

## Environmental Technological Change: The Czech Republic

R&D and fast market diffusion of resource-efficient technologies will be important contributors to sustainable development transitions. This MATISSE case study focused on the transition of economies in connection with the adoption of technology. Starting from a more general development pathway examined in the first iteration of this ISA case study, a possible introduction of environmental tax reform was the focus of the second iteration. Besides analysis on the European scale, the case study focused in particular on the Czech Republic.

The use of fiscal measures to stimulate change away from environmentally-damaging behaviour is already well-established. In contrast to environmental taxes the practice of environmental tax reform (ETR), in which the overall tax burden remains unchanged but taxes are re-structured (for example to be higher on resource use and waste generation and to be lower on employment and income), is less widespread. To date the focus of implementing environmental taxes has been most common in the areas of energy and transport followed by waste and water. Taxes are applied in some countries in other limited areas, such as pesticides and fertilisers, packaging, resources, and chemical waste.

### What was done?

Although starting the analysis on the scale of EU-25, this case study focused on the Czech

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Republic and the process involved several meetings with stakeholders in this country. Initial work and discussions aimed at providing stakeholders with information on underlying trends and indicative impacts that technology might be able to achieve in relation to sustainable development. An alternative development scenario was designed and implemented in E3ME, a multinational dynamic model of the EU-25 (further information on E3ME can be found at: [www.e3me.com](http://www.e3me.com)).

Comparing the outcome of the scenario with that of the MATISSE baseline provided an initial indication to the stakeholders of the extent to which investment in technology (in a broad sense) can contribute to their vision of a sustainable future.

The scenario developed fulfilled an important role in providing an initial quantification of underlying trends and possible impacts, which helped to focus areas of concern and possible

development paths. The discussions with stakeholders reinforced their emphasis on material use (and the potential to produce absolute dematerialisation in the future) and social sustainability (especially reducing, rather than increasing, the well-being differential between the urban and rural areas), as important for sustainable development.

To provide more focus on potential drivers of change the discussions with stakeholders suggested that a scenario exploring the effects of an ecological tax reform (ETR) would be of interest. This coincided with the topic of ETR returning to the centre of the political debate in the Czech Republic.

The impact of the proposed development pathway was modelled through a series of sequential scenarios, each of which examined the effects of a particular driver for change in the context of other changes that have been modelled. The scenario analysis used E3ME.

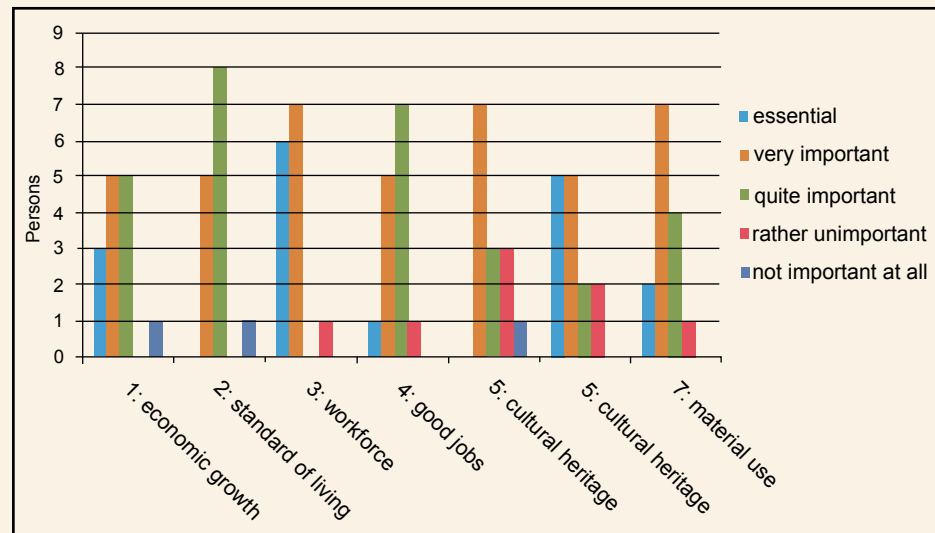
In summary these scenarios involved

- the introduction of a revenue-neutral carbon levy on energy throughout the EU-25;
- increases in business R&D (stimulated by the increased cost of energy); and
- improved material use efficiency.

### A Vision for the Czech Republic

The pathway for the Czech Republic is built on the assumption that it actively embraces environmental tax reform as a means to limit the potential environmental impact of future economic growth. It is keen to achieve far-reaching efficiencies in resource use and for efficiencies to be improved in many economic sectors. The push for more active policies in this area results from the desire to encourage competitive businesses and environmental responsibility, but also from a belief that more far-reaching environmental tax reform will, in time, become the norm within the EU and that by being at the forefront of the movement, the Czech Republic will achieve longer-term benefits for the economy.

Specifically, the vision for the Czech Republic focuses on reduced demand both for non-renewable raw materials (from all sources), and for commodities that have high environmental costs (whether associated with their production or use). Therefore, in addition to implementing taxes on energy in an attempt to reduce demand and promote the uptake of energy-efficient production techniques, the Czech Republic also introduces a materials input tax on the use of certain raw materials and a materials tax on the use of key manufactured commodities by certain sectors that are environmentally-damaging, where the environmental burden relates to more than the sourcing of its material



The participants of the third workshop in Prague were asked to rank seven elements of the Czech sustainability vision according to how important they seem to them. The results are shown in this figure.

inputs or the (potentially) high use of energy in its manufacture.

The issues relating to the introduction of ETR to areas other than energy are expanded on in more detail below.

### Results of ETR Scenario Modelling

The first scenario included a levy from 2008 as a flat rate charge on the carbon content of fuels. The levy is set at 200 euros per tonne of carbon (55 euros per tonne of CO<sub>2</sub>). The purpose of the levy is twofold: to raise the price of energy and thereby encourage improved efficiency in its use, and to encourage users to switch to less carbon-intensive sources of energy. The levy is assumed to be revenue-neutral for each country, with the revenues raised matched by an offsetting reduction on social security payments by employers.

The impact of the levy and revenue recycling is to raise GDP in the EU-25, though the overall impact is relatively small (by 2030 GDP is around 0.5 percent higher than in the baseline projection). The impact is greater within the EU-10 than EU-15. The overall impact on employment is positive, though as with the impact on GDP it is relatively small (0.5 percent, 1.2m people in EU-25 by 2030), and the largest relative impact is within the EU-10. All countries (with the exception of a couple of the smaller EU-10) see positive employment effects. The overall

demand for energy in EU-25 is almost 10 percent lower in 2020 and 15 percent lower in 2030. The reductions are slightly stronger in the EU-10 than the EU-15.

The second scenario assumed that introducing a carbon levy indirectly makes businesses raise the level of their R&D efforts. This would be in an attempt to lower their own costs by improving their processes, as well as to improve the energy-efficiency characteristics of the products they produce. For the EU as a whole it means that business R&D spending would represent around 2.5 percent of GDP. As a result, R&D is some 40 percent higher than in the baseline scenario in both 2020 and 2030.

The overall impact of the additional R&D is to raise GDP in EU-25 by 2.5 percent by 2030. The largest relative impact is in the EU-10, where GDP is around 5-5.5 percent higher. The employment impact amounts to 1 percent (some 2.7m jobs) by 2030. Most of these net additional jobs are created in the EU-15. There is a relatively quick impact on energy use, with energy use in the EU-25 10 percent lower by 2010 as a result of the additional R&D.

The earlier scenarios have shown that while

	Energy tax	Increased R&D	Material efficiency	Total
GDP	1.0	7.0	-0.6	-7.5
Employment	7.0	2.0	-3.9	-1.3
Energy	-10.7	-5.7	-2.9	-28.8
GHGs	-16.7	-7.1	-3.2	-25.6
Material use (TMR)	-0.9	1.5	-6.6	-6.1

Summary of scenario impacts: Czech Republic, in % of baseline in 2020

a focus on raising the cost of energy, or on improving the energy efficiency of production can have a favourable impact on the material intensity of an economy, it does so in a limited way. This is typically either by reducing the extraction/use of energy products (coal, oil) or by focusing additional growth on the less resource-intensive parts of the economy. There is little impact on the more general resource use and requirements of the economy.

In the third scenario it is assumed that an additional indirect benefit from the introduction of the carbon levy, and the focus this gives to using the energy resource effectively, is that it focuses attention on the efficient use of all resources. This results in a variant on the so-called 'Aachen scenario' occurring, where manufacturing and construction sectors achieve a 20 percent reduction in material input costs through the widespread implementation of currently-known technologies and best practices by 2015 (i.e. achieving efficiency improvements of 2.2 percent per year).

In this scenario, GDP in the EU-25 is lower than in the absence of the stronger resource efficiency trends, by around 3 percent by 2015 (the year in which the main additional resource savings are achieved) and by around 2.25 percent in the long term. In the short term, the impact is mainly felt in the EU-15, the economies that will be supplying most of the manufactured inputs for which demand is being reduced as a consequence of the improvements in resource efficiency. There are important differences in the impact that the scenario has on different indicators of economic output. While the impact on GDP is negative there is a positive impact on value-added. The impact on GDP varies greatly by industry and thus by country. Many countries in the EU-10 see a positive GDP impact. As a result of the lower levels of economic output (as against value-added) in the EU-25 in the scenario, the use of energy is lowered by 5-6 percent from 2015.

The table on the previous page summarises the impact of the scenarios on the Czech Republic in terms of several 'headline' indicators of sustainable development. Together, the measures result in a higher level of economic output, though slightly lower employment, and reduced levels of energy demand, GHG emissions and resource use.

### Tensions

There are important issues and potential tensions for sustainable development raised by each of the scenarios considered. Concerning material use, it was shown, for example, that improved resource efficiency can result in lower output but higher value-added, that the scale of impact on material use can reduce over time, and that higher R&D will not necessarily lower overall material use. The distribution of impacts varies within the economy (for example, between sectors) and between economies, which may lead to difficulties in getting such policies as have been considered widely accepted unless they are a part of a broader policy package. For example, economies are significantly affected

if they have a dominance of manufacturing, while there is generally limited impact on public services. Equally the impact on an industry can vary between countries as policies have an impact on the relative competitive position of sectors between countries. Specific focus may be needed to increase the likelihood that such policies will lead to socially sustainable growth. Overall, a net increase in employment is not guaranteed. This, also, suggests that a broader package of measures may be needed.

### Further Reading

Barker, A., Bohunovsky, L. et al. (forthcoming). Using Environmental Tax Reform to Support Sustainable Development in Transition Economies: the case for the Czech Republic. MATISSE Working Paper 19. Available at: [www.matisse-project.net](http://www.matisse-project.net)



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