Question:
Can we create an innovation, that can produce a sufficient amount of water during major periods of drought?

Background:
Our inspiration (for this innovation), came from the drought Ontario experienced in 2016. There was a major problem happening, and no one had any idea of how to help. We started with the idea of using a dehumidifier and using the moisture it collected from the air, to use for everyday use. We had found a setback, it had already been done.

So then we got the idea of collecting condensed water from copper coil. We had cold water circulating through copper that was coiled (inside of the greenhouse), heat, and humidity (created by a hot plate, and pot), together makes condensation, which is then collected into a trough. This collected water would need to go throughout a filtration system, to remove traces of copper and pollution. This condensed water then, can be used for everyday use (showering, washing hands, drinking, watering plants, etc.).

Purpose:
The purpose of our project is to reduce the effects of drought. This innovation that has been carried out and experimented, can help places like Cape Town, South Africa. Cape Town, is currently experiencing a major drought that is limiting their water use to only one third of the regular human daily consumption. The residents are permitted to use 50 liters of water per day, when the average human consumption required per day is 150 liters of water.

Fifty liters can supply for only a two minute shower, washing your hands and face (quickly, twice), flushing a toilet (once), doing dishes (once), brushing your teeth (twice), cooking meals (twice), drinking average amount of water you need (2L), and water for your pets (2L). Therefore, an excess of 31 Litres per day (through this invention), would be quite beneficial to Cape Town, and other places like this.

Hypothesis:
The hypothesis (for our experiment) was, we could collect 10 mL of condensed water, per hour, with 75-77% humidity. The greenhouse (this is what was used, to trap the humidity and recreate a hot, humid summer day during drought), would stay at a constant 25 degrees Celsius, and the water circulating throughout the copper pipe (there was copper coil going throughout the greenhouse, to have the cold water going through, so cold pipe and warmer humidity's/temperatures together will condense) would be at 10 degrees Celsius temperature during our experiment.

We hypothesized (for our experiment, for the second set of tests), we could collect 20 mL of condensation, per hour, with 75-77% humidity, with a temperature of 30 degrees Celsius inside the greenhouse, and 10 degrees Celsius water inside the copper coil.

We hypothesized (for our experiment, for the third set of tests), we could collect 50 mL of condensation, per hour, with 75-77% humidity, with a temperature of 35 degrees Celsius inside of the greenhouse, and 10 degrees running through our copper coil.

Method:
- A Greenhouse kit was purchased and assembled as shown in the instructions, and then a copper coil of 3.048 meters was installed inside the green house
- One end of the copper coil was connected to the water source and the other end of the copper coil into a sink
- A Humidistat and a Thermometer was attached to measure the humidity and temperature of the Green house
- Under the copper coil, a trough was placed to collect the condensed water from the copper coil
- A heat source was placed under the shelf with a pot of water to create the humidity in the Green house
- After setting up all these, all the holes were covered and patched that were done during the process of installation
- A person was assigned to use the stop watch to start and stop for the experiment

Results (Experiment 1):
At Room temperature 25 ºC; Circulating water temperature 10ºC;
Duration of collection of condensed water 60 Minutes:

Humidity (%)	Amount of Circulated water (L)	Amount of water collected in condensation (mL)
75	6.953	12
75	7.053	13
75	7.927	13
75	6.877	13
75	7.464	13
75	7.364	13
75	6.532	14
77	7.846	13
77	7.202	13
77	7.103	12.5

Average: 13 mL, and 7.23.L of water circulated in the copper coil.

Results (Experiment 2) :
At Room temperature 30 ºC; Circulating water temperature 10ºC;
Duration of Collection 60 Minutes:

Humidity (%)	Amount of Circulated water (L)	Amount of water collected in condensation (mL)
75	5.197	26
75	6.221	26
75	7.279	26
75	5.638	27
75	6.107	26
75	7.283	27
75	6.288	26
77	7.103	27
77	6.489	26
77	7.283	26

Average: 26 mL and 6.488 L of water circulated in the copper coil.

Results (Experiment 3) :
At Room temperature 35 ºC; Circulating water temperature 10 ºC;
Duration of collection 60 Minutes:

Humidity (%)	Amount of Circulated water (L)	Amount of water collected in condensation (mL)
75	7.017	67
75	7.010	65
75	6.327	69
75	6.988	68
75	6.760	68
75	7.991	67
77	8.760	65
77	7.213	67
75	8.435	65
75	6.938	68

Average: 67 mL (66.9) collected, 7.307.L water circulated in the copper coil.

Results (Experiment 4) :
At Room temperature 40 ºC; Circulating water temperature 10 ºC.
Duration of collection of condensed water 60 Mins:

Humidity (%)	Amount of Circulated water (L)	Amount of water collected in condensation (mL)
75	8.551	96
75	8.076	97
77	7.938	101
77	8.650	97
77	7.932	98
77	6.461	95
77	6.913	95
77	6.799	95
77	6.037	95
77	6.938	96

Average 96.5 mL, and 7.4295 L of water circulated in the copper coil.

Observations:

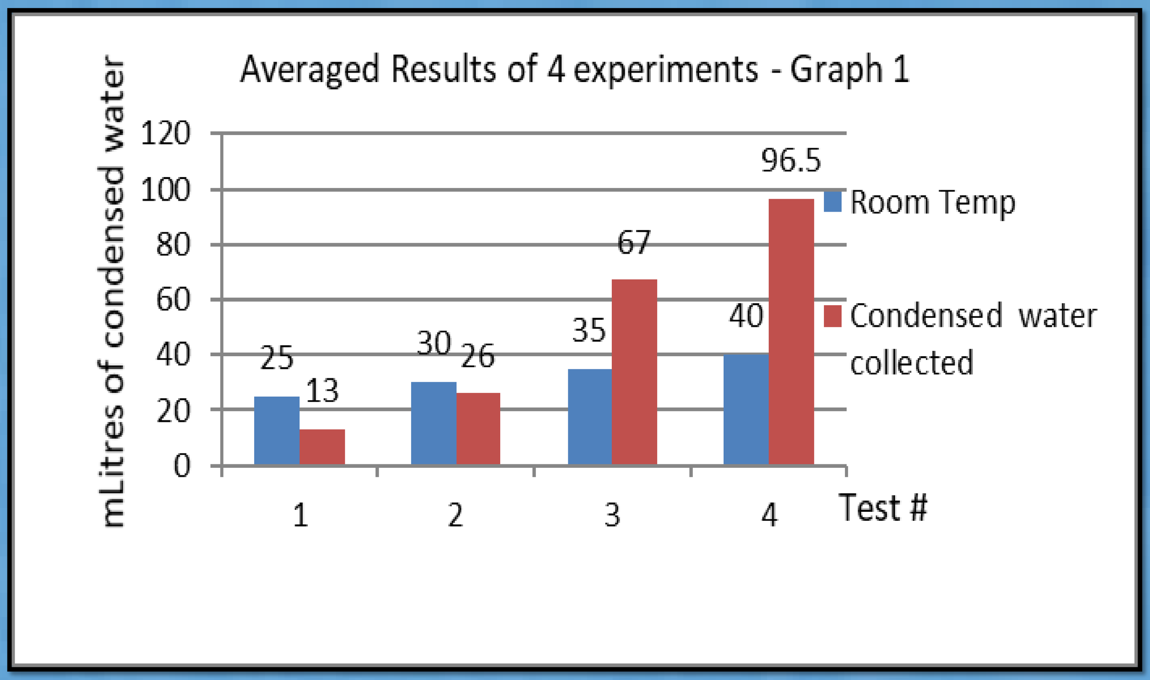
We have observed, that during the testing of 25ºC temperature, 10ºC water going through the coil, and 75-77% humidity, we could collect 12.95 mL of condensation, per hour from 3.048 meters of copper coil. On our house model we could collect 1,295 mL per hour with 304.8 meters of copper coil, and 31,080 mL in one day.

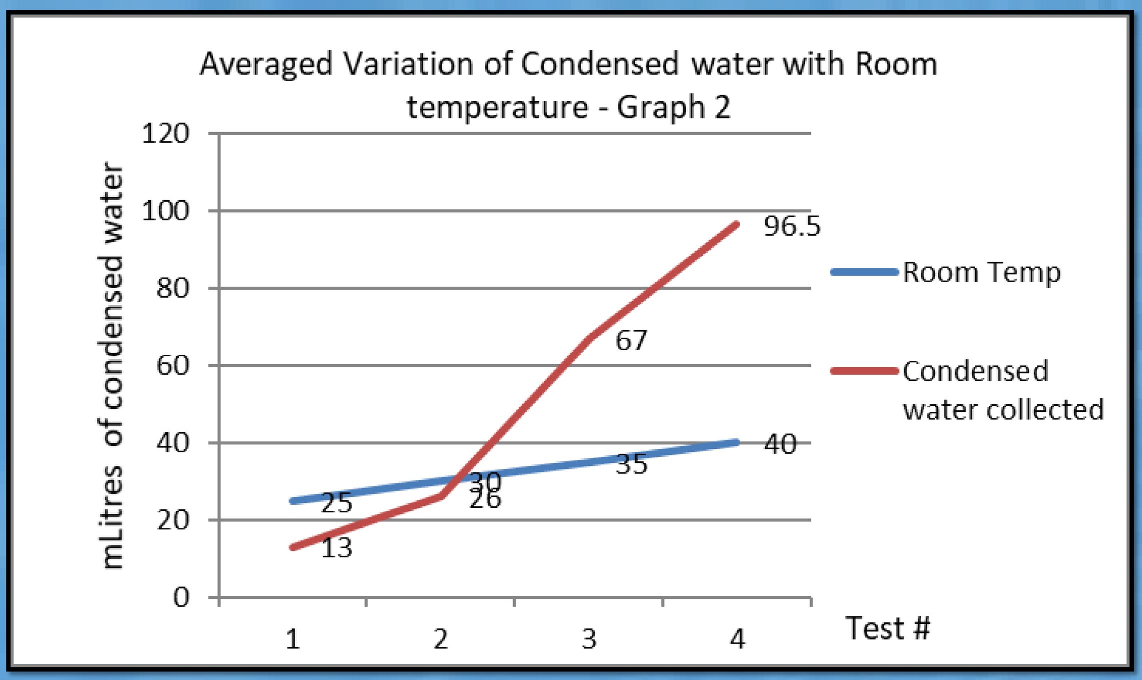
We have observed, that during the testing of 30ºC temperature, 10ºC water going through the coil, and 75-77% humidity, we could collect 26.3 mL of condensation, per hour from 3.048 meters of copper coil. On our house model we could collect 2,630 mL per hour with 304.8 meters of copper coil, and 63,120 mL in one day.

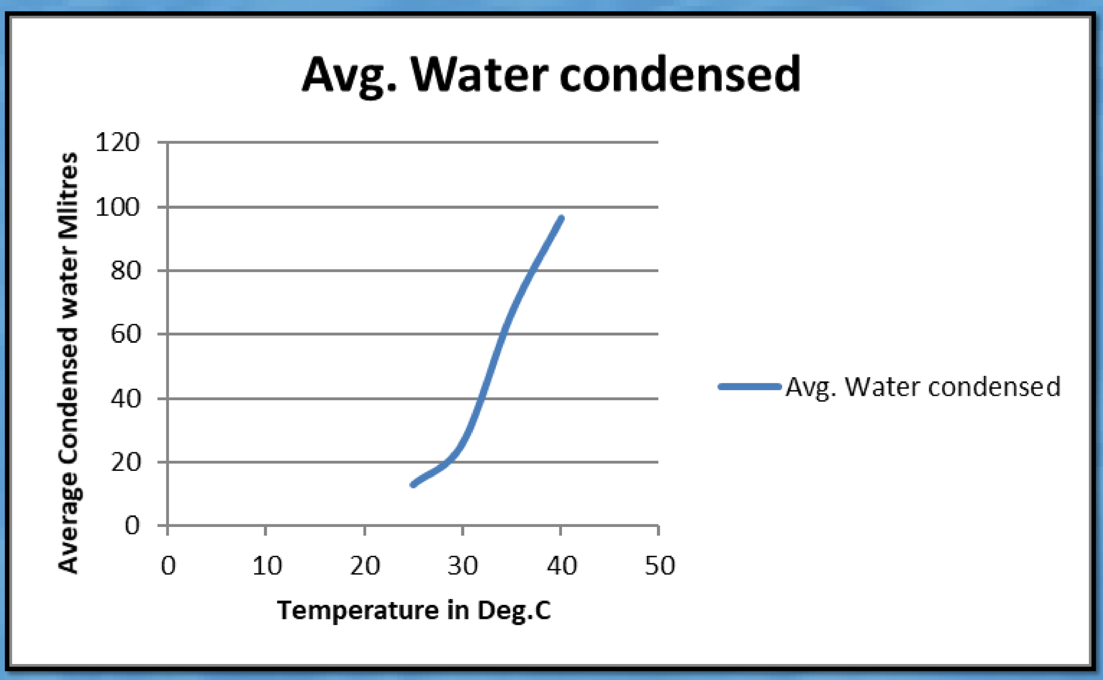
We have observed, that during testing of 35ºC temperature, 10ºC water going through the coil, and 75-77% humidity, we could collect 66.9 mL of condensation, per hour from 3.048 meters of copper coil. On our house model we could collect 6,690 mL per hour with 304.8 meters of copper coil, and 160, 56 mL in one day.

We have observed, that during the testing of 40ºC temperature, 10ºC water going through the coil, and 75-77% humidity, we could collect 96.5 mL of condensation, per hour, from 3.048 metres of copper coil. On our house model we could collect 9,650 mL per hour with 304.8 metres of copper coil, and 231,600 mL in one day.

Test #1	Room Temp C	Average Condensed water collected mL
1	25	13
2	30	26
3	35	67
4	40	96.5







Conclusion:

In conclusion, we believe this innovation will be beneficial to those live in tropical countries. We are finding that humidity does play as an important factor, but heat is mostly needed for the innovation to yield good condensation. If we were able to install this innovation, we think installing it in places in India would work quite well due to their average temperatures 30*ºC*. Also, it may work better in North American countries due to the temperature of the circulating water coming through the underground pipe is cold water to form condensation. It is evident from our experimental readings, the higher the difference in temperature of circulating water and the room temperature yield more condensation of water with varying humidity level. We believe this could potentially save our world from a significant problem.

Our 4 experiments show that having 3.048 meters of copper pipe for condensation produces average of 13 mL (.013 L) to 101 mL (.101) of condensed water, hence if we install 304.8 meters of copper coil in an average home in a tropical country, it is possible to increase the yield of condensed water 1.3L to a maximum of 10.1L per hour, while doing this the temperature and the humidity, and heat of this country needs to be higher.

We believe this extra water (as the hourly collected amounts may sound minimal, over time this tallies up), and it could potentially save the human race. Even though it is a small amount, when minimal water is available, over a liter more an hour could really help. If you think about it in the big picture that is 31L 80 mL - a day. This extra water could help us, after going through a filtration system (to get rid of any bacteria or traces of copper), and used for everyday use like washing the dishes, taking a shower, washing your hands, anything you would usually use regular water for.

We are still in the process of doing our experiments with each variable varying and keeping other variable constant with the view of producing more yield of water through condensation.

Limitation:

- Green house temperature cannot be kept constant, and always find to be drifted slightly higher sometimes
- Humidity depends on room temperature, hence adjustment of one affects the other, hence it is difficult maintain at constant value of each
- Air leakages inside/outside of Green house
- Time elapses during accurate timing measurements – human error

Assumption:

- Collected condensed water was the true measurement in litres
- Humidity and temperature was maintained constant during the appropriate experiment
- Stop watch timer was accurate
- Circulating water through the copper pipes was maintained at constant temperature during experiments

Acknowledgements:

We would like to thank our parents for their support throughout this project, supplying transportation picking up materials during the course of our project. We would also like to thank two teachers: Mr. Bayfield for purchasing materials allowing us to recreate the innovation in an experiment model, and teaching us the proper way to coil copper coil, without kinking the ends after bending them. This, as well as our teacher Ms. Zaporzan, for lending us class time to work throughout the project, to make this project excellent. We would like to thank Mr. Berry, and Panch for their advice during the process of our project. We would also like to thank Noble Trade, as they gave us a discount on our copper elbows. We would like to extend our thankfulness to these people.