encourages the *education* of its workers. Clean energy companies often develop new programs with community colleges, so that students who might otherwise get no further than a high school diploma . . . can now study for

another two years at a community college, with the security that they will have a well-paying job waiting for them when they graduate. If they want to continue their education, their job can develop into a lifelong career, with travel to job sites around the country, and potentially around the world.

The economist may read to the students a report from the International Renewable Energy Agency, informing them that in 2016, 9.8 million people around the world were working in clean energy industries. “In the last four years, the number of jobs in the solar and wind sectors combined has more than doubled.”³ In China, a country moving rapidly from fossils fuels to the sun and the wind, 3.64 million people are now working in the field of clean energy. In the United States, “jobs in the solar economy rose 17 times faster than the overall economy, growing 24.5% from the previous year (2015) to over 260,000.”⁴ She could add, “We expect that the number of people working in the renewable sector could reach 24 million by 2030 . . . becoming a major economic driver around the world.”⁵

Thus, young people of the world, if you want a job, if you want a career, which will enable you to support your family *and* feel proud about the work that you are doing, take a close look at one of the most important industries of the 21st century.

The students would do well to invite a clean energy protester to speak to them: someone who *hates* wind turbines, who *hates* solar panels, and who does not want to see them anywhere near his home.

Everyone can learn from a good healthy debate. Perhaps the other person has a few good points. And where you disagree, how do you best argue your own point? Where do you find the information to support your rebuttal?

The information can come from a global online library of books, articles and videos which focus on clean energy in all its forms. This library will be constantly growing as new materials—both professional and the result of student research—are added, in a multitude of languages.

Every school around the world should also subscribe to the daily online journal of clean energy, **Recharge News** (www.rechargenews.com), the international trade magazine read by everyone in the clean energy industry. (You can order a free trial subscription for two weeks, so that you can see for yourself that **Recharge News** is truly a gold mine of information.) Students can read about the latest developments in energy production from not only the sun and the wind, but from ocean waves and

currents, from high altitude kites, from biomass sources such as woodchips, and from volcanic heat in the Earth.

Recharge News has an archive section. Students can look up their own country and read articles going back to January of 2009 (when the magazine was first published). How has solar power developed in India? Why is Scotland one of the leading offshore wind turbine developers in the world? How close is Costa Rica to becoming the first country to reach 100% clean electricity? What is Elon Musk doing with his electric Tesla cars in California? Which country is leading the clean energy Renaissance in Latin America, Mexico or Brazil? What role does little Vietnam play in the global wind turbine market?

If you are worn out by all the bad news in the world, take a look at **Recharge News**, the *good news* journal. It will give you hope.



An early user of solar energy.

By exploring both the global online library and **Recharge News**, students will continue to become masters of research. They will learn how to gather a growing body of information, until they have enough to write a comprehensive report on some

subject which fascinates them. Here is a skill which will be useful to them for the rest of their lives.

And while they are learning, they will also confirm, again and again, that there is an enormous amount of *progress* going on in places where they never would have expected it.

Do you remember that the Arab Spring began in the little Arab country of Tunisia? Then, of course, the Arab Spring fell apart in all those Arab countries and now they are all killing and bombing each other and . . . Wait! Take a closer look. Engineers in Tunisia have built an entirely new way to harness the sun. An array of thousands of mirrors reflects the intense desert sun onto a tall tower which contains salt, and a steam-driven turbine connected to a generator that produces electricity. The mirrors reflect the sunlight onto the tower; the sunlight heats the salt until it becomes molten, almost like lava; the molten salt can heat a flow of water so that it becomes steam, both by day and by *night*; the steam drives the turbine which drives the generator, which produces electricity at three in the morning.

That's the *good news*.



An early user of solar energy.

Students can read about Belfast, the port in Northern Ireland where a great shipbuilding industry once flourished. (The *Titanic* was built in Belfast.) But then shipbuilding moved to Asia, and the workers of Belfast lost their jobs. Today, however, Belfast is booming again because the workers are building offshore wind turbines. Companies from a dozen countries have set up offices in Belfast; the city has become one of the important hubs of the international wind industry.

Equally important: after centuries of conflict between Northern Ireland and southern Ireland—generations grew up as victims of a slow-burning war—the wind turbine industry has increasingly woven the two “countries” together. The wind blowing across the North Atlantic does not care about Catholic or Protestant, about green or orange; the wind simply wants to spin the blades of offshore wind turbines. People in offices in Belfast now phone people in offices in Dublin, asking about a shipment of wind gauges in the supply train. People in offices in Dublin now phone people in offices in Belfast, and in London, and Paris, and New York, and Beijing, asking about a shipment of aviation lights to be installed on top of the offshore turbines, making them visible to airplanes at night.

Thus we have an example—one of a steadily growing number—of clean energy bringing *peace* to the world. The kids of Ireland no longer grow up throwing bricks at each other. They are studying to become engineers, economists, and visionaries.

Students can read about a number of countries which are designing and constructing tall buildings that combine apartments and offices with . . . thousands of trees. A variety of trees and plants grow on special balconies—on every floor—as well as on the roof. The trees not only provide an entirely new environment for the people working and living there; they also take carbon dioxide out of the smoggy air and replace it with oxygen.

Students can read about a huge new wind turbine farm being built on a remote desert in Kenya, where the challenges are many: 1,300 kilometers of rural roads between the port of Mombasa, where wind turbine components arrive by ship from a multitude of factories, to the wind farm site deep in the Rift Valley; heat and dust, which can damage the machinery; and a skeptical local population, most of whom have never seen a wind turbine before, and thus are not sure that they want these giant

machines as their neighbors. But the work goes forward, and Africa will soon have a showcase development, encouraging further projects.



An early user of solar energy.

Students can read that on December 25, 2016, the people of the United Kingdom had a very green Christmas. 41% of the electricity which powered the bright lights on their Christmas trees came from renewable sources. 75% of that clean electricity came from wind turbines.

The UK's first wind farm was built 25 years ago, when ten onshore turbines were installed in Cornwall, located in southwest England near the sea. The United Kingdom now has over one thousand commercial wind projects, both onshore and offshore, providing electricity to more than 9.5 million British homes.

This is unprecedented progress. Yes, this is the Renaissance of the 21st century.

The students might discover, while reading an article by Wind Europe in the library, that on February 22, 2017, 18.8% of the electricity used in Europe came from

the wind. Nearly one in five light bulbs burning in Europe that day, nearly one in five coffee machines, nearly one in five laptops, were powered by the wind.

Germany produced 52% of its electricity, more than half, from the wind. Ireland produced 42%. Poland, showing how quickly it is developing, produced 20%. Little Lithuania, a country we rarely read about, produced 19%. Romania, a country which we almost never hear about, produced 16% of its electricity from the wind.

And little Denmark, the pioneering country of wind power—Denmark manufactured the world's first commercial wind turbine in 1979—produced 104% of its electricity from the wind on that historic day. More than it could use, so it sold the excess 4% to neighboring countries . . . at a profit.

We could of course go on and on, visiting Pakistan, Ethiopia, Finland, the Gulf of Mexico (where offshore wind turbines will gradually replace the filthy oil rigs), Japan, Mongolia, and even Russia.

Russia! Yes, Russia is now teaming up with both Denmark and the Netherlands to build its first wind turbine factories. And what's more, Russia is talking with India about developing solar power. The oligarchs are worried.



An early user of solar energy.

But let's move along to that most exciting aspect of **Clean Energy, the Solution:** the weaving of schools around the world.

Once again, while we are weaving the schools together—grade schools, high schools, colleges and universities—we are also weaving together a global generation. For the first time in human history, an international generation can grow up *together* as they explore, and design, and build the unprecedented technology which will help to control the worst ravages of climate change . . . and which can potentially lead to a healthy and prosperous future for all of the peoples of the Earth.



The boys are smart, but the girls are smarter.

Students from Vermont, a state where many people *do not want wind turbines* on the ridges of their beloved Green Mountains, can communicate with American students from states bordering the five Great Lakes, and the St. Lawrence Seaway—as well as with Canadian students from provinces bordering on the northern shores of the Great Lakes and the Seaway—to discuss building offshore wind farms which would power the entire region, north and south of the border. If a multitude of European countries can work together to build a network of offshore wind turbines, feeding

power into an international grid, why can't the states and provinces of North America do the same?

Students who want to develop underwater turbines which spin as the tide pours into a long narrow bay, such as the Bay of Fundy, and then pours out again, can link up with students from a dozen countries around the world who also want to design and test and potentially build tidal turbines.

Or wave turbines.

Or kite turbines. The higher the kite, the stronger the winds.

Of course, every refugee camp in the world should be powered by the sun, powered by the wind. Let the kids growing up out in a desert wasteland, where the sun beats down all day, and the wind blows dust both day and night . . . let them see that yes, there is something intelligent going on in the world outside their barbed wire fence. Let them see a glimpse of a hopeful future, and let them too plug into the global online library, and the global network of schools. Some of the most motivated students in the world live in dusty tents, far, far from home.



Refugee boat wrecked on the shore of Lesbos Island, Greece.

Toward the end of the spring semester, students will once again write their reports, and prepare their presentations, so that they can share what they have learned about clean energy with their classmates . . . and with their colleagues on the other side of the equator.

Students graduating from their high school, from their college, from their university, might want to give a gift to the school that brought the sun and the wind into the classroom. They might want to give a gift to the school that connected them with new friends around the world.

What if a graduating class raised the money to put enough solar panels on the roof of their school to produce 10% of the electricity used in the classrooms? What if next year's graduating class added another 10%, and so on through the years, until an especially motivated graduating class has the enormous honor of installing the final batch of solar panels, so that their school now receives 100% of its power from the sun?

Think what we could do, if we would only *do* it.

What if we set up a wind turbine beside every football field, so that while we sit in the bleachers cheering for our team, we can cheer for those spinning blades as well?



Missus Goose: "I've been learning about wind turbines. They have enormous potential. What do you think?"

Mister Goose: "Well, lemme finish my cup of coffee. Say, what's on TV tonight?"

What if every young person in the world—or even a majority of them—announced that the only car they would buy . . . must be an electric car? Perhaps their generation takes an oath: it’s either electric, or it’s my bicycle. Faced with such a statement from millions of potential buyers, how long would it take the car makers of the world to respond?

Young people of the world, you hold the purse strings.
You hold the power.

What if every young person in the world had a long talk with two people: your grandparent who has seen it all, and your grandchild who is still unborn. What wisdom could we learn? What promises could we make?

In America, people speak of the soldiers who fought and won World War Two as “the Greatest Generation”. Young people of the world, you have the potential, and the responsibility, to become the next Greatest Generation. Not because you win a war, but because you build, with help from the sun and the wind, a just and lasting peace.

The sun, which blesses me with richest earthly finery,
Shines no warmer than my hopes upon thee.



Chapter Seven

Honor the Creator by Honoring the Creation

We have come to an extremely dangerous point in our long human journey. We can perhaps manage to survive through the coming catastrophes of climate change. We have already proven that we can survive two world wars. And we have already proven that we can live for over half a century with nuclear weapons on our planet. But could we survive drought which brings the collapse of agriculture in multiple regions of the world, which triggers the migrations of desperate climate refugees looking for food and water and a safe place to sleep, which triggers the closing of national borders, which triggers riots and battles and small scattered wars?

How long before small scattered wars become larger continental wars?

How long before the first “tactical nuclear weapon” (just a small one) is fired as a warning shot?

We are already doing a miserable job in helping the refugees who have poured out of Syria, where an endless war has destroyed their cities. We have already put up walls in Palestine and Texas. What are we going to do as the glaciers in the Himalaya Mountains gradually melt, and the Ganges River gradually dries up? What are we going to do as the glaciers in the Andes Mountains gradually melt, and the Amazon River gradually dries up . . . and the dying rainforest no longer removes carbon dioxide from the air and replaces it with oxygen? What are we going to do with nine billion desperate people, seeking food and water and a safe place to sleep?

How are the armies going to defend the borders when there are no borders anymore? How are various governments going to control their nuclear arsenals when the governments themselves are crumbling into unprecedented chaos? How are we going to know what is going on in the world when global communication networks—whether television or radio or online—are collapsing into bits and pieces of unreliable news reports?

Young people of the world, is the future you want?

* * * * *

Let's take a look at our situation today within a broader perspective.

Scientists tell us that the universe was created by the Big Bang 13.8 billion years ago. We do not know how energy and matter first came into existence, and we certainly do not know *why* they came into existence, but we can today—with our telescopes peering out at the galaxies in our neighborhood, and with our arrays of dishes listening to the pulses of energy streaming through space—observe the workings of our still-expanding universe.

Scientists tell us that the earliest Earth, a coalescing ball of dust made from the debris of an exploding star, began spinning around our own particular star, the sun, 4.54 billion years ago. If we divide 4.54 billion years by 13.8 billion years, we can calculate that our Earth has been spinning around the sun for 32.9% of the time that the universe has existed. Yes, our tiny little Earth has been orbiting a star for one-third of the time . . . since time began.

Scientists tell us that life—single-celled life—first appeared on planet Earth 4.1 billion years ago. We do not know precisely how energy and matter first organized themselves into tiny cells which could reproduce themselves, and we certainly do not know *why* this miracle of life began to exist. We do know, however, that we have not yet found life anywhere else in the universe.

Life has been able to develop and flourish on this tiny planet because the planet's orbit around the star is absolutely perfect. If the planet's orbit passed any closer to the sun, conditions on the planet would be too hot for life to survive. If the planet's orbit took Earth any further away from the sun, conditions on the planet would be too cold for life to survive. Either the oceans would boil and evaporate, or they would freeze into giant blocks of ice.

We have been given the gift of perfection: just enough light, just enough heat, so that the miracle of life could flourish for 4.1 billion years.

If we divide 4.1 billion years by the age of the Earth, 4.54 billion years, we calculate that life has existed on Earth for 90.3% of the time that the Earth has been spinning around the sun. Life got an early start on this planet, and it has hung on for a long, long time.

If we divide 4.1 billion years by 13.8 billion years, we calculate that life (just on our own tiny little ball spinning in space) has existed for 29.7% of the time since the Big Bang produced the universe. For almost a third of the time that electrons and protons and neutrons have been organizing themselves into atoms, and the atoms into

elements, and the elements in molecules; for almost a third of the time that stars have been shining and overheating and exploding; for almost a third of the time that pulsars have been pulsing, and solar winds have been blowing, and black holes have been swallowing who knows what . . . life has existed in this mysterious, miraculous universe.

And now, are we, *homo sapiens*, still waving our stone axes at each other, going to bring to an end this long, long journey of life on planet Earth?

Who, us?

Yes:

By filling the atmosphere of this planet with over two centuries of our filth.

By warming the oceans, and by changing the chemistry of the oceans, and by plundering the life in the oceans.

When carbon dioxide from the atmosphere is absorbed by the oceans, it combines with water to form carbonic acid: $\text{CO}_2 + \text{H}_2\text{O}$ becomes H_2CO_3 . Carbonic acid dissolves the calcium shells of a multitude of creatures living in the sea. Large portions of oceanic food chains—diatoms and shrimp and pteropods—gradually vanish, and thus fish and birds and whales gradually starve.

Keep in mind that most of the oxygen which we breathe did not come from trees in a forest, but from vast quantities of algae in the oceans. As we poison our oceans, “the cradle of life”, we threaten to suffocate ourselves.

By refusing to acknowledge the damage we have done to our planet, and by taking far too long to fix that damage.

By clinging to the ancient scourge of war as part of our modern life. And by developing weapons which borrow their fire from the sun.

By insisting that “Our God is the one and only God, and all the rest of you are heathens.”

The time has come to put behind us the ancient squabbles, the ancient grievances. We are at the brink of destroying the only life we know in the universe.

We may not agree on our gods and our prophets, but I think we can agree that sometime, long ago, a major event took place which created—yes, created—the

universe that surrounds us—embraces us—today. We can also agree that life has been an important part of this universe . . . during 29.7% of its existence.

All religions reach back to that time, “In the Beginning . . .”, when a Creator stepped forth and created . . . life.

Who are we to end the long journey of life on planet Earth?

Who are we to end the long journey of life in the universe?

Young people of the world, you are the guardians of life on this planet. You have a big job to do, and only a few decades to do it.



This is our home. The only one we have.

Chapter Eight

A Gathering of Voices

One person alone cannot set up a global online library that covers the twin subjects of **Climate Change, the Purpose and Clean Energy, the Solution**. One person alone cannot set up a global online registry of schools and universities around the world which could work together to **Build a Better World**.

One person alone cannot invite students from around the world to a conference every four years, a conference at which they get to know each other in person, and discuss the progress they are making.

This must be the work of an entire generation of students, who reach out to schools, to companies, to research institutions, and to each other . . . and who use their extraordinary computer skills to set up an unprecedented global system of education, and action.

One person, a teacher, *can* propose a new system of education to the students in whom he deeply believes. They have the energy, and the motivation, and the genuine sense of justice, which would enable them to bring their schools into the 21st century.

That's the first step. With their knowledge of growing up in a dry, dusty village in Africa, in a smoggy city in China, in a city with few real jobs in Russia, in a city or on an island that will be underwater in a few short decades, the students *know* the reality of the world today, and they *know* what kind of world they would like to spend their lives building.

No other generation before them in all of human history has faced the twin evils of climate change and war, both of which have already begun in various locations on our planet. And no other generation before them in all of human history has ever had the extraordinary opportunity to become Architects of Clean Energy, and Architects of Peace.

Young people of the world, the 21st century is *your* century. Our human journey, so far, has lasted three million years. The time has come to stop taking baby steps, but to move forward with long bold strides. We must learn how to live in harmony with each other, and how to live in harmony with planet Earth.

Plan your journey well. Keep learning throughout your lives, and you shall discover the best that is within you.

The *best* that is within you, which, like the sun and the wind, has been waiting for a long, long time to go to work.

* * * * *



Let's go!

Footnote 1, page 9:

Elizabeth Kolbert, **The Sixth Extinction**, Bloomsbury, London, 2014, page 160.

Footnote 2, page 23:

Nuclear information provided by the International Campaign to Abolish Nuclear Weapons, ICAN, which won the Nobel Peace Prize in 2017.

Footnotes 3-5, page 49:

International Renewable Energy Agency (IRENA)
Renewable Energy and Jobs—Annual Review 2017.



Your intrepid author, with the generator
inside the nacelle of a wind turbine.

The power of the wind spins the blades,
which turn the axel, which turns the gears,
which turn the generator, which produces electricity.

This machine is the heart of a wind turbine.

This machine is the heart
of the clean energy economy.

This machine is the heart
of the Renaissance of the 21st century.

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Page 10: Arctic sea ice in 2013, maximum winter and summer ice, NASA.

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Page 13: Currents flowing through the Arctic, Jack Cook, Woods Hole Oceanographic Institute.

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Page 33: Bridge to Henningsvær, Lofoten Islands, Norway, by John Slade.

Page 33: Henningsvær Harbor, Lofoten Islands, Norway, by John Slade.

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Page 34: Harvesting the codfish, Henningsvær, Lofoten Islands, Norway, by John Slade.

Page 35: Harvesting the wind, Lowville, New York State, USA, by John Slade.

Page 37: Giant wind turbine hub, Lowville, New York State, USA, by a friend.

Page 38: Author on deck of a nacelle, Lowville, New York State, USA, by a friend.

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Vidar Lysvolds Fotoside (Facebook), @Vidars LyseVerden, lysvold@yahoo.no

Page 47: Two festive donkeys, Arkhangelsk, Russia, by Liudmila Mikhaylyukova.

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- Page 53: Bull lily pad, Little Long Lake, Adirondack Park, New York State, by John Slade.
- Page 54: Apple blossoms, Adirondack Park, New York State, USA, by John Slade.
- Page 55: But the girls are smarter, School number 11, Saint Petersburg, Russia, by John Slade.
- Page 56: Refugee boat, Lesvos Island, Greece, by John Slade.
- Page 57: Missus and Mister Goose, by John Slade.
- Page 58: Child on beach, St. Croix, U.S. Virgin Islands, Caribbean Sea, by John Slade.
- Page 62: Planet Earth as seen from a spacecraft orbiting the moon, William Anders, astronaut with Apollo 8, NASA, Christmas Eve, December 24, 1968.
- Page 64: Bicycles in Barcelona, by John Slade.
- Page 65: Author with generator in nacelle of wind turbine, Lowville, New York State, USA, by a friend.

John Slade Bøker welcomes the identification of unknown sources.

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Thank you.

Books by John Slade

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Dancing with Samuel

A Journey Out of Darkness

Herbert's Mountain

The New St. Petersburg

Covenant

Acid Rain, Acid Snow

Bootmaker to the Nation:
The Story of the American Revolution

Volume I	Rebellion
Volume II	The Long War
Volume III	Victory

Oslo in April

Adirondack Green

Volume I	Adirondack Green
Volume II	Global Warming and War
Volume III	Architects of Peace

Leif the Believer
Vikingen som vendte tilbake *

On a Starry Night:
56 Poems Waiting to Go for a Walk

Climate Change and the Oceans

Melting at One End, Bleeding at the Other
Smelter i en ende, blør i en annen *

Springboard: Launching into the 21st Century

Welcome Home, Soldier

A Renaissance Beckons

Invitation to a Renaissance
Invitasjon til en renessanse *

The Beginning of the End of the World
Begynnelsen av verdens ende *

A Letter to the Young People of the World
Et brev til de unge i verden *

Johannes og Kjempefjellet *

(* oversatt til norsk)

John Slade Bøker

www.johnsladeboker.no

Norwegian website (Norwegian and English) *

John Slade Books

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