Faculty of Economics, University of Technology in Košice
Faculty of Law, University of Pavol Jozef Šafárik
Slovak republic

Natural resources – towards sustainable use
(essay)

František Lipták

February 2008

Sustainable use of natural resources

Mankind has experienced robust economic and population expansion during last two centuries. Industrial development and rise in the life level expectancy were accompanied by increasing consumption of natural resources. It did not take much time for people to imagine possible consequences of growth by running out of its fundamentals.

History of debate over sustainability issue

There is to say that historically first roots of thought concerning sustainable use of natural resources could be traced back to era far before the industrial revolution, to of 16th century, when people firstly expressed their views on sustainability of resource use in the area of forestry, claiming that overexploitation will lead to total deforestification in England[1].

But the very first famous contemplations on scarcity vs. growth issue were made by classic economist T. Malthus (1798), arguing in marginalist style of productivity, population and food supply growth functions, claiming that population growth is unsustainable according to food resource limitations.

In addition to that, there also existed views, as presented by utilitarian and classic economist Jevons, who claimed that overexploitation of limited resources and running out of coal will lead to social turmoil and total decomposition of industrial structures according to phenomenon of massive coal consumption during industrial revolution in Great Britain[2].

On the contrary to previous theories, it is crucial to emphasize factor of technological change, which increases resource use efficiency. Technological inventions are more expensive and less efficient in the beginning, but as research continues, it brings newer technologies, which tend to increase efficiency of natural resource use. Technologies also contribute to solution of scarcity problem over time and offer substitutes to conventional natural exhaustible resources. Solutions to scarcity problems arrive, when there are incentives to provide solutions. If natural resource supplies are being still less abundant and being more exhausted, shortage is being reflected through price mechanism and signaling to economic agents, who use these resources. Signals create incentives for development of new technologies. Costs for development and transition to new technological platform imply growing fixed cost on technologies and costs concerning research, but only to some point. After a threshold when basic problem is solved, additional research adds only to cost decline over time by contributions to utilizing already existing technologies. If we tried to graphically describe this phenomenon, it would be most probably graph of decreasing function composed of inverted U curves.

Although previous arguments were not without some merit, this one is clearly consistent with empirical evidence. England did not run out of woods, but used coal as substitute Industrial countries did not run out of coal, because of replacement by oil. There exists hypothesis, that the oil will be replaced by different technological solution, which will determine energetic sustainability for following periods.

Another variable which makes this problem more complex is the time dimension. What if the signaling process was imperfect or failed for some reason in time? Is there possibility to get in some kind of “technological transition trap”, if the price for using conventional resources

would be high and growing and remaining supplies would be insufficient, while technological development of new technological solutions would be in first phases and thus expensive to far to be implemented in daily use?

Challenges for technological research and economic policy

Next significant problem concerning transition to relatively unlimited renewable and cleaner energy supplies is that newer technologies were for a long time less competitive in prices. Relatively long and stable price of oil created disincentives to investments in alternative sources of energy. After oil shocks in 1970´s, Gulf war, war in Iraq and other factors including growing energy demand from India and China, price of oil increased over $92 per barrel, offering sufficient space for other alternative sources of energy. For instance [3], sugar cane based ethanol is already competitive with gasoline. Natural gas seems to be relatively cheap substitute, at $30 per oil barrel equivalent, although it is not absolutely clean. Coal to liquid equivalent is also promising at $35-40 per oil barrel equivalent. Coal supplies, at current technological level, can cover world consumption for following 180 years, although research concerning CO_2 compression (elimination of possible impact on global warming) did not yet bring technology to solve this problem. Biodiesel is interesting alternative, tough rising moral issue. Being competitive at $45-60 per oil barrel equivalent, burning food would be unacceptable, while people in other parts of the world are suffering from starvation. Energetic source which could decrease carbon emissions to zero is hydrogen. Resources for hydrogen extraction are practically unlimited, but it becomes economically efficient when prices of broadly established oil cross $90. There exist also other cheap technologies with various degree of pollution, but how should the application look like?

Almost two-thirds of recent global growth in oil demand has come from China and other economies with lower per capita national income. While world oil production is expected to increase 30 percent by 2030 [4], there is to note that total production will have to be adjusted in structure in favor of alternative energy, because of other backside effects – externalities – related to possible adverse impacts and risks of global warming.

We have to underline implementing clean technologies is crucial in developing economies, because if they built up their energy sectors on principles of low cost and polluting plants, it would be hardly replaceable by clean and sustainable technologies, seeing obstacles in transition to cleaner technologies referring to high- income countries. Transition costs would be immense and countries without higher per capita incomes would not spend their expenditures on other than basic and primary problems [5], handling environmental issue as one of secondary tasks somewhere in future. Huge expansion of polluting energy sector in next 30 years would also be the environmental thread for the rest of the world; it would be environmentally hazardous and unsustainable.

In this process, richer countries and international institutions should support the transfer of clean technologies to developing countries; international institutions should prevent investors from policy risks and assist in building transmission infrastructure; investors will not be willing to undertake building up great plants and be involved in such extensive projects based on uncertain processes. This indicates substantial public subsidies to support the emergence of clean energy sector[6].

In our eyes, governments should impose as low taxes as possible on clean sources of energy. Tax breaks motivate investor entrepreneurial activities and innovations in emerging sector.

Transition to diversificated energy sectors and building it up on clean principles could be less painful and more motivating.

The most significant challenge for economic policy is to create incentives and change preferences to natural resource sustainability. Tax policy is one of possible approaches. This is not always, but in general most certain way to change preferences of individuals, because effectiveness of this policy depends upon elasticity of demand and varies according to features of markets. Taxes which should internalize negative externalities are imminent part of philosophy of social regulation coming from welfare economics presented by professor Pigou. Let us say, that elasticity of price demand is relatively low, then, higher prices may occur after imposing tax but high dependence on resource does not offer sudden response in change of consumption pattern. Tax burden creates economic distortions in short term with neglible impact on consumption. Econometric research demonstrates, that in next period, price elasticity changes to (-0,3 to -0,6) because of substitutes involvement. Other recent studies measured price elasticity of energies in long-term and found it to be -0,8 and -1,1 for total consumption by households, - 1 for fuels[7]. This means that tax policy has substantial influence on consumption patterns in long term and is efficient. Considering opposite extreme, If the demand for of oil, i.e. in California is highly price elastic, then, tax policy has no effect on change of consumer preferences, but on producers, (Elasticity can be also influenced by accessablity, distribution, competition and so on) limiting sector efficiency. Such a tax is not Pigouvian because it does not deal with change of attitudes of polluting consumers. Tax policy should be balanced and used in case of inelastic demand.

Until now, we have not touched the issue of renewable resources.
In this case, economic approach to solving this problem should be similarly based on mechanisms creation, establishing efficient rules. This can be empirically demonstrated on evidence from Finland, where alternative institutional structures and private ownership of forests lead to efficient allocation of scarce wood resources and also to persistent and stable expansion of woods area since 19th century[8].

Alternative mechanism for administration of woods in Finland is based on principle of private property, based on intergenerational family ownership of woods. Intergenerational relationship and respect to nature is based on attitudes of individuals who administer woods. Individuals cooperate under 154 associations[9], what creates imperfect form of competition (lowers the number of economic agents and supports coordination) and thus, strengthens bargaining power of individuals, who would otherwise have to compete by lowering prices and extending volume of wood exploitation.
Anecdotal evidence supports this mechanism by results of expanding area of woods in Finland, based on the responsibility of individuals and sound alternative institutional structure. It is win-win strategy. Woods owners yield higher revenues and invest it in woods development. Contract frequencies of exploitation are limited and offset by higher prices provided by associations and partly by governmental subsidies.

Conclusion

Natural resources are very interesting interdisciplinary issue, but because of limited space we have, it was almost impossible to discuss all important questions. Sustainability of natural resources should be key priority today, to avoid international conflicts in future and promote peace across the world.

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