China Green Lights – A national programme with global repercussions

Liu Hong
China Green Lights

Lu Wenbin
TBA, China State Economic and Trade Commission

Adam Hinge
China Green Lights Special Consultant, Sustainable Energy Partnerships

Stuart Jeffcott
Chief Technical Advisor, China Green Lights

KEYWORDS

China, Green Lights, energy growth, national programme, electricity consumption growth, growth rate, China Green Lights, savings target, improved quality of lighting products

ABSTRACT

China's energy consumption is currently growing at 5% a year, with the consumption of electricity growing even more rapidly. One of the fastest growing sectors of electricity growth is in lighting energy consumption. Annual growth in electrical consumption by lighting was 15% for much of the 1990s. Lighting currently accounts for approximately 13% of lighting energy use in China. Given the predominant reliance on coal as a generation fuel, this consumption level is causing serious health and environmental problems.

Funded by the China State Economic and Trade Commission (SETC) and the Global Environment Facility, the China Green Lights Project began its expanded implementation in September 2001.The primary objective of the China Green Lights Project is:

"By 2010, reduce lighting energy use in China by 10% relative to a constant efficiency scenario"

Through the implementation of a comprehensive range of market transformation activities (ranging from the development of minimum efficiency standards for lighting products and designs through to the development utility based DSM programmes and the promotion of lighting Energy Management Company schemes) the China Green Lights project will create

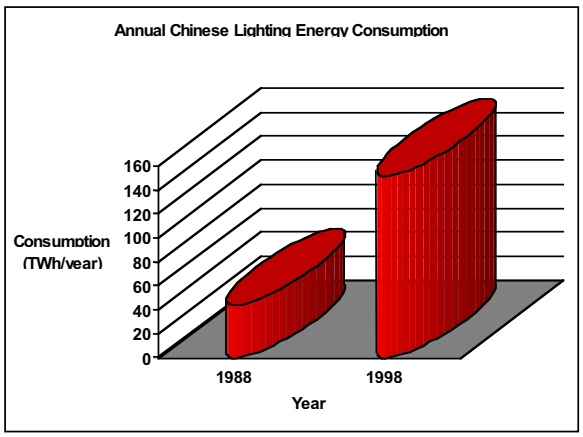
- Much greater awareness of, and confidence in, efficient lighting products by designers, installers and end-users;
- A wider range of higher quality energy-efficient products are available at affordable costs;
- Product testing, certification, standards and other supporting activities will be in place to maintain the market share and quality of efficient lighting products;
- A range of market mechanisms (and associated actors) will have been mobilised to create a self-sustaining demand for and supply of efficient lighting products.

Overall, by 2010, it is estimated that the programme will be yield electricity saving of 18,715 million kWh and 7.5 MMT each year with savings to the consumer of EURO 1,031million RMB helping to alleviate poverty and improve industrial competitiveness.

Further, China is the worlds leading supplier of many lighting products and is committed to supplying high quality, low priced lighting products to the world. If successful, the actions of the China Green Lights project could boast efforts to promote green lighting around the globe.

CURRENT CONSUMPTION/GROWTH PREDICTION

China's energy consumption is currently growing at approximately 5% a year, with the consumption of electricity growing even more rapidly. Growth is likely to remain high in the foreseeable future with continued economic growth and increasing living standards. Given the countries predominant dependence on coal, this increasing consumption is leading to substantial increases in greenhouse gas emissions (China is already one of the world's largest emit-



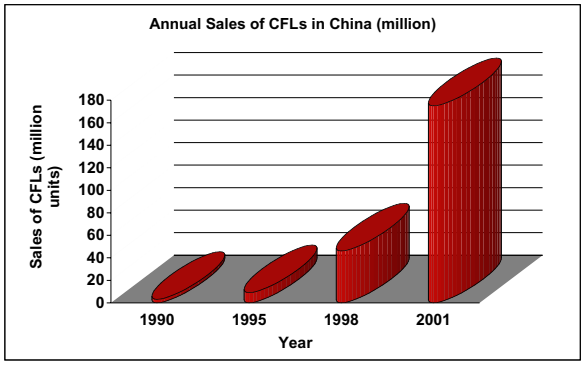
ters of green house gases, although low in per capita terms). Further, the overall emissions are leading to serious health problems including pulmonary heart disease related to air pollution from coal burning. Further, the emissions are causing potentially disastrous environmental damage; acid rain is causing severe damage to crops, forests and aquatic life throughout China. Serious efforts are being made throughout the Chinese economy to manage this growing demand "at the lowest cost with minimum environmental damage", i.e. energy efficiency is being placed high on the political agenda. Not surprisingly the energy consumed by lighting is drawing significant attention.

Lighting is one of the fastest growing areas of electricity use in China. Spurred by increasing numbers of international standard commercial buildings and greater residential use (related to higher income levels), the annual growth in electrical consumption by lighting was 15% for much of the 1990s. Over the decade from 1988 to 1998, estimated energy consumption on lighting grew from 44TWh to 152TWh per year. Currently lighting accounts for approximately 13% of total electricity consumption across the Chinese economy.

THE POTENTIAL FOR SAVING AND THE BARRIERS TO LIBERATING THOSE SAVINGS

There is a technical potential to reduce lighting energy consumption by 40% in China simply by using more efficient lighting technologies. As would be expected, a large proportion of this potential saving can be achieved through the substitution of incandescent lamps by Compact Fluorescent Lamps (CFLs). Other major reductions can be achieved through the use of advanced fluorescent tubes and ballasts and the replacement of older blended and mercury vapour lamps with new generation High Intensity Discharge Lamps (HID), eg High Pressure Sodium and Metal Halide lamps and ballasts.

Some of this potential has already begun to be tapped. As adjacent figure indicates, between 1990 and 2001 sales of CFLs in China grew from 3million to 175million per annum, at a time when international sales grew at only one third this speed. Similar, although less dramatic, sales increases were seen in other efficient lighting sources, e.g. T8 fluorescent tubes, electronic ballasts and HIDs. Unfortunately, this explosive growth in sales and the associated



major shift in manufacturing capacity has led to the formation of serious problems within the Chinese marketplace for efficient lighting.

As a result of the massive expansion in demand, many new (and often small) companies began manufacturing "high efficiency" lighting products. As supply grew, prices fell rapidly. In 1994 a CFL had a Chinese average retail cost of approximately 5.5 EURO. By 1999, the average retail price had fallen to 0.68 EURO. While the price level has since recovered slightly (a recent survey across 4 cities puts the price at 3.4 EURO), it was impossible for manufacturers to maintain quality control and product consistency at the low prices. This led to the familiar vicious circle of falling prices (and no market regulation) leading to poor quality products that could only be sold by further lowering the price. Consequently inferior products flooded the market and consumers began to perceive the products did not last as long as promised and so may save energy, but not money. While there has been some improvement in quality recently, consumer perceptions are still low. This is also true of the industrial and commercial sector where a survey of purchasers of efficient lighting products found over 30% unhappy with their purchases due to quality problems or short lifetimes.

In 1996, UNDP awarded a EURO 1.15million TRAC grant for Capacity Development for China Green Lights. This project was intended to introduce market mechanisms to increase the demand for energy efficient lighting in China, and to build consumer awareness and confidence in, and address the barriers to, the use of energy efficient lighting. Primarily operating in a number of pilot regions, the results of the project's activities include:

- Significant increased consumer awareness of green lighting issues;
- Support from the Chinese government to energy-efficient lighting product manufacturers;
- Increased manufacturing capacity of efficient lighting products;
- Increased market share of energy-efficient lighting products.

In December 1999 UNDESA completed an impact assessment of this China Green Lights Program. The assessment concluded the program has been successful in overcoming a number of barriers to efficient lighting in

China, but significant barriers remain. Primarily these barriers were:

- A continued lack of awareness and information about the use and benefits of efficient products, particularly in the residential, industrial, and government sectors;
- Poor product quality, in part due to poor quality of raw materials and components used in the manufacture of many efficient lighting products;
- Confusing market conditions, such that consumers can not distinguish between high and low quality products;
- Lack of financing in some sectors for more efficient options that have lower life cycle costs but higher first costs.

The assessment provided several recommendations on ways to improve a future programme's impact, particularly:

- Undertaking pilot government mass purchase programs;
- Implementing a labelling program;
- Adopting mandatory energy efficiency standards.

Each of these recommended elements has been built into the new China Green Lights project.

CHINA GREEN LIGHTS – A FULLY INTEGRATED MARKET TRANSFORMATION PROGRAMME

The new China Green Lights Project is a EURO 30million joint initiative funded primarily through the Global Environmental Fund and China's State Economic and Trade Commission (SETC). The project has been designed as a fully integrated market transformation activity that addresses all aspects of the market, and wherever possible, has been designed to maximise sustainability. The project structure is shown in Figure 1.

The project has a core goal of

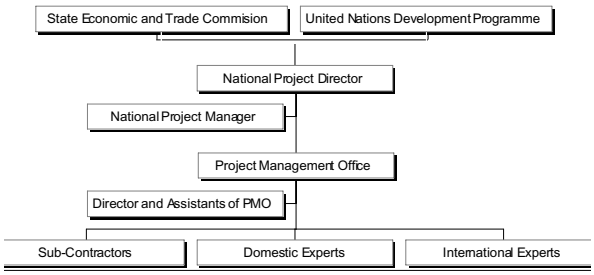
"By 2010, reduce lighting energy use in China by 10% relative to a constant efficiency scenario"

This goal is being achieved through the targeting of particular market actors to bring about transformation through Technology Push (increasing the supply of quality energy efficient lighting products) and Demand Pull (creating the information and awareness environment that will stimulate demand for the improved product offering).

Technology push:

a. **Creating Basic Protection and Information for the Consumer:** The project will assist in establishing an efficiency floor for both lighting products and lighting design by developing **minimum efficiency standards for six different lighting product categories** as well as **design standards for six categories of buildings**. The product standards element will be combined with a product certification to provide an easy way for consumers to identify high quality and high efficiency lighting products (note that a comparative label may also be developed for lighting as a result of labelling framework regulations currently under development). Efforts will be made to create an enabling environment for exports of energy efficient lighting products, by assisting in co-ordinating standards and labelling initiatives with international certification organizations. An important component of the certification and labelling scheme is to improve the **consistency between national and international test laboratories**, both to facilitate the initial standards/labelling and the ultimate enforcement activities.

Figure 1. China Green Lights Project Structure



b. **Improving Product Quality:** Inferior input **raw materials and components** frequently result in production processes failures and in the quality of the final product being poor. The project will survey major raw material and component supply routes to identify the core supply chain failures causing the quality problems. Methodologies will then be developed (and implemented) to mitigate these problems and provide lighting manufacturers with improved supply lines. It is expected that number of **technology retrofit projects** will be undertaken to demonstrate the application of improved raw material and component supply supported by appropriate production techniques. Major dissemination activities are to be undertaken to enable other manufactures to benefit from the improved component and production options. Manufacturers of better quality products will be identified and these manufacturers offered financing and other assistance (through SETC's Energy Efficiency in the Lighting Industry Special Loan Program) to **improve and expand their product offerings** and production capacity.

Demand-pull

a. **Market Aggregation:** Working together with government units, commercial buildings and other major buyers, mass purchase projects are to be organised with the condition of a guarantee of a minimum lifetime and/or quality level for the lamps. Further, the government is developing new procurement approaches for government purchases and the project will work with those new emerging procurement guidelines to ensure efficiency is one of the criteria used in purchasing decisions. These market aggregation activities will aid in **providing consumers with information** on the better quality and efficient products to purchase, and aid in **lowering the first cost** (both for the specific purchases and in the wider market due to economies of scale for the manufacturers).

b. **Raising the Knowledge Level:** To further generate demand and increase consumer awareness and understanding of efficient lighting products, significant **consumer**

education campaigns and information dissemination are being organized. **Mass media promotion** plans are being carefully designed to maximize cost-effectiveness. Promotion is also to take place through **retail point of sale activities**, **educational publications** and a Green Lights **Web page**. Substantial training for lighting and building design professionals and large lighting end-users is to be conducted across the country

c. **Improving Access to End-User Finance:** The project plans to promote two types of financing that are innovative to China, **Utility Financing** and **Energy Management Companies** (EMCs). While there are significant complications to utility involvement in promoting energy efficiency in China (due to restructuring of the utility sector and a current electricity-supply surplus in some regions), utility financed programs for energy efficient lighting could generate additional revenues for utilities, help defer costly and uncertain long-term investments in generation assets and increase customer satisfaction and loyalty in the increasingly competitive environment. However, these benefits are not immediately apparent to Chinese utilities that lack general experience with open market activities and in running these types of consumer loyalty programs. Initial pilot programs are to be undertaken with selected utilities to demonstrate the direct commercial benefits of these activities. The Green Lights project will also build on the experiences from a major GEF/World Bank project to support and promote the development of Energy Management Companies (EMC). It is anticipated that primary activity in this field will be geared to identifying successful lighting projects already undertaken by EMCs and undertaking strong promotion of these case studies to fledgling EMCs and to potential users.

Programme Sustainability

The majority of the China Green Lights project has been specifically designed to ensure market transformation is self-sustaining. In some cases government agencies are likely to sustain activities as part of their on-going governmental functions, for example standards, labelling and certification. Government bulk-purchase programs are also likely to continue if proven successful. In other areas, the lighting related EMC activity is likely to continue without further assistance. Effective promotion of quality products should deliver demonstrable profitability benefits, which will encourage ongoing communication/promotion activities directly from the larger manufacturers.

However, depending on the progress of electric utility restructuring in China, strategies for continuing utility financing programs may need to be developed. Similar market uncertainties have created the necessity for a separate element to the project examining sustainability issues and to create strategies to overcome developing barriers. In developing approaches for sustaining project activities, international and domestic experience will be reviewed and detailed recommended action plans developed. Implementation of this action plan will begin in the final years of this project so by the time GEF financing runs out, most, if not all, key activities are self-sustaining.

Programme Evaluation

Given the ambitious size and long-term nature of the project, a complex evaluation structure is being developed. A critical part of the evaluation planning will be the development of hard, quantifiable indicators of project performance to be used to evaluate the project on an ongoing basis and identify areas where the project can be improved. During development and implementation of the evaluation programme, it is anticipated that the project will draw heavily on the experiences of the ELI programme to develop measurement mechanisms for many of the soft project activities (e.g. standards, certification, training and education, etc) and the impact on a range of market actors. At the completion of the project in 2005 there will, of course, be a full evaluation covering:

- Actual energy saved;
- Impact of individual project elements;
- Degree of REAL market transformation;
- Sustainability of actions.

PROJECT PROGRESS

At the time of writing the project has been underway for five months. To date, the primary progress has been:

a. Primary data has been collected and analysed for fluorescent tubes and CFLs in preparation for the creation of minimum efficiency standards. It is anticipated these standards will be in place by September 2002. Standards for High Pressure Sodium and Metal Halide lamps will follow. Criteria for certification of premium products are being developed in parallel with standards development and data for a comparative label being collected in preparation for comparative labels if required. (Note: In the development of these standards/labels extensive investigations are conducted to ensure, wherever appropriate, harmonisation with other international activities is achieved to facilitate effective international trade).

b. Development plans are being formed for representatives from a number of test laboratories from around China to visit similar international establishments. The experiences gained (and the resultant equipment purchased) will be used to develop improved consistency between test laboratories both nationally and internationally.

c. Preparations are well underway for a range of baseline surveys to provide the absolute measure of project progress and ultimate success against targets.

d. A number of other subcontracts (national and international) have recently been agreed to provide media liaison and training material targeting residential and professional audiences.

Significant progress is expected by the time of the Right Light 5 conference (including preliminary results from the baseline survey) and further updates will be provided at that time.

PREDICTED NATIONAL RESULTS/IMPACT

By the completion of the project it is anticipated that there will be a fundamental, stainable transformation of the lighting marketplace in China resulting in:

- Much greater awareness of, and confidence in, efficient lighting products by designers, installers and end-users;
- A wider range of higher quality energy-efficient products are available at affordable costs;
- Product testing, certification, standards and other supporting activities will be in place to maintain the market share and quality of efficient lighting products;
- A range of market mechanisms (and associated actors) will have been mobilised to create a self-sustaining demand for and supply of efficient lighting products.

If successful, then the 10% saving of lighting consumption can easily be met. Predicted project savings by year are shown graphically below.

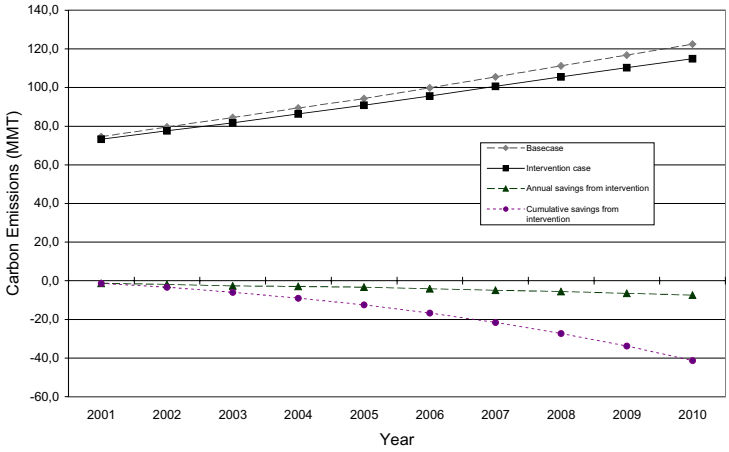
Overall, by 2010, it is estimated that the programme will yield electricity saving of 18,715 million kWh and 7.5 MMT of carbon emissions with a cumulative saving of 103,277million kWh and 41.3 MMT of carbon emissions. On top of this environmental benefit and in many respects more importantly, this will yield annual savings to the consumer of EURO 1,031million RMB. These savings will help industrial competitiveness through a reduced cost base at a time of increasing international competition brought about through China's entry into the World Trade Organisation. Further, the savings will help alleviate poverty through reduced domestic electricity costs and more secure employment.

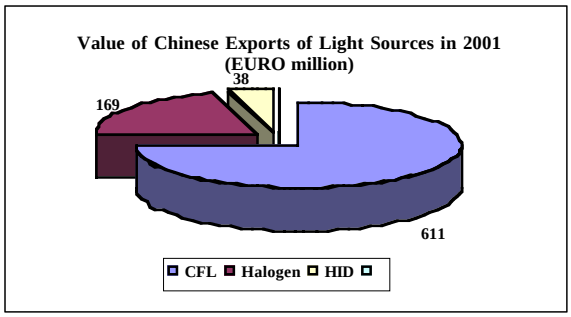
INTERNATIONAL IMPACT

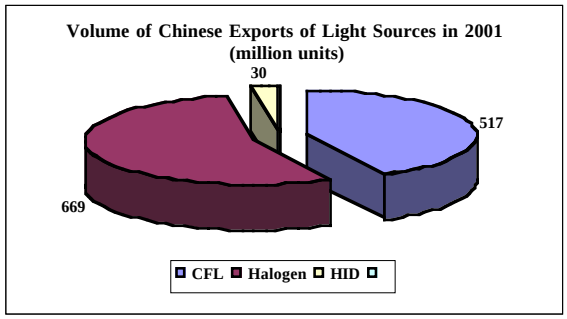
We have reviewed the project goals, implementation methodology and current progress, yet the title of this paper refers to global repercussions – why? Obviously there are the global benefits of reduced carbon and other emissions; however, there are other, more direct impacts on the international community. Within China, the lighting manufacturing industry is regarded as a high growth industry with large export potential. The low labour costs of the economy have already resulted in China having the largest lighting industry in the world and it is the world's No 1 producer of lamps, lighting fixtures and a range of other lighting equipment. In 2001, the total value of lighting products exported from China exceeded EURO 4.3 billion. China already supplies 1/3 of the world's CFL market with 2001 sales reaching EURO 611 million (517 million units), a rise of 77% on the previous year.

It is the view of some in the international community that this Chinese domination of international lighting markets has restricted the growth potential of Energy Efficient lighting. Concerns have been expressed that by supplying cheaper, inferior quality lamps and accessories, Chinese manufacturers have degraded the international consumer's image of efficient lighting products. In much the same way as China, this market scepticism has limited the impact of programmes to promote the use of efficient

Chinese Carbon Emissions Attributable to Lighting







lighting across the globe. As a matter of national pride, and to maximise the export potential, China is committed to rectifying this situation and to supplying high quality, low priced lighting products to the world. If successful, the actions of the China Green Lights project will:

- Make efficient lighting products more affordable and effective thus increasing consumer confidence and consequential demand;
- Facilitate greater international trade/cooperation through more transparent standards.

Such actions have the potential to reinvigorate the international market for efficient lighting products and deliver REAL economic and environmental benefits to countries around the globe.