MODELING OF THE CASPIAN REGION ENERGY SYSTEM

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INTRODUCTION.

The Central Asian and Caucasus Republics of Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan (see the map below) hold abundant and different energy resources, which are not evenly distributed within these borders, with Azerbaijan having large oil reserves, Kazakhstan having both large oil and coal stocks, and Uzbekistan and Turkmenistan having considerable natural gas reserves. Such a distribution of resources in the Area opens a room for possible mutually beneficial cooperation among these countries both in terms of hydrocarbons export to the rest of the world, and in terms of domestic energy system development. In 2009, the overall production of the Area was around 145 million tonnes of crude oil against a consumption of 35 million tonnes, and around 150 billion cubic meters of natural gas against a consumption of 100 billion cubic meters, with more than 145 Mtoe exported using (mainly) Russian infrastructure. Oil and gas pipeline networks were indeed designed to supply the central planned economy of the former Soviet Union, so that a profitable exploitation of the potential synergies across the four Countries is currently far from being realized.
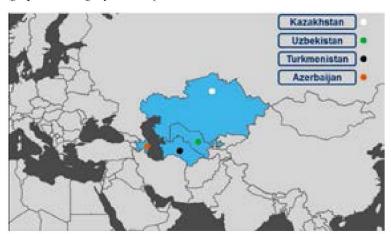
METHODOLOGY AND RESULTS.

Making use of the TIMES model generator code, based on which two complementary sets of system elements such as the economic aspects and the technical aspects (including energy, emissions and engineering) can be represented, a technical economic model of the whole Area was built and launched by using a mixed-integer programming solver.

CONCLUSIONS.

This is the first instance when the Caspian Region fuel and energy complex is modeled with sufficiently detailed representation of both supply and demand sides (bottom-up approach). The technological description of the existing mix of plants, demand devices, industrial chains can be further improved, nevertheless there are several energy-environmental actions that might be tested and evaluated using this model:

- a cooperative implementation of energy commodity inter-trade across the four Countries and exports levels (quantities) of the Area as a whole;
- the insertion of national-specific constraints aiming at stressing the systems on prospects of the renewable energy usages and on energy efficiency potential;
- the insertion of a single environmental target for the whole area in the context of GHG reduction.

Figure 1. The map of the geographic coverage of the analysis