

急待转型的人类社会

从上个世纪的中叶，由于人口暴增，人均消费的大量增加，人类在地球上开始超载了。也就是说太阳已不能够把人类产生的东西循环回归到大自然。环境的破坏，使人类在地球上的永续发展，不但变成很严重的问题，极端气候与可能发生的突变，将使人类在地球上的生存受到严重的威胁。

环境变迁中的一个重要因素，是人类使用的能源，在工业革命之后开始过度依赖化石燃料。它燃烧产生的二氧化碳在大气中的增加，严重地影响地表上「吸收」与「放出」的能量平衡。非常明显地，我们已看到地表「吸收」的能量比「放出」的能量多，也开始量测到地表温度的上升所与它带来的气候变迁。

2015 年 12 月在巴黎召开的 COP21 会议，195 个国家领袖得到一个共识，那就是人类社会必须急速「减碳」，也就是在这个世纪的下半叶，全球要达成「碳平衡」的状态，也就是要减少人类社会的碳排放量，使人类社会产生的温室气体能够让大自然完全吸收。

人类社会在过去半个世纪内的经济发展，是在能源（化石燃料）能够在世界市场上充分取得，把产生的二氧化碳无止尽地排放在大气中的条件下所得到的。现在这两个条件已不复存在时，能源的转型与社会的转型变成非常迫切的问题。这场演讲，将从世界的变迁中，探讨人类社会能源的转型与我们该有的认识及决心。

Dynamics of Chemical Reactions and the Sustainable Development of Human Society

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Every macroscopic chemical transformation, whether it is atmospheric ozone depletion or the burning of a candle, consists of millions of microscopic chemical events which involve collisions between molecules. It has been the dream of scientists for a long time to observe and to understand the details of molecular collisions which transform reactant molecules into product molecules with our naked eyes. During the last several decades, because of the advances in crossed molecular beams method, especially from the measurements of angular and velocity distributions of reaction products from single collision events, it has become possible to “visualize” exact details of how chemical reactions take place through molecular collisions or through photochemical processes.

In a large fraction of my scientific career, I was involved in the investigation of energetics, kinetics and dynamics of combustions of hydrocarbons. The chemical processes are quite complicated.

For example, when CH_4 is oxidized to form CO_2 and H_2O , the collisions between CH_4 molecule and O_2 molecule will not produce CO_2 and H_2O . This chemical reaction needs to be initiated, or needs to break C-H bond first to form CH_3 to start. And it takes many many elementary chemical reactions to finally form CO_2 and H_2O molecules.

The combustion of hydrocarbon has been the most important chemical reactions which provided energy for human society during the last hundreds of years. But, as the world population increased from 1.5 billion to 6.0 billion in the twentieth century and has reached 7.2 billion last year, and with the substantial increase of human consumption. The amount of CO_2 produced by human activities has caused a serious problem of global warming trend.

In December of 2015, in the 21st conference of Parties of the United Nations, as agreement was reached to decarbonize human activities in such a way that the global temperature rise will not exceed 2°C , or preferably 1.5°C from the pre-industrial revolution period. This is a remarkable awakening of humanity.

This is the first time in human history that all human beings on Earth have been faced with learning to work together and live together as one family in a global village – the time for finally realizing that the planet Earth on which we live is only finite in space, capacity and natural resources. Our future depends entirely on how effectively the entire world would function as a community. This is a necessary awakening – vital for the survival and sustainable development of mankind. I believe that if we make the correct choice at this crossroads, then the 21st century is likely to be marked as the great turning point, or great transition – the beginning of a new era in the history of mankind.