T5: Tackle the Task of a Transition through Technological Targets

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ABSTRACT

This article provides a technology-based quantitative tool for the sharing of hypotheses, scenarios, political applications, and didactic strategies related to planning, developing, managing, using and evaluating technological targets towards climate protection and global sustainability in academia, administration, education and policy consulting. This article illustrates a problem-based educational technique and dialogic use of technology in education. The approach is to produce an improved scientific basis for the implementation of climate protection targets by assessing trends of energy-related CO₂ emissions for each country. The complete logical chain of cause and effect "socio-economic driving forces => CO₂ emissions => CO₂ concentration => global carbon cycle => resulting climate change => necessary measures to be taken" is used as an educational basis for advocating the global necessity and potential technological feasibility of CO₂ reduction. Global structural transitions can make use of intrinsic saturation effects detected by the proposed educational tool. By technologically oriented university classes, a set of CO₂ abatement measures can be identified and assessed by the analysis of intrinsic societal, economic, energy-related and technological trends and the systemic transitions proposed by such analysis. In educational and technological practice, students can undertake a detailed analysis of the energy system of any country by means of a dynamics-as-usual case as baseline for measures and a historical long-term trend analysis of the structural change in socio-economic and energy parameters.

Keywords: Climate Protection, CO₂ Emissions, Discourse, Economic Trends, Education, Foresight, Global Change Data Base, Policy Making, Scenarios, Technology, Trend Analysis

1. OBJECTIVES

This article designs an educational tool for assessing the drivers of climate change.

1.1. The Aim

This endeavour aims at integratively assessing the relative importance of long-term technosocio-economic developments driving global climate change. We ask: Which megatrends help and which megatrends hinder sustainable development?

The results of an interdisciplinary analysis of long-term trends are intended to improve factual understanding and to rank the anthropogenic causes of environmental change in order to help in the formulation of consistent environmental policies, in particular CO₂ abatement measures on global and national levels (Figure 1).

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The core of the analysis resides in quantitatively identifying and comparing the “techno-socio-economic causes of environmental change”. Scenarios for the emissions of greenhouse gases (mainly CO₂ from energy systems and also from land use change) are generated and the impact of the respective techno-socio-economic driving forces is assessed. Over 2500 data sets of relevant parameters will describe the developments of recent decades for every country across the globe.

1.2. Issues and State of the Art

Given the scientific and public increase in concern about global warming, policy makers have made several steps in the direction of cutting back greenhouse gas emissions (mainly of CO₂) in various documents, globally comprised in the UNFCCC procedures (UNFCCC, 2015). Recent literature (Weizsäcker et al., 1995; 2009) enumerates practical technological possibilities for reaching such necessary and envisaged targets. In order to strengthen the scientific basis for choosing appropriate, feasible and effective measures, the key linkages and feedbacks between human activities and behaviour – and significant environmental changes – are to be identified and evaluated by an interactive IT approach and evaluated in dialogue.

1.3. The Main Five Elements of the Train of Thought

The character of this entire endeavour (symbolised by the five letters “T” in Figure 2 representing the five learning subtasks) is truly transdisciplinary: societal, economic, technological and natural scientific aspects serve as a means for enhancing implementation of a complex political target like CO₂ emission reduction (Ahamer, 1998: 106). The following thread leads from causes to effects of climate change:

1. **CO₂ emission**: On both global and national levels, a dynamics-as-usual case of energy scenarios (Ahamer, 1994; Ahamer & Mayer, 2013; 2014) as the baseline for measures can be constructed by means of a historical long-term trend analysis of the structural change in the socio-economic and energy parameters of the world’s economies;

2. **Macroeconomics**: Views on the economic side-effects of reduction measures such as changes in GDP growth or in unemployment rates (Rauch, 2013; 2014) are provided, analysed by means of a macroeconomic model and complemented by qualitative assessment;

3. **Social processes**: When designing CO₂ abatement measures, the different views and patterns of values are harmonised during negotiation processes (Ahamer, 2012; Ahamer & Jekel, 2010; Chumakov, 2014; Sayamov, 2013, Matzenberger, 2013) between different institutions and regional aggregates;

4. **Carbon cycle**: The effects of CO₂ emissions, especially from land use change, on
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