

## Science expo WATER CONTROL SYSTEM wins special prize

*Two students, who were finalists in the 2013 Eskom Young Scientists Expo, have received a special award from the South African Institution of Civil Engineering (SAICE)'s Water Engineering Division for their project entitled: Water Control System. Debbie Besseling reports.*



Carlo Kuhn and Marlene Strauss are Grade 11 pupils from the Duineveld High School in the Kalahari, Northern Cape Province. At a special awards function held in November, they were presented with silver medals and acknowledged by SAICE's Water Engineering Division.

Carlo comes from a farming community, and is well aware of the severe impact and damage caused when a dam wall breaks. He has a large dam on the farm where he stays, which previously made use of an old flood gate system that had to be closed manually. One evening the person who was responsible for closing the system, didn't do so, which in turn caused the dam wall to collapse. The effect caused extensive damage, and Carlo knew that he had to find a more reliable system that could be used in the future.

"When a dam wall breaks, it can be at a great expense to the economy and an even greater cost to the surrounding ecosystem.

Ground erosion is but one aspect of the damage caused to the environment. In addition to this is the economic impact caused when people in the vicinity must go without water to drink, or water to irrigate their crops," says Carlo.

He explains that irrigation farmers that use sluice systems frequently allow the water to flow late into the night which means that they then have to shut-off the water source late at night so that the irrigation dams do not break. The person responsible for the flow of the water can easily forget to turn off the water, which can result in damage to, or even breaking of the dam wall.

### HOW THE SYSTEM WORKS

The water control system developed by Carlo and Marlene makes use of the mechanics of a metronome, (a device used in music to keep time), to control the amount of water that flows through a sluice gate.

"When we conducted our research we wanted to create a system that would control water with minimal human intervention, that can be used by skilled, or unskilled workers in order to limit water wastage and reduce electricity consumption," explains Carlo. "By winding a spring, kinetic energy is stored. A certain number of turns which will store energy, is directly paired to how long the plate that is fixed to the gears, will turn. You can adjust the speed of the turning gears by moving a small lead weight up or down an axis that has a counter weight at the bottom. The lower the weight on the axis, the faster it swings."

The higher the weight, the slower it swings, and the slower the gears turn, the slower the plate will turn. The plate will then turn according to the adjusted speed and time, so you will have better control over your flow of water and it closes automatically. This is all without any human intervention or electricity consumption



being required. “This technology allows us to control water at different speeds and intervals,” says Carlo.

## RESEARCH

Part of Carlo and Marlene’s research involved the compilation of a questionnaire. Marlene says that they spoke to the local farmers, mechanical engineers in the area and persons from the relevant industries who had experienced the particular problem, to obtain more information.

The feedback they received from the questionnaires was organised and further research was undertaken to be able to reach a conclusion and a way to solve the problem. Some of the questions included in the questionnaire were:

- What are the problems that can occur when your control system for regulating water is not properly used?
- Would you support this project if it was incorporated into your local canals and water supply systems?
- Do you think this system is able to replace other systems currently used for water regulating?
- Do you think that it is a good advantage to have a system that does not use electricity?
- Do you think this system is more reliable than other water control systems?

## FUTURE DEVELOPMENTS

Carlo says that the system they have devised has tremendous potential for other industries. Conventional water control systems used in the mining sector consume vast amounts of electricity via pumps which wastes precious water resources and is prone to the human-error factor. This increases the risk of damage to the ecosystem as well as a potential loss of profit.

“We have taken this project to another level, one that can be used in large dams. This can now create a flow of water more sustainable by the river by not releasing all the water at once. At companies that use water to create electricity, the problem sometimes occurs that the water pressure is too little, thus the steam that drives the turbines won’t be as effective as usual. This project allows the water to build up enough pressure until it can open the gate”.

And there are other possibilities for the system. In countries that have great shipping ports that go into rivers, they have a very advanced and expensive system that allows the ships to enter the higher river. Now we can do it without electricity and

*Above: Carlo Kuhn receiving a silver medal from the South African Institution of Civil Engineers (SAICE). Pictured from left is Dr Chris Herold (SAICE Water Engineering Division), Wanda Rossouw (Duineveld High School teacher), Carlo Kuhn, Peter Kleynhans (SAICE President 2013) and Debbie Besseling (SAICE Water Engineering Division).*

*Below: A typical irrigation water canal.*



still be able to control the height of water levels.

Carlo intends following a career in either civil or chemical engineering. Marlene will be furthering her studies in the field of industrial engineering. □