In terms of sustainable development, what strategies does Google have for Chinese Internet companies to learn?

From 2010 to 2016, the number of global Internet users increased from 19.19 million to 3.385 billion [1]. An increase in the number of users indicates an increase in the use of resources. Many Internet companies are considering how to minimize energy consumption while ensuring that demand is met [2]. As a world-renowned Internet company, Google has been making unremitting efforts for sustainable development. Furthermore, by understanding Google's sustainable development measures, it can also help Chinese Internet companies reduce energy consumption in the development process.

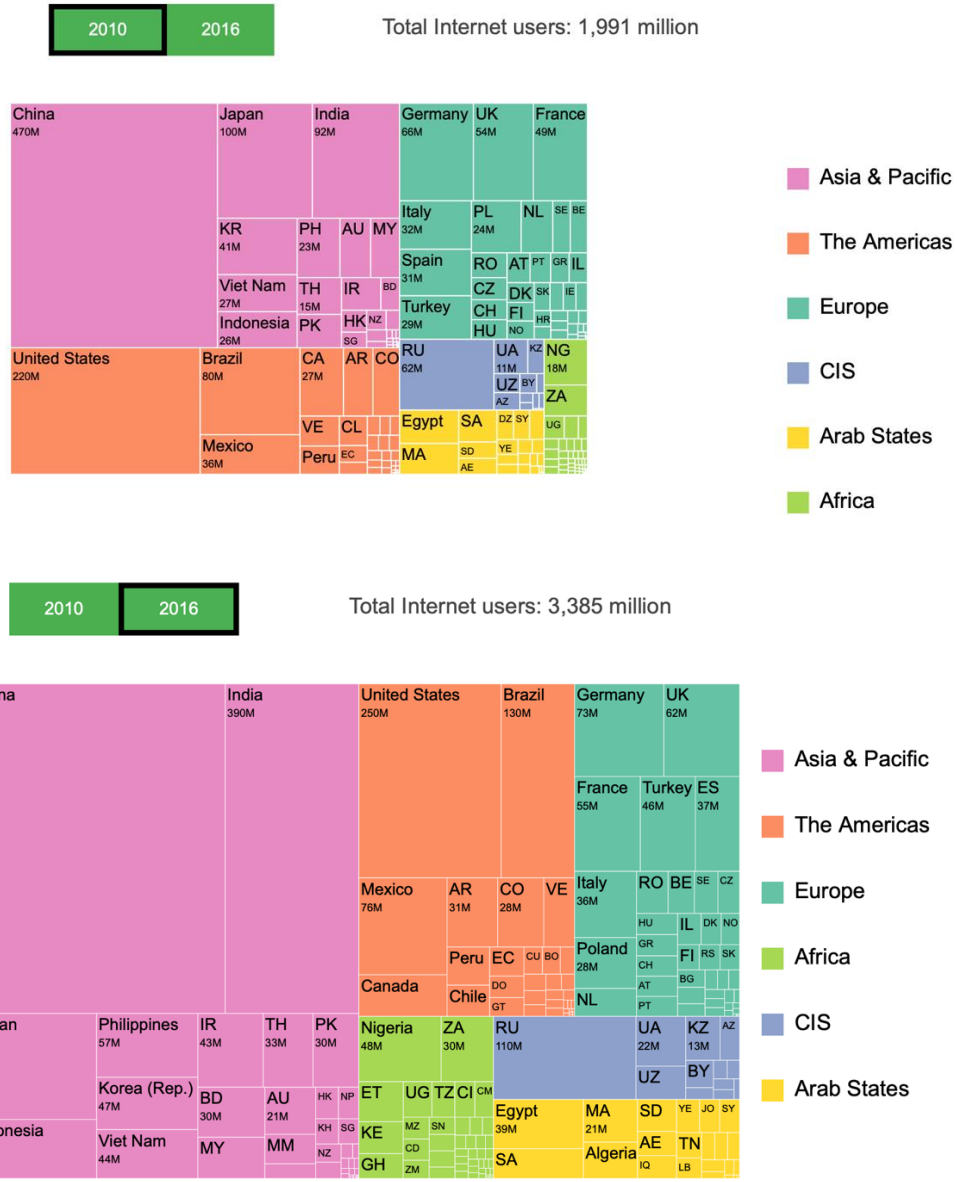

Fig.1 The number of global Internet users in 2010 and 2016[1]

Google's sustainable development efforts are mainly divided into three areas: accelerating the carbon-free cycle, improving technology, and implementing low-carbon in the working community [3].

In terms of accelerating the carbon-free cycle, Google achieved 100% renewable energy in 2017 and maintained this achievement in 2018 [4]. This goal can be achieved because, since 2010, Google has been buying a large amount of renewable energy to support the energy consumption of daily work. At present, Google is the world's largest buyer of renewable energy companies, and the energy pipes purchased have reached 2,600 megawatts of wind and solar energy [5]. With the purchase of a large amount of renewable energy, the cost of purchasing electricity did not increase too much. Between 2010 and 2017, the cost of wind energy and solar energy decreased by 69% and 88% respectively [6], which proves that renewable energy is increasingly becoming a relatively inexpensive energy source, and the use of renewable energy will not have a massive impact on costs.

The data centre can be regarded as the heart of Internet companies. In the data centre, hundreds of millions of calculations occur every day. As the number of Internet users increases, people's demand for their services is also proliferating [7]. However, because the efficiency of energy use is improving, even if the demand for cloud computing is increasing rapidly, the energy consumption of data centres around the world remains almost unchanged. In the eight years from 2010 to the following, the computing capacity of the data centre increased by 550%, but the amount of energy consumed increased by only 6% [8].

There are many ways to improve computing efficiency, such as: understanding the emerging workload space; allocating data centre resources to predict future workloads and applications, and increasing the energy ratio of each machine; establishing hardware and software communication standards [9]. In order to achieve this sustainable development goal, Google has made efforts to use advanced cooling

systems, intelligent temperature control, and machine learning tools and technologies [10]. Through the use of machine learning, the energy consumption of Google data centres was reduced by 50% from the industry average in 2014 [11]. Prove that machine learning is an effective method to improve energy efficiency using existing sensor data [12]. In 2017 Google lowered the global data centre fleet's average annual power consumption (APE) by 1.11 in contrast to the industry average of 1.71 using the combination of techniques and innovations such as advanced cooling devices, smart temperature control, and machine learning [10].

In terms of working environment, Google is committed to the harmonious coexistence of people and nature. The plants and animals growing in Google's campus are designed by external ecologists, landscape designers and planners, and local non-governmental organizations. The purpose is to expand the wildlife habitat while maintaining ecological balance and restoring part of the ecological functions lost due to the development of the office area [13]. At the same time, in Google's coffee shop, Google chose to buy vegetables and fruits that looked unsightly at a lower price from suppliers, which saved the purchase cost and also saved food that would have been wasted [14].

While Chinese Internet companies are not performing well in terms of sustainable development, in 2018, China's Internet companies were mainly powered by coal (73% of energy is provided by coal). It is expected to emit 99 million tons of carbon dioxide, while renewable energy accounts for only 23% of China's overall energy use in the Internet industry [15].

This is because, in China at present, renewability energy costs 2-3 times the price of coal-fired energy [16], so most Internet companies are more inclined to use traditional electricity generated by power generation. However, with the development of enterprises, Chinese Internet companies need to shoulder greater social

responsibilities, such as purchasing relatively more renewable energy as an energy supply. Although the cost will increase in the short term, with the development of the technology and market, the price of renewable energy will decline to some extent.

In improving technology, many Chinese Internet companies have made their contributions. Baidu said that by improving related technologies in the data centre, it could help the company reduce carbon dioxide emissions by 210,000 tons per year [17]. Alibaba has built a data centre near Qiandao Lake in Hangzhou, China. This data centre uses natural water bodies for cooling. The data centre using new technology consumes 80% less energy than traditional methods [18].

Although the Chinese government does not explicitly limit the amount of electricity and water that Chinese Internet companies can use, many cities have also indicated that they want more facilities to save water and electricity and use clean energy in their cities [18]. For this kind of problem, China Internet Corporation can choose to establish related facilities in areas with natural climate advantages. For example, a data centre can be established in northeast China, where the temperature is low all year round, and the natural low temperature is used to alleviate the heat dissipation problem [19].

In general, Google's achievements as a global Internet company in sustainable development are admirable. Whether it is encouraging the use of energy or improving its technological strength, it is worth learning by Chinese Internet companies. While China's Internet companies are developing rapidly, they should also take responsibility for protecting the environment and reducing carbon dioxide emissions.

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