EXTRACTIVE/ENERGETIC:

The Adaptive Reuse of Minescapes as Landscapes of Renewable Energy in the Anthracite Coal Mining Region of Northeastern Pennsylvania
THE ANTHRACITE REGION OF NORTHEASTERN PENNSYLVANIA:
A HISTORY OF EXTERNALITIES
THE ANTHRACITE REGION OF NORTHEASTERN PENNSYLVANIA: A HISTORY OF EXTERNALITIES
THE ANTHRACITE REGION OF NORTHEASTERN PENNSYLVANIA:
A HISTORY OF EXTERNALITIES
THESIS SITE: HUBER BREAKER, ASHLEY PENNSYLVANIA
THESIS SITE: HUBER BREAKER, ASHLEY PENNSYLVANIA
INTRODUCTION
ENVIRONMENTAL EXTERNALITIES
Minescapes:

Landscapes which exhibit 4 different conditions resulting from mining practices.

*As identified in the northeastern Pennsylvania anthracite coal region
Minescape Type 1:

Deep Underground Mine (aka “Room and Pillar”)
ENVIRONMENTAL DEEP UNDERGROUND MINE MAPS
ENVIROMENTAL DEEP UNDERGROUND MINE
SUBSIDENCE

Source: Underground Miner's Website

ACID MINE DRAINAGE

Source: Underground Miner's Website

ENVIRONMENTAL SUBSIDENCE AND ACID MINE DRAINAGE
Number of years needed to fix abandoned mine hazards with the current level of federal funding, for selected states

- Kansas: 279 years
- Oklahoma: 120 years
- Pennsylvania: 60 years
- West Virginia: 50 years
- Missouri: 48 years
- North Dakota: 46 years
- Alaska: 40 years
- Kentucky: 32 years
- Iowa: 29 years
- Virginia: 28 years

Source: Department of the Interior, Office of Surface Mining, Reclamation and Enforcement
ENVIRONMENTAL UNDERGROUND MINE NETWORK AT HUBER BREAKER SITE
ENVIRONMENTAL GEOLOGIC SECTIONS OF COAL SEAMS, ANTICLINES & SYNCLINES, AND UNDERGROUND MINE POOLS
Minescape Type 2:

Open Pit Mine (aka “Surface Mine”)

ENVIROMENTAL
ENVIROMENTAL OPEN PIT MINE

5 = Average number of coal mine workers employed per mine in 2011

600 = Number of coal mine workers employed per mine in 1900
Minescape Type 3: Reclaimed Mine
Reclaimed open pit mine sites near Pottsville, PA
Former mine site, now a soccer field in Ashley, Pennsylvania

Walmart adjacent to coal mine site in Pottsville, PA as part of Acres for America Program

ENVIRONMENTAL  RECLAIMED MINE
## Remediation Strategy

### Soil, Sediment, Bedrock, and Sludge

- **In Situ Biological Treatment**
  - Bio Venting
  - Enhanced Remediation
  - Phytoremediation

- **In Situ Physical/Chemical Treatment**
  - Chemical Oxidation
  - Electrokinetic Separation
  - Fracturing
  - Soil Flushing
  - Soil Vapor Extraction
  - Solidification/Stabilization

- **In Situ Thermal Treatment**
  - Thermal Treatment

- **Ex Situ Biological Treatment**
  - Biopiles
  - Composting
  - Landfarming
  - Slurry Phase Biological Treatment

- **Ex Situ Physical/Chemical Treatment**
  - Chemical Extraction
  - Chemical Reduction/Oxidation
  - Dehalogenation
  - Separation
  - Soil Washing
  - Solidification/Stabilization

- **Ex Situ Thermal Treatment**
  - Hot Gas Decontamination
  - Incineration
  - Open Burn/Open Detonation
  - Pyrolysis
  - Thermal Desorption

- **Containment**
  - Landfill Cap
  - Landfill Cap Enhancements/Alternatives

- **Other Treatment**
  - Excavation, Retrieval, Off-Site Disposal

### Ground Water, Surface Water, and Leachate

- **In Situ Biological Treatment**
  - Enhanced Bioremediation
  - Monitored Natural Attenuation
  - Phytoremediation

- **In Situ Physical/Chemical Treatment**
  - Air Sparging
  - Bioslurping
  - Chemical Oxidation
Minescape Type 4:
Supporting Infrastructure
Supporting Infrastructure and Underground Mine Network at Huber Breaker Site

Underground Mine Network
Above is a plan of a mine network underneath the Huber Breaker site, which sits at 300 feet below the surface grade. There are four levels of mines still intact, however each level is filled with water and slurry. The white in the above plan are the coal pillars still standing, and the black indicates the "rooming" where coal was extracted.

Huber Breaker
Opened in 1935, it was the last standing colliery breaker in the southern Anthracite coal region.

Power House
Retail Coal Pocket
Foreign Coal Dump
Storage Tanks
Smoke Stacks and Coal Silos
ERCAMR Office
Sewer Easement

ENVIRONMENTAL
POLITICAL EXTERNALITIES
Concerns over the environmental impacts of coal mining resulted in passage of some of Pennsylvania’s very first environmental laws. Regulation of the mining impacts began in earnest in 1913 with the passage of Act 375 prohibiting the discharge of anthracite coal, culm or refuse into streams.

1872 The General Mining Act of 1872
Codified the informal system of acquiring and protecting mining claims on public land.

1937 The Clean Streams Law
Attempt to regulate surface coal mining. Formed the basis of modern environmental regulations covering surface coal mining operations.

1945 The Surface Mining Conservation and Reclamation Act
Largely protects streams from pollution. It was amended in 1945 to include acid mine drainage and again in 1965 to define acid mine drainage as an industrial waste, requiring all mines to treat their drainage to specified standards.

1968 Anthracite Coal Mining Act
In 1968 a $500 million bond issue was passed, in part, to finance the reclamation of abandoned mined lands through a new Operation Scarlift and to purchase land for conservation and recreation purposes. The Coal Refuse Disposal Control Act was passed in that same year to help control pollution from coal refuse piles.

1979 Borough of Deep Mine Safety Created
DEP’s Bureau of Deep Mine Safety was officially created in the former Department of Environmental Resources in 1979, having been in existence in various forms as part of predecessor agencies back to 1903 in the Department of Mines. Its primary purpose is to improve safety conditions in mines through training and setting safety requirements. The Bureau also investigates mine accidents and conducts mine rescue operations.

1980 CERCLA (Superfund) Act Created
The Comprehensive Environmental Respose, Compensation and Recovery Act created a tax on chemical and petroleum industries, established requirements concerning closed and abandoned hazardous waste sites. The act also provided liability for persons responsible for releases of hazardous waste sites.

1992 SMCRA Amended
In 1992 the Surface Mining Conservation and Reclamation Act was amended to better protect water supplies and provide incentives for remaining previously abandoned areas.

1994 Mine Subsidence and Land Conservation Act Amended
The Mine Subsidence and Land Conservation Act was amended in 1994 to better protect water supplies affected by deep coal mining and to revise the procedures for repairing or replacing buildings damaged by mine subsidence. Legislation was also passed to encourage the siting of coal refuse disposal areas on lands previously affected by mining (Act 114).
“Mineral Rights” entitle a person or organization to explore and produce the rocks, minerals, oil and gas found at or below the surface of a tract of land. The owner of mineral rights can sell, lease, gift or bequest them to others individually or entirely. For example, it is possible to sell or lease rights to all mineral commodities beneath a property and retain rights to the surface. It is also possible to sell the rights to a specific rock unit (such as the Pittsburgh Coal Seam) or sell the rights to a specific mineral commodity (such as limestone). In the United States and a few other countries, ownership of mineral resources was originally granted to the individuals or organizations that owned the surface. These property owners had both “surface rights” and “mineral rights”. This complete private ownership is known as a “fee simple estate”.

Fee simple is the most basic type of ownership. The owner controls the surface, the subsurface and the air above a property. The owner also has the freedom to sell, lease, gift or bequest these rights individually or entirely to others.

The General Mining Act of 1872 established surface and mineral rights regulations that are still today’s standard.
Going Deep:
WELL STIMULATION TECHNOLOGY DEPLOYED THOUSANDS OF FEET BELOW THE WATER TABLE.
SOCIAL EXTERNALITIES
Wilkes-Barre, PA

demographics

POPULATION
40,964

POVERTY: 2009

UNEMPLOYMENT: 2011

ENERGY

UTILITY GAS 76%
ELECTRICITY 13%
FUEL OIL, KEROSENE 8%
BOTTLED, TANK, LP GAS 1%
COAL 1%

EDUCATION

HIGH SCHOOL 76.8%
BACHELOR’S DEGREE 12.8%
GRADUATE OR PROFESSIONAL DEGREE 4.7%

ECONOMIC
SITE ANALYSIS

ABANDONED MINE LANDS, ACID MINE DRAINAGE AND RECLAIMED MINE SITES IN THE NORTHERN ANHRACITE COAL FIELD

[Map showing locations of abandoned mines and reclaimed sites]
SITE ANALYSIS

RENEWABLE ENERGY POTENTIAL, BROWNFIELD AND SUPERFUND SITES IN THE NORTHERN ANHRACITE COAL FIELD
Biomass Resources of the United States by County: Methane Emissions from Domestic Wastewater Treatment

*Source: National Renewable Energy Laboratory
SITE ANALYSIS

ASHLEY AND WILKES-BARRE, PENNSYLVANIA ANALYSIS: MINE LANDS AND WATER BODIES

PATCH TOWN EXTENTS
RIVERS AND STREAMS
FLOOD PLAIN
MINE DUMP AREA
OPEN PIT MINE AREA
RAILROAD
POLITICAL BOUNDARY
SITE ANALYSIS
ASHLEY, PENNSYLVANIA AERIAL: 1992
SITE ANALYSIS
ASHLEY, PENNSYLVANIA AERIAL: 1999
ASHLEY, PENNSYLVANIA AERIAL: MINE DUMP AREAS
Design Intervention:

ADAPTIVE REUSE OF MINESCAPES

Use Huber Breaker Site as testing ground for energetic landscape prototypes infused with remediation...

...thus spawning a new chapter in energy landscapes for the anthracite coal region.
Address externalities through program dictated by remediation status:

Environmental

- Site and design energy prototypes based on cyclical energy of former coal mine sites through geothermal and biomass

Political/Legislative

- Private companies purchasing mine lands
- Develop private interest groups that work with local government to spearhead legislation

Economic

- Provide funding for renewables researchers through federal/state grants
- Provide “green jobs” for those working at prototypes at Research and Development

Social

- Industrial heritage tour as educational tool
SITE ANALYSIS

FORMER MINE DUMP SITE
75 ACRES

RECENTLY CAPPED AND REMEDIATED AREA, PREPPED FOR COMMERCIAL BUILDING

CULM PILES SET IN FLOOD PLAIN, FILLED WITH ACID MINE DRAINAGE

DEVELOPABLE SITE 1
17 ACRES

-RECENTLY REMEDIATED THROUGH CAPPING USING COAL REFUSE MATERIAL
-PREPPED FOR BUILDINGS

HUBER BREAKER SITE
12 ACRES

-MOST TOXIC
-INCLUDES HUBER BREAKER AND UNDERGROUND MINE NETWORK

RECENTLY CAPPED AND REMEDIATED AREA, PREPPED FOR COMMERCIAL BUILDING

REMEDIATION STATUS
PROPOSAL

RESEARCH AND DEVELOPMENT FACILITIES AND CLASS ROOMS

BIOMASS WASTE DEPOSIT AREA

PHYToremEDIATION PLOTS

WETLANDS AND ACID MINE DRAINAGE TREATMENT

ATV PARK ON CULM PILES

GEOTHERMAL FROM UNDERGROUND MINE WATER

FUTURE BUILDOUT FOR BIOMASS PLANT FACILITIES TREATMENT

BIOMASS CROP AREA

BUFFER AND BIOMASS FOREST

RESEARCH AND DEVELOPMENT FACILITIES AND CLASS ROOMS

BIOMASS WASTE DEPOSIT AREA
Supporting Infrastructure and Underground Mine Network at Huber Breaker Site

PROPOSAL
REPURPOSE BUILDINGS AT HUBER BREAKER SITE FOR BIOMASS
Repurpose Buildings at Huber Breaker Site for Biomass

- Underground Mine Area
- Piping for mine water transport
- Borehole and drilling site

- Water Tank
- Heat pump
- Low-temperature underfloor heating
- Borehole Heat Exchanger
- Water from underground mine room
PROPOSAL

PHYTOREMEDIATION PLOTS CONVERTED TO BIOMASS

PHYTOEXTRACTION REMOVES TOXINS FROM WILLOW
WILLOW BECOMES ESTABLISHED
MATURE WILLOW IS FELLED FOR CONVERSION TO BIOMASS ENERGY

CO2

electricity

power plant

plantation

transport
PROPOSAL

BIOMASS ZONES

BIOMASS AS PHYTO  BIOMASS AS GRASSLAND  BIOMASS AS CROP  BIOMASS AS WETLAND
PROPOSAL

LUSATIA SEE 2010 PROJECT - LIGNITE MINING REGION OF LUSATIA, GERMANY
LUZERNE COUNTY VALLEY
INDUSTRIAL HERITAGE AND ENERGY LANDSCAPES
TOUR LOCATIONS

1. Huber Breaker and EPCAMR Office
2. Empire Silk Mill
3. Dorrance Colliery
4. Solomon’s Creek and AMD Boreholes
5. Old Forge
6. Newport Lake AMD Stripping Pit
PROPOSAL

RESEARCH AND DEVELOPMENT FACILITIES AND CLASS ROOMS

BIOMASS WASTE DEPOSIT AREA

PHYTOREMEDIATION PLOTS

WETLANDS AND ACID MINE DRAINAGE TREATMENT

ATV PARK ON CULM PILES

GEOTHERMAL FROM UNDERGROUND MINE WATER

FUTURE BUILDOUT FOR BIOMASS PLANT FACILITIES TREATMENT

BIOMASS CROP AREA

BUFFER AND BIOMASS FOREST

RESEARCH AND DEVELOPMENT FACILITIES AND CLASS ROOMS

BIOMASS WASTE DEPOSIT AREA
The objective of the summer school “Energy Landscapes 3.0” is to analyse potential network
geographies and concepts for the post-fossil fuel era and their impacts on settlement structures in
Europe. We will thereby explicitly refer to classical visions of utopian thought on a large scale – con-
nected ideas for new Energy Landscapes promulgated decades ago by Herman Sörgel in 1928 with
Atlantropa and Richard Buckminster Fuller in 1972 with World Game. The findings of these
visions should result in a development project for the design of new, “ideal” Energy Landscapes
from the perspective of landscape architecture and urban development. –– The interdisciplinary
summer school is open for all students and post-graduate students of architecture, spatial planning,
art, design, environmental technology, the environmental sciences, philosophy etc. ––
apply now! www.bauhaus-dessau.de/energylandscapes
June 13th
Ain Beni Mathar

Plant Profile:

- Developed by the Office National de Electricite (ONE) and put out for bid:
  - Manufacturer: Abengoa (Spain)
  - Power Island: Alstom (France)
  - Solar Island: Solar Abengoa (Spain)
  - Civil Engineering: Arcobeton (Morocco)
- Global cost of 4.6 billion MAD (Dirham), funded by:
  - African Development Bank
  - Spanish Instituto de Credito Official
  - Global Fund for the Environment
  - Remainder provided by Office National de Electricite (ONE)
- Employs 50-60 people
- Total 100 with subcontracted work
**Business Concept**

**Forest Biomass**

- Sunlight
- Photosynthesis
- Bosque
- Wood Cutting
- Sawdust
- Combustion
- Forest Biomass and Agricultural Biomass are grown and produced. Forest Biomass goes to the urban grid directly through a biogas pipeline.

**Agricultural Biomass**

- Vegetables+Crops
- Kitchen Garbage
- Toilet
- Greenhouse
- Blackwater
- Fermentor
- Oversupply to neighboring farms or urban grid
- Agricultural Biomass is both centralized and decentralized. Fermented biogas goes back to the farm as biogas energy, with excess going to the neighboring farms or urban biogas pipeline.

**Consumption**

- Forest or Agricultural Biomass

**Production**

1. Biogas
2. Biogas

**Storage**

1. Biogas
2. Gas pipeline
3. District heat
Summary of Project Research and Design Observations:

- Consider alternatives to energy production and consumption

- Consider the short- and long-term initiatives and funding for remediation, reclamation and design

- Consider the wide possibilities for research and development in the region with the partnership of local universities...

- Is is possible to change the Pennsylvania energy grid? Can energy landscapes of Pennsylvania become more localized and decentralized as a regional infrastructure?