



THE REGULATORY ASSISTANCE PROJECT

Energy Efficiency Power Plants: A Policy Option for Climate-friendly Air Quality Management in China

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Introduction: Efficiency Power Plants as a Tool for Air Quality Management

An Efficiency Power Plant (EPP) represents a specific bundle of energy efficiency programs designed to deliver a specified amount of capacity and energy savings over a specific time period. This bundling approach encourages cost comparison with conventional supply-side resources, allowing energy efficiency resources to be integrated into power sector planning and financing.

In China, responsibility for demand-side management and energy conservation has traditionally fallen to authorized departments across energy and macro-economic planning agencies. However, this division of labor fails to recognize the significant environmental benefits that can be achieved through the energy efficiency power plant model. Resulting in avoided emissions of both carbon dioxide and conventional and toxic pollutants associated with coal-fired power generation, the EPP may in fact be considered a climate-friendly air quality management tool.

A conventional coal plant burns at least 340 grams per kilowatt hour, emitting 4 grams SO₂ per kilowatt hour and similar amounts of NO_x. By contrast, an Efficiency Power Plant represents a aggregation of energy efficiency programs that meets electricity load growth, substituting for conventional coal-fired power generation, yet it burns no fuel and emits no pollution. Furthermore, preliminary analysis shows the average cost of an EPP is about 15 fen/kWh, which compares very favorably to the cost of new power supply, about 40 fen/kWh.¹

International Experiences with Energy Efficiency in Air Quality Management

There has been growing consensus among environmental planners in the United States and European Union that energy efficiency is a critical component to air quality and environmental management. Increasingly, State Implementation Plans (SIPs)² across many states in the US consider not only conventional pollution control measures and technologies, which tend to be

¹ The Regulatory Assistance Project, "The Efficiency Power Plant (EPP): An Energy Conservation Resource Management Project for the Asian Development Bank," July 2007, available at <http://raponline.org/Feature.asp?select=11&Submit1=Submit>.

² State Implementation Plans (SIPs) are a chief planning tool in the United States used to negotiate environmental protection efforts between the state authorities and those at the federal level Environmental Protection Agency (EPA).

end-of-pipe interventions, but also consider energy efficiency and demand-side energy resource options. Air regulators' active participation in regional electricity market design has resulted in equal treatment of demand-side and supply-side resources. As a result, energy efficiency now provides about 5% of the electricity capacity resources in the New England region.³ Another region, which is served by the regional transmission organization PJM, the largest region in the US, has also recently agreed to treat demand and supply-side resources equally. Several US states, including California, New York, Maryland, Utah and Delaware are now collaborating at the resource planning level to assess the ability for energy efficiency to help meet ozone and fine particulate air quality standard, reduce greenhouse gas emissions and be part of the resource mix to meet future electricity demand and to satisfy electricity reliability requirements. Furthermore, US Environmental Protection Agency (EPA) has begun to work with the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) on ways to coordinate their respective planning activities at the national level.⁴

In the case of the first mandatory greenhouse gas cap-and-trade scheme in the US, the Regional Greenhouse Gas Initiative among 10 northeastern states, investment in energy efficiency plays a critical role in reducing emissions. Under the RGGI regulations, 90% of the CO₂ emissions allowances are being auctioned, and 80% of the revenue generated through the auctions is invested in clean energy – 75% is invested in energy efficiency programs. The quarterly auctions of allowances are expected to generate as much as a billion dollars per year. Majority of CO₂ reductions from the RGGI program will come from these investments in energy efficiency – not from the emissions cap itself.⁵

Energy efficiency has the same advantages for controlling conventional pollutant emissions: SO₂, NO_x, PM and mercury. In the state of Connecticut, recent analysis for NO_x indicates that end-of-pipe pollution control measures alone are insufficient for meeting NO_x targets.⁶ The graph below shows emissions projections resulting from various policy options, including combinations of end-of-pipe pollution controls on power generating units and energy efficiency measures. The study indicates that NO_x emissions pollution controls on Connecticut's stock of older coal and oil-fired power generation units can only provide approximately a third of the emissions reductions needed to meet the target. Energy efficiency accounts for the remaining two-thirds of emissions reductions – in this case a policy of energy efficiency savings equal to 3% of total annual electricity sales, more than offsetting the percentage of annual load growth. This study pertains to NO_x emissions, but SO₂ emissions reductions would follow the same trend.

³ ISO New England, Forward Capacity Auction results, available at http://www.iso-ne.com/markets/othrmkts_data/fcm/cal_results/ccp11/index.html.

⁴ In the EU, energy efficiency is a central pillar of the Integrated Pollution Prevention Control (IPPC) regulations on power and industry across member states.

⁵ The Regulatory Assistance Project, "The Regional Greenhouse Gas Initiative in the Northeastern United States: Auctioning Emissions Allowances / 美国东北部区域温室气体行动：拍卖排放权," January 2008, available at <http://raponline.org/Feature.asp?select=11&Submit1=Submit>.

⁶ Synapse Energy Economics, "Reducing Emissions in Connecticut on High Electric Demand Days (HEDD)," prepared for the US Environmental Protection Agency, July 2008.

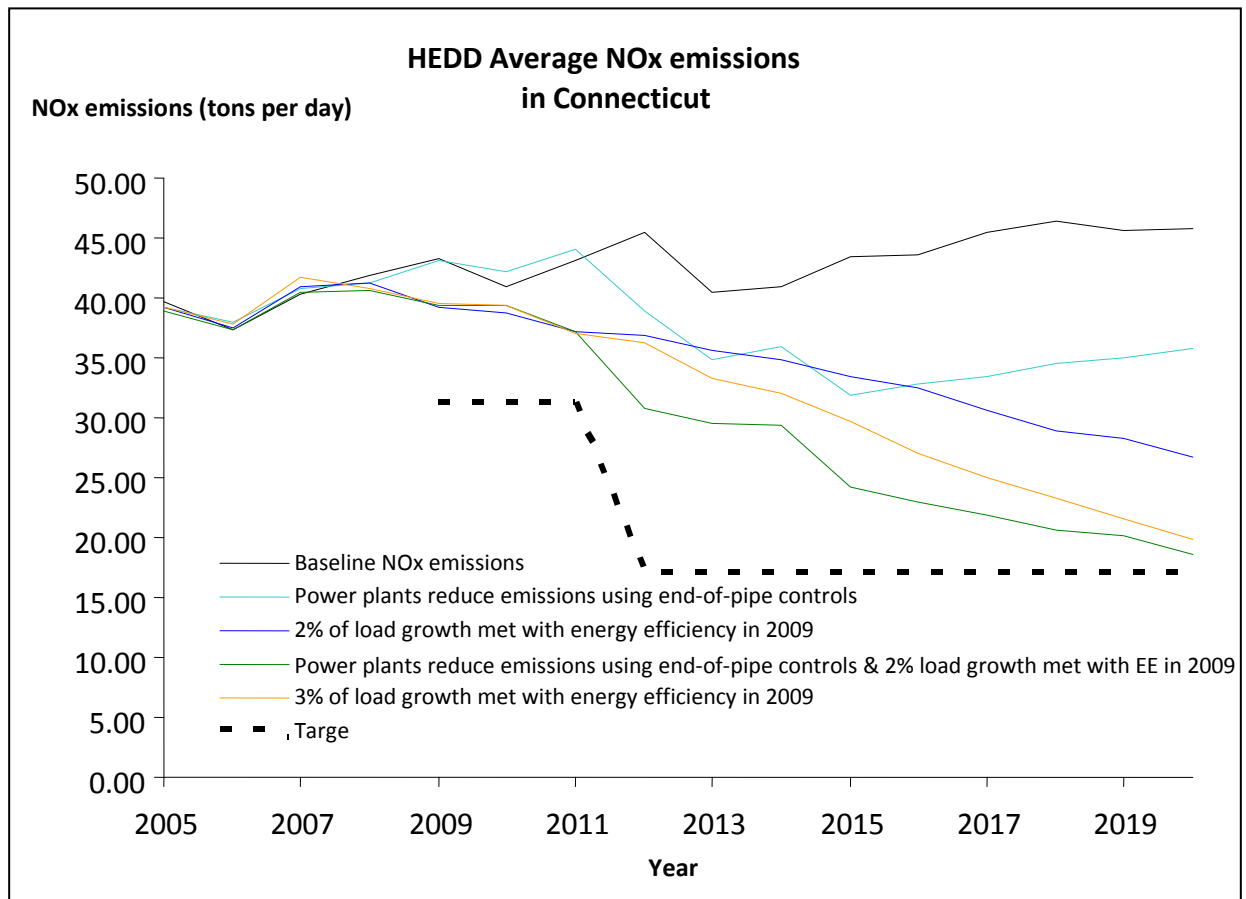


Chart 1. Analysis of potential NO_x emissions reductions from varying pollution control measures in the US state of Connecticut on High Electric Demand Days (HEDD)⁷

Current Status of EPPs in China

The Chinese central government is increasingly receptive to promoting demand-side management (DSM). The National Development and Reform Commission (NDRC) has designated DSM as a leading mechanism for realizing the national 2010 20% energy intensity target. Recent government laws and regulations, such as the amended Energy Conservation Law, implemented on 1 April 2008, and the State Council's "Decision on Strengthening Energy Conservation Work", stress the importance of DSM and support increased energy efficiency investment through models such as the EPP.

An EPP can be "constructed" by requiring utilities to invest in upgrading end-use equipment on the same scale as building a new power plant. A number of provinces and municipalities across China have begun to do just this, including Jiangsu, Hebei, Guangdong, Beijing, Shanghai and Suzhou.

⁷ Ibid.

Some of these efforts are described here in greater detail below.

In 2007, National Development and Reform Commission (NDRC) and Ministry of Finance (MOF) selected Suzhou as a national pilot city for DSM. The program aims to achieve at least 200 MW of electricity savings between 2008 and 2010. By September 2008, Suzhou had completed a DSM implementation plan and obtained approval from relevant authorities.

At the provincial level, Jiangsu, Hebei and Guangdong are at varying stages of designing and implementing EPP pilot projects. Jiangsu has especially excelled at DSM implementation: from 2003 to 2005, more than 1.8 billion RMB (\$260 million) of public and private investment had produced annual energy savings of over 1.2 billion kilowatt-hours, reducing peak demand by 450 MW and saving 780 million RMB (\$100 million). The electricity saved represented an annual CO₂ reduction of 1.2 million tons.

In 2006, the State Grid Corporation DSM Instruction Center began developing and implementing EPP programs in Jiangsu. After completing the first 150 MW EPP in 2006, Jiangsu invested over 100 million RMB (\$14 million) of public revenue in 2007, which leveraged nearly 300 million RMB (\$44 million) in private investment and completed a second set of EPP projects totaling 190 MW. Combined, the EPP achieved annual savings of 1.8 billion kWh and 1.7 million tons CO₂ emissions. By the end of 2009, Jiangsu expects to have completed a total of 600 MW of EPPs over the period of 2005-2009, at a third of the cost of building a conventional coal-fired power plant of equivalent capacity.

Between 2007 and 2008, Hebei invested nearly 1.5 billion RMB (\$220 million) of public and private finance in EPP pilot projects. Combined, these projects have saved close to 1 billion kWh annually, equivalent to 920,000 tons of annual CO₂ reductions. In 2008, the Hebei DSM Instruction Center also completed a five-year DSM plan including a province-wide implementation roadmap. Hebei DSM Instruction Center recently established an ESCO-like institution, which is expected to draw more social funding resources for energy conservation efforts in the province.

The financing mechanism employed in Hebei is the most dynamic to date. Whereas other EPPs are largely supported through direct government subsidy, up to 80 percent in some cases, Hebei follows a “public benefit fund” model. A public benefit fund is a method of financing energy efficiency by adding a small surcharge across all electricity users. Funds are used to purchase energy saving upgrades which benefit all users by reducing pressure on the electricity system and reducing pollution emissions. Whereas direct government subsidy does not provide a reliable and perennial revenue stream, the public benefit fund does, which helps to institutionalize continual investment in energy efficiency. The US state of Vermont exemplifies this model well. In the case of Hebei, the province has created a special fund for DSM by collecting a surcharge equal to one thousandth (0.001) of a Yuan per kilowatt-hour from customers of urban public utilities. These funds are being used to support the EPP energy conservation activities in the province.

EPP Implications for Air Quality Management in China

As the cases above illustrate, the EPP has been applied in China primarily as a means of energy conservation. However, the concept has a number of potential applications as a tool for pollution prevention and control. Below are some ways in which environmental regulators can more effectively employ the EPP as an air quality management tool.

1. Certify the EPP as a pollution reduction strategy.

The first step for environmental regulators is to apply the substantial expertise at the Ministry of Environmental Protection (MEP) and associated regional and provincial departments to certify EPPs as a specific emission reduction technique. This may involve several practical steps:

- a. **Define what qualifies as an EPP for air quality purposes.** This may mean specifying the minimum size and other characteristics of the EPP, the administrative structure and methods of government oversight.
- b. **Measure and certify the amount and duration of energy savings and emissions reduction.** When a power generator installs a flue gas desulfurization (FGD) unit, emission monitoring equipment is required to assure that a plant is operating the pollution control equipment properly and that SO₂ emissions are in fact reduced. In China, environmental regulators are responsible for installing and managing data collection and accuracy of these emissions monitors. Enforcement is a joint effort between environmental and energy regulators. The latter use the data to determine the electricity tariff rate to be paid to the generator, which in China will earn a higher rate for producing cleaner electricity to compensate for the additional cost of running the control equipment. Similarly, emissions reductions from EPPs can be monitored and verified to ensure the effectiveness of the policy. Evaluation, monitoring and verification (EM&V) of energy efficiency upgrades would involve assuring that equipment has been installed, that it is being operated continuously, and that the projected energy savings are realized.
- c. **Certify the EPP's pollution reductions.** Energy savings from an EPP will need to be converted into the equivalent reduction in SO_x, NO_x, PM, CO₂ and other pollutants. MEP could use reasonable emission factors based on the mix of existing or new generation in a province or region.

EPPs that met these tests and provided verifiable SO_x, NO_x, PM and CO₂ savings would be a powerful tool for air quality planning and modeling purposes.

2. Build EPPs into power sector reform and related policy framework.

There are numerous opportunities to strengthen the environmental benefits of energy efficiency investments, or EPPs, by incorporating them in existing and planned policies.

For example, one possible application of the EPP would be a modification to the “small plant

closing” policy. The goal of this policy is to save 25 Mtce per year by 2010 by replacing 50 GW of small, dirty coal-fired units with 50 GW of large conventional coal plants, which have higher thermal efficiency rates and thus are cleaner. The policy implementation framework includes requirements that new generation must be partly offset by shutting down existing small inefficient power plants. While the country is on track to meet the initial target of 50 GWs of closed plants, the policy can easily be extended to deliver substantial environmental benefits through EPPs. The policy framework can give enterprises seeking to build new generation an option: to get approval for new construction, enterprises can either close small, inefficient power plants; OR build (or pay for) a certain amount of EPPs.

Another way in which MEP and associated agencies can enhance the positive environmental impacts of EPPs is by helping to ensure that EPPs are integrated into China’s plans for power sector reform . In the type of competitive electricity market that China plans to create, generators will compete to produce electricity at lowest cost. International experience demonstrates that this system favors electricity from inexpensive generators, which are generally dirty, coal-fired power plants. China’s current power sector reform plans do not include any opportunity for energy efficiency resources to compete in the market alongside conventional supply-side resources.

There is relevant international experience in the six New England states, where energy efficiency programs can bid into a forward capacity market, competing against oil, coal and other supply-side resources. As of October 2009, three auctions in the forward capacity market had taken place, in which energy efficiency and demand-side resources successfully bid a total of 2,897 MW out of a market 32,000 MW, largely displacing oil and coal generation.⁸ While still a relatively new policy intervention, the participation of energy efficiency is expected to increasingly expand in coming auctions.

China’s EPP concept provides an excellent way to take international experience and scientifically apply it to the future design of China’s electricity market. EPPs, bundled and certified, can provide an avenue for energy efficiency to meet electricity demand in a competitive market environment, giving air regulators a new and powerful approach to reduce emissions from the power sector.

⁸ The total capacity of 2,897 MW includes demand-side resources such as energy efficiency (both merchant and utility), distributed generation, combined heat and power, real-time demand response resources, and real-time emergency generation. ISO New England’s third forward capacity market auction concluded in October 2009. See: “ISO New England’s Third Forward Capacity Market Auction Concludes Successfully,” press release, 17 October 2009, available at http://www.iso-ne.com/nwsiss/pr/2009/final_news_release_fca3_prelim_results.pdf.