THE SALT PROJECT
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Desertification is greatest threat to planet, expert warns

UN's top drylands official says people must be paid via global carbon markets for preserving the soil.

UN issues desertification warning

Tens of millions of people could be driven from their homes by encroaching deserts, particularly in sub-Saharan Africa and Central Asia, a report says.

Soil erosion threatens to leave Earth hungry

Arable land is turning to desert or to salt at an ever-faster rate, lessening the hope that we can feed our booming population.
52% of land used for agriculture is affected by soil degradation
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1.5 billion people are affected
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1400 hectares of arable land is lost every hour
52% of land used for agriculture is affected by soil degradation

1.5 billion people are affected

1400 hectares of arable land is lost every hour

74% of the poor worldwide are affected by desertification

A BIOMIMETIC APPROACH
AVAILABLE RESOURCES
SEAWATER GREENHOUSES
& SAHARA FOREST PROJECT
FRESH WATER

SEAWATER

SALT

FRESH WATER

PRODUCE
WHAT IS SALT ARCHITECTURE?

HOW DO WE MAKE IT?

HOW DO WE BUILD WITH IT?

HOW DO WE INTEGRATE IT?
FUSED DEPOSIT MODELING (3D PRINTING)
THE CAST SALT BRICK
TESTING STICKS
DENSITY & COMPRESSIVE STRENGTH COMPARED

- Compressive strength in MPa
- Density in kg/l

Materials:
- soil brick
- marble
- granite
- clay brick
- high performance concrete
- common brick
- low performance concrete
- masonry
- rammed earth
- salt
- ice
- oak
- cedar
- pinewood
- glass
- high performance concrete
Rammed earth

Masonry

Ice
WHAT IS SALT ARCHITECTURE?

HOW DO WE MAKE IT?

HOW DO WE BUILD WITH IT?

HOW DO WE INTEGRATE IT?
THE SEAWATER INFRASTRUCTURE
SEAWATER GREENHOUSES
& SAHARA FOREST PROJECT
0.2 m deep

0.25 m/s speed

0.3 g biomass/l/day

3.5-7% salinity

5% water loss per harvest

parabolic solar collector

steam turbine

boiler filled with sea water

steam heating boiler

waste heat

electricity

oil heating boiler

steam

Possible in metal pans or rocky pans

Heating with waste heat from CSP

hot humid air

CaCO crystallizing on cardboard

condensation on mesh

3.5-7% brine

CaCO crystallizing on cardboard

3.5-7% brine

condensation on roof

15-20% brine

fresh water condensing on mesh

30-100% salinity

30% brine recovery

Optional drip irrigation

- Wind protection
- Humidification

15-20% brine released over hedges

15-20% brine

Possible in metal pans / rocky pans

brine solution of 30-100% salinity

fresh water

humid cool air flow
MASTERPLAN FOR LUSAIL, QATAR
New Salt Villages
Salt Pans
1 ha Seawater Greenhouse
Desert Greening
Salt Factory
Algae Farming (Neochloris)
Pump System
Concentrated Solar Power

TO DOHA
TO LUSAIL
TO AL KHOR
TO MADINAT ASH SHAMAL

Phasing

2,5 Million cubic meters of seawater evaporated per year
90,000 Tons of salt is won for construction
92,000 Tons of produce from Seawater Greenhouses
550 Hectares of regreened desert

LUSAIL NEW

TOW

PERSIAN GULF

MASTERPLAN | A DEVELOPMENT STRATEGY FOR LUSAIL
scale 1:15.000
THE SALT FACTORY CONCEPT
Saltwater algae *Neochloris*

Starch

Blending salt & starch

Option 1: pouring in mould

Heating & hardening

Salt collection & storage

Salt grinding

Option 2: 3D printing with D-Shape printer

Coating
Production process
Maximum flexibility
Easy expansion
Large open space
FACTORY SUPPORT

Production process
Maximum flexibility
Easy expansion
Large open space

Office, bathrooms, conference rooms etc
Easy access to factory
Comfortable climate
Clear organisation
FACTORY SUPPORT PUBLIC ROUTE

Production process
Maximum flexibility
Easy expansion
Large open space

Office, bathrooms, conference rooms etc
Easy access to factory
Comfortable climate
Clear organisation

Range of experiences
Separation between operational part
Clear overview of operation
THE SALT FACTORY EXPERIENCE
Concrete foundation
First arch supported and tensioned

Concrete foundation
Concrete foundation

Second and third arch supported and tensioned

First arch supported and tensioned

Concrete foundation
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Concrete foundation
Added supports, panels and tensioning

Second and third arch supported and tensioned

First arch supported and tensioned

Concrete foundation
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

First arch supported and tensioned

Concrete foundation
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

First arch supported and tensioned

Concrete foundation

Continue with same system
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

Continue with same system

Subfloor for tiling

Concrete foundation

First arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

Continue with same system

Subfloor for tiling
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

Continue with same system

Subfloor for tiling

Salt tiling

First arch supported and tensioned

Concrete foundation

Salt tiling

Subfloor for tiling

Continue with same system

Close arches to create shell structure

Added supports, panels and tensioning

Second and third arch supported and tensioned

First arch supported and tensioned

Concrete foundation
Concrete foundation

First arch supported and tensioned

Second and third arch supported and tensioned

Added supports, panels and tensioning

Close arches to create shell structure

Continue with same system

Salt tiling

Subfloor for tiling

Salt paste finish over panels

First arch supported and tensioned

Concrete foundation

Subfloor for tiling

Salt tiling

Salt paste finish over panels

Close arches to create shell structure

Added supports, panels and tensioning

Second and third arch supported and tensioned

First arch supported and tensioned

Concrete foundation
Concrete foundation
First arch supported and tensioned
Second and third arch supported and tensioned
Added supports, panels and tensioning
Close arches to create shell structure
Continue with same system
Subfloor for tiling
Salt tiling
Salt paste finish over panels
Waterproof coating
Subfloor for tiling
Salt tiling
Salt paste finish over panels
Waterproof coating
Concrete foundation
First arch supported and tensioned
Second and third arch supported and tensioned
Added supports, panels and tensioning
Close arches to create shell structure
Continue with same system
Subfloor for tiling
Salt tiling
Salt paste finish over panels
Waterproof coating
Paneling system with tensioning cables

Salt paste coating

Waterproof coating
VENTURI ACTION BASED ON BERNOULLI PRINCIPLE

OVER PRESSURE FROM WIND FOR NATURAL VENTILATION
Concrete foundation
Concrete foundation

Salt columns
Salt stabilizers
Salt columns
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults

Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Waterproof coating
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Waterproof coating
Subfloor for tiling
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Waterproof coating
Subfloor for tiling
Salt tiling
Concrete foundation
Glass railing on steel anchor
Salt tiling
Subfloor for tiling
Waterproof coating
Salt paste finish
Salt overlapping vaults
Salt stabilizers
Salt columns
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Waterproof coating
Subfloor for tiling
Salt tiling
Glass railing on steel anchor
Plastic window frames glued to cast groove
Concrete foundation
Concrete foundation
Salt columns
Salt stabilizers
Salt overlapping vaults
Salt paste finish
Waterproof coating
Subfloor for tiling
Salt tiling
Salt stabilizers
Salt columns
Concrete foundation
Salt 3D printed mesh pattern glued to groove
Plastic window frames glued to cast groove
Glass railing on steel anchor
REFLECTION
THANK YOU

TJALLING HOMANS MARTIJN STELLINGWERFF ENGBERT VAN DER ZAAG PIERIJN VAN DER PUTT PETER KOORSTRA LISA GEBOERS MARIJKE DE JONG CHEYENNE HENSGENS ERIKA GYURKÓ & THE AE STUDIO GROUP