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Renewable energy: GIS-based mapping and modelling of potentials and demand

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Worldwide demand of energy is growing and will continue to do so for the next decades to come. IEA has estimated that global primary energy demand will increase by 40 - 50% from 2003 to 2030 (IEA, 2005) depending on the fact whether currently contemplated energy policies directed towards energy-saving and fuel-diversification will be effectuated. The demand for Renewable Energy (RE) is undenied but clear figures and spatially disaggregated potentials for the various energy carriers are very rare. Renewable Energies are expected to reduce pressures on the environment and CO2 production. In several studies in Germany (North-Rhine Westphalia and Lower Saxony) and Austria we studied the current and future pattern of energy production and consumption.
In this paper we summarize and benchmark different RE carriers, namely wind, biomass (forest and non-forest, geothermal, solar and hydro power. We demonstrate that GIS-based scalable and flexible information delivery sheds new light on the prevailing metaphor of GIS as a processing engine serving needs of users more on demand rather than through 'maps on stock'. We compare our finding with those of several energy related EU-FP7 projects in Europe where we have been involved – namely GEOBENE, REACCESS, ENERGEO - and demonstrate that more and more spatial data will become available together with tools that allow experts to do their own analyses and to communicate their results in ways which policy makers and the public can readily understand and use as a basis for their own actions. Geoportals in combination with standardised geoprocessing today supports the older vision of an automated presentation of data on maps, and – if user privileges are given - facilities to interactively manipulate these maps. We conclude that the most critical factor in modelling energy supply and demand remain the economic valuation of goods and services, especially the forecast of future end consumer energy costs.