Machine Landscape
Coal mining sites for hydro-pump electricity storage, Greene County, PA, USA

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Summary by the jury
The project foregrounds the need to promote renewable energy production in the United States and specifically proposes to utilize abandoned underground coal mining sites for hydro-pump electricity storage in Greene County, Pennsylvania. The water collected in the subterranean caverns comprises a form of embedded energy that can be easily harnessed by using time-honored methods of hydroelectric power generation. During the night, when energy consumption is generally low, the water is pumped into surface lakes and then channeled through turbines to produce electricity during daytime peak consumption hours. Water is basically recirculated in endless loops from reservoirs below ground to lakes above ground, taking advantage of the altitude differential to produce clean energy.

Appraisal by the jury
Notwithstanding the simplicity and ingenuity of the proposed technology, the submitted project recognizes its design potential, particularly its implications for landscape planning. The jury highly applauded the idea to combine abandoned infrastructure, energy production, and spatial design into a “machine” that is both useful and beautiful, one that performs a much needed function, one that is inherently sustainable, one that reuses and recycles deserted sites, and one that ultimately touches the senses.

Image 1: The key concept of the proposal is to utilize abandoned or soon to be abandoned underground coal mining sites as potential site to install hydro-pump electricity storage system. The project intends to emphasize the dual function of land, acting as a machine-power generator and simultaneously be an accessible destination for people. From both perspective of “landscape” and “infrastructure”, the project explores the boundary of the two and attempts to juxtapose them with elaborated spatial design.

Image 2: Section image illustrating the contrast of what is happening above surface and below surface; “tranquil waterfront environment” versus “hard-core power plant” underground. What is unique about the proposed water-bodies is that water circulation speed is extraordinarily fast. Due to the daily cycle of circulating water for electricity storage purpose, waterbodies fill-up and discharge all the water within a day, and repeat the cycle daily, thus bringing a dramatic landscape to visitors.

Project data
- Context: Landscape, urban design and infrastructure
- Client: Not applicable
- Background: Research project

Further authors
Image 3: Estimated growth of electricity storage capacity in USA by 2050.

Image 4: GIS and geographical analysis of USA power grid system and coal mining operation.

Image 5: Macro scale site description, West Pennsylvania, and the layout of underground mine at project site.

Image 6: System plan, highlighting five waterbodies and infrastructural network.

Image 7: System operation and rendered view during night: water to be slowly introduced to ponds.

Image 8: System operation and rendered view during morning hours: ponds to be fully filled with water.

Image 9: System operation and rendered view during evening: water to be fully flushed to generate electricity.

Image 10: Adaptable system; this proposal is a flexible design strategy that can be adapted to other sites.