Name and Student ID: _____

Due 25 Nov 2014. You can turn in these pages or another printed version.

1. (7 points) The Presidents of China and the US announced an agreement to reduce GHG emissions (http://tinyurl.com/padvb5r). Such an agreement may represent a break from the "tragedy of the commons" path that those nations were taking with respect to international action to address climate change.

   (a) (3 points) Describe how and why those nations' carbon policies affect *policies in other countries*, using statistics for China, US and global GHG emissions for 2013 (or most recent year) and defector-reciprocator-cooperator vocabulary. Why might China and the US have a different impact from the EU's impact on the behavior of other countries?

   Solution: In 2012, according to UNFCC, the EU (28) had GHG emissions of 4,240MT (Million Tons) CO_{2e}. The US had 5,546MT, China had 7,045MT (2005), and the World had 34,081MT. Easier to compare 2010 numbers from Wikipedia are EU (28) at 4,663MT, China at 9,679 MT, US at 6,668MT and World at 42,669MT.

   The EU's share (11%) is smaller than shares of the US (16%) and China (23%). The magnitude of US-China emissions means they are important to talks, treaties and actions on climate change. US-China policies affect other countries by undermining (no policy) or augmenting (low carbon policy) those countries' policies. If the EU cooperates (lowering carbon into the world's commons), but the US and China defect, then the EU's actions are useless but expensive.

   Action from the US and China, given the EU's current policies, can have a strong influence on others' attitudes and policies, as they would swing "actors" from 11% of emissions to 50%. That swing is not just important in terms of leadership; it raises the probability that humans can successfully decarbonize and thus slow (or reverse!) climate change.

   NB: There's no current sign of slowing, let alone a reverse, but it's still possible, with a HUGE shift in public and government attitudes.

   (b) (2 points) Some observers (e.g., http://tinyurl.com/nqomx6l) note that neither President can "deliver" his country very easily. Describe the simple game (two President prisoner's dilemma) and then describe the prisoner's dilemma that each President is playing with his domestic political allies/rivals. In both cases, you will need to identify current costs and future benefits to cooperation. Optional: Use 2x2 payoff matrices, but explain payoffs and actions *very* clearly.

   Solution: The two presidents are not really in a prisoner's dilemma because they can talk, make intermediate promises and actions, and observe each other; see 1(c). On the other hand, they can "shake hands" on an action but fail to make any progress, due to real (or faked) opposition at home from Congress (US) and GDP-chasing regional governors (China).

   It's clear that cooperate, cooperate is best for both, in terms of future damage from climate change, but some would claim there's a short-run (upto 20 years) advantage to the country that burns cheap energy while the other does not. This claim doesn't make too much sense from a social perspective (most consumers could absorb price increases), but it's clear that each country's energy and business sectors would want

cheap energy to make profits domestically and abroad, respectively. Those short-term considerations would be overwhelmed by a cost-benefit analysis that included the predicted impacts of climate change by 2050.

(c) (2 points) It's clear that these games are neither simultaneous nor one-shot. How do those characteristics make it easier to design mechanisms to reach a (cooperate, cooperate) equilibrium? Suggest two mechanisms.

Solution: Designs: I-move-you-move (tit-for-tat) actions to gradually decrease carbon outputs. Incremental agreements to hit targets, then discuss next actions. Pledge to use carbon tax revenues (or cap and trade revenues) on domestic spending, rather than giving away carbon permits or spending money to keep carbon-intensive industries alive. A change in accounting, so that countries were "responsible" for half their production carbon (helping the US) and half their consumption carbon (helping China); see Question (2).

2. (3 points) EU biofuel policies give subsidies and/or low-carbon status to energy generated from wood or biomass; see, respectively, http://tinyurl.com/cdugm5l and http://tinyurl.com/oe769uw.

Discuss the costs and benefits of EU polices on carbon emissions on an EU and global scale. Pay special attention to the differences between "producing" and "consuming" carbon (see this http://tinyurl.com/q6nc8b4), and discuss if the EU is offshoring pollution (http://tinyurl.com/noyqpe9), using common pool resource vocabulary.

Solution: NB: I meant " discuss EU polices on WOOD OR BIOFUEL carbon emissions," but I left out wood and biofuel.

Generally, the EU's policies cost citizens money and disrupt the energy-system. Job creation is not necessarily a benefit. Lower carbon emissions are good for the World, but not necessarily the EU (while it's alone in reducing carbon), especially as local pollutants (SO_x, PM2.5, etc.) are bigger worries. When it comes to biofuels, there are additional negative externalities, i.e., biofuel-driven land diversions that cause deforestation (virgin land) or higher food prices (former crop land). Even worse, biofuels (and definitely wood) brought to the EU may not be carbon-neutral if fossil fuels are used to process or transport it.

The EU "produces" less carbon than it consumes, due to its import of products whose production releases carbon outside the EU. This "offshoring" means that the EU may not be helping the world with its low-carbon policies, which are really just displacing – rather than reducing – carbon emissions to another part of the world that is part of the same "commons."