Urban Underground Space Energy Planning

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Goal 11: Make cities inclusive, safe, **resilient and sustainable**

Goal 9: Build **resilient infrastructure**, promote sustainable industrialization and foster innovation

Goal 7: Ensure access to affordable, reliable, **sustainable and modern energy** for all

Goal 13: Take urgent action to combat **climate change and its impacts**
Urban Underground Space (UUS) use transitions

- Soil-vegetation
- Groundwater aquifer
- Utility lines
- Motor-rail transport
- Brown fields-contaminated soils
- Groundwater aquifer
- Pre-settlement
- Village & town
- City
- Urban agglomeration

Bobylev & Jefferson, 2014
**UUS resources** (after Parriaux, Bobylev, Sterling)


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**Urban Underground Space planning – basic concepts & methodology**

- Physical space
- Geomechanical properties of disturbed ground
- Geoenvironmental properties and underground flora/fauna
- Geothermal - high extraction rate
- Excavated or extracted materials
- Cultural heritage
- Drinking water supply
- Irrigation
- Surface water exchange
- Geothermal energy
- Geothermal - seasonally balanced
Next: Urban Innovations: land use and critical infrastructure management

Housing support infrastructure development trends (from Bobylev, upcoming)
Urban Futures: 3D city – active use of underground space

Photo: Nikolai Bobylev - Tokyo
Urban Underground Space Use Statistics

<table>
<thead>
<tr>
<th>Population density, person/km² (thousands)</th>
<th>Urban Underground Space use density m³/m², (shown in centimetres)</th>
<th>Urban Underground Space volume per person m³/person</th>
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</tbody>
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Urban Underground Space Use Statistics

Distribution of underground infrastructure by depth
Alexanderplatz, Berlin

Contemporary agenda for UPI planning - Energy

Max-Schmeling Halle, Berlin

Photo: Sebastian Greuber – Max-Schmeling Halle, Berlin
Projects:

(1) Alexander von Humboldt Foundation project on Interplay between ecosystem and infrastructure services in the urban environments,

(2) ERA.Net RUS Plus initiative and the Russian Foundation for Basic Research AUCAM project on “Opportunities for and challenges to urban development and social cohesion in Russia’s Arctic under climate change impacts” (ID # 527, 18-55-76003),

(3) Freie Universität Berlin – Saint Petersburg State University Joint Seed Money Funding Scheme project on Sustainable Urbanization & Comparative Development.
Thank you for your attention!

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