Proposed Sectoral Approach for the Steel Sector in Japan

Consultation Document, 10 November 2010

Climate Strategies have developed a proposed sectoral approach for the steel sector in Japan. They now wish to consult stakeholders regarding:

1. their views on the proposed sectoral approach;
2. how the proposed sectoral approach could be implemented.

The document below details the proposed approach. It is a work in progress, to be finalized by 31 January 2010. Planned 'Next Steps' are shown on the last page of this document.

Climate Strategies welcome your comments and views, at a conceptual or detailed level. Please address these to the Climate Strategies Project Leader:

Peter Wooders, Senior Economist, International Institute for Sustainable Development (IISD), Geneva. E-mail: pwooders@iisd.org. Telephone: +41 76 430 50 26.

It is planned that the approach will be written up as a paper and submitted to the *Climate Policy* journal.

Summary of the Proposed Sectoral Approach

The proposed sectoral approach aims to:

> ***develop and implement breakthrough technologies and/or carbon capture and sequestration (CCS), as quickly as possible.***

Two variants are proposed:

1. **implement a fully-resourced plan of RDD&D** to develop breakthrough technologies and CCS by certain dates, with companies needing to meet minimum levels of effort.
2. **regulate CO_2 limits** such that steel plants exceeding these could not be constructed or operated after certain dates, leaving industry to pursue its own RDD&D path.

The first variant requires the identification of funding and a plan for its expenditure; the second leaves actions and their organization to those involved in the Japanese steel sector.

Background and Scope

Climate Strategies (CS) is a not for profit, academic membership organization. Its 18-month study on sectoral approaches is nearing completion. The scope of the study was focused on

one sector (steel) and three countries (Japan, China and India), in order to allow for the detailed analysis needed to progress the design and discussion of a sectoral approach.

Steel is important internationally, representing around 5% of world emissions, with projections of a 50% rise in emissions in 25 years even if all energy efficiency options are taken up.

The focus on steel, and on the three countries chosen, does not imply that this sector or these countries are most in need of mitigating their greenhouse gas emissions, nor that a sectoral approach would have the most chance of success. The study does not compare how effective a sectoral approach would be compared to carbon pricing or other policies and measures, nor does it assess the potential for demand reduction from the steel sector or the economy.

A separate case study has been undertaken for each of the three countries. The starting point has been to ascertain how far the sector could go in each country on a unilateral basis, the premise being that anything that requires international agreement or co-ordination becomes more difficult to implement. This does not preclude international actions, but the study analyses what would work nationally first. If this could then be replicated internationally, or credited by other countries as being of value in mitigating greenhouse gas emissions, then this could lead to an international approach being developed from the 'bottom up'. The study has not considered 'top-down' international approaches, which many other studies have analysed.

Development of a Sectoral Approach for the Japanese Steel Industry

Japan's steel sector is recognised as the world's most advanced technologically. There is little that could be done to improve energy efficiency or emissions using currently available technologies. It would be possible to increase the use of scrap in Japan, for example by increasing net imports of scrap. This would not decrease emissions from steel worldwide, as scrap is a very valuable commodity and is already collected at very close to maximum possible rates worldwide and is traded internationally.

Valuable contributions to emissions reductions could be made by the use of improved steels by downstream consumers and by the export of Japanese steel-making technology. Calculating reductions for these activities creates some technical difficulties and the debate on who should be credited for the emission reductions has controversial elements. This study does not assess reductions made overseas (offsets), focusing only on what the Japanese steel sector could reduce from within its own boundary.

Reductions from the sector, from within its own boundary, will be required if Japan is to meet its stated target of an 80% reduction in GHG emissions by 2050. The precise figure for the steel sector has not been assigned, but is understood to require a reduction of at least 50% by 2050. Assuming steel production remains at around today's level, this will require a major

improvement in the primary steel production process – currently blast furnaces fed predominantly by coke – and/or the capture and storage of carbon dioxide emissions (CCS). Current, non-captured emission levels per tonne of steel from blast furnaces are not sustainable if deep cuts in national emissions are required: other sectors, which would equally be required to make large reductions, would find it extremely difficult to go further and offset continuing emissions from the steel sector.

Japan, in common with countries around the world, already has a series of policies and measures governing the steel sector in general and its GHG emissions in particular. Of note are:

- the Keidanren's Voluntary Action Plan on the Environment, and its Commitment to a Low Carbon Society successor, with their progressive voluntary targets on energy efficiency;
- the APP (Asia Pacific Partnership), whose work on the steel sector has involved identifying technology options and improving opportunities for its members to invest in each other's economies;
- the energy and carbon tax, which applies to coal and petroleum products purchased by industry.

Amongst any number of future policies which could be implemented are federal and prefecture-level ETS (Emission Trading Schemes), which are currently under discussion in Japan.

The sectoral approach developed in this study argues that Japanese steel sector GHG emissions can only be reduced to sustainable levels through the successful development and implementation of breakthrough technologies and/or CCS. This could happen under business-as-usual activities – R&D efforts are underway, Japanese steel companies are aiming to develop new technologies for future markets and a range of activities on CCS are being undertaken. This study argues that a better approach is to set the aim of **developing and implementing these technologies as quickly as possible**. There is a need to define:

a. the mechanism to be employed;
b. how finance would be raised;
c. what the targets should be;
d. who would be responsible for meeting the targets.

A further item, optional to this study's scope, is to assess:

e. the possibilities of making the sectoral approach international, at least partially.

Developing and Implementing Breakthrough Technologies and CCS

Progressing the two potential solutions requires different actions:

- *Breakthrough technologies*. There is no clear breakthrough technology which Japan could invest in and would be guaranteed to reduce GHG emissions by a significant amount (e.g. 50%). Fundamental research continues across the world. The COURSE50 (Japan) and ULCOS (Europe) projects have identified a limited number of the most promising technologies, and are taking these towards demonstration. Both are co-operative programmes, with COURSE50 financed by government and ULCOS including government and industry funding. Both programmes include CCS components. Neither can guarantee that it will successfully develop breakthrough technology;

- *CCS*. Capture of carbon requires changes to the blast furnace. Technically, this appears feasible, although the economics have yet to be proven. Worldwide, there have been over 30 roadmaps for how CCS could be developed and implemented. The key unknown in Japan is the sequestration of captured carbon – is there sufficient storage capacity available, and is it financially and politically possible to develop pipelines to transport the captured carbon to these sites? Without these assurances, talking of CCS as an option appears premature. Uncertainty can be reduced by further work and expenditure in the area, but who should be responsible for this work is unclear at present.

Variant 1: Implement a fully-resourced plan of RDD&D

a. the mechanism to be employed

Fundamental research tends to be financed by government, with industry then developing promising options towards commercialisation. In Japan, it is the steel sector companies who have tended to perform this second role and who have retained the IPR (Intellectual Property Rights). The COURSE50 programme involves funding from NEDO, a public body which receives its funding from a share of the proceeds of the carbon and energy tax. It is natural to think of national level collaboration but this is not necessarily the best option. If company-level research and development is the normal model, then there will almost certainly be some disadvantages in moving away from this. Conversely, demonstration programmes can be expensive and sharing costs and learning nationally and even internationally is indicated.

b. how finance would be raised

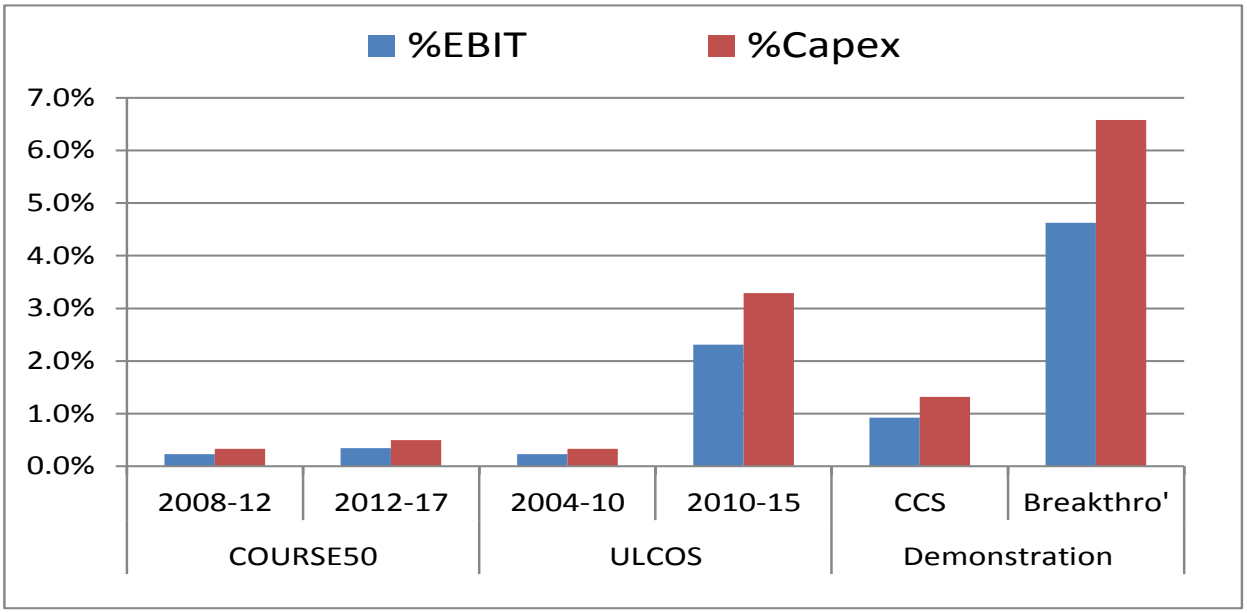
There is the possibility of increasing the scale of scope of the energy and carbon tax, or of creating a similar new tax, and hence raising more public money. Any changes due to the Basic Law discussions currently underway (late 2010) in the Diet may give more guidance as to the potential utility of this option.

There does not appear to be the option of raising money from the auctioning of allowances under an ETS, as even the strongest supporters of an ETS in Japan do not envisage auctioning in at least the early years of the scheme.

The alternative is to make the steel sector liable for raising the necessary finance, whether this is spent internally within the companies or if it goes into a wider fund or scheme. There appear to be resources available to significantly increase funding for RDD&D from current levels. As an illustration, which does not imply that it is the companies who should wholly or fully finance activities:

- the 4 largest Japanese steel companies produced around 75 Mt/year of steel over the period 2001-09, with revenue averaging ¥8,000 billion (US$80 billion) per year;
- EBIT (a profit measure) averaged ¥850 billion (US$8.5 billion) per year over the period, and capital expenditure (Capex) ¥600 billion (US$6 billion);
- The *Figure* below shows that average annual expenditure on the first two phases of COURSE50, and the first phase of ULCOS, is equivalent to 0.2% of EBIT or 0.3% of capex. Phase 2 of ULCOS would require of the order of 2% of EBIT or 3% of Capex;
- The Figure shows that a CCS demonstration programme would require around 1% of EBIT or Capex, equivalent to a charge of around $\$1/tCO_2$. Investing over 5 years in the breakthrough technology demonstration plant costing US$1.5 billion which the ULCOS programme has suggested may be possible would take 5% of EBIT or 7% of Capex. This could be financed by a $\$4/t$ steel charge or $\$6/tCO_2$.

Figure: Costs of technology development and demonstration programmes relative to the average profit and capital expenditure of the 4 largest Japanese steel companies 2001-09



Raising more money for RDD&D activities will at some point start to suffer from declining returns, and, for research, this point is not necessarily far in advance of current expenditure levels. What is also clear is that there does appear to be the resources to significantly scale up current activities. Demonstration plants could be financed from these resources, but implementation could be considerably more expensive. Implementing CCS at a possible cost of $100/tCO2 presents a much different challenge that financing demonstration plants with a cost of $1/tCO_2$.

c. what the targets should be

The proposed sectoral approach requires technologies to be developed and implemented as fast as possible. This requires sufficient – perhaps defined as 'the maximum cost-effective' - resources and effort to be put in. Ascertaining what the optimum level is, and then measuring it, presents technical difficulties. It is also clear that the indicator would be an input, rather than a result. A financial indicator may be the easiest – for example a fixed charge per tonne of carbon emitted from the primary production route - although the quality of how the funds were spent would be a key consideration.

d. who would be responsible for meeting the targets

Responsibility could be either at the sectoral or company level, depending on the design of the scheme.

e. the possibilities of making the sectoral approach international

There are clear attractions to combining RDD&D efforts, at all stages of the cycle. Demonstration plants are often expensive and the latter stages of development and implementation may be most attractive for international collaboration on the basis of cost.

Variant 2: Regulate CO_2 limits

a. the mechanism to be employed

Regulations would be set governing maximum permissible levels of GHG emissions from individual plants. A phased approach is indicated, with regulations first applied to new plant and then, at a later date, to existing plant. No requirements would be set as to how plants should meet these limits.

One design option which could improve the acceptability of the option would be for buy-out price to be included, i.e. for plants which had not met the permissible level to be allowed to continue to operate by paying a penalty. The level at which this penalty should ideally be set would allow the money raised to finance equivalent reductions in other sectors of the Japanese economy. Given how expensive emission reduction options are understood to be in Japan, and

the very large reductions needed in the economy by 2050, such a buy-out price would likely to be prohibitively high.

An alternative approach would be to set absolute caps on emissions from the sector. This is essentially what an ETS does, and is not considered further.

b. how finance would be raised

This would be up to the companies involved. Step-change effects are important: if new regulations are put in place from a certain date, a company may decide to make no investments or changes and simply take its plant out of commission from the date; alternatively, it may choose to build up savings to allow it to stay operational after the new regulations come in place.

c. what the targets should be

Targets would only be set on steelmaking using the primary route (currently blast furnaces in Japan). There does not appear to be any need to include steel production from scrap in electric arc furnaces (EAF), at least if the current Japanese electricity mix continues and the marginal new plant is not fossil-fuel fired. Difficulties arise because scrap steel can be used to some extent in primary route plants, and EAF can be housed on a site which also has a blast furnace.

Targets should reflect what share of reductions are required from the steel sector. A possible first level for the target for blast furnaces could be 50% of current emission levels, i.e. around 0.8 tCO_2/t steel, with new plant needing to comply by 2025 and existing plant by 2030. A second, more stringent, target could be set at a later date.

d. who would be responsible for meeting the targets

Responsibility is at the plant level.

e. assess the possibilities of making the sectoral approach international

The proposed approach is a unilateral one, and does not assume any coordinated, equivalent or other actions from other countries. If Japan takes on and enforces stringent targets unilaterally, the Japanese steel sector could be exposed to significant competitiveness and leakage impacts.

As an example, CCS in Japan may cost of the order of \$100/tCO_2 captured, or around \$150/t steel produced from the primary route. This is of the order of 20% of the value of steel, roughly equivalent to the combined average profit (EBIT) and capital expenditure of the steel sector over the past decade. Clearly the Japanese steel sector would be likely to lose out in export markets and also in the domestic market at this level. For Japan to be willing to make

such a unilateral commitment, it would be very likely to need to implement a protective measure such as a border tax applied to both imports and exports.

A better alternative would be international agreement but, based on experience to date, this is likely to be very difficult to agree in practice.

Next Steps

1. Develop the details needed to allow a debate on the potential implementation of the two Variants:
    a. referring to the guidance provided by the UNFCCC (see Box below);
    b. the potential funding mechanism for both the public sector and private sector options;
    c. sequestration and transport of captured carbon, including whose responsibility the development of this option should be;
    d. analyse how the proposals could be integrated within a system which has one or more ETSs;
2. Consult further on the proposals, notably after the Basic Law considerations in the Diet;
3. Introduce the idea of Japan putting forward this proposal as one that could be made more international, using forums such as the OECD Steel Committee and the World Steel Association.

Box: "Issues for Further Development" of Cooperative Sectoral Approaches, UNFCCC for the AWG-LCA and AWG-KP meetings, Barcelona and Bangkok, 2009[1]

0. Purpose
1. Criteria for eligible countries and sectors
2. Determination of sector boundaries
3. Treatment of potential leakage between sectors
4. Methodology and process for determining reference level (including preparation, submission, review, approval)
5. Monitoring, reporting and verification requirements for emissions
6. Issuance, allocation, management and accounting of credits/units
7. Means of engaging stakeholders (public and private)
8. Duration of crediting/trading periods
9. Carry-over of credits/units between periods
10. Eligible credits/units for purposes of achieving trading thresholds/targets
11. Consequences of not achieving a reference level, including facilitative measures
12. Governance

[1] FCCC/AWGLCA/2009/INF.2.Add.2. This lists items 1-11; "Purpose" (0) and "Governance" (12) have been added by IISD.