

Smart Energy

From Fire Making to the Post-Carbon World

Jianping Liu
Shaoqiang Chen
Tao Liu



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Smart Energy

Foreword

Silent Spring, written by Rachel Carson in the 1950s, attracted the public's attention to the problem of the environment. In the 1980s, the United Nations officially put forward the concept of sustainable development that was valued by countries all over the world and has since become a critical problem related to human beings' survival. After several thousands of years of agricultural civilization and hundred years of industrial civilization, human beings are entering the knowledge society in which there is a need for a new civilization—the ecological civilization of saving resources, protecting ecology, and living in harmony with nature. The people-oriented, comprehensive, coordinated, and sustainable scientific outlook on development proposed by the Communist Party of China (CPC) Central Committee is a powerful response to such a civilization. The 18th CPC National Congress called for the building of an ecological civilization and a beautiful China, which is certain to further incite the whole world to attach greater importance to energy and environment problems.

If capital is the blood of economy, then energy is the food for economy. Both capital and energy are indispensable for the economic growth and social development of a country. For a long period of time, mainly relying on the consumption of coal, petroleum, natural gas, and other fossil energies, human beings have achieved economic and social development. However, fossil energy is nonrenewable and will run out eventually. Besides, global climate change caused by enormous carbon dioxide emissions that is mainly attributable to fossil fuel use has become the biggest threat to human beings. Therefore, new energy has become a hot topic and has gained a lot of attention from many countries and governments in recent years.

At present, there are many different definitions of new energy, such as “green energy,” “renewable energy,” “low carbon energy,” etc., whose implications are not completely the same. In my opinion, new energy can be defined at two levels. In a narrow sense, it includes wind energy, solar energy, tidal energy, geothermal energy, biofuel, and other energy forms that were not widely used before. In a broad sense, in addition to the aforementioned, it should also contain nuclear energy, hydro-power energy, and even clean coal technology.

After the global financial crisis of recent years, every country in the world has to look for new economic growth points and adopt a new development pattern. I think new energy is certain to be a new economic growth point. From a wider

historical perspective, the first three Industrial Revolutions mankind experienced were led by the steam engine, electric power, and the computer, respectively. Each of them brought the industrial development level to a new height and benefited consumers. Therefore, several years ago, I had stated that the fourth Industrial Revolution will be an energy revolution driven by new energy.

At present, it is the western countries' view of the future that dominates global public opinion. We as Chinese should also have our own voices and opinions affecting the world in the 21st century. It is the need of the hour to present important and systematic opinions about the issue of energy as this has a significant effect on the world. In my opinion, the formulation and systematic thinking of energy revolution integrating new energy, environment, economic development, social progress, China, and the world as a whole is of great significance.

Based on this, when three young and middle-aged authors who were, respectively, born in the 1960s, 1970s, and 1980s asked me, through my secretary, to write the preface for their new book *Smart Energy—From Fire-making to the Post-Carbon World*, although I had never met them before and was quite busy with other work, I agreed to do it after I read the book.

The “smart energy” the authors talk about in this book is defined as “the energy form which integrates human beings’ intelligence in the whole process of energy development, use, production and consumption,” “and which has self-organization, self-check, self-balance, self-optimization and other human brain functions to satisfy the requirements of system, safety, cleanness and economy.” Starting from a macrohistory perspective, the authors discuss energy and civilization, which is a topic of common concern, and explore smart energy and human development. They link theory with practice as much as they can, combine contentions and arguments, go from the easy to the difficult, and excel with regard to illustrations and text, which brings in a new style of writing—the “quasi-academic book.”

The authors put forward some interesting viewpoints, for example, smart energy takes energy form as a carrier, but is not limited to it, and it combines energy form, energy technology, and energy system; smart energy embodies human intelligence that supports the advance of human civilization; the developing ecological civilization and any upgraded civilization in the future cannot exist without the support of smart energy; different forms of human civilization have different requirements of energy, and the upgraded civilization in the future must require energy of higher intelligence, etc. Although it is only statements of one school of thought, a Chinese saying goes “the benevolent see benevolence, the wise see wisdom.” The systematic thinking of energy is indeed a useful trial.

Finally, I would like to point out that the development trend of new energy in China is satisfying in general, but faces serious challenges. The challenges include: (1) lack of a considerate and careful plan for the development of new energy, at present, and many controversies over the development of new energy; (2) less key technologies and innovation in new energy; (3) universally higher cost of new energy at present; and (4) the high dependency on fossil energy, currently as high

as 90% in China, which is difficult to change in a short period, although the public are eager to resolve haze and other serious environment problems as soon as possible. Therefore, the development of new energy in China must be on a firm footing and must move forward with calm consideration to avoid excessive hype. The coordinated development of energy and environment in China must be promoted from economic, technological, and political aspects, with firm direction and even steps.

I hope the publication of this book will catch the attention and arouse the thoughts of people with insights who could make due contributions to resolving the serious problems of energy and environment that curb the economic development of our country in the future.

Cheng Siwei

*Vice President of the Standing Committee
of the Tenth National People's Congress,
China*

Preface

Innumerable years have passed since mankind came into being in this world. In the endless long river of history, we have been ceaselessly familiar with, adapted to, and aware of nature and have gradually found and utilized fire, thus, beginning to obtain the magic weapon—energy—with which we could change heaven and earth and by which we have achieved myriad successes and dreams. Our common fate has continuously changed and improved. Especially now, in less than ten thousand years since the time of written records, energy has been a major driving force of human civilization and is a link that removes the distances created by the seas and unites the continents in the world as a whole.

Inquiry into the Origin of Life

Where did we come from? Where do we go? These are the ultimate and unanswerable questions that we, looking up at the stars, have pondered upon since time immemorial.

The earth revolves round the sun, one of over 10 billion stars in a galaxy that is one of several million galaxies in the universe. The universe, the sun, and the earth were, respectively, formed about 15 billion years, 5 billion years, and 4.5 billion years ago, and this was calculated according to the theory of the Big Bang. Regarding the origin of life, there are not only religious and scientific explanations, but even within the scientific community, controversy exists between proponents of earth autogeny and outside help. The only concrete conclusion that we can arrive at is that by some miracle or chance there is life on the earth, which has continuously evolved from low level to high level, forming diversified and colorful biospheres.

If the appearance of life on earth is a miracle, the appearance of human beings is a myth and a mystery. There have been different legends about the origin of human beings since time immemorial, but no convincing explanation so far. Although no final conclusion has yet been reached on this matter, Darwin's theory of evolution, which says humankind evolved from apes, has been accepted by most people. At first, a kind of anthropoid evolved from the lower apes. Later, about six million

years ago, “humans and apes bowed to each other and said goodbye,” and each went their own way. From then on, mankind has made their mark on the colorful stage that is the earth.

Probing the Path of Civilization

We live on the earth with many different living things. As time has brought great changes to the world, mankind has also experienced difficult changes from being a *Homo habilis*, ape man, and ancient man to a new man, and from ignorance and savagery to civilization.

“Only a few stones were polished in the childhood.”[†] The rise of the human civilization went through a preparation period that was nearly four million years long. In the Old Stone Age, our ancestors invented stone implement-making technology, fire-making technology, and language, which are, respectively, seen as the embryo and origin of machine-making technology, energy conversion technology, and the present information technology. The invention and evolution of those three technologies laid the foundation for the origin and development of the human civilization. The use of fire is of extremely special significance for mankind as it helped to master energy, the magic weapon: “Making fire by friction made people dominate a kind of natural force for the first time and differed them from animals in the end.”[‡] Why do we say that the human being is the wisest of all creatures? Because it is humans who created tools and dominated fire. At that accidental and inevitable moment when our ancestors groped and knocked two flint stones together or drilled wood to make fire, humans accepted nature’s selection and became the most intelligent of all creatures.

The important turning point in the course of the generation of human civilization was the New Stone Age, and agriculture became its accelerator. Because the growth of crops were periodic, humankind who lived in areas suitable for farming settled down from nomadism and increased labor productivity greatly. With surplus products, commodity exchange, private property, and private ownership came into being. As social products could support more people, division of labor, different social groups, and various interest groups also came into being. With disputes caused by interest distribution, military democracy arose. Because of more frequent wars under military democracy, military leaders and gentile aristocracies gradually separated from equal clan members, rose to power, and built corresponding powerful ruling organizations; thus, countries were born. The early human civilization, like the first rays of the morning sun, first shone on the region from 20° E to 120° E longitude and from 20° N to 40° N latitude,

* *Hexinlang, Reading History* by Mao Zedong.

† *Hexinlang, Reading History* by Mao Zedong.

‡ *Selected Works of Karl Marx and Friedrich Engels*. Vol. 3. People’s Publishing House, 1995.

covering Mesopotamia, the Nile Valley, Yangtze River Valley and Yellow River Valley, Indus Valley, and the Aegean Sea coast.

Casting a Brilliant Foundation

Mankind entered the civilization of recorded history six thousand years ago. The history before this is generally called prehistory, with millennium as units. The unit of the history of civilization continues to be shortened, gradually becoming one hundred years and even ten years. Like the birth of mankind and the origin of life, the history of civilization is very short, compared with prehistory. Having entered civilization, humans from different areas did not develop from the same starting line or at the same speed but independently and separately until after AD 1500 when the west started the Age of Exploration by sailing on oceans first with sailboats and then with steamships, connecting the world and making it an inseparable whole. From then on, human civilization began to bid farewell to the agricultural civilization, stepped into the industrial civilization, and then gradually transited to the new era of information civilization.

Important scientific discoveries and inventions have continuously sprung up and thoroughly changed human being's production mode and lifestyle since the industrial civilization. The British invented the steam engine in the late half of the 18th century, burning coal instead of wood, which was a great change in energy form. Later, the invention of the internal combustion engine let petroleum replace coal, which has increased productive efficiency greatly. The currently popular airplanes and automobiles are all masterpieces that cannot work without the internal combustion engine. The invention of the generator by Siemens is of epoch-making significance, similar to the invention of the steam engine by Watt. Electric energy provides huge amounts of power for human civilization. All kinds of modern communication tools continuously spring up, creating the brilliant modern information civilization.

Starting the Future Engine

The use of coal, petroleum, and electricity has brought us unprecedented economic prosperity, while making the modern society more and more seriously dependent on fossil energy. For a century, the excessive exploitation and use of fossil energy has generated a series of severe problems: Global warming, extreme climate, environmental disruption, drying up of rivers, resource shortage, disputes about energy getting worse, etc.

Solving the abovementioned problems depends on scientific innovation and breakthrough as well as the fundamental change of the mode of production, consumption, and even social system. This is a severe challenge and arduous mission.

Everyone living on the earth should shoulder this unavoidable responsibility. We should join hands and work together to realize the existence and development of human civilization, which is of common interest to all human beings.

Looking back at the past ten thousand years of history that is filled with glories and dreams, and wonders and brilliance, we are filled with ambition; looking back at the past ten thousand years of our history that is also glutted with hardships and sufferings, and setbacks and sorrows, we have a thousand misgivings. Over the past ten thousand years, our ancestors discovered fire when they were ignorant; with fire, an impassable gulf between mankind and other creatures was formed, and mankind became the wisest of all creatures; our ancestors used cattle and horses to plough and employed water wheels and windmills for irrigation and processing, by which they lived and evolved; they then utilized coal and steam engines to enter the great epoch of industrial revolution, striding forward, singing songs, never stopping from advancing; they used dazzling electricity to create the information civilization, which is progressing with each passing day.

In all these eras, energy was of prime importance. It was the elf that brought light; it was the warm and driving force of development and advancement; it was also the ghost that brought suffering, pain, stagnation, ruin, and horror. It played an irreplaceable role in each scene of civilization, pushing our history forward. Energy and civilization coexist and supplement each other. As human wisdom ceaselessly accumulates and develops, energy is constantly transformed and replaced. Firewood, animal power, wind power, water power, coal, petroleum, and electricity have provided us with a steady flow of driving force on our way forward. We have experienced the hunting–gathering civilization, agricultural civilization, industrial civilization, and information civilization. What will tomorrow’s energy form, which will start the engine of the future and embrace the brilliant ecological civilization for us, be like?

About the Authors

Jianping Liu received his master's degree of Labor Economics, PhD in Industrial Economics from Renmin University of China, and his post-doctoral in Environmental Science and Engineering from Chinese Academy of Sciences. He then worked in the Finance Ministry, State Administration for Industry and Commerce, and the State Electricity Regulatory Commission. At present, he is division director of the Department of Development and Planning, National Energy Administration; research fellow of the Institute of Urban Environment, Chinese Academy of Sciences; and professor of China–EU Institute for Clean and Renewable Energy, Huazhong University of Science and Technology. He has published more than 20 papers on a wide range of topics in system reform and energy development. He has also written four books since 2006, and his latest book *Smart Energy—From Fire-making to the Post-Carbon World* (written in Chinese) won the Popular Science Books Award of the Chinese Society for Electrical Engineering and China's Weekly Reading Top 100 Books Award in 2013. The book was also nominated for the Popular Science Books Award by the China Science Writers' Association.

Shaoqiang Chen obtained a master's degree in finance from Zhongnan University of Economics and Law, a master's degree in public policy management from Hitotsubashi University, and a doctorate degree in economics from the Research Institute for Fiscal Science, Ministry of Finance. He now works in the Research Institute for Fiscal Science, Ministry of Finance, as researcher and supervisor of postgraduate students. His research interests lie in the field of fiscal and monetary policy, state-owned asset management, social security, and energy-saving and emission-reduction policies. He has already published dozens of articles in these areas.

Tao Liu obtained a master's degree in management from Changsha University of Science and a doctorate degree in economics from the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. He is a postdoctoral scholar of the Institute of Economic Management, Tsinghua University.

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