Why is this challenge relevant?

- Over the course of the next century, extreme heat conditions will become much more common, along with their imposing health risks. In the United States alone, the number of days with highs of 100° Fahrenheit (38° Celsius), could double. Along with this, June of 2019 broke the record for the hottest June ever recorded in Europe and around the world.
- We are interested in a technique that allows us to take advantage of the **heat of the subsoil**. The internal architecture of passive or bioclimatic houses is one of the simplest systems that we can find. Circulating the air through the surface layer of the subsoil will provide to the home's **coolness in summer** and a **warm temperature in winter.**

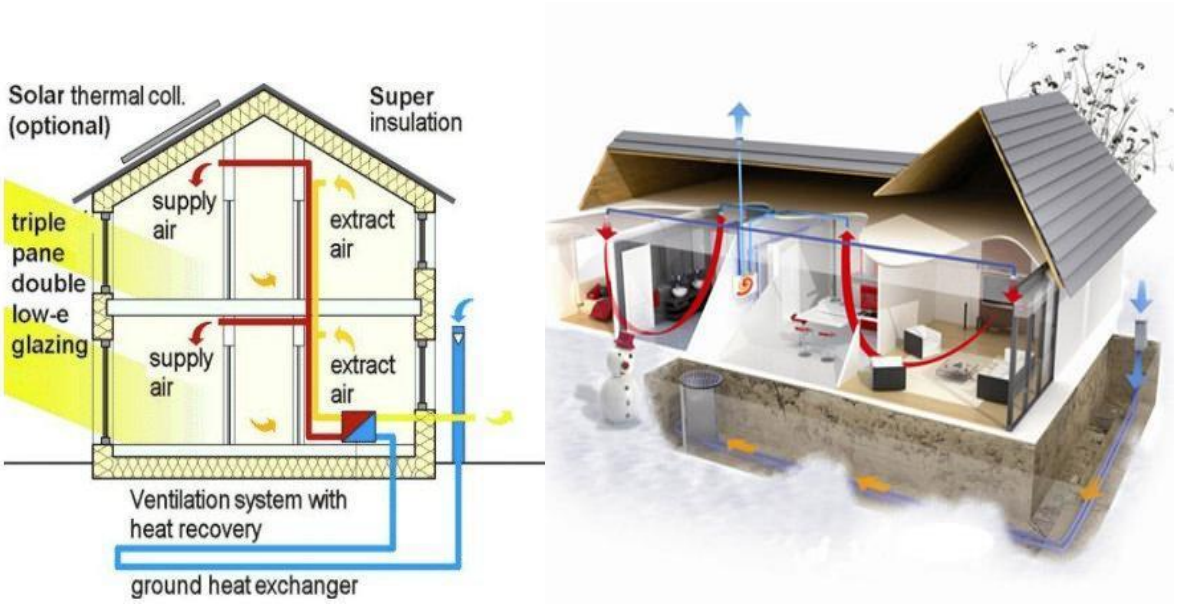
Overview:

- The system consists of the use of the geothermal inertia of the land to condition the air that we make flow into the interior of a building through buried pipes at a certain depth of the ground. The goal of these systems is to heat or cool the air in a natural manner.
- If we assume the temperature of soil at a depth of approximately 2 meters is nearly constant throughout a given year, we can utilize this natural preservation of temperature to pre-heat or pre-cool the air flowing into a building.
- In this challenge, we consider the air the thermal conduction, the floor the caloric accumulator, Canadian wells pipes are the heat exchangers, and the buildings are the beneficiary of a naturally tempered ventilation system.
- Any skeptics doubting the performance of Canadian wells as conventional air conditioning substitutes will find that these systems can also be connected to artificial air conditioning systems in order to preheat the air they use. This reduces the thermal jump and energy expenditure. This factor is of vital importance in the most extreme climates where bioclimatic ventilation is not enough to suppress the thermal temperatures entering the buildings.

Elements for the solution:

The Provencal Well

- Passive geothermal zero consumption
- Underground cellars

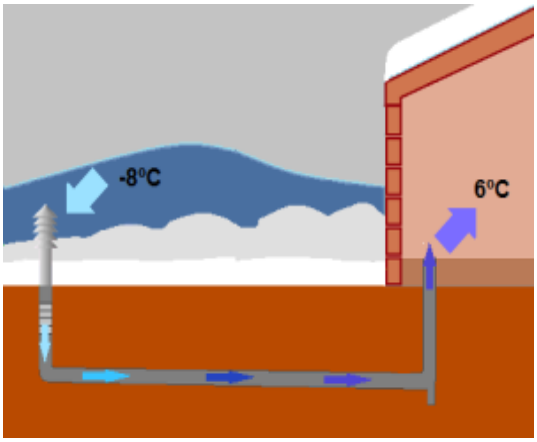


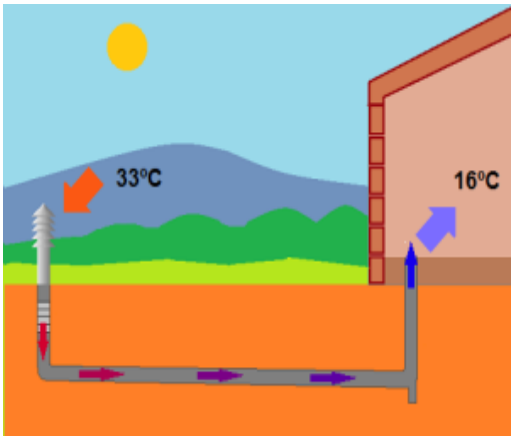
(Sources: https://sgarq.com/fr/canadian-or-provencal-well/ https://www.e-zigurat.com/blog/en/bio-climactic-solutions-for-building-ventilation-provencal-and-canadian-wells/)

Objectives of the Challenge:

- Adapt existing natural cooling systems to the size of a city.
  1. The Provencal well is a natural system that is environmentally friendly.
  2. Some cities have subsoil that is adapted to this solution. Paris, for instance, has lots of subsoil that has been dug up to provide rocks for the construction of its buildings. This means there are many underground areas with significant depth that could be utilized for a natural cooling system.
  3. Pictures of Paris' carrières, catacombes, and petite ceinture:

We estimate that at a depth of about 20 meters we can find a constant temperature throughout the year. However, at a depth of about 3-4 meters we already have temperatures that we can consider close to the optimal comfort temperatures in a home (18º to 23º).





Advantages:

- The operation requires practically no energy.
- A passive system, preheating or cooling the air in a natural way, causing no unwanted carbon footprints or harm to the environment.

Preferred Criteria:

General:

- Propose innovative ideas for new underground cooling techniques that improve the air temperature in a natural manner.

Technical:

- The proposed system should be able to be plugged into or on the air heating systems.
- A retrofit option to be able to adapt the solution to traditional central heating systems.
- Innovative air systems in the case of electric heating systems.

Economic:

- Set-up costs should be relatively similar to the costs of traditional heating/cooling systems.
- The ROI (Return On Investment) should be justified by the lower level of energy to heat or cool the air.

Environmental:

- The systems should emit a carbon footprint significantly lower than traditional heating/cooling systems.

Expected Format:

- A few paragraphs explaining your innovative idea(s). **This should include:**

1. A technical description
2. Different options that include existing systems
    i. Heating
        a. Centralized heating
    ii. Cooling
    iii. Ventilation
    iv. Etc.
3. Estimated costs
    i. Set-Up
        a. ROI-vs-Traditional Systems
    ii. Materials
    iii. Etc.

Reward:

We are offering a **3000-euro** reward for the solution deemed the most applicable to the challenge.