Geoengineering transforms climate into a global political project, yet operates on a single, shared planet still divided by asymmetries of power unable to govern its consequences. Through speculative architectural storytelling, future scenarios are staged at the threshold between reality and fiction, making their implications visible and revealing uneven capacities to decide and bear their effects

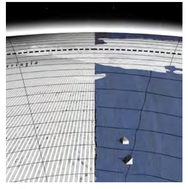
DESIGN EARTH is a research practice founded by Rania Ghosn and El Hadi Jazairy in 2010. Their work engages the medium of the speculative architectural project to make the climate crisis public. Their previous works include “Geographies of Trash” (2015) and “Geostories: Another Architecture for the Environment” (2018-2022)

The Planet After Geoengineering

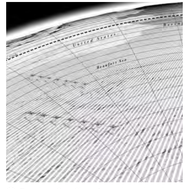
WORDS BY VALENTINA CAMPANA
IMAGES BY DESIGN EARTH

STORY II

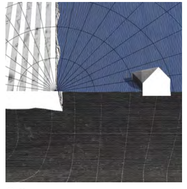
ARCTIC ALBEDO



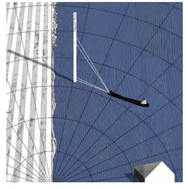
❶ The Arctic is warming twice as fast as the rest of the planet



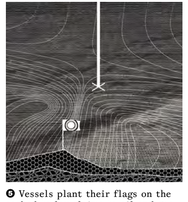
❷ Bands of reflective glass beads are applied to slow the meltdown



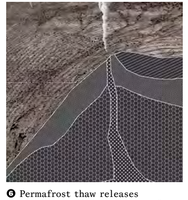
❸ Yet, the exposed darker areas of seawater and soil absorb more solar radiation leading to further warming



❹ An ice-free Arctic summer looms on the horizon. Less sea ice means more ship traffic



❺ Vessels plant their flags on the seabed to lay claims to oil and gas reserves below the ice



❻ Permafrost thaw releases hundreds of millions of years of buried carbon into the atmosphere



❼ To restore the Earth's white pole, seawater is pumped onto floating dome structures



❽ Herds of large herbivores are released onto the tundra to create vast grasslands. Extinct woolly mammoths are cloned and introduced as well



❾ The grazers stomp thick topsoil, protecting the carbon-rich permafrost



❿ Extreme wildfires consume the old-growth boreal forests



⓫ Indigenous Guardians rekindle with prescribed burns, setting off controlled fires within cleared perimeters



⓬ The word for world is (Still) Forest



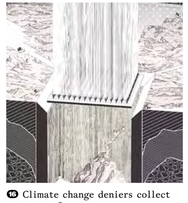
⓭ The Alaska-based HAARP facility harvests methane emissions from a giant snow globe



⓮ Tiny particles of diamond fall from the sky



⓯ The energy-intensive operation is powered by natural gas



⓰ Climate change deniers collect even more fortunes

STORY III

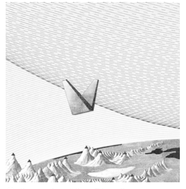
SKY RIVER



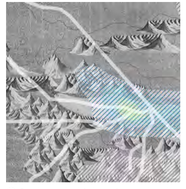
❶ Rainmaking artificially induces precipitation by dispersing substances into the clouds



❷ Extreme droughts and global warming have spurred a renewed interest in the pattern modification of vapor flows



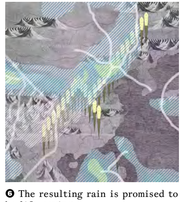
❸ Operation "Sky River" melts snow



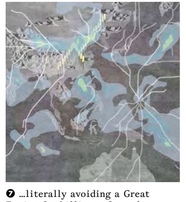
❹ It channels high-moisture bands of air from the Tibetan Plateau...



❺ ...to mitigate drought and irrigate the Gobi Desert



❻ The resulting rain is promised to be life-saving...



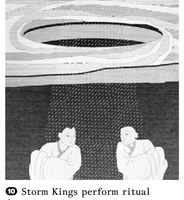
❼ ...literally avoiding a Great Famine for billions of people



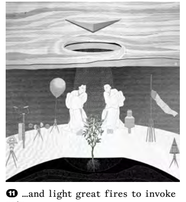
❽ Tens of thousands of crystal-like fuel-burning chambers blast silver iodide into the atmosphere



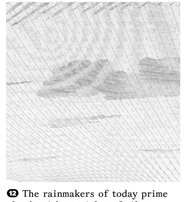
❾ Political strife grows between highlands and lowlands as they compete to secure freshwater resources



❿ Storm Kings perform ritual dances...



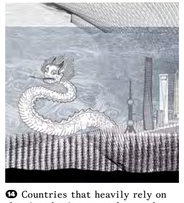
⓫ ...and light great fires to invoke rain



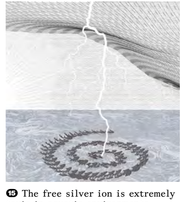
⓬ The rainmakers of today prime clouds with particles of silver iodide



⓭ The water cycle is a zero-sum game: increased rainfall in one region is moisture missed elsewhere



⓮ Countries that heavily rely on the river basins quarrel over the skies for rain



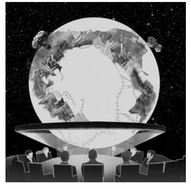
⓯ The free silver ion is extremely toxic in aquatic environments



⓰ A Spiral Jetty of dead juvenile fish emerges from the waters

STORY IV

SULFUR STORM



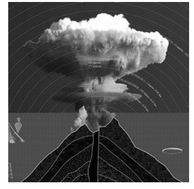
❶ Climate scientists debate the use of solar radiation management techniques



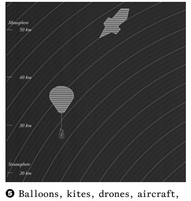
❷ Edward Teller, "father of the hydrogen bomb", proposes injecting sulphate aerosol into the atmosphere to reflect sunlight away from Earth



❸ The thickening shroud of particles mimics the solar shield of volcanic dust to recreate the global cooling effects of the 1815 eruption of Mount Tambora



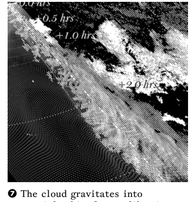
❹ Operation Sulfur Storm detonates the Cold War nuclear arsenal in the magma chambers of tropical volcanoes



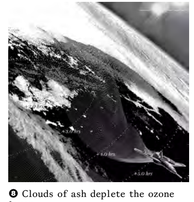
❺ Balloons, kites, drones, aircraft, and naval artillery continuously spew millions of tons of tiny sulphate particles into the sky



❻ A bright afterglow is a familiar sight at sunset



❼ The cloud gravitates into equatorial orbit. Saturn-like rings circle the Earth



❽ Clouds of ash deplete the ozone layer

❾ The exhaustion of the ultraviolet shield has dire implications for life on Earth

❿ Aerosol particles make it hard to breathe

⓫ A Crystal Vivarium is a refuge for the one and a half-billion winners of geoengineering

⓬ Four times this number are left standing outside

⓭ The Continuous Drywall City converts excess sulphur dioxide...

⓮ ...into synthetic gypsum – wallboard, plaster, and soil additives

⓯ Sulphur dioxide also inhibits photosynthesis

⓰ The same sulphate production line filters the air for sensitive species

Materials

THE PROJECT

"The Day the World Ended" is the title of the first chapter of *Cat's Cradle*, the 1963 novel that brought Kurt Vonnegut to international attention. In the book – a book about a book – the protagonist John, or Jonah, reconstructs the story of Dr. Felix Hoenikker, a Nobel Prize-winning physicist who took part in the creation of the atomic bomb dropped on Hiroshima. But Hoenikker is also the inventor of *ice-nine*, a "prodigious" chemical compound capable of instantly freezing water and, with it, everything that contains it: plants, animals and human beings.

The effects are devastating: after a series of complex vicissitudes involving soldiers, dictators and holy men, *ice-nine* ends up in the sea, triggering a chain reaction that turns the entire planet into a frozen expanse. "It was winter, now and forever".

What makes this narrative of scientific, religious, political and apocalyptic fiction particularly compelling is that it is not entirely speculative. A liquid polymer capable of crystallising water does exist: it was discovered in 2018 by researchers John Keith and Sachin Velankar at the University of Pittsburgh.

But that is not all. As Ursula K. Le Guin observed, "science fiction is not predictive; it is descriptive"; and a biographical detail brings fiction and reality into uneasy proximity: Kurt Vonnegut was the brother of Bernard Vonnegut, the inventor of silver iodide, used to induce rainfall in cloud seeding—a weather modification technique that can be seen as an early, small-scale form of geoengineering.

The term "geoengineering" – or the more reassuring "climate engineering" – refers to deliberate interventions in Earth systems directed at counteracting the effects of climate change. These are large-scale technologies designed to "fix" the planet's climate and can be broadly classified into two categories: solar radiation modification (SRM), which seeks to reflect a small portion of sunlight to cool the Earth, and carbon dioxide removal (CDR), which aims to extract CO_2 from the atmosphere through natural or industrial processes. To these can be added glacial geoengineering, which works to slow the loss of glaciers, ice sheets and sea ice.

In 1991, following the eruption of Mount Pinatubo in the Philippines, global temperatures fell by around 0.4 °C. Replicating this effect artificially is now the subject of study and debate: as the climate crisis accelerates and the ecological transition struggles to keep pace, some governments and institutions are beginning to view geoengineering as an emergency option. Certain techniques, such as direct air capture (DAC) or ocean fertilisation, are already being tested. However, the scientific community remains divided over whether such practices should be deployed, given the significant risks involved: unpredictable impacts on ecosystems and disruptions to rainfall patterns, along with the possibility of technological lock-in—once initiated, these interventions may be difficult to halt.

It is within this context that *The Planet After Geoengineering*, the animation by DESIGN EARTH presented at the Biennale Architettura 2021 *How will we live together?*, situates itself, addressing geoengineering not as a technical solution but as a field of political and design imagination.

The project – here revisited in the form of a storyboard (with reference to Superstudio's 1969 film script for *The Continuous Monument*) – unfolds across five geostories: *Petrified Carbon*, *Arctic Albedo*, *Sky River*, *Sulfur Storm* and *Dust Cloud*. Each narrates a possible future for the Earth following the adoption of a specific geoengineering technique, situating these visions within a genealogy of climate-control projects ranging from nineteenth-century rainmaking machines to Cold War military plans.

In *Petrified Carbon*, where cities become smog-eating machines, carbon dioxide is captured and transformed into diamonds, stored in repurposed nuclear shelters. In *Arctic Albedo*, Arctic ice becomes a surface to be designed through reflective materials that regulate its extent, opening new shipping routes and enabling access to fossil resources. To offset the resulting emissions, ecological measures are introduced that even include the cloning of mammoths.

Sky River imagines a world in which the diversion of atmospheric currents through cloud seeding produces rainfall in arid regions such as the Gobi Desert, while *Sulfur Storm* explores the injection of particles into the atmosphere to shield incoming solar radiation, and its impact on an increasingly unequal society.

Finally, *Dust Cloud* shifts intervention into space, where an artificial cloud between the Earth and the Sun regulates the amount of light reaching the planet but makes the air unbreathable, triggering a process that acts more as palliative care than a long-term solution.

These five geostories function as cautionary tales for the Anthropocene—critical devices that do not merely illustrate technical solutions but render visible what models tend to abstract: the material implications and the political and geopolitical asymmetries of an engineerable planet. In doing so, they raise a series of fundamental ethical questions: which forms of life are in need of being safeguarded, from what threat, by which actors and means, to which ends and at what cost? Crucially: who decides on actions that have planetary consequences and therefore concern us all?

The Earth cannot be placed in a laboratory. To intervene in it is to intervene in the very conditions of life itself. How can we imagine – and therefore guide – an experiment in which we ourselves are the guinea pigs?

Once again, it is in the tension between reality and fiction that certain answers may be glimpsed. The architectural project, as a speculative narrative practice, can communicate the climate crisis, geoengineering and its controversies to a broader public, galvanising debate and interrogating responsibilities in order to anticipate other possible worlds.

In this sense, Vonnegut's narrative returns with renewed relevance. On 6 August 1945 – *the day the world ended* – we might also recognise one of the largest geoengineering experiments ever undertaken.

Since then, we have never stopped designing the planet. How to do so collectively remains the central question.

1991

The eruption of Mount Pinatubo in the Philippines released vast quantities of ash and sulphur dioxide into the atmosphere, lowering global temperatures by around 0.4 °C for nearly two years–a natural event that revealed the planetary scale of atmospheric intervention.

1945

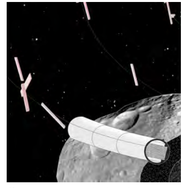
The atomic bomb dropped on Hiroshima on 6 August 1945 marked a turning point in humanity's capacity to alter the planet. While its climatic impact was limited, it signalled the emergence of technologies capable of producing global consequences–an early, violent form of large-scale artificial intervention.

STORY V

DUST CLOUD



❶ A shield that protects the atmosphere from two percent of solar radiation offsets the warming effects of greenhouse gas emissions



❷ A giant space shade orbits in equilibrium between Earth and the Sun



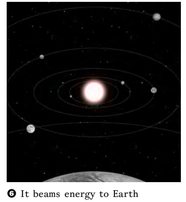
❸ The shield is an artificial constellation of dust that is mined from near-Earth asteroids



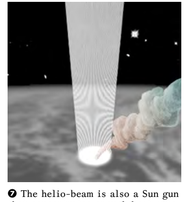
❹ The empty capsules cross paths with the Earth's orbiting junkyard of satellites



❺ The compacted junkyard is polished into a space-based solar power plant



❻ It beams energy to Earth



❼ The helio-beam is also a Sun gun that concentrates enough heat onto a point to make an ocean boil or a city burn



❽ The thick dust and smoke dull the starry sky



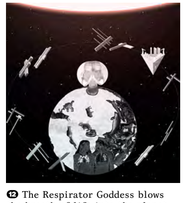
❾ All wars on life begin by attacking the respiratory system



❿ The terror of geoengineering is to be forced to live intimately with the death of the atmosphere…



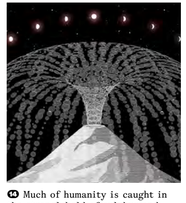
⓫ …contemplating suffocation as a real possibility



⓬ The Respirator Goddess blows the breath of life into the planet



⓭ Dust plumes close in an artificial eclipse



⓮ Much of humanity is caught in the stranglehold of sulphur and dust storms



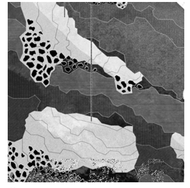
⓯ Swirling whorls of dust sweep through barren lands



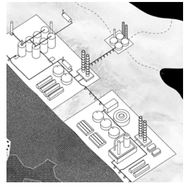
⓰ The Earth deserves palliative care. Welcome to the climate emergency

STORY I

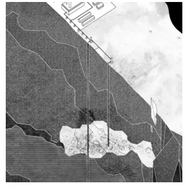
PETRIFIED CARBON



❶ Can the planet have its carbon cake and eat it too?



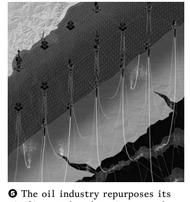
❷ The fossil fuel industry promotes carbon dioxide capture and sequestration in depleted oil and gas reservoirs



❸ More oil out; more carbon dioxide in; more revenue for the largest polluters



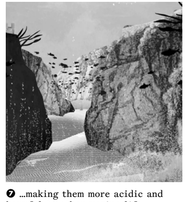
❹ The Earth trembles and cracks under pressure



❺ The oil industry repurposes its pipelines and tankers into a carbon storage infrastructure



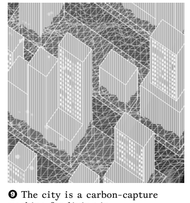
❻ The oceans, the Earth's largest carbon sink, absorb a third of humanity's carbon dioxide emissions…



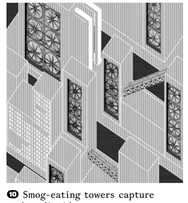
❼ …making them more acidic and harmful to other marine life



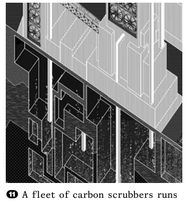
❽ Fully loaded tankers roam the oceans, capturing carbon dioxide emissions in open-water algae plantations



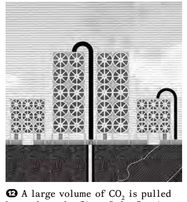
❾ The city is a carbon-capture machine for living in



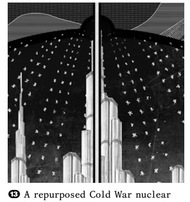
❿ Smog-eating towers capture carbon dioxide



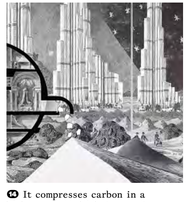
⓫ A fleet of carbon scrubbers runs down facades



⓬ A large volume of CO_2 is pulled beneath to the City of the Captive Carbon Globe



⓭ A repurposed Cold War nuclear shelter, the City is a recovery plant



⓮ It compresses carbon in a high-pressure, high-temperature process and turns it into diamonds



⓯ The carat is the new unit of measurement of carbon footprint



⓰ City air makes one (carbon) free, they say