Reducing carbon emissions: some choices

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Background: The accompanying resource on "Stabilization Wedges[1]" introduces a methodology for reducing carbon emissions over the next 50 years using existing technologies which has been developed by Robert Socolow and Steve Pacala, Princeton, Co-Directors of the Carbon Mitigation Initiative[2].

Overview and motivation for this exercise: This activity (the Stabilisation Wedges Game) has been developed by Roberta Hotinski of the Carbon Mitigation Initiative, Princeton. By considering various existing technological options available for reducing CO_2 emissions, students will develop some understanding of the scale of the carbon mitigation challenge and the trade-offs involved in planning climate policy.

In examining the possibilities, they will have to practice several transferable skills including communication and presentation skills, teamwork and critical thinking. There is no "right answer" in the stabilization wedge game and creativity is also encouraged by asking students to come up with alternative strategies.

General and Specific Resources: The ImpEE resource on the Stabilisation Wedges[1] provides an overview of the stabilisation wedges concept.

The stabilization wedges concept is described in detail on the website of the Carbon Mitigation Initiative[2] at Princeton. This includes full details of how to play the Stabilization Wedges Game.

The ImpEE resource on Stabilisation Wedges is based on the paper by S Pascala and R Socolow[3] and a presentation made by Roberta Hotinski, Princeton Environmental Institute.

Suggested Activity: The "Stabilization Wedges Game" is a team based activity, details of which are given in the pdf appended to this document, or from the Carbon Mitigation Initiative website[4].

Students are asked to collate a portfolio of 'stabilization strategies' to avoid a doubling of atmospheric carbon dioxide over pre-industrial levels in the next 50 years, and assess their impacts and costs.

Each team is judged on its ability to defend its portfolio of strategies in a 5 min oral report, considering both capacity constraints and social (political and economic) impacts of each technology. The team with the highest scoring stabilization triangle wins.

Links:

1. "Stabilisation Wedges", ImpEE Resource, http://www-g.eng.cam.ac.uk/impee/?section=topics&topic=stabilisationwedges
2. Carbon Mitigation Initiative, hosted at Princeton University, http://www.princeton.edu/~cmi/resources/stabwedge.htm

3. "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies", Science, 13 August 2004, Vol. 305, No. 5686, pp 968-972. Available on-line at:

http://www.sciencemag.org/cgi/content/full305/5686/968?ijkey=K6cRPbiYRFwus&keytype=ref&siteid=sci

4. "The Stabilization Triangle: Tackling the Carbon and Climate Problem With Today's Technologies", Carbon Mitigation Initiative, Princeton Environmental Institute, Princeton University. Available on-line at:

http://www.princeton.edu/~cmi/resources/CMI_Resources_new_files/Wedges_Concept_Game_Materials_2005.pdf

Transferable Skills:

(The numbers after each transferable skill refer to the CDIO Syllabus available on-line at http://www.cdio.org)

Analysis with Uncertainty (2.1.4) All the wedge strategies presented are based on a number of assumptions. Full details of the assumptions made are given, but nothing is hard fact. Although this is reflective of the real world, it is quite different from what is done in the standard curriculum so many students feel uncomfortable. Teams should consider whether the assumptions made are reasonable.

System Thinking (2.3) A strategy for mitigation of CO_2 emissions must involve system thinking: social and technical context of each strategy, prioritization and focus, trade-offs, judgement and balance of various factors.

Critical Thinking (2.4.4) This aspect includes the statement of the problem, logical arguments and solutions, supporting evidence, contradictory perspectives, theories and facts, logical fallacies hypotheses and conclusions. Students should be encouraged to test the given 'wedges' and not simply take them at face value.

Oral Presentation and Inter-Personal Communications (3.2.6) Each team is required to give a 5 minute oral report on the reasoning behind their choices and is judged on its ability to defend its portfolio of strategies, considering both capacity constraints and social (political and economic) impacts of each technology. This involves making judgments on which aspects to concentrate on and to communicate a complex topic in a short time.

Contemporary Issues and Values (4.1.5) The choice of each stabilization wedge involves a consideration of contemporary issues and values. Is it appropriate to ask people to drive less or choose more fuel efficient cars? Is the choice of nuclear power acceptable to society and governments?

Developing a Global Perspective (4.1.6) CO_2 emissions is a global problem, and even if strategies are being developed or a single country, these should not be considered without reference to the wider world.

ESD Skills Developed:

Each of the strategies involves a consideration of economics and societal issues as well as environmental. This is an essential feature of the choices made. Thus engineering for sustainable development is an essential feature of this exercise.