Decoupling – past trends and prospects for the future

A REPORT FOR THE SWEDISH ENVIRONMENTAL ADVISORY COUNCIL

1 Decoupling economic growth from environmental impact

Economic growth often implies increased use of energy and materials in society, which in turn gives rise to environmental degradation through emissions and pressure on ecosystems. Material flows influence the environment from the time a material is extracted, through processing, manufacturing and use, to its ulitmate disposal as waste. It is therefore important to find ways of decoupling economic growth from environmental impact.

There are three main limitations on the use of energy and materials:

- Human health and the capacity of the ecosphere to assimilate different materials set limits for the acceptable emissions of various pollutants.
- The availability of fertile land and requirements for ecosystem integrity will limit the management options, potential harvest and societal intake of various bio-resources.
- The limited availability of non-renewable geological resources implies restrictions on possible extraction scenarios for these resources.

2 Energy

Despite a decrease in the use of energy per unit of GDP the total use of energy has increased. Energy intensity fell more rapidly following the oil crises in the 70s and the 80s than during the 90s. Energy intensities are falling as a consequence of energy efficiency improvements and structural changes in many economies, with the service sector becoming increasingly important. This tends to be counteracted, however, by rapid increases in transportation volumes and electricity use driven by continued income growth.

The total use of primary energy was roughly 50 per cent higher in 1999 than in 1971 in OECD-countries.

ANNUAL CHANGE 1960–1998

	Energy supply	Energy supply/GDP
EU	2.6%/yr	-0,4 %/yr
Japan	4.8 %/yr	-0.2 %/yr
U.S.A	2.0 %/yr	-1,0 %/yr

Prospects Present, primary energy supply per capita in the EU, Japan and the US is 160, 170 and 348 GJ/cap/yr, respectively. Let us assume that increased income levels combined with energy efficiency improvements will bring the primary energy supply to an average of 100 GJ/cap/yr over the entire world by the year 2100. With a global population of 10 billion people, this will give us a total primary energy supply roughly 2.5 times higher than its current global level.

3 CO_2

There has been some decoupling of CO_2 emissions from GDP but absolute emissions have increased. Some countries have experienced periods of constant or even falling absolute emissions, but this is the exception rather than the rule, and it has in most cases been triggered by oil crises or economic recessions. The drop in CO_2 intensity has been prompted by both decoupling of energy from GDP and CO_2 decoupling from energy (a result of an increased use of natural gas and nuclear power). In most developing countries fossil CO_2 per energy tends to increase from rather low levels. With industrialization, the proportion of fossil energy in the total energy supply mix rises.

ANNUAL CHANGE 1960–1998

	CO_2 emissions	CO_2 emissions/GDP
EU	1.8 %/yr	-1.2 %/yr
Japan	4.2 %/yr	-0.9 %/yr
U.S.A	1.6 %/yr	-1,4 %/yr

Prospects Stabilizing atmospheric concentrations of CO_2 at 450 ppm (corresponding to the Swedish target) would require carbon emissions to fall to 4 gC/MJ primary energy supply by the year 2100. This can be compared to fossil fuels which give rise to carbon emissions corresponding to 15, 20 and 25 gC/MJ for natural gas, oil and coal, respectively. Thus, a major restructuring of the global energy system is required.

4 Materials

Concerning the over all use of materials, there is no clear tendency towards an increase or decrease. This means that economic growth is roughly cancelled out by a decrease in materials intensity. For single groups of materials, the tendency varies substantially relative to GDP. The use of plastics and aluminium, for example, has increased faster than GDP for several decades, while the use of paper has increased more or less at the same rate and iron and steel use has increased more slowly. The accumulated stock of materials in society is still growing, mainly due to expansion in building volumes and infrastructure. A large proportion of the materials taken into society is, however, not added to the stock, but is used dissipatively (e.g. biomass in agriculture, energy fuels and chemicals).

Prospects It is reasonable to assume that societies will be more saturated with materials in the future and that the share of recycled materials will increase. An important question for the future is: How can the material flow quality of recycled materials be safeguarded? We have to be prepared to handle big volumes of recycled materials effectively and to introduce well-functioning material labeling systems and standards, which can help to avoid unwanted mixing and therefore facilitate the management of the material flow quality.

5 Emissions, chemicals and wastes

The flows to air and water of emissions detrimental to health and the environment, such as sulphur dioxide, particulates and CFCs, have in many cases been considerably reduced in industrialized countries. In particular, emissions from the production system (factories, chemical plants, etc.) have decreased. Consumption emissions are, on the other hand, still increasing for many materials and can often be traced back to certain specific uses. An example of this is emissions of copper which predominantly emanate from brake linings and the tap water system. As regards **hazardous chemicals and waste**, we see no tendency towards decreasing volumes. They are increasing somewhat faster than GDP.

Prospects The increasing amount of hazardous chemicals will be of great concern in the future. Both chemicals that are used dissipatively and chemicals leaking from the still growing material stock in society, have to be focused. Better statistics and strategies for action are urgently needed. A policy for tackling this might be an “acupunctural strategy” giving priority to the most problematic leakages. In spite of higher fees for waste disposal and other measures such as producer responsibility, volumes are still increasing. Further policies are needed to come to grips with this problem.

6 Policy recommendations

- **Focus should be on trends in absolute terms** as long as GDP grows faster than the impact-to-GDP ratio drops.
- **Policy-makers should focus on the key areas of concern** (e.g. emissions of metals and persistent chemicals, CO_2 and acidifying substances) rather than on a general decoupling.
- **Equity and land use policies might be required** if bio-productive areas become more scarce as the demand for food and biomass increases.

We cannot expect economic growth to solve environmental problems automatically. Sometimes environmental impact is reduced in line with economic development. Such correlation could imply that economic growth automatically leads to reductions in environmental impact. In reality, improvements are generally a consequence of specific environmental policies. Solutions to environmental problems are often triggered by societal debates and regulation, e.g. the strong interest in fuel cells that existing and foreseen legislation in California has prompted. Thus policies are required and these should include:

- price incentives (higher prices on emissions via taxes or permit trade systems)
- technology development incentives (R&D and niche markets)
- regulatory measures (energy efficiency, emissions standards)

There are prospects for continued economic growth in developed countries and for a very rapid growth in many developing countries with high populations. This will lead to increased pressure on ecosystems and to emissions detrimental to human health unless we can decouple economic growth from environmental degradation.

The Environmental Advisory Council of the Swedish Government has invited scientists at Chalmers University of Technology to draw up a synthesis report on decoupling. Their report, ***Decoupling – past trends and prospects for the future***, summarizes key trends for energy and material use over time in some major developing and developed countries. This brochure presents some of the main findings in their report.

The report and the brochure are available at **www.mvb.gov.se**, or can be ordered from:

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