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Sir Nicholas Stern
Stern Review on the Economics of Climate Change
2nd Floor, Room 35/36
HM Treasury
1 Horse Guards Road
London SW1A 2HQ

Re: What is the Economics of Climate Change Discussion Paper (January 31, 2006)

Dear Sir Nicholas,

Caiteur Group Inc. is pleased to provide this submission pursuant to the climate change review you are conducting on behalf of the Cabinet Office and HM Treasury. We understand that your review is focused on more comprehensively understanding the challenges of the economics of climate change and how they can be met in the U.K. and globally, with the review results to be taken forward to the Prime Minister and Chancellor by autumn 2006.

Caiteur Group, through its policy research think tank arm Caiteur Group Climate Change Institute, specializes in climate change policy and business implementation frameworks, climate change data management, modeling, and information technology strategy, and climate change risk management. Our policy work includes submissions to U.S. and Canadian climate change policy reviews and other requests for policy input from stakeholders.

We address the key questions identified by the Review in your Discussion Paper as follows:

Part 1, P.34: The Science of Climate Change and the International Response

What are the economic and social implications for people in different countries and regions of a range of possible climate change outcomes, including in terms of incomes, lives and vulnerabilities?

We feel the Review is covering the key areas of economic and social implications. Utilizing Caiteur Group's analysis, we put forward additional factors for **new decision-support tools**.

Additional integrated assessment modelling & impact analysis factors

1. Impact on the Economy
 - Impact on continued economic growth in developed countries due to major climate change events in the developing world.
 - Major disruption of economic markets on a scale not experienced before.

- More need for economic, development, and humanitarian aid from developed countries to developing countries, impacting developed countries' budgets and economies.
 - Potential for large-scale class-action climate change litigation against both governments and the private sector and subsequent economic impact.
2. Impact on the Insurance Industry
 - As a subtext to the Impact on the Economy factors listed above we wish to separately highlight the impact on the insurance industry, particularly the Property & Casualty industry. While most losses experienced in the developing world are uninsured losses, sufficient evidence has been submitted to the Review by the insurance industry detailing their unprecedented loss exposures around the world and resulting capital capacity constraints due to climate-change related events. Larger catastrophic losses could trigger failures in the financial systems in developed countries.
 3. Impact on Human Health
 - Effects of health issues in different parts of the world and the propensity and probability for transition to other countries including developed countries, i.e. spread of disease and outbreaks of new diseases.
 4. Impact on Human Security
 - Security issues and predictions of human behaviour due to large scale catastrophes. Predictive economic models must include both developing and developed countries given the 2005 experience of security issues in the U.S. from Hurricane Katrina.
 5. Impact on National Boundaries and Sovereignty
 - Threat to national and international borders and boundaries due to large-scale movements of people both within countries and between countries, including flow of refugees issues and impact on human security per above.
 - Disruption of immigration patterns that form part of the economic planning base of many developed countries.
 6. Impact on the Environment and Self-Preservation Behaviours
 - Includes such factors as impact on flora and fauna and long-term socio-economic impact of changed human behaviours.

How should we tackle the problem of forecasting future emissions growth, and what is the range and likelihood of possibilities under different assumptions?

The Review reflects upon many factors that make forecasting future emissions growth difficult, including GDP growth, energy prices, population growth and so on. We believe that the issue of convergence of GDP per capita between developed and developing countries and the uptake of new clean technologies are two important factors for forecasting future emissions that will also

help in the movement toward persuasion and international collective action. These are best regarded as complementary, not conflicting goals of the Review.

We are also strong proponents of open sharing of the emissions data from international systems such as the Global Earth Observation System of Systems (GEOSS) between developed and developing countries to aid in advancing emissions forecasting.

How should policymakers understand and respond to the predicted increased risk of extreme events and major irreversible changes?

We agree with the precautionary approach principle of the United Nations Framework Convention on Climate Change (UNFCCC or the Convention) that “where there are risks of serious and irreversible damage, a lack of full scientific certainty should not justify postponing action”. The Convention also recognizes that climate change controls should be “cost-effective”. This acknowledges that policymakers need economic mechanisms on which to base their climate change response decisions.

Caiteur Group proposes development and broad use of **an Economic Index that accounts for the impact of climate change on the economy using discounting** of commonly available economic data and drivers. **Climate change requires new decision-support tools**. What gets publicly measured in as simple a way as possible gets paid attention to by policymakers and ultimately gets responses from governments. Discussions of economic growth need to factor in risk of large reductions to growth from climate change events. To the extent possible the climate change family of economic indices should include impact on future generations.

At the January 31, 2006 Oxonia Distinguished Lecture to the Oxford Institute of Economic Policy you referred to the U.S. administration voicing concerns about the impact of mandatory climate change action on growth and the way of life in the U.S. These commonly used expressions of concern by policy makers are based on decision-support factors that are measured, indexed and discussed on a daily basis in all countries around the world. Including the consequences of climate change in the debate requires similar historical and predictive measures and indexing in a systematic, analytical way.

What do we know about the possibilities for, and constraints to, adaptation to climate change?

See our responses in Part 2.1: Key Challenges for the Economics of Climate Change (Adaptation) and Part 3: Creating and Sustaining International Collective Action.

More generally, how can the world act in a coherent and collaborative way to tackle a problem that is global in its origins and effects?

The world can act in a coherent and collaborative way to tackle the climate change problem that is global in its origins and effects by:

- Supporting all existing agreements, treaty arrangements, and institutions that are working to tackle the problem such as the UNFCCC, Kyoto Protocol, Gleneagles Dialogue on Climate Change, Asia-Pacific Partnership on Clean Development, and the Convention Dialogue and post-2012 agreement negotiations.
- Fostering new agreements and institutions to tackle the problem and integrating the ones which overlap to reduce dissipation of efforts, redundancy, and administrative costs.
- Committing to mitigation actions through mandatory emissions reductions.
- Committing to immediate urgent adaptation actions for the most vulnerable countries.
- Committing to transfers of data, systems, processes and clean technologies and involvement of the private sector in this effort.
- Conducting intensive campaigns in climate change education, persuasion and behavioural change of preferences.
- Pushing for rapid global collective action and inclusion of emerging large emitter developing countries such as China and India.

See our additional responses in Part 3: Creating and Sustaining International Collective Action.

Part 2.1, P.68: Key Challenges for the Economics of Climate Change (Adaptation)

What is the potential impact of climate change, including both impacts of multiple extreme weather events and adverse impacts on the overall environment, on paths and patterns of growth and development in richer and poorer countries?

The potential impact on paths and patterns of growth and development is severe but unequal between developed and developing countries, since poorer countries lack the funding, resources, institutions, and built-in economic mechanisms to respond to the potential impact.

Additionally those countries that have better predictive systems and adaptation mechanisms will fare better. Currently these are the developed countries and not the high-risk, poorer countries.

In this case we break down adaptation mechanisms into two areas:

- **Prevention adaptation mechanisms** such as flood barriers.
- **Response adaptation mechanisms** such as disaster planning and emergency preparedness.

How are integrated assessment models (discussed in paragraph 60) used to arrive at estimates of the damage of climate change and how could the combination of economic, social and scientific aspects be improved in modelling?

See our response in Part 1, Question 1 on **additional integrated assessment modelling & impact analysis factors** which provides specific additions in areas such as health, human security, and broader macroeconomic impacts to improve integrated assessment modelling.

What is the potential for adaptation to changes in the climate, and how might this vary by country and region?

Unfortunately it must be acknowledged that the potential for adaptation to climate change is limited, especially in regions and countries with a high risk profile for large-scale or complete flooding such as low-lying states of the Caribbean and the Pacific. These are natural environment constraints that need to be planned for by the global community over the long-run.

Additionally there are budget constraints and limitations to the development of clean technologies but these are likely to improve over time as climate change predicting, indexing, planning, and profit-generating market based mechanisms advance and mature. Improvements are likely to occur first in developed countries. Hence transfers to poor countries are essential.

What are the roles of equity weighting and discount rates in estimates of the 'social cost of carbon'? And are approaches both to intergenerational equity and discounting likely to vary strongly across countries?

See our response in Part 1, Question 3 above. We propose development and broad use of **an Economic Index that accounts for the impact of climate change on the economy using discounting** of commonly available economic data and drivers. To the extent possible the climate change family of economic indices should include impact on future generations. A broad commonly used economic index adjusted for climate change impact should limit the variability of the approaches to such a measurement across countries.

Part 2.2, P.84: Key Challenges for the Economics of Climate Change (Mitigation)

How can action be taken to make deep cuts in greenhouse gas emissions without a significant reduction in the rate of growth and competitiveness? Can innovation and technological change help us to move to higher growth paths?

In order to reduce negative impact to growth rate and competitiveness of countries, actions to reduce GHG emissions would have to take into account and leverage the natural and economic abilities of countries to make GHG emissions cuts.

We look at Canada as an example of what will be required in some countries:

Canada's emissions targets under the Kyoto Protocol (with 2010 BAU emissions projected at about 48% above the Kyoto target) is currently the highest of all Kyoto signatories. Much of this is due to the country's energy intensive economy with cold weather and large distances between population centres all playing a factor, its resource-based economy, and its rapid economic growth (43% GDP growth in the 12-year period between 1990 and 2003). This makes achieving the deep emissions cuts required under Kyoto a challenge for Canada.

At the same time however Canada has significant natural abilities that it can leverage for GHG emissions cuts including vast forests and agricultural lands to sequester GHG emissions under LULUCF (see also Question 2 below) and a large oil and gas industry that can not only store GHGs underground by pumping carbon dioxide into oil reservoirs but could also realize production increases of as much as 25% from mature oil reservoirs from this underground sequestration process. In addition Canada estimates its fuel cell technologies (i.e. clean technology) market will reach about \$46 billion by 2011.

As a developed country and a country with natural capabilities to aid GHG mitigation, Canada may be able to take mitigation action that does not significantly impact its growth. However even for Canada this will be a difficult balancing act. Many countries in the developing world will not be able to cope with all the intricacies required of an expanded action plan post-2012.

We therefore recommend to the Review that **post-2012 agreements include models that account for and leverage natural and economic capabilities** and lay out recommended action plans that are more country-specific for countries that need this scenario-planning assistance.

How far can land use change and forestry play a part in mitigating climate change?

Caiteur Group's analysis concludes that countries such as Canada and Brazil that have the ability to capitalize on their natural advantage of vast forests and agricultural lands to sequester GHG emissions will play the greatest role in the land use change and forestry (LULUCF) category of climate change mitigation. In addition these carbon sink sequestrations will provide significant economic benefit to these countries both domestically and internationally since they generate tradeable credits under the LULUCF category of the Kyoto Protocol.

On the other hand drought-prone countries in Africa need to be urgently assisted with land reforestation to the extent possible.

We also draw the Review's attention to the 2005 *Trading Water for Carbon with Biological Carbon Sequestration* report¹ from the multi-institutional study led by Duke University's Professor Robert Jackson which revealed that growing tree plantations to remove carbon dioxide from the atmosphere could trigger other environmental problems that may outweigh some of the

sequestration benefits. Synthesis of more than 600 observations showed that plantations decreased stream flow by 227 millimeters per year globally (52%), with 13% of streams drying completely for at least one year. They concluded that plantations can help control groundwater recharge but can also reduce stream flow and salinize and acidify soils.

How can policymakers create sufficiently clear and credible signals and the institutions to support them?

Caiteur Group's assessment is that policy makers can create signals and supporting institutions through use of the following:

- **New Decision Support Tools in Modelling.** Using expanded integrated assessment modelling tools that account for other factors such as social, health, and broader macroeconomic impacts of climate change. (Ref: our response in Part 1 to the question *“What are the economic and social implications for people in different countries and regions of a range of possible climate change outcomes, including in terms of incomes, lives and vulnerabilities”*).
- **New Decision Support Tools Utilizing Indices.** Creating and using new economic indices that account for climate change impact and any subsequent benefits from climate change action. (Ref: our response in Part 1 to the question *“How should policymakers understand and respond to the predicted increased risk of extreme events and major irreversible changes”*).
- **Strong Collaborative Action.** Using the institutions available, creating new institutions to support new frameworks, and integrating existing institutions where redundancies exist. (Ref: our response in Part 1 to the question *“More generally, how can the world act in a coherent and collaborative way to tackle a problem that is global in its origins and effect”*).

What is the role of persuasion and education to change preferences?

Persuasion and education are central elements to changing preferences with regard to climate change by both reluctant governments and the general public. Education and persuasion need to be combined with insistence on mandatory targets and requesting immediate adaptation assistance for vulnerable countries. Experience has shown that a combination of education and persuasion and mandated policies can change actions and preferences across society. We see this in the overall adoption of activities such as carbon monoxide monitoring, smoke detectors, radon gas detectors, asbestos removal, tobacco and smoking in public places, recycling and so on.

See also our responses in Part 3, Creating and Sustaining International Collective Action that discusses how modelling can be used in the education and persuasion of policymakers.

How might these policies interact with existing incentives embedded in complex markets, particularly those for fossil fuels and electricity generation and supply?

Ref: our response to the question that immediately follows this one, with regard to the appropriate policy instruments to overcome market barriers.

What are the market barriers and failures that may prevent the development and deployment of new and existing low carbon technologies, and what are the appropriate policy instruments to overcome these?

Caiteur Group sees the key market barriers to the development and deployment of new and existing low carbon technologies arising mainly from:

- Entrenched existing regulations and direct and indirect subsidies across fossil-fuel industries (upstream and downstream). Many existing regulations have yet to be reviewed to include climate change impact and policy.
- Misallocated incentives to certain industries that will discourage them from switching to clean and low-carbon technologies.
- Initial high prices for clean and low-carbon technologies, subsequently reducing market penetration.

The appropriate policy instruments would be:

- The review and realignment of existing regulations.
- The creation of the proper stimulation incentives, including a system of global subsidies approved by the World Trade Organization where necessary, to encourage development of clean and low-carbon technologies by the private sector.

What is the scale of investment required internationally and in developing countries, and what policy arrangements including economic instruments and flexible mechanisms could promote appropriate flows?

Significant investments are required internationally, first in developed countries that must meet their Kyoto Protocol emission reduction targets for mitigation. We feel that the flexible market-based mechanisms under the Kyoto Protocol are a sufficient initial start to promote the appropriate flows of capital required for this effort. However post-2012 mechanisms should include **new and innovative economic instruments that leverage the natural and economic capabilities of the parties** for meeting their mandatory mitigation targets.

See also our response in Part 2.2, Question 1 “*How can action be taken to make deep cuts in greenhouse gas emissions without a significant reduction in the rate of growth and competitiveness*”.

Part 2.3, P.92: Key Challenges for the Economics of Climate Change (Uncertainties)

How should one assess the degree of uncertainty about aspects of climate change?

Collectively a global methodology and standards of assessing uncertainty need to be developed and agreed upon, including accounting for irreversible impacts and the existence of capital assets that are not as conducive to emissions reduction and mitigation efforts.

Individually each country should also make its own uncertainty assessments based on its climate change exposure and risk profile. For example, flood-prone countries and hurricane-prone countries need to assess with a smaller degree of uncertainty built into their models. Each country also needs to tie its climate change mitigation and adaptation action plan to that assessment.

How can discounting be used to value costs and benefits into the future in the presence of uncertainty?

Since countries and societies will base their decisions primarily on economic outcomes, the discounting used to value costs and benefits into the future in the presence of uncertainties should be similar to that used in economic indices discounting and adjustments.

What are the implications of uncertainty, and of the possibility of very harmful outcomes, for policy-making?

A key implication is that uncertainty could be, and indeed has been used as an excuse for inaction on climate change in policymaking.

Additionally policymakers who are willing to make deep emissions reduction cuts need the appropriate decision-support tools to help them sell their policies internally and also internationally to encourage collective action from hesitant countries. So we again recommend easily available, adjusted national and international measures for policymakers to use. This helps to move the focus away from uncertainty and toward policy debate and action.

See also our response in Part 1 to the question “*How should policymakers understand and respond to the predicted increased risk of extreme events and major irreversible changes*” which discusses creating indices for climate change.

How should the presence of uncertainties and irreversibilities affect the analysis of the appropriate timing and scale of action?

As mentioned above high risk countries that are for example flood-prone or hurricane-prone countries cannot wait for certainty to time and scale their actions, particularly on adaptation. These countries need to use smaller degrees of uncertainty in their decision-support models and analysis.

Lower risk countries (and richer countries) are also not immune as we have explained. They face the indirect consequences of security and immigration issues due to large-scale movements of people into their countries and economic market disruptions from climate change events in high-risk countries. Therefore the presence of uncertainties and irreversibilities in climate change and related economic models should not skew the analysis toward delayed responses or inaction.

Part 3, P.112: Creating and Sustaining International Collective Action

How can the Review best illustrate how different frameworks for international action affect different parties?

We recommend **a combined theoretical and practical/field results approach** to best illustrate the outcomes and impacts of different frameworks on different parties, as follows:

- Develop and put forward for discussion theoretical impact studies and economic analysis using those widely shared common expectations from within the climate change economics community as inputs. To provide balance and opportunities for validity comparison, the theoretical studies should where possible also incorporate models using the expectations of those key countries such as the U.S., China, and India that do not currently support climate change action based on emissions reductions.
- Develop and put forward for discussion impact studies and economic analysis based on scaled-up field results from climate change actions that have already occurred. This involves looking at those micro-strategy and small to medium-scale actions that have occurred within countries, for example, within a particular state, province, or town within a country. We further recommend scaling these micro-strategy and small to medium-scale action up to country/national impact level and where possible, to a regional level using predictive modelling and other integrated analysis tools. This provides real and demonstrable outcomes of impacts of different frameworks on which to base future expectations of impact.

All of our references to impact studies include social, economic, health, and human security impact studies.

How can international arrangements, and in particular the incentives, institutions and scale they embody, be taken forward to respond to the magnitude of the challenge?

Our analysis with respect to the Kyoto Protocol arrangements indicates the following needs:

- With specific reference to the flexible market-based mechanisms of the Kyoto Protocol, there will be **a need for further integration and scalability** of institutional processes, data and systems particularly in the project based arena of the CDM and JI mechanisms. As a point of reference, as of March 2006 the CDM program is already reporting 139 projects registered, with 270 million projected CERs before the end of 2012 and a total of 630 projects in the CDM pipeline, with 800 million projected CERs produced by 2012.²
- There is **a need for extraordinary levels of built-in good governance and operational risk management**, again particularly in the project based arena of the CDM and JI mechanisms. This will mitigate the risk of misuse of these systems as they are scaled up and moved forward to address the magnitude of the challenge.
- There is **a need for institutional fast response mechanisms for adaptation**. The critical area of adaptation was not addressed under the Kyoto Protocol which focused on market-based mechanisms for emissions reductions. A post-2012 agreement must build an adaptation mechanism.

How can government action and public discussion build a common understanding to help change preferences and strengthen prospects for collaboration?

At the Oxonia Lecture you discussed the need to make climate change “part of the story” and finding ways to sustain those stories. We pick up on this discussion by calling for more public discussions and government action to make it part of the story. Terrorism, nuclear proliferation, and drugs are major stories. Climate change needs to be included in these discussions, especially since insurance and other projections estimate that far more people and national economies are at risk from climate change. More can be done to convey the importance of climate change through sustained public discussion, education, persuasion, and availability of new technologies, choices and options in order to change national policy and consumer-level preferences and actions.

What is the role for action in a single country or region, such as the UK or EU, in promoting international collective action?

We feel that the role for action in a single country or region should be **unlimited**. Countries must do all they can to promote international collective action. Annex 1 party nations must take a **strong leadership** role in demonstrating the impacts of climate change and promoting and persuading responsible actions within their own countries and the global community.

Examples of such action include the UK’s leadership in tabling international collective action on climate change as a top priority item at the 2005 G8 Summit in Gleneagles.

How can the international community, including the private sector, support adaptation in the most vulnerable countries?

We agree with the Review that “the adverse impacts of climate change will be felt most acutely and soonest by poor people in developing countries, in particular in Africa.”

Caiteur Group has submitted recommendations to other policy inquiries in Canada³ and the U.S.⁴ on the subject of supporting adaptation in the most vulnerable countries. We outline a number of our recommendations here for the Review:

- **Immediate Investments in Adaptation Infrastructure.** First developed countries need to immediately make significant investments in the adaptation infrastructure of the most vulnerable countries given the high risk exposure profile of these countries and the length of time that infrastructure development projects require. These should be conducted as joint efforts between developed countries, developing countries, and the private sector.
- **Climate Change Data, Process and Methodology Transfer.** Governments and industry in developed countries need to actively share and transfer climate change data and climate change risk management techniques, methodologies and processes with vulnerable and resource-constrained developing countries, particularly those in high-risk climate variability exposure regions in Africa and in the low-lying states of the Caribbean and Asia. This will mean helping developing countries build and implement the decision support systems and frameworks that will allow transfer of climate change data and adaptation action analysis between developed and developing countries. Adaptation decision support systems, process, and methodologies under this transfer plan would include base climate change data, impact analysis, predictive analysis, and rapid response and emergency preparedness data, processes, methods, systems, and training.
- **Climate Change Funding Instruments and Resource Transfer.** Resource-constrained developing countries in high-risk climate variability exposure regions will require more innovative long-term funding instruments, capital provisions and training from both public and private sector agencies, including organizations such as the Global Environment Facility (GEF) and the World Bank. OECD governments and Annex 1 parties need to aggressively leverage the work of the GEF and the World Bank’s portfolio of Carbon Funds to fund and create more special facilities for grants, loans, and incentives for adaptation action in developing countries. Using the experience and administrative capacity of these institutions would lower costs for such programs. Private sector involvement should be increased in direct adaptation areas such as sea barrier construction and indirect areas such as climate change data processing and methodology transfer.
- **Global Insurance Fund.** Additionally we assess that there is an urgent need for a global insurance funding mechanism to help the most vulnerable and poor developing nations. Historically developing countries have incurred the largest amount of losses due to extreme

weather events but the majority of these losses are uninsured due to poverty and insufficient insurance availability and affordability. To this extent the special role of the insurance industry as a private sector party in the global adaptation effort must be highlighted given the large amounts of capital capacity that will be required of this industry sector.

Caiteur Group appreciates the opportunity to provide this response to your call for input into the Economics of Climate Change Review. We would be pleased to discuss our views in further detail with you and the review team if that was considered useful.

Respectfully submitted,

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¹ Jackson, Robert B., Jobbagy, Esteban G., *et al.*, (2005): *Trading Water for Carbon with Biological Carbon Sequestration*. *Science* magazine, December 23 2005 issue, <http://www.sciencemag.org>

² UNFCCC CDM data as at March 2006 from UNFCCC website, <http://unfccc.int>

³ Hoyte, P. and Johnson, J. (2005): *Line of Inquiry 4: Climate Change Adaptation, Caiteur Group's Response to Canadian Government's UNFCCC COP-11 Line of Inquiry*, http://www.climatechangeinstitute.com/policy_contributions.html

⁴ Hoyte, P. and Johnson, J. (2006): *Caiteur Group's Response to the U.S. Senate Committee on Energy and Natural Resource on the Design Elements of a Mandatory Market-based GHG Regulatory System White Paper by Sen. Pete V. Domenici and Sen. Jeff Bingaman*, http://www.climatechangeinstitute.com/congressional_activity.html