Long-term Incentive Strategies for Energy Efficiency

Interim Report of the Task Force on Economic Instruments for Energy Efficiency and the Environment in China

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Executive Summary

The China Council for International Cooperation on Environment and Development Task Force on Economic Instruments for Energy Efficiency and the Environment in China assembled a group of environmental policy experts and academics from China, Denmark, France, Germany, Singapore, South Korea and the United States. They are to analyse existing economic instruments in China, especially in regard to effectiveness, efficiency as well as constraints and barriers hampering the effectiveness of economic instruments in China. They shall suggest changes and propose new economic instruments, based on a survey of the experiences of Western countries with economic instruments. In addition, the potential of economic instruments to support the achievement of efficiency targets set in the 11th Five Year Plan should be analysed.

There is now a window of opportunity for China to develop an innovative interaction between its overall social planning system and the use of government-controlled market-based instruments in the energy and environment sectors. In the first instance, it is imperative to improve energy efficiency in view of the energy requirements for continued economic development and China's position as a net importer of energy. In addition, the desire to reduce overall environmental burdens for the economy, as reflected in the 11th 5-year plan, combined with the wide array of pre-existing energy taxes and environmental levies, presents a policy platform that can be extended into a coherent and effective architecture of economic incentives that allow for improvements in overall economic and social welfare. Given that the drafting phase for the 12th 5-year plan has begun, making considerations on long-term energy efficiency strategies is very timely.

The CCICED recognized this opportunity for China and its active initiatives in development of economic instruments for raising energy efficiency and reducing pollutant emission (refer to Appendix I and II). Consequently, it established a two-year-term "Task Force on Economic Instruments for Energy Efficiency and the Environment". The purpose of the Task Force is to make strategic and concrete policy recommendations to the State Council of China and its relevant ministries on environmentally-related taxation, green credit and pollution liability insurance, whilst making reference to related experiences and lessons of the international community.

Empirical data and economic studies show that economic instruments have considerable positive impacts on the environment, employment, innovation and the economy as a whole. Billions of Euros have been and can be saved, which so far are used for importing energy and resources as well as for combating pollution. Several policy processes in the European Union (EU) show that increasing energy and resource efficiency are and will remain high on the political agenda. At the EU Summit in March 2007 the European Council (heads of state) decided that energy efficiency should be improved by 20% by 2020. The European Commission in turn has launched a 'Green Paper on market-based instruments for environment and related policy purposes[1] in March 2007, which takes stock of the implemented economic instruments and sketches out possible potential for broader application.

[1] Resource: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0140:FIN:EN:HTML .

The Task Force held its inception meeting in April of 2008. In the succeeding months, the Task Force has prepared this interim report for the 2008 AGM of the CCICED, with focus on long-term incentive strategies for energy efficiency. In addition, the Task Force intends to conduct a study tour to Europe to get hands-on experience in discussions with top-level professionals from academia, science, politics, non-governmental organisations and associations and to enrich the Task Force Members' practical impressions on how to deal with economic instruments in developed countries. A roadmap towards the more effective application of existing and the introduction of new economic instruments shall be proposed. This shall include an incentive strategy for energy productivity as well as detailed implementation steps for economic instruments by the groups: environmental taxation and greening credits and insurance. The overall research results and the recommendations elabourated by the Task Force shall be presented at an international conference. The general working progress of the Task Force is presented separately in the appendixes and the overall outputs of the Task Force will be finally reported to the 2009 AGM.

The Task Force acknowledges both the contribution by a previous CCICED Task Force on environmental taxation, and also the parallel existence of the Task Force on a low carbon economy. However, it identifies its separate strategic role as bringing together environmental and energy efficiency concerns under a coherent perspective. The CCICED addresses market-based policy instruments as a vehicle for reforms that are both economically efficient and environmentally consistent.

The Task Force proposes a fiscal reform that progressively and predictably moves fuel and energy prices upwards. It also proposes long term infrastructure planning, based upon the assumption of these rising prices. This double strategy can be designed to be socially benign, thus avoiding any additional inflation and stimulating long term technological progress.

Significant technical opportunities for dramatic increases of energy productivity do exist, but are so far dormant, waiting to be developed and applied. The foreseen long term rising energy prices and taxes, can spur technological innovation in the direction of high energy productivity, promising prosperity and environmentally sustainability at the same time.

The Task Force takes note of the implications of China's aim to maintain a harmonious society with continued economic development and recognizes the sensitivity of inflation in the current situation of increasing energy prices and thus comes up with proposals contributing to this aim.

The rising of energy prices can be attributed to two subtly different rationales. In one case, the revenues flow directly to oil and coal producing countries. In the other situation, the energy taxes are domestically imposed, so the revenues from increasing the energy prices are captured and recycled back to lower other taxes, in order not to increase the tax burden. In addition, a portion of the revenue is spent to stimulate innovation and diffusion of energy-efficient technologies. The Task Force has reviewed international experiences with market-based instruments and provides below a preliminary account of its findings and observations on energy taxes. The concrete recommendations on the implementation of environmental taxes will be reported to the AGM 2009.

The following preliminary recommendations are made:

1) The concept of energy productivity suggests that energy policies should target not only the energy supply side but also the energy demand side as well. Thus, it is vital to optimize the whole system of socio-economic activities. China should take a systematic and long-term strategy of increasing energy productivity as a national goal.

2) Raising energy price is a fundamental driving force to raise energy productivity through curbing energy demands and stimulating technology innovation. In the past 200 years before 2000, the real prices of raw industrial resources including energy had been falling in general trend, and the prospecting, mining and transport technologies were the main drivers of reducing prices. Consequently, the incentives have weakened for all investors to put their money into high technology efficiency innovation.

3) Considering the complexity of raising energy prices, China can adopt a long-term strategy - the 'escalator' idea of adding small, announced, periodical price signals. The escalator strategies should be kept stable for many decades and the slope of the upward escalator could be determined annually or every five years by the cycle of the five-year plans in line with measured average productivity gains over the previous years. Raising prices at the same rate as raising productivity concurs to the concept of a Harmonious Society.

4) Regarding impacts of energy-related taxes, the link of the tax increases to the productivity gains will ensure to have no negative effects on welfare and thus would be no average suffering. If the fiscal revenue from energy taxes is re-channelled into the economy by reducing the fiscal or parafiscal load on human labour, it would give an additional push to overcome unemployment. To this end a tax shift could be made from value added taxes (VAT) to energy taxes with a net neutral effect on inflation. If the increase of energy prices is linked to energy productivity gains, pioneering countries are likely to be at the forefront of a trend that will come worldwide anyway. Aiming at the largest potentials for energy efficiency first (Chinese industry), this will limit impacts on the consumer prices, too.

5) It is conceivable that similar long-term escalator strategies are applicable to other natural resources such as industrial materials and water.

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1. Energy productivity as a national goal

1.1. Understanding the importance of energy productivity

In economics, productivity is the amount of output created (in terms of goods produced or services rendered) per unit input used. For instance, labour productivity is typically measured as output per worker or output per labour-hour. Resource productivity refers to the economic output per resource input. The Chinese GDP of 2007 divided by the amount of resources consumed in that year is the Chinese resource productivity of 2007. This can, of course, be subdivided and differentiated for different resources such as energy, water, minerals etc.

Like labour or capital productivity, energy productivity measures the output and quality of goods and services (or welfare) generated with a given set of inputs, taking into account of the entire energy chain as illustrated in Figure 1.

End-use energy consumption includes several resources that fall into two categories, i.e. primary energy such as coal, oil, nuclear, natural gas, hydropower, biomass and so on, and secondary energy such as electricity, thermal power, gasoline and so on that are converted from primary energy. The needs like a “light, warm room” or a “cool drink” have to be considered too, since there are different ways of providing these services. It thus goes one important step further; from primary energy via end energy to services. This allows for a much larger potential of energy productivity to be exploited.

Factors which influence China's energy productivity include: technology innovation; development and deployment; resource allocation structure; industrial structure and institutional arrangement; management and mechanisms; subsidy; price and tax structures; demand preferences which are dependent on prices; infrastructures; institutional presetting; cultural habits; etc.

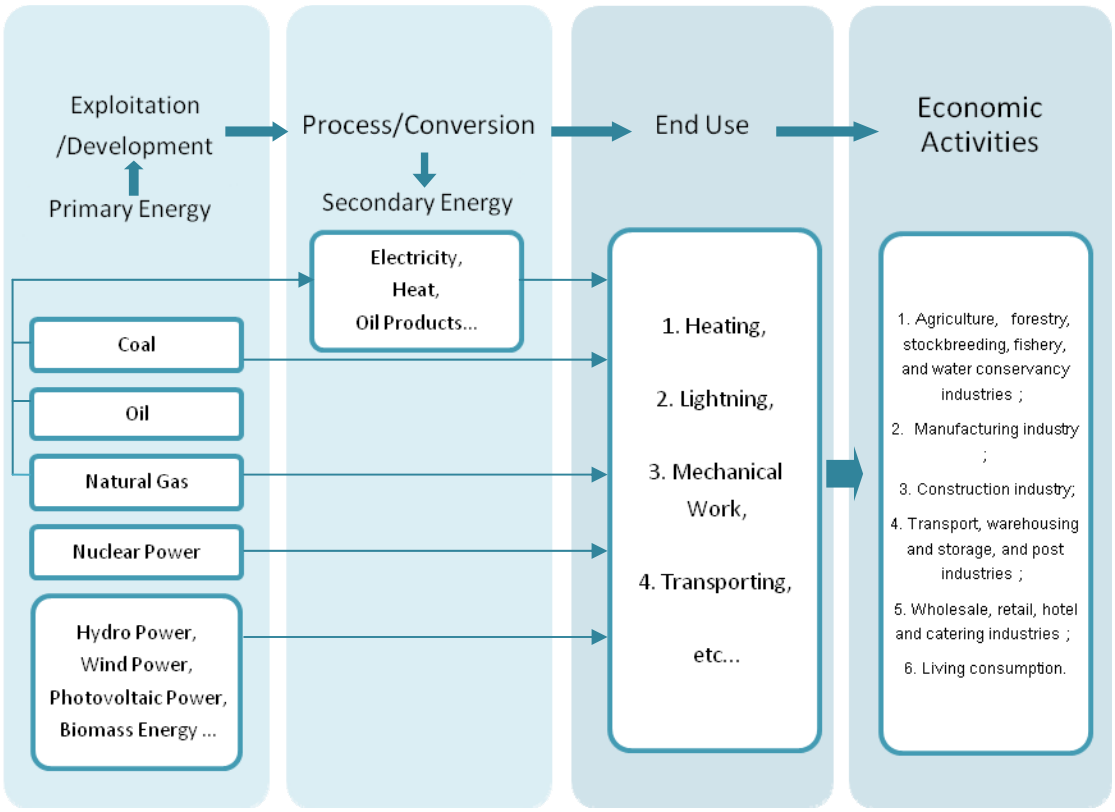

Figure 1: Comprehensive Energy System

The concept of energy productivity provides an overarching framework for understanding the evolving relationship between energy consumption and economic growth. Energy-productivity improvements can come either from reducing the energy inputs required to produce the same level of energy-related services or from increasing the quantity or quality of economic output without increasing energy inputs. Within each of these, there are multiple components that can change over time. Thus, emphasis of energy productivity should focus on energy efficiency improvement as well as substantial system changes.

1.2. Taking increase of energy productivity as a Chinese national goal

Energy demand is rising in China and world-wide at high speed. Oil and gas are becoming increasingly scarce and expensive. Coal is available, but causes big environmental problems locally (in particular health damages) and globally (global warming). Renewable sources of energy enjoy strong growth rates. However, for the considerable future, they will remain a limited option - chiefly for reasons of space and cost. Nuclear energy in relevant amounts will be facing serious problems of uranium scarcity (uranium prices rose much faster than oil prices in recent years). There are also other problems to consider, such as radioactive wastes and the nuclear cycle's vulnerability to terrorism and wars.

The core of the answer to the energy challenges may not come from modified energy supplies but from a systematic, long term strategy of increasing energy

productivity, which essentially means curbing energy demands' whilst further increasing prosperity.

It is actually a fact that huge efficiency increases are theoretically available. In a book, Factor Four, also available in Chinese[2], fifty examples are presented of a quadrupling of energy and material productivity. A more ambitious sequel, called Factor Five[3] is under preparation and will focus more on systemic productivity increases beyond isolated efficiency technologies. Eventually, even a factor of twenty should be feasible. This could solve most energy-related problems of climate, the local environment and social equity, both in China and world-wide.

A strategic increase of energy productivity looks like a highly attractive national goal for China. According to the 11th Five-Year-Plan, the Chinese government has established detailed plans specifically in energy conservation, such as the Comprehensive Working Scheme on Energy Conservation and Reduction of Pollutant Emissions, in which it set out the targets for the year 2010:

- energy consumption per 10,000 Yuan GDP reduced from 1.22 tons of standard coal in 2005 to below 1 ton, down by about 20%;
- water consumption per unit of industrial value added reduced by 30%; and
- discharge of major pollutants reduced by 10%".

2. Surprise lesson from history: resource prices have been falling

Despite basically well-known potentials, there are few signs in any country of aggressively pursuing the energy productivity agenda. Australia's and other countries' decisions of phasing out incandescent light bulbs; Japan's top runner program; the EU's emissions trading system ETS; and China's commitment in the 11th Five Year Plan to increase energy productivity; compare favourably with the inertia in other parts of the world. But even these laudable measures fall very short of meeting the challenges.

The basic reason for inertia on this front, so it seems, is a world-wide policy of keeping energy prices as low as possible. This has understandable social reasons but it also sends a signal to consumers, manufacturers, and investors that energy efficiency and productivity will be mostly left to idealism or some mild state intervention. The trillions of yuans, dollars, and euros invested annually in new businesses and infrastructures have almost no commercial motive of addressing energy productivity. This is the reason why many of the Factor Four examples, such as Amory Lovins' high tech 'Hypercar' needing less than 2 litres per 100 kilometres, have not made it to the market. To successfully reach the market in significant numbers, they require huge investments, which will not pay off under present conditions.

To make such strategic investments in resource productivity profitable, resource prices should go up. However, so far, the opposite has occurred. Combined efforts by

[2] Von Weizsäcker, Ernst Ulrich, Amory Lovins, Hunter Lovins. Factor Four. Doubling Wealth, Halving Resource Use. London. Earthscan, 1997; also available in 12 other languages including Chinese.
[3] Von Weizsäcker, Ernst Ulrich, Charlie Hargroves, Michael Smith. Factor Five. London Earthscan, 2009.

politicians, entrepreneurs and mining engineers have established a long term trend of continuous decreases of resource prices, as shown in Fig. 2 for "raw industrials", meaning natural resources of industrial importance, including energy. This comes as a big surprise to many who are accustomed to complaining about high resource prices. The price hikes of the past couple of years have just brought us back into the *lower* confidence interval of the long-term downward trend. (The picture does not reflect the development after 2004!)

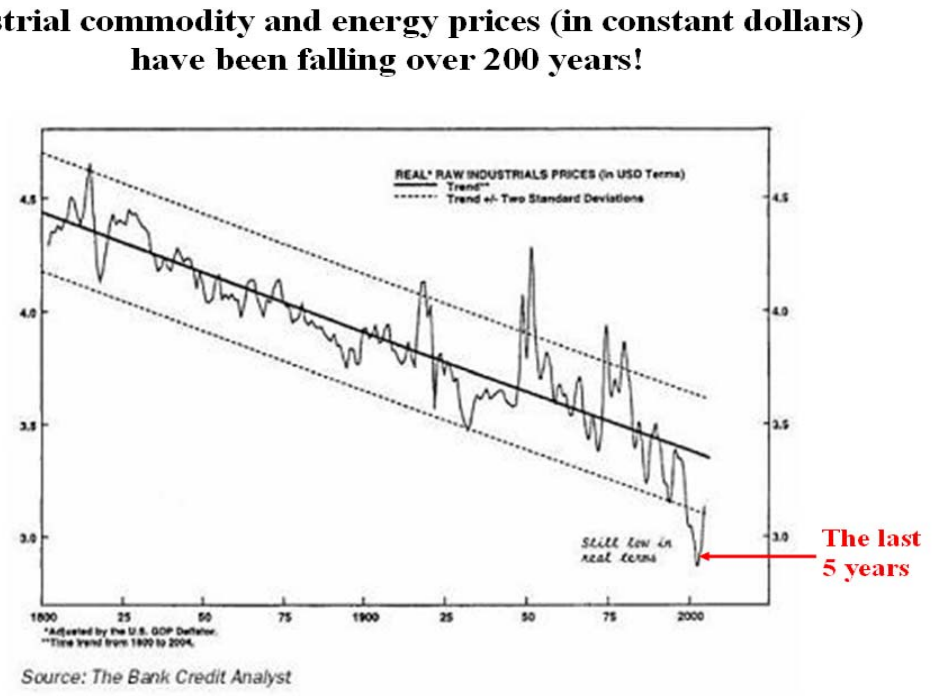

Fig. 2. Industrial raw resource prices, inflation adjusted over 200 years. Prospecting, mining and transport technologies were the main drivers. The price hikes since 2000 have just brought us back into the lower confidence interval of the downward trend! Source: The Bank Credit Analyst, 2005

There have been a few periods during which resource prices increased, notably the two World Wars. More memorable in our times have been the oil price shocks of the 1970s, which can also be seen in Fig. 2. In 1973, the oil exporting countries managed to quadruple oil prices overnight and push it further up in 1978. However, the rest of the world reacted by significantly increasing prospecting and mining until, by 1982, oil prices had come down to pre-1973 levels.

During the early years of the 21st century, many people felt that finally, resource prices were now going up irrevocably. The new surge of oil, gas and other mineral resource prices was triggered by steeply rising demand from the rapidly developing Asian economies - led by China. However, China and the world wide mining companies have immediately injected a lot of money into new prospecting and mining, which brought the

surge to a halt and there are indications that commodity prices may come down again, at least in constant dollars.

Typically, it is the geological limits and extraction and refinery cost that ultimately determine prices. In earlier decades, also access and transport limitations played a major role, but the share of transport cost has been falling systematically over time. If the geological limits remain the main determinant factor for resource prices, it could be assumed that oil prices will come down to something like $80 per barrel, reflecting the price of coal (at a high estimate of $100 per short ton of coal) plus the liquefaction cost at industrial scale plus company profits. Clearly, this price would be a blow to all investors putting their money into high tech vehicles like the Hypercar.

3. International experiences in raising energy prices: introduction of environmentally-related taxes

If markets (plus socially motivated price subsidies) lead mostly to low prices and if low prices are seen as the main obstacle to the efficiency revolution, then it would seem evident that China and the world should go for a policy shift from keeping prices low to actively increasing them.

Different instruments are available to put price tags on energy, or, more specifically, on carbon dioxide. In fact, energy can be seen as a good proxy considering all greenhouse gas emissions, so that addressing greenhouse gas emissions (not just CO_2-emissions) via a general energy taxation, is the best choice. The overall objective is to increase energy productivity and to achieve a major shift of the economic structures. To this end, it would by far not be sufficient to concentrate on CO_2 and end up with basically spending many financial resources on an end-of-the-pipe-technology like carbon capture and storage (CCS) with a high uncertainty of permanent success. Furthermore, such a limited strategy would lead to substituting coal with very inefficient nuclear power, leading to other serious problems and thus preventing a substantial increase of energy productivity. Considering this, many OECD countries focus on energy, only sometimes supplemented by CO_2.

Theoretically, prices can be fixed by the state, although in the past this was mostly done to keep prices low. Fees and charges can be levied. The EU's emissions trading scheme (ETS), a cap and trade regime, serves to put a price tag on fossil fuels. Some states, notably in Europe and beginning in Scandinavia, have introduced CO_2-/energy taxes.

In several EU-member states carbon-/energy taxes have been introduced as part of more comprehensive Environmental Tax Reforms (ETR) (referring to Appendix III), that have shifted the tax burden away from taxes on labour in return for innovative taxes on energy products and CO_2. As a result of these reforms, annual tax payments of more than 25 billion Euros have been shifted. The member states in question and the year for the first shifts were Finland (1990), Sweden (1990), Norway (1991), Denmark (1992), Netherlands (1996), Slovenia (1997), Germany (1999), UK (2000); Estonia (2006) and the Czech Republic (2007).

The European countries show a reduction in fuel demand that results from the ETR. The size of this reduction is dependent upon two factors. One relies upon the tax rates imposed i.e. how they are applied to the various fuels and fuel user groups and how easy it is for fuel users to substitute between the various fuel types and non-fuel inputs. The other relies upon the scale of the secondary effects from resulting changes in economic activity. The reductions in fuel demand attained in 2004 were in the range from 1.5% to 5%, when the ETR-effects have been carefully separated out from underlying trends.

In Finland, it is estimated that, in the absence of energy-/CO_2 taxation, carbon emissions would have been 7% higher in 1998, if taxes had remained at the 1990 level. In Norway, carbon dioxide taxes lowered CO_2-emissions of some stationary combustion plants by some 21%.

The reductions in GHGs closely follow the results for total fuel consumption, with the largest reductions (up to 5.9% in 2004) occurring in regions with the highest tax rates, e.g. Finland. In contrast, the German ETR was not particularly efficient in reducing emissions because it did not initially include coal. However, overall the ETR alone resulted in a reduction of 2-3% of CO_2-emissions; and in the transport sector clearly larger effects were noted. In reaction to the world oil price increase, transport fuel sales in Germany dropped by 17% between 1999 and 2007 – after steady increases over several decades.

European countries that implemented ETR did not experience a negative impact on economic growth (GDP) from ETR. In some cases it was even slightly positive. In addition, the number of jobs created increased substantially, e.g. by up to 0.5% or up to 250,000 between 1999 and 2003. To ensure optimal effects and smooth implementation, it is necessary to follow some guidelines for implementation (refer to Appendix III).

As ETR results in higher fuel prices it is considered likely that there will be an increase in the overall price level. The degree of this is likely to be dependent on the scale of the increase in fuel costs; how easy it is for industry and consumers to switch between fuels to cheaper alternatives (and non-energy inputs); and how much of the cost is passed by industry on to consumers (dependent on the level of competition in the industry). It should also be noted that price effects should be reduced through a tax shift (e.g. reductions in employers' social security contributions i.e. labour costs or corporate taxes), or recycling back the revenue to industry, while keeping the incentive effect at the margin.

The measure of inflation, the consumer price index (CPI), will record a larger increase in cases where the taxes are levied on households rather than industry. The reason for this is that the consumer price index is a weighted average of the price of consumer products, including energy. In the cases where the tax is levied on households the whole tax is reflected in the consumer price index rather than just the share that is passed on by industry. Therefore, it is not unexpected that an increase in the consumer price index was seen in Sweden whereas the five other European countries showed no or negligible increases in CPI.

A complication can arise with energy-intensive companies, because the compensation they receive via the reduction in social security contributions does not fully match the additional energy costs. They may have a small labour stock, while they

consume large amounts of energy. However, due to significant energy-savings as well as certain special arrangements (such as tax exemptions) the effective tax burden for energy-intensive industries has in Europe been kept at less than 2 per cent of gross operating surplus.

In Denmark, industry improved energy intensity by close to 30% in the decade from 1990-2000, whereas Netherlands obtained improvements in the range of 10-15%. A particular aspect of Denmark's program of carbon-/energy taxation, believed to have been significant for the marked impacts on energy productivity, was the earmarking of 20% of the revenues to co-finance energy efficiency measures and upgrade production technology.

An interesting variant of energy taxation has been the "escalator" idea of adding small annual price signals that were agreed for many years in advance. This has been first introduced in Great Britain and copied in Germany with some modifications. In retrospect, it can be said that the escalator proved very effective in reducing demand (see Fig. 3, comparing Great Britain, Germany, Canada and the USA with regard to fuel consumption/ CO_2 emissions per capita per year.

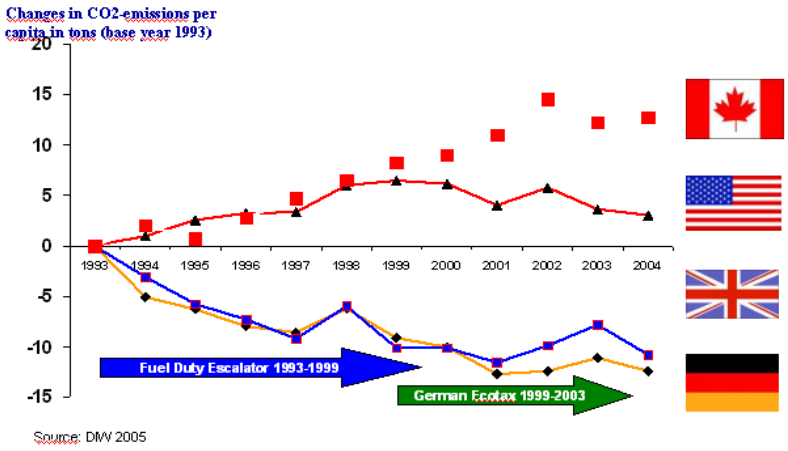

Fig. 3: Steering effect of fuel tax escalators (Picture: FÖS, 2006, Database: DIW, 2005)

4. Increasing energy prices in parallel with energy productivity gains

Combining the escalator idea with the long term goal of increasing energy productivity, leads to a novel policy proposal. The policy suggests, to politically establish a trajectory of steadily progressing energy and commodity prices, with the slope of the trajectory being determined by the statistically established increases of energy and resource productivity.

If energy prices increase only in line with average energy productivity gains, then, by definition, there would be no detrimental social consequences. This is of highest political significance and contrasts favourably with experiences from the past of rising energy prices causing major hardship for families, small enterprises, and whole branches

of industry. The negative effect, however, has always been associated with the size of the price increase and with its unpredictability, allowing no advance adaptation.

Despite this welcome feature of low social impact, the long term escalator sends a strong signal to investors, manufacturers, consumers, and infrastructure planners to be prepared and to adapt. In all likelihood, the signal will actually accelerate investments into energy efficiency technologies and energy productivity creating systems.

The trajectory would have to be kept stable for many decades. Investors will be all the more confident the longer they can rest assured of the trend. The time horizon of the measure should be at least as long as the payback time of the most important investments, meaning long lasting infrastructures. A glance back in history shows that under the conditions of the low gasoline prices in the USA, an investment like the Japanese bullet train (Shinkansen) would never have been possible.

Besides, the OECD country Switzerland has successfully made experiences with a somewhat related approach. For public investments it was tested to calculate the external costs, in addition to the ordinary investment and operational costs, into large investment projects such as infrastructure and buildings. This led to a much improved profitability of energy efficient and renewable technologies.

Are there alternatives to a tax system for establishing the price corridor? In theoretical terms, increasing resource prices could also be induced by an ambitious cap and trade regime with gradually tightened cap levels. However, past experiences with cap and trade regimes show very unpredictable fluctuations of the price, resulting in part from speculation. There is no way of linking resulting prices to previous efficiency gains.

5. Is there a problem for the poor or industry or inflation?

Objections against an ecological tax escalator can come from advocates of the poor, industry and from inflation fears.

Advocates of the poor will hint at the relative importance for the poor of the energy costs in the consumer basket. Energy and water taxes tend to be “regressive”, i.e. negatively impacting the poor more than the rich. To answer this problem, it is possible to grant a tax free or tax reduced minimum tableau of approximately one gigajoule of energy per person and week. Then the really poor would actually benefit, while the burden would shift towards the middle income and rich strata of the society.

Blue collar workers, too, have a tendency of opposing energy taxes. They typically adopt the arguments of the poor and have the concern that energy taxes might destroy industrial jobs. However, as demand for industrial output is rising, a country like China needs not fear net job losses if the price increase goes slowly and predictably.

Industry and investors are actually likely to benefit from the predictability of the transition. They can move into ambitious technological and infrastructural projects with very limited risks. This would hopefully then lead to major advantages over competitors working under conditions of fluctuating (if somewhat lower resource prices) who invariably give too little attention to the long term scarcity of resources.

Another concern, very relevant in China today, is inflation. However, a tax shift could be made from value added taxes to energy with a net neutral effect on the price level.

Evidently, it would be desirable for both ecological and economic reasons to find an international agreement on price trajectories. However, if the increase is linked to productivity gains then pioneering countries are likely to benefit and not loose because they will be at the forefront of a trend that will come world wide anyway.

6. The paradigm of a twenty-fold increase of labour productivity

The history of technological progress so far is the history of the increase of labour productivity. It has been a revolution indeed, the Industrial Revolution. Labour productivity grew at least twenty-fold over time. During the 19th century, the increase in what became to be the industrialised countries was approximately one percent per year, which is not particularly impressive. The rate increased to one and a half percent during the first half of the 20th century and to two percent thereafter. In contrast, there have been phases like Germany during the late 1950s, Japan during the 1960s and China after 2000, where labour productivity increased more than seven percent per year. Though, to a large extent, this can be attributed to copying technologies that had been developed elsewhere.

One fact, well-known by organised labour and by employers, is that wage negotiations have always taken labour productivity gains as their yardstick. It was only during the recent neo-liberal and neo-conservative phase since the early 1980s, that wages began to lag behind productivity gains. From the employers' perspective, this was chiefly due to competition from low wage countries. What is not so well known is that productivity gains also went up in parallel with gross labour cost. What was the hen and what was the egg? Empirically, we observe wages and productivity going up in parallel (Fig. 4).

This trend of labour costs spurring labour productivity is an exciting indication for the potential of using energy price signals for spurring energy productivity gains. As a matter of fact, the "oil crisis" of the 1970s served as an (unplanned) experiment for this hypothesis. As energy prices went up across the board, a new mentality set in that focused on energy efficiency. Fig. 5 shows the effect.

Fig. 4: Rise of wages and of labour productivity mostly in parallel. The picture shows this for a time span of fifty years in the USA, but very similar pictures are available for other countries and other periods of time.

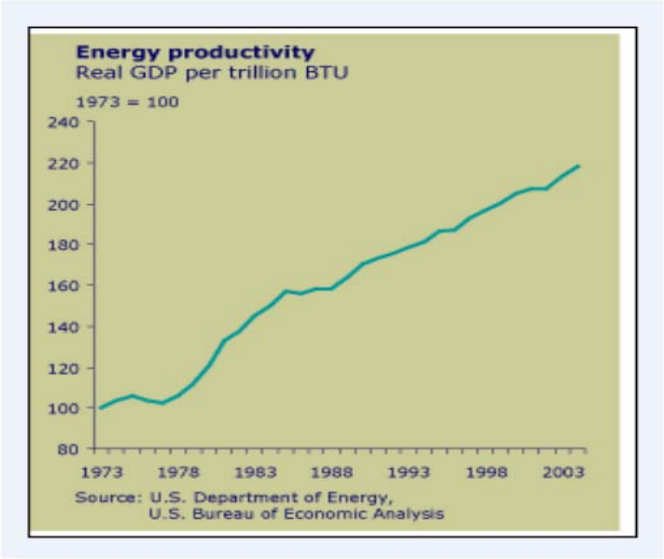

Fig. 5: The oil price shocks of 1973 and 1978 triggered a steady increase of energy productivity in the USA. The new mindset of energy efficiency survived even the period 1981 – 1998 of receding energy prices.

7. A revenue-neutral ecological tax reform

The paradigm of labour productivity seems to support the idea of a steady increase of energy prices. As stated earlier, if energy prices increase in line with average energy productivity gains, there would be no average social suffering. The situation can become even more attractive if the fiscal income from energy taxes is re-channelled into the economy by reducing the fiscal or parafiscal load on human labour thus giving an additional push to overcome unemployment. However, if inflation is the highest concern, the reduction of VAT and/or other taxes could be considered.

The new idea is to make the trajectory of energy prices very predictable by compensating world market fluctuations. Downward fluctuations would be compensated upwards and upward fluctuations, such as the painful price hikes of late 2007, could be compensated downwards, so as to bring prices back to a previously agreed price corridor. The slope of the upward corridor could be determined annually (or every five years by the cycle of Five Year Plans) in line with measured average energy productivity gains over the previous year (or years). Adjustments could be allowed on a quarterly basis so as to make prices even more predictable.

The system could be differentiated for vehicle fuels, electricity, carbon content, and other criteria. It will be a matter of political priority setting weighed against simplicity. This system of increase should be made a law that is valid for the long term, e.g. some twenty years or even fifty or more years, with fairly tough clauses for exemptions or deviations from the rule.

It is conceivable to develop a similar system for materials and for water. If prices for primary raw materials and for water extracted from nature go up steadily, the incentives increase for reuse of materials and for water purification. Simultaneously, the profitability of mining operations go down - which is highly desirable.

8. Long term price elasticity is high

Generally, it can be said that energy and resource consumption have a reasonable low price elasticity in the short term. Otherwise, the upward curve in Fig. 4 would have started in 1973 or 1974, not in 1977! In the long run, however, the price elasticity is astonishingly high, as can be seen from an observation made by Jochen Jesinghaus4.

The picture shows a striking negative correlation between fuel prices and per capita fuel consumption. Ten years after the introduction in the US of the Corporate Average Fuel Economy (CAFE) standards in 1975, this country although admirably catching up on per mile fuel consumption was still the country with by far the highest per capita fuel consumption. In layman terms, under the condition of low fuel prices, what CAFE conveyed to drivers was: "Now you can drive more miles for your bucks". In the absence of any price signal, single efficiency gains did not prevent per capita annual fuel consumption from steeply growing, mostly due to increased mileage and consumers switching to bigger cars.

[4] Ernst von Weizsäcker and Jochen Jesinghaus. 1992. Ecological Tax Reform. London, Zed Books.

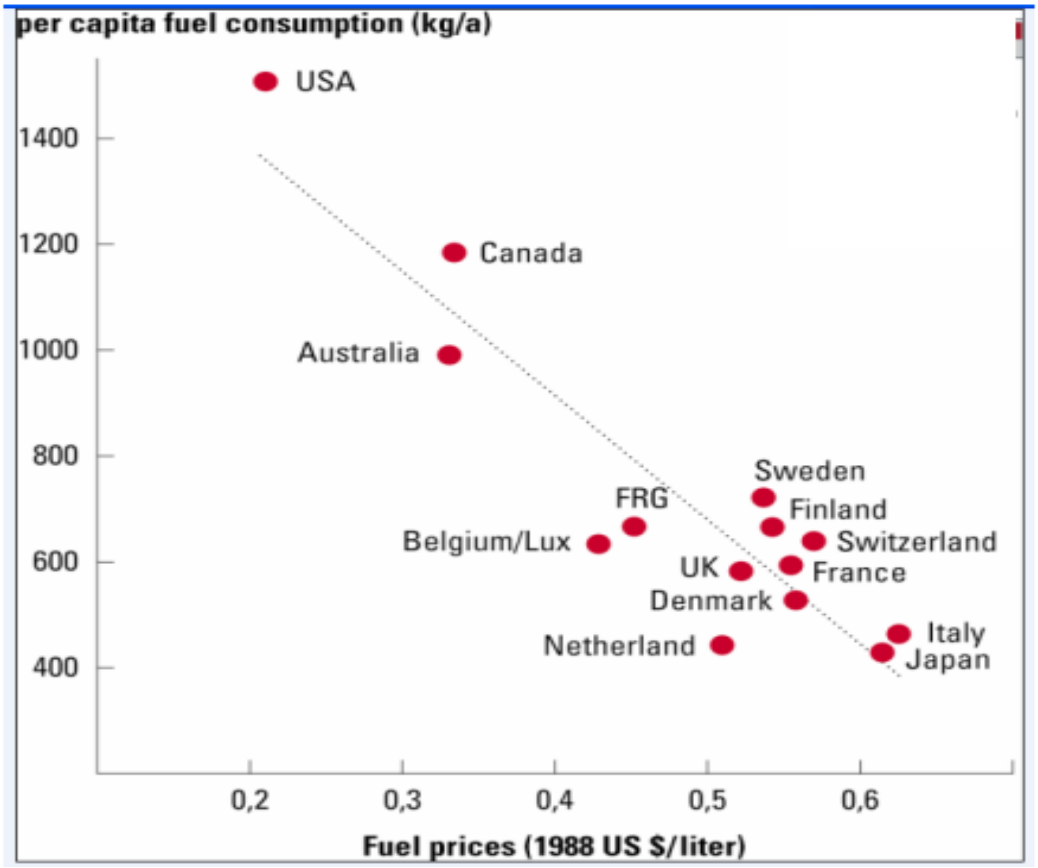

Fig. 6: Even for petrol consumption which is often referred to as nearly inelastic to price changes, we observe a clear correlation between prices and fuel consumption – if we ask the right question. The question asked for this graph was: how much petrol is consumed per capita and year in different OECD countries that have nearly equal levels of wealth and mobility? Countries had more or less stable policies on domestic fuel prices for many years preceding the year (1988) in which the data were collected. The picture reflects long term price elasticity.

This experience is very valuable for determining a price trajectory overcoming the dilemma of short term instruments. We can safely rely on small signals if we give the society assurance of a long term upwards trend for energy and other resource prices.

9. Conclusions and strategic recommendations

1) The concept of energy productivity provides a holistic, strategic, thinking and systematic policy approach to energy challenges. It suggests that energy policies should target not only the energy supply side but also the energy demand side as well. This means considering not only production but also consumption, with a view of curbing energy demand while further increasing prosperity. Thus, it is vital to optimize the whole life cycle of energy resource utilization and the whole system of socio-economic activities. With this understanding, China should take a systematic and long-term strategy

of increasing energy productivity as a national goal, which provides China with a large potential to deal with energy challenges.

2) Both theoretical analysis and practical experience prove that raising energy price is a fundamental driving force to raise energy productivity through curbing energy demands and stimulating technology innovation. In this regard, policymakers may be misled by fluctuation of energy prices in the past. In the past 200 years before 2000, the real prices of raw industrial resources including energy had been falling in general trend, and the prospecting, mining and transport technologies were the main drivers of reducing prices. Consequently, the incentives have weakened for all investors to put their money into high technology efficiency innovation.

3) Considering the complexity of raising energy prices, China can adopt a long-term strategy - the 'escalator' idea of adding small, announced, periodical price signals. The escalator strategies should be kept stable for many decades and the slope of the upward escalator could be determined annually or every five years by the cycle of the five-year plans in line with measured average productivity gains over the previous years. Raising prices at the same rate as raising productivity concurs to the concept of a Harmonious Society. Prices rising only as fast as productivity gains will not, on average, create any social hardship.

There are a number of evidences to support the escalator idea:

(i) The long term escalator sends a strong signal to investors, manufactures, consumers and infrastructure planners to be prepared and to adapt. In all likelihood, the signal will actually accelerate investments into energy efficiency technologies and energy productivity creating systems.

(ii) The history of technological progress so far is the history of the increase of labour productivity. Since the Industrial Revolution, labour productivity in the industrialised countries has grown at least twenty-fold. Concurrently, we observe labour wages and productivity going up in parallel. This trend of labour costs spurring labour productivity is an exciting indication for the potential of using energy price signals for spurring energy productivity gains.

(iii) Generally, energy and resource consumption have a low price elasticity in the short term. Longer term, however, the price elasticity is often surprisingly higher. This experience is very valuable for determining a price trajectory overcoming the dilemma of short term term upwards trend of energy and other resource prices.

(iv) OECD countries' experiences suggest that introduction of comprehensive environmentally/energy-related taxes such as fuel tax, carbon tax, pollutant-related tax, etc. is a good way to establish long term escalator strategies for energy prices. Yet, it should be noted that environmentally harmful subsidies and tax provisions must be removed first.

4) Regarding impacts of energy-related taxes, the following conclusions and observations could help to mitigate the concerns, which are very relevant in China today:

(i) If energy prices increase in line with average energy productivity gains, the introduction of environmentally/energy-related taxes should not have negative effects on welfare and thus would be no average suffering.

(ii) The situation can become ever more attractive if the fiscal revenue from energy taxes is re-channelled into the economy by reducing the fiscal or parafiscal load on human labour thus giving an additional push to overcome unemployment. As demand for industrial output is rising, a country like China need not fear net job losses if the price increase proceeds slowly and predictably.

(iii) A tax shift could be made from value added taxes (VAT) to energy taxes with a net neutral effect on inflation.

(iv) Succinctly, if the increase of energy prices is linked to energy productivity gains, pioneering countries are likely to benefit, not loose because they will be at the forefront of a trend that will come worldwide anyway.

(v) Another means of keeping impacts on price levels low is by aiming at the largest potentials for energy efficiency first, thus starting with Chinese industry, since 70% of energy consumption takes place in that sector. The production costs are so low in China that impacts of potential cost increases due to energy tax increases hardly exist while the above mentioned opportunities are great.

5) It is conceivable that similar long-term escalator strategies are applicable to other natural resources such as industrial materials and water.

Appendix I

Current Situation and Roadmap of Development of Environmental Economic Instruments in China

1. Challenges in command-and-control approach

China now shares a common understanding nationwide that energy and resource shortage and environmental pollution have become a bottleneck hindering its sustainable development after 30 years' rapid growth in economy. The shortage of energy and other natural resources concurs in two dimensions: quite limited capacity of supply on the one hand, and low efficiency in production and consumption on the other hand. As a result, China is suffering from high intensity of pollutant emission caused by low efficiency of energy and natural resource utilization. Generally it is estimated that the average intensity of energy and natural resources per unit products in China is 30 percent higher than that in industrialized countries. This gap would be much bigger if calculating the intensity in per unit of GDP, for example, SO_2 and NOx emission per unit GDP in China would be as high as eight times of averages of OECD countries.

To attack the issue, Chinese Government has taken very extensive and intensive actions since the beginning of the century. Among those actions, of particular significant have been national initiatives in energy-and-resources saving and pollution abatement with legal-bounding targets set in the 11th Five-year Period Plan Outlines for National Economic and Social Development (2005-2010). For instance, As compared with the situations in 2005, China has to reduce its energy intensity of per unit GDP by 20 percent in 2010; the total volume of SO_2 and COD, by 10 percent and water intensity of per unit of industrial value-added, by 30 percent.

For long, command-and-control instruments have dominated China's policy package to address energy and environmental issues, however, no substantial changes in the current national actions to achieve the two legal-bounding targets of energy-saving and pollution abatement have occurred up to now. Consequently, China is facing a number of difficulties and challenges in enforcement of policies and achievement of environmental and resource targets: 1) high costs: a Sino-US Joint Economic Study, for example, shows that 16 percent of costs could be reduced to achieve the 11th Five-year targets of energy-saving and pollution abatement in power sector of China if applying emission trading system, instead of command-and-control instruments; 2) enforcement of some command measures such as shut-down of small enterprises in energy-and-pollution intensive sectors often raise social equity and stability problems and even the legitimacy questions to the enforcement body of government, which contravenes the country's effort in building-up harmonious society; and moreover 3) command-and-control measures can produce immediate effectiveness but such effectiveness can not sustain due to less economic incentives and self-willingness to complying with the command measures.

2. New initiatives and difficulties in development of economic instruments

Fortunately China sees the coming of a strategic transformation period, where Chinese Government has substantially renewed its attitude, strategies, principles and policies to dealing with the relationship of environment and development (Special Study of Strategy Transformation, CCICED, 2007). Regarding the challenges raised by command-and-control measures, Chinese Government has brought forward clear requirements to introduce economic instruments. At the 6th National Conference on Environmental Protection held in 2006, Premier Wen Jiabao pointed out that we shall resolve environmental problems through transformation from mainly relying on administrative means to integrating legal, economic, technological and necessary administrative measures, and follow the economic rule and the natural rule consciously to upgrade environmental protection endeavors. The 17th Congress of CPC, held in 2007, required that reform in fundamental economic systems such as price and taxation shall take environmental protection into consideration and formulate fiscal policies towards sustainable development. More specific requirements for development of market-based policies were set up in the State Council Scheme for Energy-saving and Pollution Abatement issued in 2007.

In responses to the calls of national government, SEPA, NDRC, Ministry of Finance, and other relevant ministries have launched active initiatives. Pan Yue, Vice minister of SEPA, published a SEPA roadmap of development of economic instruments in his article in 2007. The roadmap consists of seven groups of instruments: environmental taxation, pricing and environmental fees, green crediting, environmental insurance, emission trading, eco-compensation mechanism, and green trading policies.

1) Regarding environmental fees related, China has accumulated good experiences. Pollution fees on SO_2, NOx and other main pollutants have been levied for more than twenty years, and sewage fees and waste fees are applied nationwide. The future efforts will be in improving the existing systems, in particular increasing the fee rate with aim at producing sufficient incentives.

2) Emission trading system was introduced several years ago, yet it is still in experimental stage in a number of cities and sectors. With US EPA support, relevant collabourated studies have been done and a few are ongoing.

3) The issue of eco-compensation mechanism (similar to payment for ecosystem services in other countries) has been discussed for a decade and incorporated in a few sectoral policies and experimentally implemented in a number of local communities. Although there is a long road to establish eco-compensation mechanisms nationwide, many studies such as CCICED Task Force on this topic conducted from 2005 to 2006 has provided good grounds to policymaking. SEPA published Guidance of Launching Pilot Projects on Eco-compensation last year.

4) How to mitigate environmental impacts of trade is a pressing concern of green trading policies nowadays in China. In this regard, many studies have touched upon the point, including two task forces of CCICED at its second and third phases. SEPA established a special study team on WTO and environment several years ago, which now is working

intensively on green trading policies. In fact, Chinese Government started strong intervention to reduce exportation of energy-and-pollution based products last year through removing export tax preferential.

Intensive initiatives have taken place since 2007 in environment taxation, green credit, environmental insurance and green stock.

5) SEPA, Ministry of Finance and National Taxation Administration start to discuss the possibilities and approaches of creating new independent environmentally related taxes and incorporating environmental context into the existing tax systems. The discussion is still ongoing. Considerable technical work needs to be done in terms of both general framework of environmental taxation and design of specific tax.

6) In July 2007, SEPA, the People Bank of China and the Supervision Committee for Banks jointly issued the Opinions on Enforcement of Environmental Laws and Prevention of Credit Risks (refer to green credit system hereafter). It requests banks to cancel or postpone lending funds to those enterprises that violate environmental laws/regulations. The issuance of the Opinions has brought about very active responses from local governments, financing institutions and business circles. However, the Opinions is just a starting point of the process, and a number of important technical issues remain there, hindering the process moving forward. For instance: 1) green credit requirement is not workable on many small-and-medium enterprises that raise funds from illegal financing bodies or individuals; 2) there is lack of information-sharing mechanisms and platform between the banks and environmental management bodies; 3) the banks feel hard to make decision on cancellation and limitation of fund lending due to the lack of methodologies and criteria to evaluate enterprises' non-compliance behavior of environmental laws and their environmental risks; And 4) no incentives encourage the banks to implement green credit system.

7) In February 2008, SEPA and the Supervision Committee for Insurances jointly publicized the Guiding Opinions for Liability Insurance of Environmental Pollution. The Guiding Opinions comes out specially referring to the frequent occurrence of pollution accidents in recent years. It is due to the just recent generation and quite general and principle statement in the Guiding Opinions that the actual process of implementation does not start yet and the know-how for implementation is not available now.

8) One week after the publication of environmental insurance, SEPA issued its third new economic instrument alike—Guiding Opinions on Enhancing Environmental Management for Enterprises in Stock Market. The Guiding Opinions is based on two requirements: one is that environmental performance check by environmental management bodies shall be one of qualifications when enterprises apply for entering the stock market; and another is that enterprises in the stock market shall disclose their environmental performance information periodically. SEPA recognizes this system as an economic instrument because it is related to fund-raising of enterprises, a kind of indirect approach against direct borrowing funds from the bank that green credit system is aiming at. As compared with another two new initiatives - green credit and environmental insurance - environmental management for enterprises in stock market has a better technical basis.

3. Concluding remarks

Five observations from all above:

1) Nowadays in China it is a right time to develop economic instruments for resource-saving and environmental protection, characterized by a strong governmental willingness and active initiatives.

2) China has developed the roadmap of environmental economic instruments system, including about 8 instruments and the process to developing specific instruments has been initiated and intensively pushed forward.

3) In terms of technical basis, implementation experiences and existing studies, environmental taxation, green credit and environmental insurance need systematic studies to guide their development.

4) Some other potential instruments beyond the roadmap developed in China, such as environmental bonds, lottery and other market-based financing tool, need to be explored.

5) As compared to the situation of economic instruments for environmental purpose, the development of incentive instruments targeting at energy-and-resource-saving seemingly lags behind.

Appendix II

Assessment of Current Policies for Energy Productivity in China

1. Abstract

Energy productivity refers to the output and quality of goods and services generated with a given set of energy inputs. It is not only about energy efficiency, but also system optimization. Higher labour productivity is caused by the increase of wages, an equal mechanism can be applied with energy productivity. Market based instrument helps the optimization of resource allocation and the efficiency of energy utilization, thus achieves better energy productivity.

The paper reviews of current policies for energy productivity in China, including command and control instruments, market based instruments, information publicity, and persuasion and encouragement, among which command and control and market based instruments are the major two types, with the latter one gradually becoming a major role in policy mix. In order to better achieve policy effectiveness in promoting energy productivity in China, the optimization of policy mix is recommended, enforcing the latter tendency, together with institutional and policy reform.

2. Background

Energy shortage has become a crucial issue in human development. At the present level of energy productivity, the world will only feed and accommodate 1.5 billion people at OECD's average standard of living. Energy efficiency is a popular topic in different events and occasions. It is either emphasized on improving energy supply capacity or reducing end-use consumption. Together with a dramatic increase in the supply of sustainably generated renewable energies these are the two key elements to solve the energy and climate problems. Developing economies are an increasingly dominant force in global energy demand growth while they are marching into their industrialization processes, as industrialized countries did several decades ago. Rather than primarily seeking to reduce end-use energy demand and needs, there should also be a focus on improving energy utilization in a more productive way. Energy productivity is a useful yardstick of progress and a tool to analyze the public policy by substantial system improvements and energy efficiency enhancement.

3. Definition of Energy Productivity

3.1. Energy Consumption System

End-use energy consumption includes several resources that fall into two categories, i.e. primary energy such as coal, oil, nuclear, natural gas, hydropower, biomass and so on, and secondary energy such electricity, thermal power, gasoline and so on that are converted from primary energy. The logistic system is illustrated in Figure 1.

Specifically, energy productivity has to take into account of the entire chain which also includes the needs and services. Hence, the needs like a “light, warm room” or a “cool drink” have to be considered, too, since there are different ways of providing these services. It thus goes one important step further: From primary energy via end energy to services. This allows for a much larger potential of energy productivity to be exploited.

3.2. Definition of Energy Productivity

In economics, productivity is the amount of output created (in terms of goods produced or services rendered) per unit input used. For instance, labour productivity is typically measured as output per worker or output per labour-hour. Resource productivity refers to the economic output per resource input. The Chinese GDP of 2007 divided by the amount of resources consumed in that year is the Chinese resource productivity of 2007. This can, of course, be subdivided and differentiated for different resources such as energy, water, minerals etc.

Like labour or capital productivity, energy productivity measures the output and quality of goods and services (or welfare) generated with a given set of inputs. Factors which influence China's energy productivity include: technology innovation, development and deployment, resource allocation structure, industrial structure and institutional arrangement, management and mechanisms, subsidy, price and tax structures, demand preferences (which are dependent on prices, infrastructures, institutional presetting, cultural habit, etc.

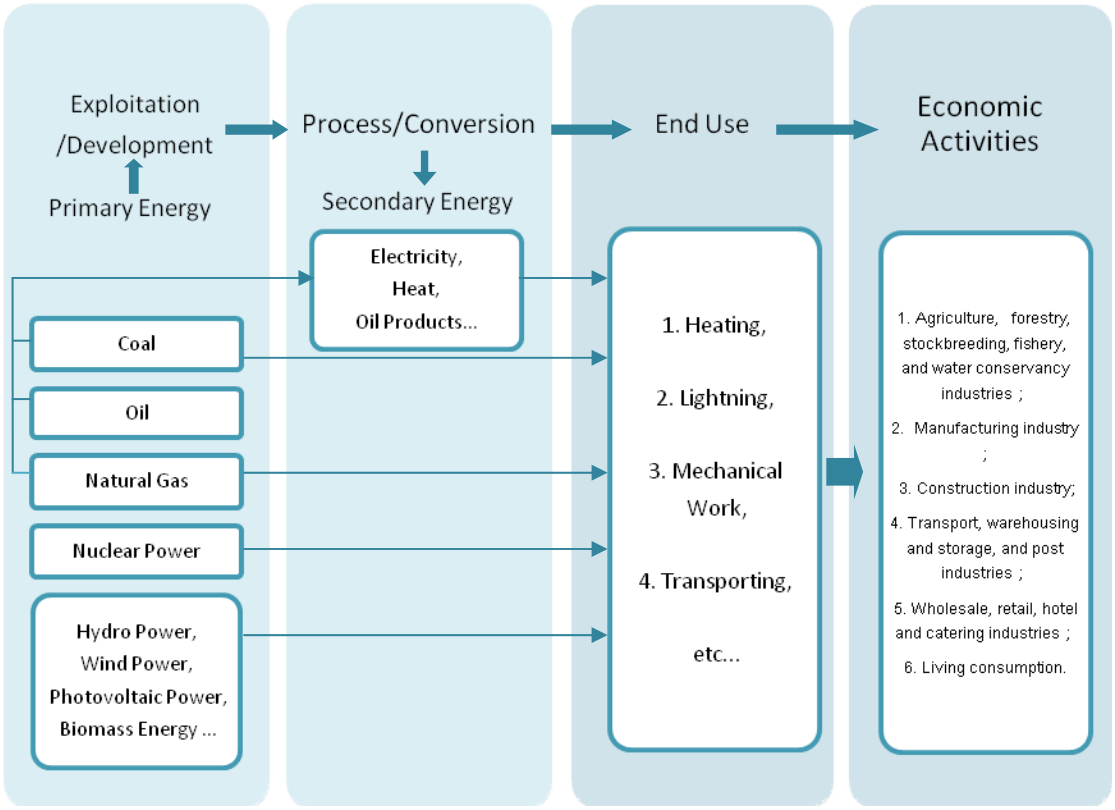

Figure: 7. Comprehensive Energy System

The concept of energy productivity provides an overarching framework for understanding the evolving relationship between energy consumption and economic growth. Energy-productivity improvements can come either from reducing the energy inputs required to produce the same level of energy-related services or from increasing the quantity or quality of economic output without increasing energy inputs. Within each of these, there are multiple components that can change over time. Thus, emphasis of energy productivity should focus on energy efficiency improvement as well as substantial system changes.

4. Current Policy System for Energy Productivity in China

Policy instruments for energy productivity in China include several policy instruments such as command and control instruments, market based instruments, persuasion and encouragement, etc. Policy system in energy productivity is illustrated as bellow.

4.1. Command and Control Instruments

Command and control instruments play a very important role in Chinese policy system, including three categories of strategic planning and sectoral policies, laws and regulations, and administrative commands and guidance. These policies have strong and positive impacts on energy productivity in China.

4.1.1. Strategic Planning and Sectoral Policies

As China's highest level of guiding planning, the 11th Five-Year Plan (11th FYP), has switched its focus from fast economic development to economic development in a sound and fast way. Here "sound" refers to a sustainable and clean way, emphasizing on economic development as well as environmental protection, which can translate into energy conservation and reductions of major pollutants. Following with the 11th FYP, the government has established detailed plans specifically in energy conservation, such as the Comprehensive Working Scheme on Energy Conservation and Reduction of Pollutant Emissions, in which it set out the target of "for the year 2010 included:

- energy consumption per 10,000 Yuan GDP reduced from 1.22 tons of standard coal in 2005 to below 1 ton, down by about 20%;
- water consumption per unit of industrial value added reduced by 30%; and
- discharge of major pollutants reduced by 10%".

In 2007, the State Council released two papers planning the country's energy development, the White Book on China's Energy Conditions and Policies, and The 11th Five Year Plan for Energy Development by NDRC. These two papers portray China's energy conditions and thus summarize the energy policies conducted and to be made in China. The essence of Chinese energy policy is to improve energy production capability to satisfy increasing demands of social production and the elevation of people's living standards, on the base of which emphasizing on energy conservation and environmental protection, and to improve energy efficiency.

In 2004, the Medium and Long Term Energy Conservation Plan was released, one of the major outcomes of which is to implement ten key energy conservation priority programmes:

- Upgrading of Low-efficiency Coal-fired Industrial Boiler (Kiln),
- District Heat and Power Cogeneration,
- Recovery of Residual Heat and Pressure,
- Oil Saving and Substitution,
- Energy Conservation of Motor System,
- Optimization of Energy System,
- Energy Conservation in Buildings,
- Green Lighting, Energy Conservation in Government Agencies,
- Building the Energy Conservation Monitoring and
- Technological Support System.

Trough the implementation of these ten programmes, it is estimated that 240 Mtce can be conserved during the 11th Five-Year Plan period (2006-2010), equivalent to 550 Mt CO_2 emission reductions.

Policy System

(According to importance)

1. General Guiding Planning:
   1) The Eleventh Five-Year Plan for National Social and Economic Development of the People's Republic of China , 2006.3;
   2) Comprehensive Working Scheme on Energy Conservation and Reduction of Pollutant Emissions, the State Council, 2007.6.3;
   3) White Book on China's Energy Conditions and Policies, the State Council, 2007.12;
   4) The 11th Five Year Plan for Energy Development, NDRC, 2007.4;
   5) Medium and Long Term Energy Conservation Plan, NDRC, 2004;
   6) Interim Regulations on Promoting Industry Structure Adjustment, 2005;
   7) Industry Structure Adjustment Guiding Catalog 2005, NDRC;
   8) Industry Structure Adjustment Guiding Catalog 2007, NDRC (Opinion Soliciting Draft);
   9) China's National Climate Change Program, the State Council, 2007.6.4;
   10) China's Specific Scientific and Technical Actions on Climate Change, MOST, NDRC, SEPA, MFA, MOF, etc. 2007.6.13;
2. Sectoral Plan and Policy:
   11) The 11th Five Year Plan for Coal Industry Development, NDRC, 2007.1;
   12) Coal industrial policy, NDRC, 2007.11.23;
   13) Medium and Long Term Development Plan for Nuclear Power (2005-2020), NDRC, 2007.10;
   14) Natural Gas Utilization Policies, NDRC, 2007.8.30;
   15) Medium and Long Term Development Plan of Renewable Energy, NDRC, 2007.9;
   16) The 11th Five-Year Plan on Renewable Energy Development, NDRC, 2008.3;
   17) International Scientific and Technical Cooperation in Renewable and New Energy, MOST, NDRC, 2007.11.12.

These plans are focusing more on energy conservation by improving energy efficiency and by technology improvement. Since late 1980's, Chinese government has emphasized more on the transformation of economic development and the adjustment of economic structures, in order to reduce natural resource and energy consumption, and to improve clean production, as major parts in Chinese industrial policy. There are two Industrial Restructuring Guiding Catalogs in 2005 and 2007 to improve the industrial structures. In the Catalog 2005, over 20 sectors are sorted into three categories of encouragement, restriction, and elimination, within which 47 energy industries are encouraged, 6 are restricted, and 18 are to be eliminated. The number of encouragement, restriction, and elimination catalog of coal sector are 14, 4 and 12 respectively. The numbers in electricity industry are 17, 2, 3. Six items in oil and gas sectors are encouraged, and 3 are to be eliminated. At the moment, Catalog 2007 is still on the state of opinion soliciting

draft, but will generate better and timely energy conservation effect once it is officially released.

Specifically, in facing the challenges of global climate change, China takes a positive and responsive reaction to address the issue, being the first one in developing countries to release China's National Climate Change Program by the State Council, and later China's Specific Scientific and Technical Actions on Climate Change in 2007. As energy conservation, renewable energies and reductions of major pollutants are one of the two actions to fight climate change, namely mitigation and adaptation, by specifically addressing climate change on the national and local level, the country would achieve a great effect in saving energy at the same time.

Besides, China has established sectoral planning and policies regarding to different energy sectors, such as coal industry, nuclear power industry, the utilization of natural gas, and renewable energies. These plans will better facilitate the implementation and application of general energy guiding plans in specific industries with corresponding policies, targets, and instruments.

4.1.2. Basic Energy Laws and Regulations

In 2007, the Energy Conservation Law was revised on the basis of its 1997 version. The revised new law has come into effect on April 1, 2008. This law was revised due to the great progress in social economic development, as well as to better ensure the achievement of the targets set in the 11th FYP of improving energy efficiency by 20%. The revised Energy Conservation Law is greatly supported by a good number of regulations and measures, as well as administrative commands. It is a great progress in various aspects such as:

1) In addition to strengthen relative regulations in industrial energy conservation, by ruling energy conservation policies in different industries and technology upgrade policies, the revised law added energy conservation articles in building, transportation, and public sectors which contribute a great portion to total energy consumption.
2) The revised law perfects energy management and standards system.
    a) Energy saving targets responsibility and energy saving assessment systems. The system is established to set targets for local governments and officers in charge, they will need to report to the central government about implementation effects of energy conservation and will receive negative performance assessment if they fall short of the targets.
    b) Capital assets investment project energy conservation assessment and censor system. With the mandatory energy conservation standards and design norms, the system is to control blind and fast development of high energy consumption industries.

Legal System

(According to importance)

1) Energy Conservation Law, 2008.4.1;
2) Regulation on energy conservation of civil buildings, State Council, 2008.10.1;
3) Measures of Implementation of Energy Conservation Law in Highway and Waterway Transportation, Ministry of Transport, 2008.9.1;
4) Regulations on energy conservation in public institutions, the State Council, 2008.10.1;
5) China's Policy Outline in Energy Conservative Technologies, NDRC, MOST, 2006.12;
6) Renewable Energy Law, 2006.1.1;
7) Law of Energy (opinion soliciting draft), 2007.12.3;
8) Mineral Resources Law of the People's Republic of China, 1996.8.29;
9) Electric Power Law of the People's Republic of China, 2003.09.18
10) Law of the People's Republic of China on Coal Industry, 2003.09.18;
11) Cleaner Production Promotion Law, 2003.02.10;
12) Measures on Energy Saving Management, under revision, 2000.12.29;
13) Implementation of Construction Energy Conservation Monitoring and Management System in Office Building and Large-scale Public Buildings, the Ministry of Housing and Urban-Rural Development, 2007.10;
14) Energy Saving Management Measures in Key Energy Consumption Units (revision);
15) Regulation on Civil Building Energy Conservation Management, the Ministry of Housing and Urban-rural Development, 2006.1.1;
16) Interim Measures on Clean Production Auditing, NDRC, SEPA, 2004.10.1;
17) Measures on Coal Ash Comprehensive Utilization Management, 1994;
18) Measures on Coal Gangue Comprehensive Utilization Management, 1998;
19) Interim Regulations on Lubricant Recycle and Reuse (revision);
20) Regulation in Compilation and Assessment of "Energy Conservation Chapter" in the Feasibility Assessment Report in Fixed Assets Investment Construction Projects;
21) Air Pollution Prevention and Control Law, 2000.4.29.

c) System to eliminate backward high energy consumptive products, facilities and producing processes. On the one hand, the system controls the market entrance of high energy consumptive products, facilities and processes; on the other hand, it enhances shutting down the backward production facilities.

d) Energy management system in key energy consumption units.

e) Energy efficiency label management system. It is established as a law system, declaring implementation targets and punishment measures.

f) Energy conservation honor and awarding system. It is an encouragement

measure by establishing energy conservation models, in order to stimulate working positivism and enthusiasm in the whole society.

3) The revised law defines two systems: energy conservation target duty system, and energy conservation assessment and evaluation system. These two systems include energy conservation targets in the assessment of local governments and officials in charge.

4) The revised law improves economic policies; in regulating that central and provincial government should arrange specific funds to support energy conservation work, to carry out tax preference to listed energy conservative technologies and products, to subsidize the promotion and application of energy conservative products, to induct financial institutes to increase credit support to energy conservation projects, etc.

5) The revised law defines the subjects of energy conservation management and monitoring. The revised law was strengthened with 19 legal responsibilities, defines responsive punishment and increases the scale and degree of punishment.

4.1.3. Administrative Commands and Guidance

1) Decision on Strengthening Energy Conservation by the State Council, 2006.8.6;

2) Guiding Notice of the Ministry of Transport on Port Energy Conservation and Emission Reductions of Pollutants, the Ministry of Transport, 2007.12.20;

3) Several Opinions on Speeding up Shutting Down Small Thermal Power Plants, UNRC, 2007.1.20;

4) List of Backward Cement Production Facilities to be Shut Down in 2007, UNRC, 2007.12.28;

5) Notice of NDRC on Promoting Energy Conservation and Reduction of Pollutants in Small and Medium Companies, 2007.11.27.

4.2. Market-Based Instruments

4.2.1. Energy Pricing Mechanism Reform

1. Electricity Pricing Reform

1) Electricity Pricing Reform Development:

Most relevant to our TF: Since 1985, China has implemented several electricity pricing policies, such as repayment of capital with interest (RCI pricing), fuel and transportation (FT pricing), and operation period (OP pricing). These pricing policies helped turn the long-term power supply shortage situation, thus supported the fast social economic development for a certain period. However, such policies could not accommodate current power demands and market structure change, hindering the healthy development of power industry. In July 2003, Electricity Pricing Reform Scheme was proposed by NDRC, printed and distributed by the General Office of the State Council. This new round of electricity pricing reform started since then.

Policy System

(According to importance)

1) Notice of General Office of the State Council on Printing and Distribution of Electricity Price Reform Scheme, 2003.7.9;
2) Notice of National Development and Reform Commission on Printing and Distribution of Implementation Measures of Electricity Price Reform, 2005.3.28;
3) Interim Measures on On-grid Electricity Price, NDRC, 2005.5.1;
4) Interim Measures on Transmission and Distribution Electricity Price, NDRC, 2005.5.1;
5) Interim Measures on Retail Electricity Price, NDRC, 2005.5.1;
6) Circular on Establishing Coal and Electricity Price Linkage, NDRC, 2004.12.15;
7) Circular on Establishing Coal and Heat Price Linkage, NDRC, Ministry of Housing and Urban-Rural Development, 2005.10.25;
8) Notion on promoting electricity consumption by price leverage, 1999;
9) Interim Management Measures on Burden Sharing of Renewable Energy Power Price and Fees, NDRC, 2006.1;
10) Interim Measures on Renewable Energy Power Additional Price Income Allocation, NDRC, 2007.1.

2) Direction and Goal for Electricity Pricing Reform:

Gradually establish electricity pricing mechanism in market economy system, to optimize resource allocation, to promote healthy development of power industry, and to satisfy increasing power demands; establish a sane electricity purchase mechanism by pricing leverage, to protect the legal rights of electric power companies and consumers; and implement price linkage mechanism of electricity and coal, and that of electricity and heat, to advocate energy conservation and improve energy efficiency.

a) Long-term Goal:

Along with the institutional power reform, power prices will be divided and defined as four parts: onto-grid price, transmission price, distribution price, and sales price. Onto-grid price and sales price are influenced by market competition, while transmission and distribution prices will be fixed by the government. Meanwhile, canonical and transparent price management system should be established.

b) Short-term Goal:

Establish onto-grid price mechanism adapting to moderate competition of

power generation, basing on the separation of power plant and grid company; initially establish transmission and distribution prices mechanism to improve healthy development of power grid; linkage of sales and onto-grid prices; optimization of sales price structures; in conditions permitting areas, relatively high voltage level or electricity consumption users purchase directly from power plants as a trial implementation.

3) Electricity Price Forming Mechanism:

Sales price is under government guidance with unified policies and multi-level management. Sales price is composed by four parts: onto-grid price, transmission and distribution loss, transmission and distribution price, and government fund. An average sales price according to the sum of the four parts, is called benchmark price fixed by the government. There are three different categories of users, resident living electricity utility, agriculture producing utility, and industrial and commercial utility. Electricity prices to different category of users will then be fixed accordingly. The principle in fixing sales prices is equal burden sharing and effective power demand adjustment, as well as paying attention to public policy targets and establishing the linkage with onto-gird price mechanism. Take full advantage of price leverage to better allocate power resources and protect the legal rights of power companies and users.

a) Sales Price = Onto-Gird Price + Transmission and Distribution Loss + Transmission and Distribution Price + Government Fund

i. Onto-Grid Price:

If participating in regional competitive power market: Onto-Grid Price = Capacity Price (fixed by government in charge) +Quantity Price (determined by market competition);

If not participating in regional competitive power market: Onto-Grid Price is fixed by government in charge.

ii. Transmission and Distribution Loss: after grid companies purchase electricity from power plants (including those belonging to grid companies) or other grid companies, the normal loss in transmission and distribution process.

iii. Transmission and Distribution Price = Transmission and Distribution Service Price in Public Network + Special Service Price + Assistant Service Price. (TD price is fixed by the government, with unified policies and multi-level management)

iv. Government Fund: fund and add-ons charged by quantity, according to relative national laws, regulations or those approved by State Council or departments authorized by the State Council.

b) Sales Price Categorizing Reform:

i. Resident living power utility, agriculture producing power utility: unique quantity price;

ii. Industry, commerce and other power utilities: two tariff electricity price= quantity price+ basic price.

c) Sales price adopts peak-valley, rainy-dry-season, and seasonal differentiating prices.

d) Sales prices adjustment: periodic adjustment and linkage adjustment.

i. Periodic adjustment: the government department in charge of prices adjusts sales prices every year. If annual change is small, sales price should try to keep constant.

ii. Linkage adjustment: correlate with onto-grid price, but only applicable to industry, commerce and other users.

4) Coal and Electricity Price Linkage Mechanism

a) Link onto-gird price and coal price, and link sales price and onto-grid price, in order to reduce power plant cost and improve efficiency. But power plant need to assimilate 30% of the price increased.

b) Price linkage period is 6 months in principle. If coal price fluctuation reaches or exceeds 5%, onto-grid electricity price should be adjusted. (and electricity sales price will be adjusted according to the fluctuation of onto-grid price)

c) In order to relieve the coal fire power plants' operation difficulties, China has implemented two coal-electricity price linkages in the past three years. The onto-grid price of power plant raised by 5.01 RMB cents per KWH, which released the operation pressure in power plants to a certain extent.

i. 2005.5.1，initial coal-electricity price linkage, onto-grid price was raised by 2.52 RMB cents;

ii. 2006.6.30, second coal-electricity price linkage, onto-grid price was raised by 2.49 RMB cents.

5) Unique Electricity Price in Urban and Rural Areas

6) Lowering Small Coal Fire Plant Generation price: for those small coal fire plant which have higher sales price than benchmark price, their sales prices will then be lowered to benchmark price.

7) Subsidy for Renewable Energy Additional

By nationwide burden-sharing and proper subsidies, increase onto-grid price properly and gradually fix grid transmission and distribution prices, in order to improve renewable energy power generation, increase sales price and adjust the structure of sales prices. Those projects within subsidy catalog will receive 0.1 Yuan/kwh as subsidy.

8) Summary on Electricity Pricing Reform

Electricity pricing reform has gone through a long history together with institutional reform and market structure adjustment. At present, the coal price is

connected with international market, while the sales price of electricity is under government guidance. The goal of electricity pricing reform is to better establish an electricity system that utilizes the leverage of prices to optimize electricity resource allocation, as well as to establish a normative and transparent price management system.

Coal and electricity prices linkage system has been established to resolve the overturn situation of increasing coal price and frozen electricity price. China has implemented two rounds of coal-electricity price linkage to relieve the market tension, which was a progress on the way to further pricing reform. However, coal price increase weighs over than the increase of electricity price. Coal price almost tripled during the past seven years, while there were only two rounds of coal-electricity price linkage, raising electricity price by 5.01 RMB cents in the past 3 years. Current electricity price hasn't yet completely reflected the market situation of demand and supply, more efforts are expected to be made in pricing reform.

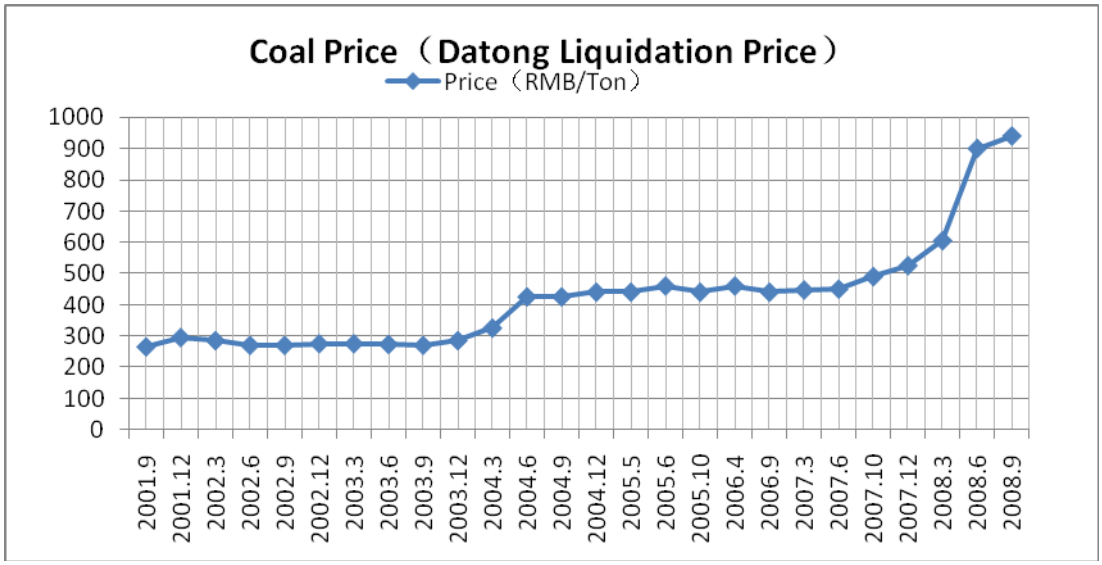

Figure 8: Coal Price Development in China

Due to the long-term low electricity prices, current price reform leads to price increase. On the one hand, it reflects the market condition and better allocates resources by market mechanism with higher efficiency; on the other hand, it also becomes an economic incentive to consumers to save energy.

While increasing the price of electricity generated by conventional coal fire power plants, China is also adopting renewable energies into power generation and certain subsidies are offered to these plants to foster its development. Being cleaner and renewable, these energy forms will achieve the same targets of emission reduction and environmental protection, as well as to substitute to limited fossil fuels and in the mid- and long-term cap the electricity price in case the experience of the German success story of renewables is applied. Here the "merit-order" impact requires that plants are connected to the grid according to their specific costs. Once the electricity price has exceeded the rate of the feed-in-tariff-scheme like often in the case of relatively competitive wind

energy in Germany, the price for electricity will not rise anymore in case of availability of wind energy. In Germany it is estimated around 5 billion Euros p.a. The conclusion to be drawn is that this is an important advantage of such a promotion system by fixed 20-years legally guaranteed, technology-specific support schemes. However, it has one problem which is that it counteracts our general approach of setting the right price signals.

Besides, the system of unique electricity price in urban and rural areas is established to secure social justice and ensure the basic living standards of rural population. While increasing the electricity price, the government also increased the low-income population subsidy. This is very reasonable on one hand. On the other hand we should also consider whether it is – in the mid- and long-term so wise to spend the public money just for compensating the higher energy expenditures. Or if it would not be much more effective if these higher expenditures would be avoided by spending the money in funding efficient/renewable equipment.

2. Oil Pricing Reform

1) Several Stages in Oil Pricing Reform:

   a) On 3 June 1998, the former National Development and Planning Commission issued Crude Oil and Oil Products Prices Reform Scheme, stipulating that the crude oil transaction settlement price is determined by negotiation between the two corporations of China National Petroleum Corporation (CNPC) and China Petrochemical Corporation (Sinopec). The price is composed by crude oil base price and discount (or premium), within which crude oil base price is determined by the former National Development and Planning Commission according to the last month average price of similar quality crude oil international price, and discount is negotiated by supplier and buyer. The prices of gasoline and diesel oil are government referential prices. The former National Development and Planning Commission fixed retail median price by importing tax cost plus domestic proper circulation price. CNPC and Sinopec fix the retail prices with a 5 percent fluctuation range on the basis of retail median price.

   b) Since June 2000, domestic oil products prices started to connect with the international market. Domestic oil products prices adjusted according to the international price changes, but only referred to Singapore price at that time.

   c) In October 2001, according to problems of over direct and transparent connecting method and over price change frequency, oil price connection methods were further adjusted and improved. Since 2006, the prices of oil products are determined on the basis of weighted average prices in Brent, Dubai and Minas, added by refinery cost, proper profits, domestic custom tax, and oil products circulation fees.

2) Current Oil Pricing Mechanism and Policy: in March 2006, General Office of the State Council printed and distributed Oil Price Comprehensive Reform Scheme, in order to further adjust oil price and reform oil pricing mechanism. The current price policy are as follows:

a) Crude oil price connects with international market, reflecting the international oil price changes;

b) Considering factors such as domestic market supply, producing cost and various social endurance, government department in charge macro-controls retail prices, while admitting a 8% of fluctuation space for oil product retailers;

c) Allowance mechanism to social vulnerable group and commonweal industries corresponding to oil price increases;

d) Price linkage within relative industries, such as oil price and transport sector price (e.g. taxi price) linkage;

e) Fiscal adjustment mechanism to oil companies price increasing incomes: oil special profit tariff, started to charge on 26 March 2006, with the highest rate of 40%, by Decision of the State Council on imposition of oil special profit tariff;

f) Upstream-downstream profit adjustment mechanism within oil companies, such as crude oil price and oil products prices linkage mechanism.

3) Summary on Oil Pricing Reform

The process of oil pricing reform is companied with the institutional reform of oil industry in China. The oil industry has gone through four major periods since the foundation of the country, from highly concentration and monopoly management, to current market competition system under government macro control. Within the periods, there were two oil circulation system reforms. The first one took place in 1994 that all the crude oil was distributed according to government plans, and the prices of crude oil and oil products were fixed by the former National Planning Commission. Since 1998, a grand pricing reform has been carried out to introduce market mechanism and price leverage, as well as to connect domestic price with international market.

The current pricing system, although needs further and deeper improvement, has achieved good progress in optimizing resource allocation and improving energy utilization efficiency. At present, gasoline price in China is around 1 USD per liter, while the price in EU is around 2 USD per liter and in America 1 USD. The price is lower than that in EU but almost the same with US. If taking income levels into account, the current oil price is higher than that in US and EU. The prices are still under the guidance of the government, which will have a price change lag to the international price fluctuation. Oil and oil products prices are reflecting the international level to a large extent.

Similar to electricity pricing reform, the oil pricing reform leads to larger price increase. It better reflects the market situation of demand and supply as well as international markets conditions, thus optimize energy resource allocation and works as an economic incentive to energy conservation.

Besides, while increasing the oil prices, subsidies to agriculture production industries as well as low-income and rural population increase responsively.

Table 1: Oil Products Prices Adjustment

Date	2008-6-20		2007-10-31		2007-1-14		2006-5-24		2006-3-26	
(RMB/ton)	Price	Markup	Price	Markup	Price	Markup	Price	Markup	Price	Markup
Gasoline	6980	1000	5980	500	6200	-220	5700	500	5400	300
Diesel	6520	1000	5520	500	5520	0	5020	500	4820	200
Jet Fuel	7450	1500	5950	500	6040	-90	5540	500	5240	300
Date	2005-7-23		2005-6-25		2005-5-23		2005-5-10		2005-3-23	
(RMB/Ton)	Price	Markup	Price	Markup	Price	Markup	Price	Markup	Price	Markup
Gasoline	5100	300	4900	200	5050	-150	5050	0	4750	300
Diesel	5470	250	4420	150	4420	0	4270	150	4270	0
Jet Fuel	4940	300	4640	300	4640	0	4640	0	4640	0

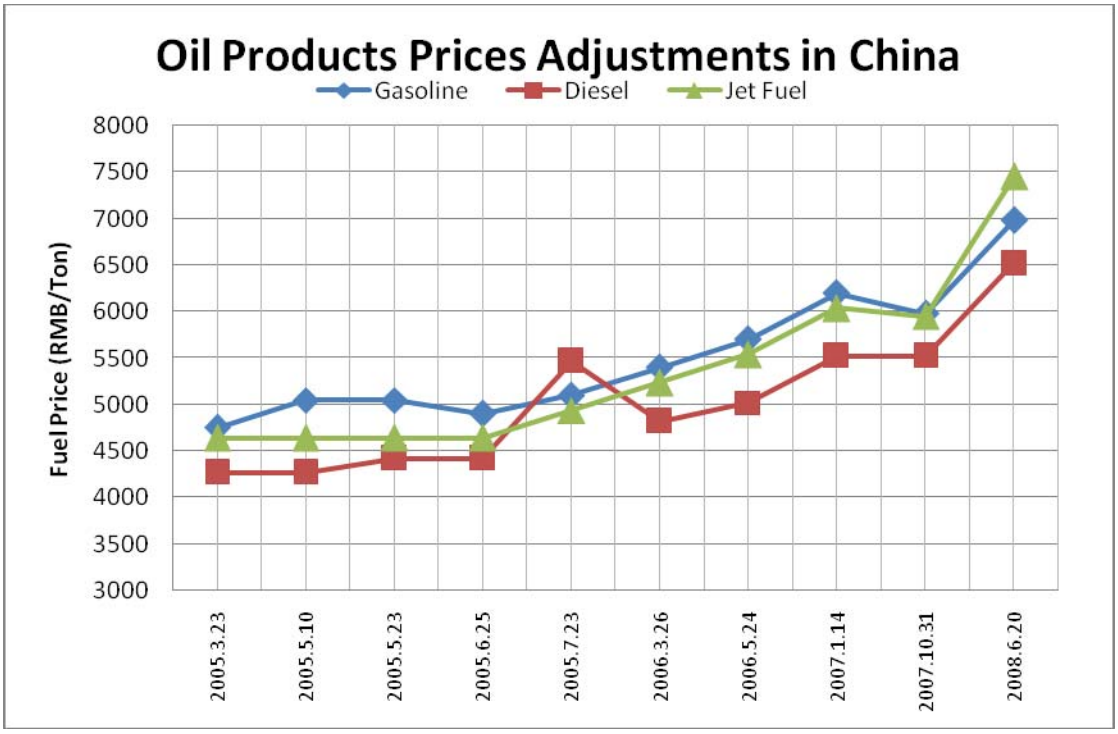

Figure 9: Oil Products Prices Adjustments in China

3. Natural Gas Pricing Reform

On 26 December 2005, National Development and Reform Commission issued a circular on natural gas producing price forming mechanism reform and natural gas producing price rising. The circular declared the pricing reform of natural gas. Major contents in the circular include:

1) Simply price category into fertilizer producing gas, industry gas, and urban gas, and gas from different gas fields are categorized into two grades.

2) The price is government guided. The government provides a factory reference price, with a 10% of fluctuation range determined by market.

3) Price linkage and adjustment system is established. Price linkage is established with substitutional energy prices, and gas prices are adjusted every year.

4) Gas price will be gradually increased. The two grades will achieve a unique price within three to five years.

5) Current gas prices are as follows:

    a) Grade 1 Gas Price:

        1. Fertilizer Gas: 560-710 RMB/1,000m^3
        2. Industry Gas: 585-920 RMB/1,000m^3
        3. Urban Gas: 560-920 RMB/1,000m^3

    b) Grade 2 Gas Price: 980 RMB/1,000m^3

    c) Retail Price (2007.4): 2.05-2.3 RMB/m^3

4. Renewable Energy

Apart from the conventional fossil fuels, renewable energies are positively promoted in China. There are various kinds of renewable energies that are under rapid development, such as solar power, wind power, hydro power, biomass, nuclear power, etc. The prices of renewable energies are relatively high at early stages. The government has supported their development with abundant technological and fiscal policies. Meanwhile, with technology advancement and the increasing prices of fossil fuels, renewable energies will become more attractive and competitive.

Take nuclear electricity price for example. The electricity price of nuclear power varies between different nuclear power plants in China. With the higher domestic production rate of nuclear power plant, the costs of nuclear electricity have been lowered. The electricity price in Qinshan Nuclear Power Plant 2ed Phase is 0.393 Yuan/KWH, which is the national lowest nuclear electricity price. The electricity price of Dayawan nuclear power plant is 0.414 Yuan/KWH, which the average fire electricity price is around 0.387 Yuan/KWH.

4.2.2. Taxation and Fees

1. Definition

Tax is a distribution means of social products, in order to meet social public needs, according to social functions and is prescribed by law, compulsively and voluntarily. Tax is usually collected by taxation agencies, custom and fiscal departments, and is expended by government budget in social public needs.

Fee is a kind of expense that is charged by the government agencies providing certain specific services. It is usually collected by other taxation agencies and institutions. Specific fees are collected for specific expenses.

2. Resource Tax

1) Interim Ordinance on Resource Tax, 1993:

Table 2. Resource Tax Rate in 1993

Tax item	Crude oil	Natural gas	Coal
Tax rate (RMB/Ton)	8-30	2-15	0.3-2.4

2) Resource Tax Adjustment:

   a. 2007.2, coke: 8Yuan/ton;

   b. 2005.5, resource tax of coal: 2.5-4 Yuan/ton;

3) Summary

Levying on natural resources, resource tax was designed to adjust resource rank difference revenue and reflect the compensable use of state-owned resources. Current resource tax is a specific duty, with advantages of low management cost and stable fiscal income. However, comparing with the high energy prices, the low resource tax, even though after adjustments, is weak in functioning of resource rank different revenue adjustment or improving the efficiency in resource utilization.

Further reform is recommended to transfer the specific duty into ad valorem tax, and raise various tax and fee standards related with environmental protection, in order that energy prices will properly reflect resource scarcity and the cost of resource destroy and environment recovery.

3. Eco-compensation Mechanism

1) Regulation on Mine Resource Compensation Fee Levy Collection and Management, the State Council, issued in 1994 and amended in 1997.

2) Eco-compensation demonstration areas

3) Eco-compensation standards system

4) Summary

The mechanism aims at internalization of the external costs of ecological environment, by integrating environment pollution treatment and ecological recovery fees into the production cost of mining companies. The basic principles of the mechanism are: exploiters protection, destroyers' recovery, beneficiaries' compensation, and polluters pay; the beneficiaries of eco-protection have the duty to pay proper compensation fees to eco-protectors. For instance, in the case of a gas transfer project from area A to area B, the gas receivers and consumers in area B have the duty to pay for compensation fees to area A.

A most important system in the eco-compensation mechanism is that of mineral resource exploitation. Eco-compensation Mechanism of mineral resources is designed to guarantee and improve the exploration, protection and proper exploitation of mineral resources, and to protect the state property right and interests of mineral resources.

The fee rates of oil, natural gas, coal, coal mine methane are 1%, apparently low

comparing with international levels between 10% and 16%[5]. The low fee rate underestimates the value of mineral resources, and causes poverty and inequality of the west areas of mineral regions where the compensation fee should have contributed to regional economic and sustainable development.

Thus the rate of mineral resource compensation fee is recommended to increase, transfer from specific duty to valorem duty, and to take into account of the interests of local population.

4. Tax Preference in Favor of Energy Conservation and Pollutants Reductions

Tax preferences are provided for energy and water resource conservation, resource comprehensive utilization and relative tax preference to environment sound products, e.g. in form of an enterprise income tax deduction and exemption to companies implementing energy conservation and environmental protection projects and investing in energy conservation and environmental protection equipments.

1) Enterprise Income Tax Law, 2007.3.19
    a. Article 27: three-year-deduction and three-year-exemption to the enterprise income of environmental protection and energy conservation projects;
    b. Article 33: only 90 percent of the income from enterprises with comprehensive resource utilization to produce products in accordance with national industry policies is calculated in total income for tax;
    c. Article 34: 10 percent of the investment in specific equipments of energy conservation and water saving is deducted from the total enterprise income tax payable; the equipments should be listed in Enterprise Income Tax Preference Catalog of Energy Conservation and Water Saving Specific Equipments.
2) Promotion List of National Key Energy Conservative Technologies, NDRC, 2005;
3) National Guiding List on Clean Production Technologies in Key Industries, NDRC, 2006.
4) Summary

    The tax preference is carried out according to the energy conservation and pollutants emission reductions goal in the 11th FYP, and functions as a supporting measure to energy conservation guiding plans such as Comprehensive Working Scheme on Energy Conservation and Reduction of Pollutant Emissions. The technology lists of energy conservation and clean production are designed as technical guidance to industries for technological upgrades, by applying clean and energy conservative technologies, facilities and processes, thus improve energy efficiency.

[5] Resource: http://www.mlr.gov.cn/zt/hy/gtlh/gtklh/200711/t20071122_93434.htm .

4.2.3. Emissions Trading System and Other Market Based Instruments

1. Emissions Trading System

The emissions trading system of pollutants in China, aiming at environmental protection, has a long history of academic research and experimental implementation in different areas. In order to meet up with the mandatory targets set by the 11th FYP, and better achieve the national energy conservation and pollutants reduction goals, specific SO_2 and COD emissions payable allocation and trading plans have been framed and implemented. Besides, additional electricity price quota trading systems to encourage and support the development of renewable energy have been carried out for the past several years. In recent years, emissions trading system has been introduced to climate protection such as the establishment of international carbon market, and CDM projects responsively to China.

1) Emissions Trading System of Major Pollutants (SO_2 and COD)

   a. Designing aim of emissions trading system: reduce emissions of pollutants by economic incentives, to achieve a win-win situation between environmental protection and economic development

   b. Compulsive energy and environmental protection targets set in the 11th FYP: 10% of major pollutants reduction by 2010 comparing with the base year of 2005. In accordance with and implementation of the 11th FYP, a National Total Amount Controlling Plan of Major Pollutants Discharge During the 11th FYP Period was framed by the Ministry of Environmental Protection and NDRC, and approved by the State Council in 2006. Two Total Amount Controlling Plans were set on COD and SO_2 discharge within different provinces. The 10% of COD discharge reduction is 12.728 million tons, with 12.639 million tons distributed to different provinces and 89,000 tons for payable allocation and emission trading demonstration. The 10% of SO_2 emissions reduction target equals to 22.944 million tons, with 22.467 million tons distributed to provinces and 477,000 tons reserved for payable allocation and emissions trading demonstration.

   c. Development:

      In 1980's, a pollution levy system was established. It was concentration control; since 1990, total amount control of air pollutants, discharge permits system, and emissions trading system was graduated established. In the recent years, emissions trading system have been tested in demonstration areas in seven provinces: Tianjin, Jiangsu, Zhejiang, Shanghai, Shanxi, Henan, and Guangxi. SO_2 emission rights have been traded in such demonstration areas. Emission trading system of COD was also experimented in Jiangsu and Shanghai, with good effects. However, the scale and extent of general emission trading system in China fall behind of the demands of environmental protection.

2) Renewable Energy Power Additional Price Quota Trading System

Renewable energy power additional price quota trading system was established and firstly carried out in 2006 when the initial renewable energy generated electricity price subsidy and quota trading scheme was issued. It was the symbol of the official start of burden sharing system of renewable energy power generation costs. So far, two schemes have been circulated.

a. Circular of 2006 on Renewable Energy Electricity Additional Price Subsidy and Quota Trading Scheme, NDRC and State Electricity Regulatory Commission, 2007.9.

b. Circular of January to September of 2007 on Renewable Energy Electricity Additional Price Subsidy and Quota Trading Scheme, NDRC and State Electricity Regulatory Commission, 2008.3.

3) Clean Development Mechanism

Measures for Operation and Management of Clean Development Mechanism Projects in China, NDRC, Ministry of Science and Technology, Ministry of Foreign Affairs, 2005.11.29.

2. Green Trade Policy

1) Circular on Export Controlling of Certain High Energy Consumption, High Pollution and Resource Intensive Products, NDRC, MOF, MOC, etc, 2005.

2) Cancel the Export Tax Refund of Parts of Resource Intensive Products and Lower Export Tax Refund Rate of Parts of Resource Products, Ministry of Finance, in order to restrict the export of resource- and pollutant-intensive products.

a. 2007.7.1：2831 products were involved, taking up 37% of the total in customs tariff, within which 553 high energy consumption, high polluting and resource products including liquid petroleum gas are canceled, and the drawback rates of 15 types were lowered, including steel products, to the lowest of 5%;

b. 2006.9.14: export drawback of 3 types of products, including coal and natural gas, are canceled, and export drawback rates of 5 types, including steel and cement, were lowered.

3. Green Credit System

Notion on Implementation of Environmental Protection Policies and Regulations to Prevent Credit Risks, SEPA, People's Bank of China, and China Banking Regulatory Commission, 2007.7:

1) To the new construction projects which fail environment assessment approval or the check and accept of environmental equipments, no credit support should be offered in any form by any financial institute.

2) Green credit system emphasizes on both energy conservation and pollution reductions.

4. Government Procurement

Notion of General Office of the State Council on Establishing Mandatory Government Procurement of Energy Conservative Products System, 2007.7.30;

Government Procurement List of Environment Labeled Products;

Government Procurement List of Energy Conservative Products;

5. Information, Persuasion, and Encouragement

1) Energy Efficiency Labeling System: Management Measures on Energy Efficiency Labeling, Products List of Implementing Energy Efficiency Labeling, 2008.6.1;
2) Energy Consumption per GDP Index Bulletin System, NDRC, 2006;
3) Management Measures of Green Building Assessment Labeling (Try out), 2007.8;
4) Energy Conservation Products Authentication Management Regulation, 1999.2.11;
5) Circular on encouraging energy conservative and environmental protective small displacement automobiles, NDRC, etc, 2005.12.15;
6) Bulletin of Energy Utilization Conditions in a Thousand Enterprises, NDRC and National Bureau of Statistics, 2007.9;
7) Nationwide Energy Saving Actions: Notice of the State Council on Deeply Implement Nationwide Energy Saving Actions, 2008.8.1;
8) Public participation: water price adjustment public hearing, etc.

6. Policy Summary and Assessment and Proposal

Firstly, policies and instruments for energy productivity must be designed based on the current situation in Chinese society and policy goals, considering both present and future development needs.

Policies and instruments are designed to achieve certain goals, basing on current situation of the society. When applying Chinese policies of energy productivity, we should take the current Chinese situation into consideration that the major social contradictions lie in the backward capacity of social production and increasing material and cultural demands of the people. Therefore, policy system is designed on the basis of strengthening the country's capability to meet up with the demands of social production and general living standards, while achieving energy conservation and environmental protection, as well as increasing energy efficiency.

Secondly, energy productivity policies at current stage focus more on improving energy efficiency. Further work is needed in researching and introducing policies of

system optimization and promoting renewable energies.

A good number of the policies are to improve the energy efficiency rather than considering the whole network reform or optimization of the energy system. For example, as the highest-level guiding policy of the 11th FYP set the mandatory "energy conservation" target of reducing energy consumption per 10,000 Yuan GDP by 20% by the year of 2010, underneath there are a series of policies designed and carried out to achieve the goal of energy conservation and pollutant reductions, such as the Comprehensive Working Scheme on Energy Conservation and Reductions of Pollutants Emissions, Energy Conservation Law, and so on.

Industrial structure adjustment policy was designed to achieve a better industry structure, via shutting down a number of production processes and equipments in the category of elimination, while others are limited developing or positively encouraged. One of the most important determinants is energy consumption and efficiency improvement. Structure adjustments in seven industries with surplus productivity such as electrolytic aluminum are on the agenda of the government, which is to achieve a better industry structure in the means of system optimization.

Thirdly, command and control instrument is very well applied in China, supported by a set of comprehensive policy system.

However, they are not sufficient to achieve set targets as the ones of environmental protection in the previous 5-year-plans were difficult to achieve. As guided by the highest level of the 11th Five-Year Plan, which set a 20% of mandatory target to cut down energy consumption per 10,000 GDP by 2010 basing on 2005, clear mandatory targets are set in various policies in different aspects have been carried out. We have the White Book on China's Energy Conditions and Policies as a Medium and Long Term Energy Conservation Plan, the 11th Five-Year Plan for Energy Development, and Comprehensive Working Scheme on Energy Conservation and Reduction of Pollutant Emissions, as well as several other specific sectoral plans and polices. These policies form a comprehensive system to emphasize on energy conservation and set detail clear mandatory plans for the targets, covering various aspects in different energy industries. Still, given the difficulties in achieving past targets for SO_2-emissions control in the previous 5-year-plans, additional measures which comprise more economic incentives to strengthen the self-interest of citizens and businesses, are required.

Fourthly, market based instruments are getting more and more important, yet it is expected to play a major role in instrument mix.

A long-term energy price increase in line with the energy productivity increases to accelerate innovations and structural changes is recommended as the major instrument. The rationale is that the market mechanism is considered as the key mechanism to achieve better resource allocation and to improve energy utilization efficiency. Along with institutional and management system reform, pricing reform of major energy resources and taxation reform have taken place for the past decades. At present, coal and crude oil prices are connected with international markets, and determined by market

demand and supply situation. The leverage of price plays its part here. Besides, electricity pricing and oil products pricing mechanisms have transformed from government instruction to government guidance, with price linkage with coal and crude oil. The current electricity price and oil products prices are still lower than the international average. Government sector is expected to further open energy market to transfer to market mechanism determination.

Except for pricing mechanism reform, resource tax, eco-compensation fees are expected to be perfected and the rates to rise to proper standards, better reflecting the scarcity of the energy resource, the cost of resource destroy and environment protection, as well as behaving as an economic incentive to the consumers to achieve industrial and nationwide energy conservation. Besides, new tax such as fuel tax is recommended to be carried out, not only to achieve higher fuel efficiency in single cars, but also a strong economic incentive to steering motorists to reduce their total driving miles, which in turn improve energy productivity by both energy efficiency and system optimization.

However, public sector should also consider social equity and take the society system as a whole. If the energy prices are increased sharply in a short time, or the tax rates will be raised by a large extent, social economic issues such as inflation, as well as agriculture production and the living standards of the low-income population should be fully taken into account. Therefore, steady yet increasing energy prices as well as taxes are recommended to achieve better energy productivity, taking full advantage of the market mechanism and the leverage of prices.

Fifthly, nationwide and continuous energy saving actions are needed.

Nationwide and continuous energy saving actions are greatly encouraged in China. A recent notice on that was issued by the State Council to advocate all the population to take actions to reduce energy consumption. Such measures could be a huge contribution in improving energy productivity. Once the concept of energy productivity is established nationwide, the ideology will have great impact not only in daily life energy saving but also in decision making by the people in charge of various industries.

Besides, the ideology of welfare could be discussed and redefined that when we invest more and more energy to improve our living standards, do we really enjoy the multiplying piling of energy products?

Appendix III

OECD Countries' Experience in Environmentally Related Taxes (ERTs)

1. Brief of ERTs in OECD countries

20 years experience from OECD countries indicates that environmentally related taxes (ERTs)[6] are effective and efficient. In 2006, 375 different ERTs were in use in OECD countries, of which 150 on energy and 125 transport-related. Other ERTs apply to specific air and water emissions and to products such as packaging, batteries pesticides, fertilizers, lubricants, household appliances etc. Most ERTs have proven to be successful, triggering significant emission reductions (see box 1).

Box 1: Examples of ERTs in OECD countries

There is growing evidence on the environmental effectiveness of ERTs. In *Belgium*, the tax differentiation between heavy fuels with a sulphur content below or above 1% induced a decrease in the use of the fuel with the higher sulphur content from 20% of the market in 1994 to less than 1% in 1998 (also due to a switch to natural gas). In *Denmark*, the sulphur tax caused a reduction of emission of 34,000 tons between 1996 and 2000. The tax on non-hazardous waste has reduced the net delivered waste to municipal sites by 26% in the period 1987-1996, and waste to smaller fills and private waste sites by 39% (1990-1996). The *Swedish* sulphur tax (introduced in 1991) led to a fall in the sulphur content of oil-based fuels of more than 50% *beyond the legal standards*. Also in Sweden, a tax differentiation was introduced in 1991 on *diesel fuels* in order to stimulate the use of less polluting fuel oils. From 1992 to 1996, the proportion of "clean" diesel sold in Sweden rose from 1 to 85%, which led to a reduction of more than 75% on average in the sulphur emissions of diesel-driven vehicles. In *Germany*, the sulphur tax differential between transport fuels with a sulphur content of more than 50 parts per million (ppm) and those with practically a hardly measurable content of sulphur (less than 10 ppm) led to a shift of the entire market within a few weeks only at the turn of the year 2003 towards fuels with no sulphur. Many other examples could be quoted.

[6] OECD (and IMF) defines a *tax* as a *compulsory, unrequited payment to general government*. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments. The term *environmentally related taxes* is used by OECD to describe *any tax levied on tax-bases deemed to be of particular environmental relevance*.

2. Implementing ERTs in OECD countries

Three complementary policy options are open to introduce ERTs.

Firstly, environmentally harmful subsidies and tax provisions must be removed, for instance: certain types of agricultural subsidies leading to overuse of fertilisers and pesticides, intensive farming, soil erosion etc.; energy subsidies cause energy wastage and low energy productivity; under-taxation of polluting fuels such as coal.

Secondly, existing taxes with and environmental relevance can be adapted and restructured. For instance, fuel taxes can include a carbon and sulphur content component.

Thirdly, new ERTs can be introduced on different types of emissions to air and water, domestic and industrial waste, polluting products etc.

Furthermore, as subsidies are just negative taxes, a broader perspective should be chosen, thus ensuring consistency of the policies by choosing the right policy mix. Main steps of such an Environmental Fiscal Reform (EFR), implemented in several OECD countries, comprise reforming environmentally harmful subsidies; restructuring existing taxes; and introducing new environmental taxes.

In implementing ERTs, six main issues must be carefully considered:

1) The use of tax revenue. The revenue of ERTs can be used for different purposes, such as: feeding the general Government budget or dedicated environmental funds; payment of compensation to the most affected segments of population or industry sectors. ERTs can also be implemented in a revenue neutral context, i.e. decreasing other (possibly distortionary) existing taxes such as labour or corporate taxes, thus keeping a constant tax burden on the economy. Compensating new ERTs with a reduction in existing distortionary taxes can provide a “double dividend” in terms of both environmental benefits and economic efficiency gains. Whatever option is chosen, the use of tax revenue should be explicit and transparent. Revenue neutrality greatly contributes to the political acceptability of taxes.

2) International competitiveness. Energy taxes should aim at the largest potentials for energy efficiency first, thus starting with Chinese industry, since 70% of energy consumption takes place in that sector.

As long as domestic energy prices in China remain below the international price level the implication is a subsidy connected to every good produced, not only for the domestic market, but for buyers in the international market as well. A border-tax adjustment for energy embedded in export goods would be a first step towards capturing the uncompensated loss of natural resources implied by the present arrangement, while maintaining a price policy within China in accordance with the harmonious society aim. In the longer run, however, the gap between domestic energy prices and international energy prices will tap on the strength of China’s economy, and approaches need to be identified to reserve the price-support for the most worthy consumers, such as low-income households and certain manufacturers. Taxing export goods in order to capture the rent from energy consumption could at the same time be a viable approach to remedy

certain climate policy concerns if the tax to some extent includes the carbon content of fuels in its tax base.

In addition, the Chinese government is looking for potential tools how to reduce problems of the embedded carbon caused by the export-oriented intensive trade by energy-intensive industries in China anyway. Border tax adjustments may be a means to address this problem. Furthermore, the production costs are so low in China that impacts of potential cost increases due to energy tax increases hardly exist while the above mentioned opportunities are great. Still, new ERTs can affect the competitiveness of targeted sectors of the economy (effect on prices and profits).

Furthermore unwanted effects can also be remedied through the conventional measures such as recycling the revenue back to the affected sectors (while maintaining abatement incentives at the margin); reducing other existing taxes such as labour or corporate taxes. In any case, full exemption of the ERT, that would erode the incentive effect of the tax, should be phased out in the medium to longer time perspective.

3) Social implications. ERTs can also affect poorer segments of the population, notably through price increases e.g. on energy, transport and other products. Mitigating such regressive effects by reducing tax rates for the lower income categories would erode the purpose of the tax and should be avoided. Social hardship can be avoided if price increases are politically limited to proven increases of national energy productivity in the previous year (period). Small annual steps allow to combine effectiveness; a strong stimulus for innovation; and social acceptance. Possibly remaining regressive effects should preferably be tackled through either a progressive tax design and/or base or through compensation measures, such as lump sum payment, hence preserving the incentive effect of the tax. In addition, intelligent regulation with market elements such as feed-in-tariffs for renewable energies does also have a positive impact on equalization of differently affected; particularly rural regions.

4) Acceptance building. It is essential to build consensus of stakeholders such as the business and agricultural community, environmental organisations, different government levels and departments (e.g. finance and environmental ministries). Such consensus can be build, in particular, through ex ante consultations with important stakeholders of society (e.g. “environmental tax commissions”), clear objectives, regular consultations, transparency and feedback procedures. To this end, a consistent policy mix is required. Taxes are mostly preferable as they are efficient, raise revenues, trigger and spur innovation and they are predictable in terms of price impacts. However, a sophisticated command-and-control-system should serve as a bottom line.

5) Long-term and progressive implementation. It takes time to the economy to adapt to new price signals provided by new ERTs. For instance, technical innovations, new organisations and structure of the energy sector will take place over time if clear and consistent signals are provided. Concerning energy and transport taxes, OECD data indicate that the price elasticity of demand for petrol or gasoline is relatively low in the short run (-0.15 to -0.28), but significantly higher in the long term (-0.51 to -1.07). This indicates that significant effects could be expected in the longer term – meaning 4-5 years. This also underlines that environmental tax reforms must be seen in a medium / long term context, as it takes time to the economy to adapt to evolving market signals, in

particular to enable technical change to take place. Therefore a progressive application of ERTs, according to a predetermined and predictable schedule will enable economic sectors to adapt and develop new technologies and organisation in a stable and long-term perspective.

6) Inflation. This can be avoided if energy price increases are accompanied by appropriate reductions of other taxes such as employer's social security contributions or as in China taxes on employees liable to the employer or VAT. Other options for revenue recycling, while permanently reducing energy costs, are to co-finance public and private infrastructure and equipment which builds on efficient and renewable technologies.

3. Preliminary conclusions for China

China's current reform process should take benefit of the strategic opportunities stemming from the ongoing reform of tax and fiscal, environmental and energy policies, in particular in the context of the 11th five-year plan and the preparation of the 12th plan. Reforming the tax system offers an opportunity to improve economic, social and environmental welfare in a coherent way. Reforming energy policy should be made consistent with the new tax system, in a long-term perspective. The environmental policy reform should enable to craft an appropriate "policy mix" between social planning with both command and control and economic instruments, in particular taxes. In this respect, it would be desirable to make a comprehensive assessment of existing policy instruments to identify possible duplications, conflicts and inefficiencies and maximise synergies. However, a comprehensive "Assessment of Current Policies for Energy Productivity in China" (annex) has already been carried out, providing very valuable insights in the existing policies and measures to which the proposed measures here can be well linked and integrated into the existing policies.

Many other economic and administrative instruments are available for an effective environmental policy, including environmental bank credits and insurance policies. The Task Force will explore further a range of policy instruments available.

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