Proposed Framework: Design of a Pilot Emissions Trading System for the Building Sector

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The Chinese Building Sector

In November 2009, the State Council of China announced that China will reduce its carbon emission intensity per unit of GDP by 40 to 45 percent in 2020 compared to 2005. While it is conceivable that all sectors of the economy will have a role to play in meeting this energy intensity goal, up to now, there is no direct link between the 40-45% target and the energy efficiency goal in buildings. In other words, the national goal has not been distributed to different regions and sectors, and the 12th FYP does not address this question.

Past new building requirements issued by the national government have been command-and-control, and implemented on a component-by-component basis. For example, current new building standards are based on technologies and U values of different components as well as energy efficiency targets for heating, cooling, and water heating units.

The Chinese Ministry of Housing and Urban-Rural Development (MOHURD) issued several energy conservation design standards for Chinese buildings in different climate zones:

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1 These framework recommendations were developed following multi-stakeholder workshops on trading system design options. The workshops and framework recommendations were made possible with financial support from the UK Foreign and Commonwealth Office, Low Carbon High Growth Strategic Programme Fund China. Although the workshops and framework paper were carried out with support from the UK FCO, the views expressed are those of the authors and do not necessarily represent the opinions of the Authority.
JGJ26-95: Design Standard for Energy Efficiency of Residential Buildings in Severe Cold and Cold Winter Zone

JGJ134-2001: Design Standard for Energy Efficiency of Residential Buildings in Hot Summer and Cold Winter Zone

JGJ75-2003: Design Standard for Energy Efficiency of Residential Buildings in Hot Summer and Warm Winter Zone

GB50189-2005: Design Standard for Energy Efficiency for Public Buildings

The map below shows the different climate zones:

![Climate zones in China](image)

**FIGURE 1: CLIMATE ZONES IN CHINA (MOHURD 2009)**

With respect to refurbishment of existing buildings, the national government does not set specific performance requirements. Instead, each province sets its own targets.

China’s emphasis on using command-and-control approaches to set standards for the major energy-using systems in buildings can be effective in capturing the biggest opportunities; however, policy makers may be missing out on many smaller, but lower cost options. Trading
can help reach these opportunities by encouraging market participants to identify and implement measures that cost less than the allowance price, leading to greater improvements per unit (Yuan) expenditure and a more efficient allocation of resources.

**Xiamen: Local policies and data collection efforts**

The city of Xiamen is located in the Hot Summer and Warm Winter Zone (marked in red at the bottom of the above map). Thus, in Xiamen, the main source of energy consumption is electricity (used for cooling, lighting etc.).

In 2008, Xiamen had 15,077 buildings included in their data collection program (including 264 public buildings), comprising 50,112 households and a total floor area of 5.58 million \( m^2 \). The following table includes the energy intensity and cooling energy share of different selected building types:

<table>
<thead>
<tr>
<th>Building type</th>
<th>Energy intensity (kWh/m(^2)a)</th>
<th>Cooling share</th>
<th>Rest share (e.g. for lighting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big government buildings</td>
<td>75.58</td>
<td>34.46%</td>
<td>65.54%</td>
</tr>
<tr>
<td>4 star hotels</td>
<td>155.37</td>
<td>13.46%</td>
<td>86.54%</td>
</tr>
<tr>
<td>5 star hotels</td>
<td>155.28</td>
<td>16.72%</td>
<td>83.28%</td>
</tr>
<tr>
<td>Hospitals</td>
<td>115.75</td>
<td>36.88%</td>
<td>63.12%</td>
</tr>
<tr>
<td>Schools/Office buildings</td>
<td>97.31</td>
<td>26.33%</td>
<td>73.67%</td>
</tr>
<tr>
<td>Dormitories</td>
<td>38.67</td>
<td>34.76%</td>
<td>65.24%</td>
</tr>
<tr>
<td>Low rise residential buildings</td>
<td>21.03</td>
<td>6.12%</td>
<td>93.88%</td>
</tr>
<tr>
<td>Medium rise residential buildings</td>
<td>19.77</td>
<td>5.97%</td>
<td>94.03%</td>
</tr>
<tr>
<td>High rise residential buildings</td>
<td>21.12</td>
<td>8.64%</td>
<td>91.36%</td>
</tr>
</tbody>
</table>

In 2010, Xiamen issued its Outline of a Master Plan for a Low Carbon City. The government is developing a detailed Master Plan for a Low Carbon City in line with the Outline. According to
the published Outline, the overall energy intensity per unit of GDP will be reduced by 40% below 2005 levels by 2020. It is estimated in the Outline that the GDP will be 7.14 times higher than in 2005 (assuming a GDP growth of 14% p.a.), however, the emissions will be only 4.28 times higher. This results in total emissions of 68.64 mn tons of CO₂—45.76 mn tons less than the business as usual scenario.

The rationale for proposing different approaches for new buildings and existing buildings

We suggest establishing different trading schemes for existing and new buildings due to differences in historic treatment, differences in ownership, and the potential for inequities if both building types were treated under the same system. First, whereas new buildings already face national performance standards (building codes in Xiamen call for a 65% improvement over past levels), existing buildings have been granted national and local subsidies to incent improvements. As these buildings are not used to mandates, a softer approach might be warranted at least initially. Second, for new buildings, the regulated source could be the real estate developer; whereas for existing buildings, much of the control in terms of energy use lies with the energy user (e.g. tenants). Therefore, the point of regulation could be different. Finally, whereas new units are characterized by rapid expansion (and resulting increases in energy use and greenhouse gas emissions), existing buildings are more stable, or in a slight decline. A unified cap-and-trade program would strongly advantage existing buildings over new ones, whereas a common emission rate standard would advantage new buildings (where there is opportunity to utilize the latest technologies from the beginning) over existing ones. Accordingly, suggested approaches differentiated by new and existing building types are described below.

New Buildings

New buildings would be issued an energy intensity standard (kwh/m²) since the Chinese building sector is still in a phase of rapid growth and thus the government will not allow growth to be limited with a hard energy cap. Regarding Xiamen as potential pilot city, the buildings mainly consume electricity that comes from the same grid (thus with the same emission factor). Thus, it does not matter whether the end product we trade is energy or CO₂. It may be simpler to use an energy metric, but either could work.

The determination of an appropriate standard is a critical issue. We suggest using the following methodology to establish an initial standard:

a. First, gather energy consumption data from all buildings belonging to the same building type, which came online (and began operation) in the last two years. All buildings in the sample must have a minimum occupancy rate.
b. Next, select the most energy-efficient 30%. The average value of this 30% is the standard, which applies to all new buildings in one city.

The standard could be set to improve over time, or could be reset every few years, to support continued progress in meeting carbon intensity goals. Buildings that do better than the standard are issued allowances, and those that do not meet the standard must purchase allowances.

**Point of Regulation**

Standards should apply to all new buildings of the same building type (same purpose of usage, comparable size etc.). We suggest considering real estate developers or the end-users to serve as the point of regulation. Regarding the real estate developing companies, they must decide on energy performance issues (e.g. which kind of insulation material is used for the new buildings). The end-user, on the other hand, has a direct influence of the energy consumption through its energy consumption behavior. Thus, both should be taken into account.

**Existing Buildings**

In terms of existing buildings, we recommend setting a hard cap on electricity consumption since there is no issue with rapid growth—the square footage of existing buildings will remain fairly constant over time and could even decline. Therefore, on an annual basis, the government would issue certificates for energy use at the level of the chosen electricity consumption cap. Demolition of old buildings could be taken into account by subtracting out their historic energy use from the total.

The level of the cap could be informed by the percent reduction in carbon emissions needed from the building sector in the coming years (if such a target is established). The cap level could also be informed by the technical and economic potential for energy savings. Further, to account for annual variation in weather (heating and cooling degree days), the actual percent reduction could vary from year to year so long as the total cumulative reduction target was met over, for example, a five-year compliance period. Moreover, the initial year energy use limit (cap) for existing buildings would be adjusted to an average cooling year in Xiamen. (Colder cities would focus more on heating.)

The market price for credits will be determined based on supply and demand. For example, if there are lots of ESCOs helping to undertake building efficiency projects, resulting in more credits being available than the demand for credits (high supply), the price will be relatively low. If the demand for credits significantly exceeds the supply, the price will be high. In a balanced market, the price will be about equal to the marginal cost of reducing energy or
carbon emissions. Additionally, we suggest establishing a mechanism, which ensures that the price stays above a minimum price level (e.g. the government sets up a fund which purchases credits at that minimum level and sells these credits when the price goes higher) since it is crucial for participants to have a minimum level of planning reliability.

Some key design considerations for an existing building cap-and-trade program are as follows:

**Point of Regulation**

A key design feature involves setting a workable and effective point of regulation. Since buildings are small and dispersed emitting sources, every single end-use household cannot serve as point of regulation due to high coordination costs. Thus, we must identify other entities that could undertake this role. Considerations include whether:

- All or most of the emissions in the sector will be measured by the point of regulation;
- The point of regulation is functionally capable of serving in that role; and
- The point of regulation has direct control over (or can encourage) actions that will reduce emissions.

Possible points of regulation for the building sector in Xiamen include:

1. **District:**

   The district is an administrative unit at the county level. Xiamen has six districts, the largest being Siming, with 736,000 inhabitants in 2007, and the smallest being Haicang, with just 143,000 inhabitants. Due to the limited numbers of districts within Xiamen, there is concern that there may not be enough participants to support a well-functioning allowance market.

2. **Sub-District:**

   The subdistrict (or township) is one level below the district level. Xiamen only has one more subdistrict than district (a total of seven) since it is a sub-provincial city. (In contrast, in the capital Beijing, which is a provincial municipality, the Chaoyang district is the largest district, containing 3.6 mn inhabitants and 23 subdistricts.)

   As in the case of the district-level administrative unit, there is concern that there may not be enough sub-districts within Xiamen to support a robust allowance market.

3. **Building:**
Large public and commercial buildings could be regulated sources without considering aggregation. This level of aggregation may be most workable in southern China, where the CO₂ emissions come from electricity use and electricity metering occurs at the building level. However, this point of regulation would not work in Northern China as there is very little metering for heating at the building or unit level.

**Fairness**

There is clearly a desire to develop a policy that will be seen as fair to the full range of regulated entities and end users, including those that:

- Are both efficient and inefficient; and
- Have larger and smaller mitigation opportunities.

The proposed approach is based on granting allocations on the basis of historic energy use (sometimes referred to as “grandfathering”). Under this approach, all existing buildings would cut their energy use by the same percentage, starting from their historic energy use. This approach builds in historic differentiation across entities, reflecting different building types and uses as well as different ages of building stock. However, the use of a common percent reduction from all buildings would tend to favor entities that have a relatively inefficient starting point over those that are relatively efficient to begin with. One option to address this fairness concern would be to grant credits for early actions. Another option would be to differentiate the reduction requirement on the basis of relative efficiency. (For example, entities that are relatively less efficient (e.g. consume 80 kWh/m²a) might be asked to reduce by 3.5% per year, while those that are relatively more efficient (e.g. 50 kWh/m²a) could reduce by 2.5% per year.)

Another approach would be to allocate allowances according to building type. Under this approach, every building of the same building type has the same target intensity standard, irrespective of its historical emissions or current efficiency level. This approach is easier to handle, however, there is a risk that buildings with high levels of energy use per m² would find it quite difficult to achieve the target.

**Role of ESCOs and Building Owners**

Building owners (or unit owners) will be incented to undertake energy saving projects to save on the (higher) costs of purchasing energy (that factor in the costs of credits purchased for compliance). However, building owners may not have the knowledge of the energy saving technologies and cost savings needed to independently manage decisions on energy savings
upgrades. Outside private sector experts such as energy services companies (ESCOs) can play an important role.

An energy service company (ESCO) provides services, including design and implementation of energy saving measures in buildings. It analyzes the buildings in terms of energy saving potentials and the related costs, implements the related measures and maintains the system in cooperation with the building operator/owner and gets paid back by revenues resulting from energy savings and carbon credits.

We recommend the Xiamen government strengthen the role of ESCOs since the large majority of building owners in China, especially of residential buildings, are not aware of energy saving potentials and may not be familiar with assessing the financial returns from energy saving investments.

**Implementation Steps and Capacity Needs**

1. Decide which agency will manage the program. One possible program manager could be the local government (Xiamen construction commission).

2. Implement a system to collect data on energy use from each building, including electricity metering and direct fuel use. Collect and verify data, including certification of third party providers.

3. Decide on program design features (intensity targets or caps, which entity shall serve as point of regulation, etc.)

4. Evaluate interactions with existing requirements (e.g., intensity targets for new buildings are not allowed to be less ambitious than the 65% standard)

5. Ensure a well functioning market
   a. Establish a certificate registry to track ownership and transactions
   b. Establish rules for trading
   c. Negotiate use of an existing trading platform (or establish a new one)
   d. Monitor the market (prevent manipulation, ensure liquidity)