

**Robert U. Ayres: "Natural Science Meets Social Science: Convergence or Chaos?"
June 2005**

Institute for Social Ecology, IFF Vienna (Schottenfeldgasse 29, 1070 Vienna)

Lecture 1 10.06.2005 14h-15h30 SR 6	Quantitative history of technology. Technological change as generalized increase in human capacity to create artificial environments and the efficiency of transformation of natural raw materials into useful materials and products. Discuss measures of distance from equilibrium: temperature, pressure (vacuum), sound and illumination. Measures of information, information content, processing, storage and transmission.
Lecture 2 10.06.2005 16h-17h30 SR 6	Drivers of technology. Technological change as response to crisis: military needs, socio-political changes, resource scarcity, needs(desires) created by technology itself. Historical examples. Patterns of change. The S-curve. The life-cycle. Barriers and breakthroughs. The standard neoclassical view of technology as driver of economic growth: homogeneous, uniform, smoothly increasing, exogenous "manna from heaven". Real world characteristics: fast-slow, life cycle, sector creation, K-wave. Economic incentives to innovate. Usherian (gradual) vs. Schumpeterian (radical) innovations. Risk avoidance vs. risk-seeking behavior. Discussion of general purpose vs. special purpose technologies. Spillover potential.
Lecture 3 17.06.2005 14h-15h30 SR 3	Exergy, Entropy, Information and Self-organization. The economy as a self-organized materials processing system far from (thermodynamic) equilibrium, driven by a flow of solar exergy, both ancient and current. Thermodynamic concepts: energy, exergy, entropy, power, work, efficiency. Waste as lost exergy, increased entropy. Debates: dematerialization; Georgescu-Roegen's catastrophic view. Economic and physical critiques: Scarcity vs. abundance: Paul Ehrlich and the Club of Rome vs Julian Simon and The Economist. Herman Daly vs. Solow-Stiglitz and RFF. The end of the age of oil? Hubbert et al vs. the USGS. Implications.
Lecture 4 17.06.2005 16h-17h30 SR 3	Background theory of environmental economics. Double dividends and low-hanging fruit. Exergy and material flows in the US and global economy. Process technology. The inevitability of waste and pollution. Technology as villain or savior? Is 'zero emissions' a feasible goal? Is dematerialization happening or not? Is it the solution to pollution? What does economic theory have to offer? Will "getting the prices right" solve the problem? Why not?
Lecture 5 24.06.2005 14h-15h30 SR 3	Economic growth: two paradigms. The standard theory, regards materials and energy flows as consequences of growth, driven by exogenous technical change (increasing labor and capital productivity.) What the standard theory doesn't explain. The new theory (REXS) based on positive feedback cycle. Increasing consumption of materials/exergy as a co-driver of economic growth. Technological change as increasing efficiency of conversion of raw materials into finished materials and useful physical work (cite Lectures 1,3). Production functions. Results.
Lecture 6 24.06.2005 16h-17h30 SR 3	The future. Implications of REXS. Why the US economy will probably slow down, even if there is no energy resource scarcity. Policy implications.