BREAKTHROUGH BUILDING TECHNOLOGIES
3D printing: disrupting construction industry
Construction 3D printers were introduced relatively recently on the market and now developing very fast, disrupting conservative construction industry, allowing to:

- reduce waste
- accelerate construction
- eliminate human factor
Portal type 3D printers
Mobile Crane type 3D printers
Mobile/Robotic arm type 3D printers
Mobile/Robotic arm type 3D printers
Challenges that all 3D printers face with:

- Converting architectural drawings into the 3D printer language
- Constant supply of concrete to printing nozzle
- The need of automatic mixing and supplying of the concrete
- The proper mix, suitable for 3D printing with stable properties and parameters
Sustainable 3D printing
Why geopolymer concrete is the best material for construction 3D printing?
According to the US Portland Cement Association

1 ton of cement = 1 ton of CO\textsubscript{2} 4700 MJ energy
Global Warming sea level prediction according to IPCC
According to the US Portland Cement Association, energy needs for OPC are 4700 MJ/ton.

According to the Geopolymer Institute, for 1 ton of Fly-Ash based geopolymer cement, 375 MJ of energy is needed, which is 10X less energy.

For OPC, 1020 kg of CO₂ per ton are produced, whereas for geopolymer cement, 50 kg of CO₂ per ton are produced, which is 10X less CO₂.

Geopolymer Technology
Main operational parameters for 3D:

- Short setting time
- Fast hardening
- Good workability
- Thixotropy
- High compressive / flexural strength
Using geopolymers you can easily reach the desired parameters, without adding expensive additives and reaching even better properties in terms of:

- fire resistance
- chemical resistance
- waterproof properties
- thermal resistance
Price comparison of geopolymer for 3D printing and Portland cement based mix:

Geopolymer concrete for 3D printing is **20–40% cheaper** than Portland cement based mix with the same properties depending on the availability of raw materials and the region.
The Dubai Future Accelerators is an intensive program that pairs top companies and cutting-edge entrepreneurs with powerful partners in Dubai to create breakthrough solutions. Launched by Sheikh Hamdan, Crown Prince of Dubai and Chairman of the Dubai Future Foundation, in line with the directives of His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Prime Minister of the UAE and Ruler of Dubai, the program explores and develops the technologies of the future and employs them to resolve the challenges of the 21st century.

It aims to create a global platform to attract the brightest minds from around the world to find creative solutions for the challenges of the future and implement them in the city of Dubai. The inaugural program, which finished in December 2016, created $33m in commercial partnerships and pilot programs.
25% of Dubai’s buildings will be 3D printed by 2030

UAE Vice President, Prime Minister and Ruler of Dubai, His Highness Sheikh Mohammed bin Rashid al-Maktoum

2% of building must be 3D printed by 2019
ESTIMATED MARKET GROWTH: 3 billion AED (1 bln. EUR)

NEW EMERGING MARKET

Market growth only in Dubai according to gulfnews.com
According to Al Sa’fat evaluation system, each building should meet the green building requirements and existing buildings should be retrofitted to fit this regulations.
Products based on geopolymer technology by Renca for GCC region:

- Fireproof foams
- Passive Cooling Systems
- UHPGPC
- Repair mortars
- Concrete for 3D printing

Sulphates- / Acid-resistant structures for seashore
After 28 days in 10% Sulphuric Acid Solution:

OPC
40% weight loss
70% strength loss

GPC
0% weight loss
0% strength loss

ACID resistant geopolymer concrete
Sustainable 3D printing

We have successfully used geopolymer concrete in construction 3D printing together with automatic mixing system, developed by our company, we make construction faster, safer and cleaner, providing stable properties and avoiding human factor.
### TEST REPORT

**Construction Materials Laboratory Section - Structural Unit**

#### COMPRESSIVE STRENGTH OF HARDENED MORTAR

**This Report is computer approved and authorized by Structural Unit**

It does not require any signature

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**Report No:**

**Report Date:**

**Project No:**

**Project Name:**

**Consultant:**

**Contractor:**

**Location:**

**Source:**

**Sample Description:**

**Request No:**

**Sampling Date/Time:**

**Receiving Date/Time:**

**Sample Size:**

**Nominal Size / Working Block Size L * T * H (mm):**

**Lot Number:**

**Lot Size:**

**Sender No:**

**Laying Date/Production Date:**

**Sampled By:**

**Samples Brought By:**

**Sampling Method:**

**Test Method:**

**Tested By:**

**Testing Date:**

**Sampling Report No:**

**Test Method Variation:**

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**TEST RESULTS**

<table>
<thead>
<tr>
<th>SPECIMEN</th>
<th>WATER RATION (VOL/WT) %</th>
<th>PRODUCT MANUFACTURING DATE</th>
<th>AGE AT TEST (DAYS)</th>
<th>MEAN COMPRESSIVE STRENGTH, N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS17-1076</td>
<td>06/05/2017</td>
<td>05/04/2017</td>
<td>05/04/2017</td>
<td>RENCA RUS</td>
</tr>
<tr>
<td>MORTAR</td>
<td>16 kilogram</td>
<td>NA</td>
<td>28</td>
<td>46.3</td>
</tr>
</tbody>
</table>

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**Remarks:**

1- **PRODUCT NAME**: RENCA 3D GEOPOLYMER CONCRETE
2- **DEMOLING OF SPECIMEN AFTER 60 MINUTES**
3- **MIX PROPORTION**: GEOPOLYMER CEMENT (PART A) – 30.9% + SAND 57.4% + GEOPOLYMER REAGENT – GEOSILICATE (PART B) 11.7%

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**To verify this document please go to**: [http://login.dm.gov.ae/wps/portal/documentverification](http://login.dm.gov.ae/wps/portal/documentverification) and Enter Document ID: EMTX-2017-021167 and Verification Code: 091-287 or scan the QR code below.
MoU with Dubai Municipality

Renca signed an MOU with Dubai Municipality to provide green geopolymer concrete and automatic mixing system for the pilot on-site 3D printed house in Dubai.
The need of automatic mixing system
MOBILE MIXING PLANT:

technology and research by
Alex Reggiani and designer
Athos Reggiani
FEATURES OF MIXING PLANT:

- Efficient mixing
- Ease of use
- Increased durability
- Fast cleaning
Automatic Mixing System for Concrete
RENCA deliver the all-in-one solution:

The complete system for geopolymer cement production

3D printers and automatic mixing system for concrete

Technology for production a wide range of sustainable products based on local raw materials
Architectural geopolymer concrete
High Performance Concretes
THE RALLY

8 weeks
2 continents
20 countries
300+ cars

MONGOL RALLY is an international charity rally covering 16,000+ kilometers (1/3 of the Earth), crossing mountains, navigating deserts, passing through some of the most remote terrain on the planet, traveling from London, England, to Ulaanbaatar, Mongolia, with no set route and no back up in a 1 litre vehicle.
Mongol Rally is not just about having an insane trip and hang out with crazy people. It's also about saving the planet and making the world a better place. Each team participating in the Mongol Rally shall donate at least £1000 to charity, a half of this shall go to the Official Mongol Rally Charity - Cool Earth.

www.coolearth.org

www.geomongol.ru
FUTURE IS NOW!

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