

EXTREME CLIMATIC EVENTS IN JAPAN AND THE ECONOMIC BENEFITS OF PROMOTING GREEN ELECTRICITY

MIGUEL ESTEBAN¹; QI ZHANG²; ALEXANDROS GASPARATOS³; PER STROMBERG⁴; GORKA LONGARTE-GALNARES⁵

1.WASEDA UNIVERSITY; 2.KYOTO UNIVERSITY; 3.OXFORD UNIVERSITY; 4.NATURVARDsverket; 5.NON-AFFILIATED.

Abstract:

Global warming is likely to profoundly influence future weather patterns, and one consequence of this is the likelihood of an increase in typhoon intensity. Meanwhile there is increasing international consensus on the need to mitigate climate change with the energy production sector having been identified as a key target sector.

This paper presents a cost-benefit analysis of introducing significant amounts of green energy components (solar, wind, hydro and biomass) in the Japanese electricity system in the light of the economic damage that an increase in tropical cyclone intensity could have on GDP growth between 2010 and 2085. Essentially the passage of a tropical cyclone will result not only in physical damage but also on a decrease in productivity due to precautionary cessation of the economic activity. Such disruptions can affect energy supply in the country having a ripple effect on GDP growth.

A wide variety of scenarios are employed in the model, highlighting different assumptions relating to the future cost of electricity, the influence of the maximum wind intensity of the typhoon, and GDP per capita growth levels for the Japanese economy.

By comparing the economic performance of different electricity system scenarios with the indirect economic damage of tropical cyclones from 2010 to 2085, based on annual economic data of green electricity, fossil fuel, GDP and population, it can be seen that the green electricity systems are generally a cost-effective way of mitigating the effects of these weather systems, despite the large amount of initial investments necessary.

Generally speaking the scenarios where the growth in greenhouse gas emissions is capped at 0.37% per year (cap scenarios) achieve almost the same levels of GDP by 2085 as the Control Scenarios (BAU) where the effect of climate change is ignored and the electricity mix stays the same as at present. Furthermore the cap scenarios greatly outperform the “No Action Scenarios” where climate change is taken into account but the electricity mix remains the same as presently.

The latter finding is quite significant, as it suggests that by 2085 Japan might find itself in the same situation (GDP-wise) whether it chooses to make modest cuts in greenhouse gas emissions or not, if the increased indirect damage of tropical cyclones is taken into account. The present work thus shows that it could be much more cost-efficient for a country such as Japan to enter into a binding international treaty on greenhouse gas emissions, and face an increased cost in the price of electricity in the immediate future, than face the consequences of inaction. Of course, the outcome of this calculation assumes that all countries would be acting together, and that there would be no “free-riders” in the system, which would destroy any incentive for Japan to enter into such a treaty.