TERRITH

Earth-assisted climate control.
From a UAE field prototype to a modular terracotta system.

FIELD STORY   THERMAL PRINCIPLE   R&D DIRECTION

HANI.SOLUTIONS / AUGUST 2026 / PUBLIC TECHNICAL STORY

Climate begins before the machine.

Territh asks a simple question: can outdoor air be moderated by the Earth before conventional heating or cooling has to do the hard work?

Most climate-control systems begin with a machine. Very hot or very cold air arrives at the mechanical system, and energy is spent closing the full temperature gap. Territh moves the first stage upstream. It explores the use of ground stability, thermal mass, mineral materials, controlled moisture, airflow and sensing as a low-energy pre-conditioning layer.

The first field prototype was deliberately rough. It used readily available concrete blocks instead of custom clay components, natural mud-and-straw sealing, a simple watering arrangement, buried soil mass, and a small fan. It was built on a working farm in the UAE and left in the ground until summer conditions provided a demanding test.

During the public field run, the outlet reading progressed from about 41.0°C at startup toward 33.8°C as the system stabilised. Separate field measurements included a 51.7°C noon thermometer reading and a direct-sun reading reported at about 56°C. The 56°C figure is not a standard shaded ambient-air measurement; it is useful as context for the solar exposure experienced by the site and equipment.

The result was not a finished HVAC product and it was not a certified performance test. It was something more appropriate for this stage: evidence that the direction was worth engineering properly.

33.8°C

Recorded outlet reading as the field prototype stabilised.

~41°C

Recorded outlet air at the beginning of the public run.

28 W

Small fan used in the prototype demonstration, with reported airflow around 90 m^3/h.

Positioning. Territh is low-energy pre-conditioning, not a claim of zero-energy cooling. In many applications its role may be to reduce the load seen by the next climate-control stage rather than replace that stage entirely.

An old physical idea, reframed as a modern system.

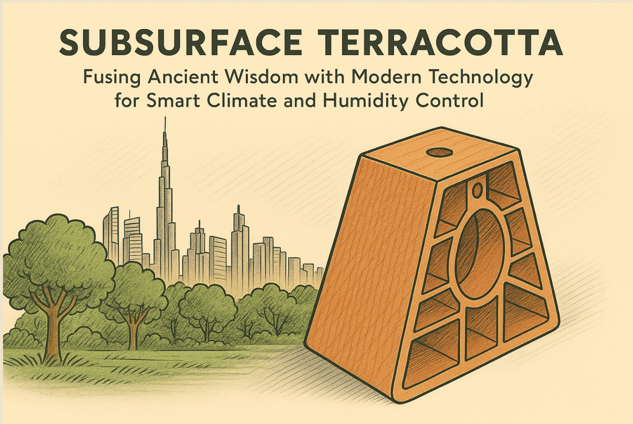
Ground-coupled air systems are not a new discovery. Buildings and settlements have used earth, thick mineral walls, courtyards, water, wind catchers and thermal mass for centuries. Modern research on earth-to-air heat exchangers likewise shows that buried airflow paths can use the thermal inertia of soil to pre-cool air in warm periods and pre-warm it in cold periods.[1-3]

Territh does not claim that underlying physical principle as new. Its R&D focus is the system built around it: a modular material architecture, manufacturability, moisture strategy, sensing, control, maintainability, integration with modern ventilation, and use across different environments.

> **Use physics first. Use energy where it is still needed.**

The earliest design direction centred on terracotta. Clay is familiar, durable and manufacturable, and its thermal mass and moisture interaction make it worth studying as an engineered climate component rather than merely a traditional building material.

But before a purpose-built clay system could be justified, the basic direction had to survive contact with real soil, real construction constraints and real UAE summer heat.



Early public concept visual - the project originally appeared as “Subsurface Terracotta” before the broader Territh identity emerged.

When custom clay was too expensive, the experiment changed - not the question.

The initial model was heading toward mould-making and custom clay production. For a first prototype in the UAE, that path was expensive. Waiting for a perfect budget would have delayed the only test that mattered: does the direction behave usefully in the ground?

DESIGN	**Purpose-built clay concept.** Early modelling explored a dedicated mineral component rather than a standard pipe.
REALITY CHECK	**Mould and production cost.** Custom clay manufacturing was not economical for a first directional test.
ADAPT	**Use what is available.** Double-hole concrete blocks became the temporary airflow body.
SEAL + WET	**Natural materials.** Mud-and-straw sealing closed joints and helped retain moisture; a watering path was added.
BURY	**Real ground.** The assembled path was covered and returned to a living farm surface rather than isolated in a laboratory rig.

Prepared field area and watering lines.

Manual construction and sealing work.

Rows of the first concrete-block prototype.

Prototype philosophy: an invention has to adapt to reality, available resources and budget. The concrete-block version was never intended to be the final Territh product; it was a practical instrument for learning.

A buried system under a living surface.

The excavation began by hand. It quickly became obvious that moving the soil with shovels would take days, so a Bobcat finished the burial in roughly half a day.

The topsoil was returned with organic material, and the surface remained usable for cultivation. Moringa later became part of the environment above the buried path.

That matters conceptually. Territh is not meant to create dead underground infrastructure while sacrificing the surface. In some applications the surface can continue to provide shade, crops, landscape or other useful functions.

Vegetation can also change surface solar loading and soil moisture. The magnitude of that effect depends on climate, soil, irrigation and planting density and should be measured rather than assumed.

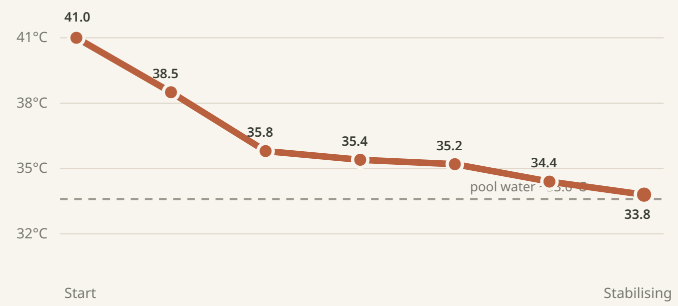
Top: burial work with the Bobcat. Bottom: the surface later returned to irrigated agricultural use.

04 / FIELD EVIDENCE

A prototype built in the ground, not in a presentation.

The summer test was intentionally a field demonstration. It was not instrumented as a laboratory calorimetry study, but it produced a useful temperature progression and environmental context.

RECORDED OUTLET PROGRESSION



Outlet readings   Pool-water reference

Sequence shown in the order reported in the field-test narration. Time intervals were not normalised, so the horizontal axis is measurement sequence rather than elapsed time.

44.6°C field reading in a shaded/afternoon context.

33.8°C recorded outlet reading.

Environmental context

Shallow soil: 42.7-42.8°C
Afternoon shaded readings: 43.5-44.6°C
Noon field reading: 51.7°C
Direct-sun thermometer: about 56°C

Water references

30 m well: 31.5°C
25 m well: 31.9°C
Pool water: about 33.6°C
System water initially: 34.2°C

33.8°C is not the claim. The reduced thermal distance is.

A useful field result becomes misleading if it is framed as a finished cooling product. Territh is better understood as a first climate stage.

01
Receive
Outdoor air enters the earth-assisted path.

02
Exchange
Ground and surrounding mass moderate the air temperature.

03
Measure
Sensors expose temperature, humidity and flow behaviour.

04
Hand off
The next stage receives air with a smaller thermal load.

Why this matters

Heating and cooling demand is strongly influenced by the temperature difference a system must overcome and by the mass flow of air being conditioned. In a simplified sensible-heat view, the thermal rate associated with an air stream scales with:

$$\dot{Q} \sim \dot{m} \times c_p \times \Delta T$$

If a passive or low-energy first stage reduces ΔT before the main HVAC equipment acts, it can reduce the load assigned to that equipment. The actual system-level energy benefit must still be measured against fan power, pressure drop, moisture behaviour, control strategy and installation conditions.

What the first test cannot prove

The field run did not establish a certified coefficient of performance, annual energy saving, guaranteed outlet temperature, or performance across different soils and seasons.

A rigorous next-stage test needs synchronised inlet/outlet temperature and humidity, verified airflow, pressure drop, soil temperature at multiple depths, water use, fan power, weather data, repeat runs and a baseline/control condition.

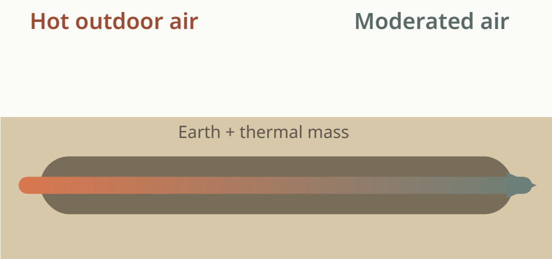
Scientific posture: the first prototype is evidence of direction, not evidence that every future Territh installation will reproduce the same numbers.

One Earth. Two seasons.

The ground does not manufacture cold or heat. It acts as a thermal mediator whose temperature varies more slowly than the exposed surface. That difference can be useful in both directions.

SUMMER

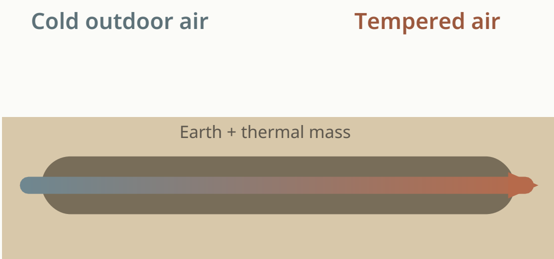
Hot air › moderated air



The surrounding soil absorbs part of the incoming sensible heat. Moisture, if deliberately used, adds heat-and-mass-transfer effects that must be controlled and measured.

WINTER

Cold air › tempered air



When outdoor air is colder than the ground-coupled environment, the direction of sensible heat exchange reverses and the same concept can provide useful pre-heating.

Soil

Thermal conductivity, heat capacity, moisture, surface condition and burial depth influence performance.[2,3]

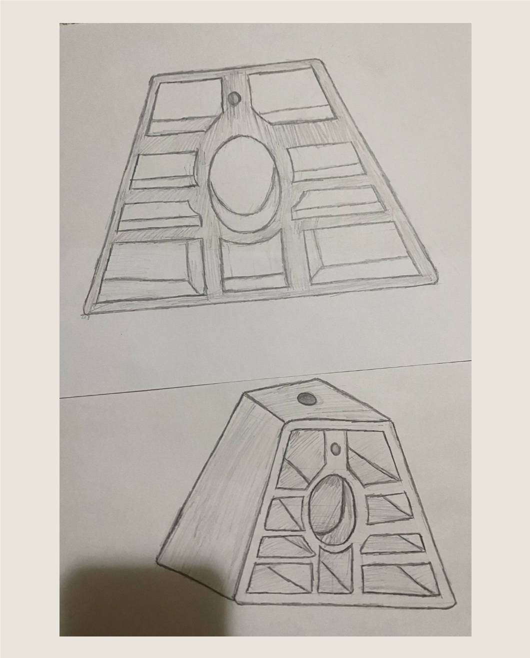
Air path

Length, hydraulic diameter, velocity, pressure drop and residence time shape heat transfer and fan demand.[2,3]

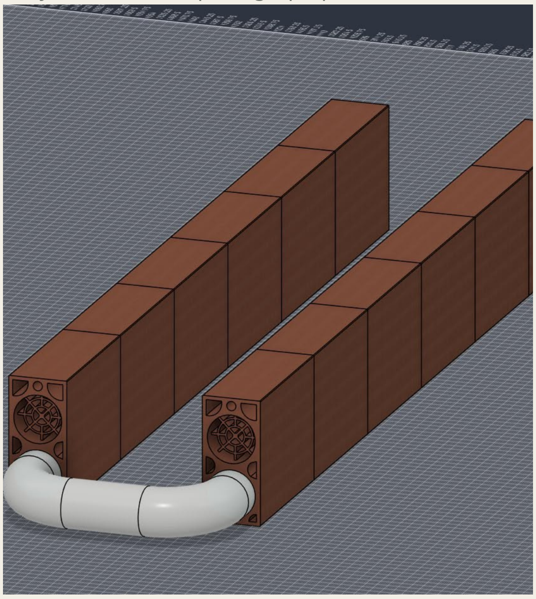
Control

Bypass logic, fresh-air fraction, recirculation and mechanical backup determine whether the overall system is useful, efficient and hygienic.

From a directional experiment to a product language.



Early hand sketch exploring a purpose-built mineral



Current modular design study. Public imagery is intentionally high-level and omits exact engineering details.

The concrete prototype answered the first question well enough to create a harder second set of questions.

MANUFACTURE	Can the climate path become a repeatable component rather than a one-off trench?
ASSEMBLY	Can modules connect quickly, seal reliably and support different installation sizes?
AIRFLOW	Can pressure drop, distribution and service access be designed rather than improvised?
MOISTURE	Can wet, dry or hybrid operation be selected deliberately for climate, hygiene and efficiency?
SENSORS	Can the system see its own temperature, humidity, airflow and air-quality state?
INTEGRATION	Can Territh hand off to filters, fresh-air control, recirculation, heat pumps or conventional HVAC?

Current direction: a purpose-built, modular terracotta architecture designed around thermal exchange, manufacturability and integration. Exact geometry, internal routing, sealing details and control logic remain outside this public story while engineering and IP work continue.

Ancient material. Engineered role.

Terracotta is interesting to Territh not because it looks traditional, but because it can be shaped, repeated and engineered as a mineral interface between air, ground and moisture.

Clay-based ceramics offer useful thermal mass and can be manufactured in repeatable forms. Depending on formulation, firing, surface treatment and glazing, their moisture interaction can also be modified. Those properties make terracotta a candidate platform for the next system, but they are not assumed to be automatically optimal.

The next development phase therefore treats material selection as an engineering problem: compare formulations, wall thicknesses, surface treatments, porosity, thermal conductivity, water uptake, durability, fouling behaviour and cleaning requirements.

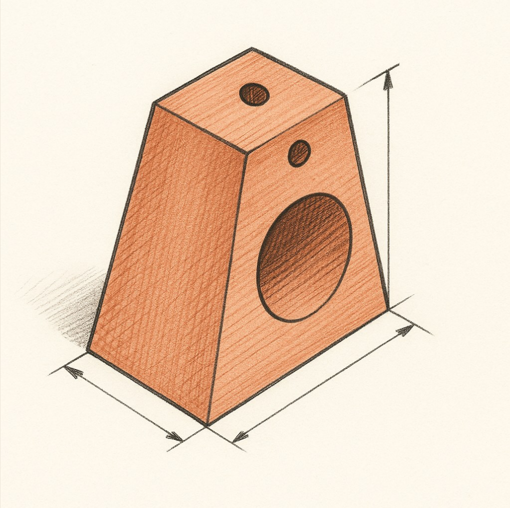
What is attractive

Mineral mass, formability, potential local manufacture, long service life, and the possibility of tailoring wet and dry surfaces.

What must be proven

Thermal performance, pressure loss, long-term moisture behaviour, hygiene, structural durability, manufacturability and installed cost.

No material magic. Terracotta is not presented as a universal "cooling material." Its value depends on how it is designed into the full heat-and-mass-transfer system.



Early terracotta form study. The public document intentionally avoids dimensions and internal manufacturing details.

One principle.
Different environments.

Territh is being explored as a climate-support layer wherever thermal load begins before people, animals or plants feel it.

CONCEPT VISUALISATION

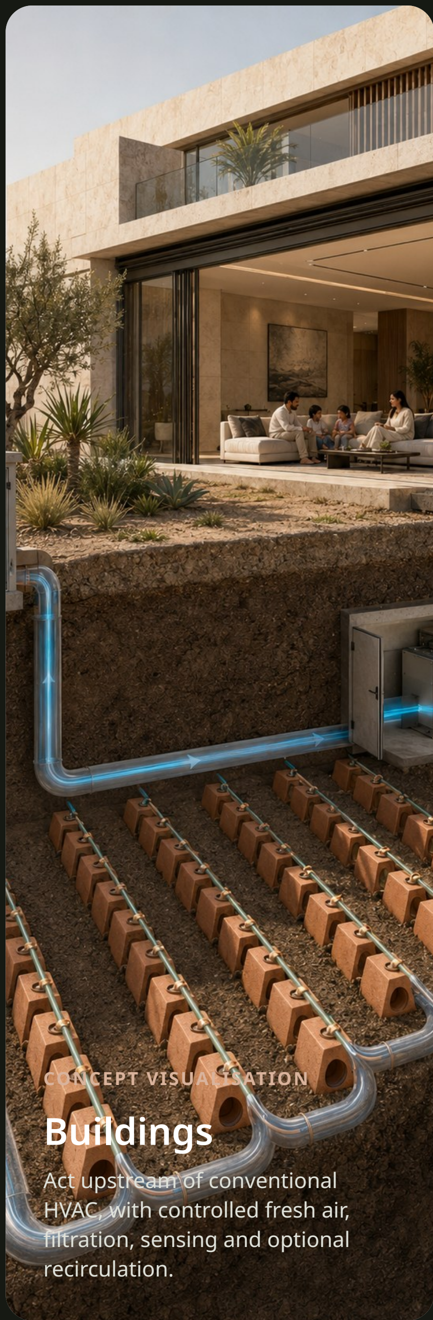
Greenhouses

Pre-condition incoming air before evaporative cooling, heat pumps or other controlled-environment systems handle the remaining load.

CONCEPT VISUALISATION

Livestock

Support high-volume ventilation and reduce heat stress without assuming every animal space must be conditioned like an office.



CONCEPT VISUALISATION

Buildings

Act upstream of conventional HVAC, with controlled fresh air, filtration, sensing and optional recirculation.

These images illustrate application directions, not completed Territh installations or final engineering layouts.

Territh is not a buried pipe.
It is a climate layer.

The long-term architecture is broader than the underground heat-exchange body. A useful system must decide when to use the Earth, what air to move, what to measure, and when to hand control to other equipment.

A

Air source

Outdoor air, recirculated air, or a controlled mixture.

›

B

Territh

Earth-assisted thermal and, where appropriate, moisture interaction.

›

C

Air quality

Filtration, drainage, hygiene safeguards and service access.

›

D

Mechanical stage

HVAC or process equipment handles the remaining thermal requirement.

What the controller needs to know

Temperature
Outdoor, inlet, outlet, soil and occupied/ process zones.

Humidity
To avoid treating evaporative effects as “free” sensible cooling.

Airflow + pressure
To quantify fan demand and distribution quality.

Air quality
CO_2 and application-specific IAQ indicators where relevant.

What it may decide

When Territh should run, when it should bypass, how much outdoor air is required, how much recirculation is acceptable, whether a wetted mode is appropriate, and when mechanical cooling or heating should take over.

This is where the project moves from a passive idea to a modern system: the physics stays simple, while sensing and controls allow it to work only when it is advantageous.

Design principle: the best operating mode may change by hour, season, climate and application. Territh should be able to respond rather than force one mode all year.

From field proof to measured engineering.

The next meaningful milestone is not a prettier render. It is a repeatable test programme that can turn the first field story into engineering data.

THERMAL	Synchronised inlet/outlet temperature, soil profiles, weather and heat-recovery effectiveness across repeated runs.
MOISTURE	Dry vs wetted operation, humidity ratio, water use, drainage, condensation and latent/sensible separation.
AIR	Verified flow, velocity, pressure drop, leakage and fan power at different operating points.
MATERIAL	Terracotta formulations, firing, surface treatments, durability, fouling and cleanability.
SEASONAL	Summer, shoulder-season and winter behaviour with control/bypass logic.
APPLICATION	Separate performance targets for livestock, greenhouses, buildings and large working spaces.

Concept visualisation of a future installation workflow - not a final construction drawing.

Success is not one temperature

A scalable Territh system should ultimately be judged by annual energy reduction, installed cost, reliability, air quality, water demand, maintenance burden, manufacturability and the value it creates in the target application.

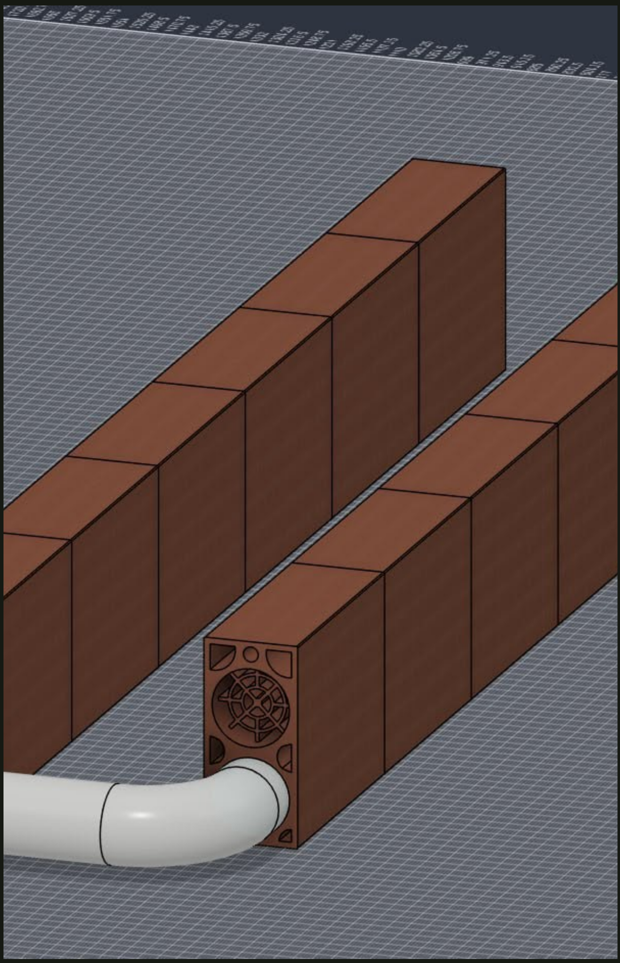
A system that cools strongly but requires excessive fan power, water, cleaning or excavation may not be a good system. The next phase has to optimise the whole installation, not a single laboratory number.

Territh is no longer an idea page.

A version was built, buried, lived through the seasons, measured in UAE summer conditions and used to inform the next architecture.

QUESTION	Can Earth-assisted airflow reduce the thermal distance before mechanical climate control?
PROTOTYPE	Concrete-block field build using available materials.
EVIDENCE	Recorded temperature progression during a UAE summer field test.
LEARNING	Construction, sealing, moisture, burial, operation and maintenance lessons.
ENGINEERING	Purpose-built modular terracotta system now in design development.
NEXT	Manufacture, instrumentation, controlled comparison and application-specific pilots.

> **We built the first one. It worked well enough to justify building the next one properly.**



Modular design study, 2026.

Public by design. The story, principle, prototype and published field readings are open. Exact geometry, internal routing, sealing, material treatments and control logic remain outside the public package while R&D and intellectual-property work continue.

Follow the experiment.

Project links

Territh project page
hani.solutions/territh
Current public project overview.

UAE field test video
youtu.be/Wvd-gfzGF2g
Build story, measurements and public narration.

Earlier concept archive

The project first appeared publicly under the working title "Subsurface Terracotta." The older solution page is retained as part of the project's evolution and may be visually updated during the wider Hani.solutions rebrand.

hani.solutions/solution?id=subsurface-terracotta

Credits

Special thanks to the Al Suwaidi family for providing the venue, funding and support that made the first prototype possible; to Salem bin Meskin for his support along the way; and to Delshad and Hossein for hands-on construction and testing work.

Built and tested in the United Arab Emirates.

Technical references

[1] Singh, R., Sawhney, R. L., Lazarus, I. J., & Kishore, V. V. N. (2018). "Recent advancements in earth air tunnel heat exchanger (EATHE) system for indoor thermal comfort application: A review." *Renewable and Sustainable Energy Reviews*, 82, 2162-2185. DOI: 10.1016/j.rser.2017.08.058.

[2] Agrawal, K. K., Agrawal, G. D., Misra, R., Bhardwaj, M., & Jamuwa, D. K. (2018). "A review on effect of geometrical, flow and soil properties on the performance of Earth air tunnel heat exchanger." *Energy and Buildings*. DOI: 10.1016/j.enbuild.2018.07.035.

[3] Mihalakakou, G., Souliotis, M., Papadaki, M., et al. (2022). "Applications of earth-to-air heat exchangers: A holistic review." *Renewable and Sustainable Energy Reviews*, 155.

Data note

Prototype values in this document are taken from the project's public field-test narration and associated photographs. They should be treated as directional field observations, not a certified HVAC test report. No annual energy-saving percentage or commercial performance guarantee is claimed here.

Document status

Public technical story / August 2026.
Prepared for Hani.solutions as a readable record of Territh's origin, first prototype, physical principle and development direction. Detailed engineering remains subject to ongoing design and IP work.

TERRITH

The project began underground.
Its real subject is where climate control begins.

Earth Systems / Territh