Energy, Environment and Security

Case studies from Eastern Europe and Central Asia

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Energy, Environment and Security interactions:

• Energy development: pollution risks and legacies
• Energy independence: “pipeline wars”, nuclear energy, contested development (fossil fuel reserves, hydropower)
• Energy choices: climate change and biodiversity
• Energy wealth: income management and distribution
• Energy (over)specialization: social and economic impacts
Regions and issues

Eastern Europe:
- Energy policies and the environment
- Environmental legacies of coal mining & use in Ukraine

Caspian Sea east (Central Asia):
- Development of coastal oil-and-gas projects: potential environmental implications and legacies of the past
- Nuclear energy and uranium production: Aktau case

Amu Darya and Syr Darya basin (Central Asia):
- Water-energy-agriculture nexus: diverging interests?
- Energy security and contested development
- Energy challenges for the poor: biodiversity is doomed
Environment and security priority areas: Eastern Europe
Energy resources production and transportation: Eastern Europe
Chernobyl impacts

Note: the map shows total deposition resulting from both the Chernobyl accident and nuclear weapon tests. However, at the level above 10 kBq per m² in most cases, the effects of the Chernobyl accident are predominant.

Total Caesium-137 deposition per 10 May 1986, in kBq/m²:
- more than 1,480
- from 185 to 1,480
- from 40 to 185
- from 10 to 40
- less than 10
- Data not available

Source: European Commission, Joint Research Center, Environment Institute; Institute of Global Climate and Ecology (Moscow); Roshydromet (Russia), Minchernobyl (Ukraine); Beihydromet (Belarus). Atlas of Caesium Deposition on Europe after the Chernobyl Accident, 1996.

THE MAP DOES NOT IMPLY THE EXPRESSION OF ANY OPINION ON THE PART OF ENVSEC PARTNER ORGANISATIONS CONCERNING THE LEGAL STATUS OF ANY COUNTRY, TERRITORY, CITY OR AREA OF ITS AUTHORITY, OR DELINEATION OF ITS FRONTIERS AND BOUNDARIES.
Coal mining environmental legacies: the Donbas region of Ukraine

- Mine dumps: air pollution, acidic effluents, land take, visual impacts
- Mine closure: legal provisions, financial means, technical solutions
- Risk assessment, communication, and public awareness
Rapid development of oil-and-gas sector in the eastern Caspian Sea region

Forecast 2015: oil production more than 100 million tonnes per year
Evolution of crude oil production and export in the Caspian region

Oil production figures are in million tonnes
Sources: BP Statistical Review 2008 (data 1990 and 2007); compilation of data on historical oil production

Map produced by UNEP/GRID-Arendal, August 2008
* oil export from Azerbaijan via Iran since August 2008
Coastal land-based and off-shore oil-and-gas projects: uncertain future of bioresources & environmental risks
Environmental issues in the northern Caspian Sea

Important biodiversity:
- Wetlands and river deltas
- Existing and planned protected areas
- Caspian seal habitats (in 2005)
- Sturgeon spawning grounds

Energy production and distribution:
- Oil and gas fields
- Major energy producing areas
- Processing plants and stations
- Oil tanks
- Oil and gas pipelines

Environmental concerns:
- Hydrocarbons pollution (mg/l)
- Abandoned and flooded oil wells
- Major waste sites
- Historical pollution due to oil spills
- Ship wrecks
- Flood risk zone

Sources: ENVSEC East Caspian assessment (field mission to Aktau, April 2006); environmental reports of Atyrau and Mangystau for 2005-2007; compilation of EIA reports
Sea level fluctuations and environmental risks
Environmental issues around the Cheleken peninsula, Turkmenistan

Important biodiversity:
- Protected areas
- Habitats of endangered species

Industrial infrastructure:
- Industries
- Tanker terminals and ports

Energy production and distribution:
- Oil and gas fields
- Major energy producing areas
- Processing plants and stations
- Oil tanks
- Oil and gas pipelines

Environmental concerns:
- Radioactive waste
- Waste sites
- Abandoned and flooded oil wells
- Historical pollution due to oil spills
- Soil degradation and scrap metal
- Flood risk zone (+5 m sea level raise)

Source: UNEP/GRID-Arendal, August 2005

Caspian Sea level change

Sea level observations at Baku and Makhachkala

Source: Panin 2007; Kozhevnikova 2006; Abuzarov 2003
Legacies of oil extraction in the eastern Caspian

Uzen oil field and water supply
Mangystau province, Kazakhstan

Energy and water infrastructure:
- Oil field
- Oil tank
- Waterway
- Oil processing
- Pipeline
- Water pumping

Environmental concerns:
- Industrial waste
- Historical pollution due to oil spills
- Soil degradation
- Depletion of groundwater and current desertification

Source: ENVSEC East Caspian assessment (field mission to Aktau, April 2006)
Map produced by UNEP/GRID-Arendal, August 2006
Uranium resources and nuclear energy in Central Asia

Uranium production in Kazakhstan

<table>
<thead>
<tr>
<th>Year</th>
<th>Thousand Tonnes per Year</th>
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<tbody>
<tr>
<td>1991</td>
<td>1</td>
</tr>
<tr>
<td>1994</td>
<td>2</td>
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<td>6</td>
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Sources: Kazatomprom, Australian Uranium Association 2007

Aktau nuclear complex

Source: ENVSEC East Caspian assessment (field mission to Aktau, April 2006)
Map produced by UNEP/GRID-Arendal, August 2008
Environmental implications of nuclear energy and uranium production in the eastern Caspian, Aktau

Abandoned uranium open cast mine near Aktau, Kazakhstan

MAEK nuclear station (closed)

Former uranium production plant
Energy facilities and lines in Central Asia

Unequal distribution of fossil fuel reserves and hydropower potential
Water quantities: upstream vs. downstream asymmetry

Upper Amu Darya: Afghan-Tajik border

Lower Amu Darya (Nukus, Uzbekistan)
Water is the key in Central Asia

Low efficiency

IRRIGATION and AGRICULTURE

ENERGY

WATER

LIVELIHOODS

ACCESS, TIMING, QUANTITIES AND QUALITY
Water-energy-agriculture nexus in Central Asia
Toktogul Reservoirs - Inflows vs. Outflows

Time (1976 - 2008)

- Reservoir inflow (km3)
- Winter Outflow (km3)
- Summer Outflow (km3)
- Total Outflow

Toktogul reservoir (October 2008)
Kyrgyzstan
Contested development: ROGUN at the Vakhsh River

Nurek dam and hydropower plant
Tajikistan

Energy crisis in Tajikistan

Site under construction
Meeting energy demands, but losing biodiversity

Collection of teresken bush in the Pamirs