



## FLL RESEARCH PROJECT 2017/18 “HYDRO DYNAMICS<sup>SM</sup>”

### Learn about the topic

People use water every day, but your team members probably don't think much about how and why they use water. Whether it's directly (drinking or washing) or indirectly (manufacturing the products they use or producing energy), they have a lot of different needs for water.

Ayana lives in a small village outside of Kemba, Ethiopia. The nearest water well is several miles away, and at certain times of the year there is very little rainfall to save for drinking, cooking and washing. Ayana and her little brother used to spend hours walking to the water well, which often kept them from attending school. Ayana's village has now installed several new towers that are each able to collect up to one hundred liters of clean drinking water directly from the air! When the people of Kemba installed these very simple towers that collect water from condensation, they allowed Ayana and her brother to spend more time in school, and less time making the long trip to other villages for water. When you are thinking about an innovative solution, don't rule something out just because it seems simple. Sometimes the simplest solution is the best solution!

Kumar lives in Chittagong, a large port city in southern Bangladesh. For years, Chittagong has suffered a water crisis due to an ever-increasing population. A year ago, Kumar took his mother to the hospital for treatment, but the hospital had closed because there was no water for the patients, nurses and doctors. The large number of water wells in Chittagong had used so much water that many wells were running dry. To use water from the nearby Karnaphuli River, Chittagong would need a modern water treatment plant, which has just been finished. The new plant, which can treat over 100 million liters of water a day, will not solve all of Chittagong's water problems, but it did allow many homes and businesses, including the hospital, to have a more reliable source of water. Kumar's mother was finally able to get the care she needs. When you are considering an innovative solution, try to remember that some problems do require engineers to “think big”!

Samantha lives in Wichita Falls, Texas, in the United States. Her mother works at a local factory that uses up to 75 million liters of water a year making packaging products. Many families in the town, including Samantha's, rely on the factory's jobs. The only problem with this arrangement was that the factory was using expensive “potable” water, or treated water suitable for drinking, to help make their products. This process was continually raising the costs for the businesses and people of Wichita Falls. The solution to this challenge was to use filtered “wastewater” – or “used” water from homes and businesses that can be released back into the environment, but is not clean enough to drink. The city's treated wastewater replaced much of the

more expensive potable water in the manufacturing process. Due to this innovation, both the citizens of Wichita Falls and the factory saved money, and helped to ensure that Samantha's mother and many others workers would continue to be able to support their families and pay their water bills. When your team is brainstorming an innovative solution, think about how joining forces with others might solve a problem!

Amahle is from Mothibistad, South Africa. Her school, a few miles north of town, did not have a reliable source of water, since the pumps and pipes that carried water to the school were often broken. This meant that some days the school had to shut down, or students would have to spend time collecting water from nearby wells. To fix this problem, the school installed a water system called the "PlayPump." The PlayPump uses a playground "merry-go-round" to pump water from a well at the school. So, during recess, Amahle and her friends get to play, while at the same time pumping water to a storage tank. This water is used to keep school in session. Engineers have learned a lot by creating the PlayPump system. They have found out that PlayPumps must be inspected and kept in good working order to be of use. They have also discovered that PlayPumps may not be the right solution for every community, since they require several people to operate, and children may not always have the time to play and pump water. However, in some places, like a schoolyard, they can be a great solution to a problem found in many parts of the world. Always remember to consider the "human factors" that might improve your approach to problem solving!

Inventor and engineer Dean Kamen has worked his whole life to try and help others. He has created medical devices, smart wheelchairs, and even founded *FIRST*® to help students around the world learn about careers in science and technology. When Dean learned about the billions of people who lacked access to safe drinking water, he set his sights on creating a machine that can make even the dirtiest water safe to drink. The result was the "SlingShot," a technology that copies nature's water cycle by evaporating and then re-condensing water. This process, called "vapor compression distillation" has a long history of providing clean water for submarines and ships, as well as delivering pure water for medical uses. The SlingShot is a simpler, small-scale version of this proven technology that can produce hundreds of gallons of water per day – enough drinking water for a school, a clinic, or a small village. The SlingShot has shown that although engineers are always trying to make the future better, they can look to the past for inspiration! Don't forget to study the inventions that are already out there. Sometimes engineers can improve on an idea that has been around for decades and still make a big difference!

Try to learn as much as possible about the human water cycle. Then have your team choose a part of the human water cycle that interests them and identify a specific problem they want to solve.

Use different sources for your knowledge: internet, books, newspapers, and ask experts etc.

**Your team's project challenge this season is to improve the way people find, transport, use, or dispose of water.**

## Identify a Problem

Not sure where to start? Try the following:

Ask your team to think about all the ways they use water. These might include everything from quenching their thirst to swimming in a pool or lake. Water might be part of the process to produce their food, energy, mobile phones, or other products. Their use of water probably even includes something as simple as flushing the toilet.

Not sure where to start? Try this process to help your team choose and explore a problem with the human water cycle:

**Ask your team** to draw or create a chart that shows the human water cycle for one or more needs. This might be a need that your team members have, or it could be a need for someone else. How is water used to help fulfill this need?

Think about questions like:

- Where does the water I use come from?
- Do I get my water from a lake or river, or from a water well?
- Does the water need to be cleaned, transported, or stored during the process? How does this happen?
- Where does water go after it is used?
- What type of professionals work to protect our water resources?
- How do people in other parts of the world get their water?
- What happens when people don't have access to clean drinking water?
- Do you notice any ways the human water cycle could be improved?

This might be a great time for the team to interview a professional. The professional could be someone who works directly with water or researches water problems for his or her job. Can a professional help your team learn about how people use water for washing, food production, medical treatment, or entertainment?

**Ask your team** to select the problem they would like to investigate and solve. You might select a problem in one of these areas (or add your own):

- Finding potable water
- Identifying and removing contamination
- Using water to produce food
- Finding problems with pipes buried in the ground
- Transporting or storing clean water
- Disposing of wastewater
- Controlling industrial or agricultural runoff into natural waterways
- Using water responsibly in manufacturing

After your team selects a problem, the next step is to find out about the current solutions. Encourage them to research their problem using resources like news articles, documentaries or movies, interviews with professionals working in the field, ask your local librarian, books, online videos, websites or make an excursion to learn more about your topic.

**Ask your team** questions like: Why does this problem still exist? Why aren't the current solutions good enough? What could be improved?

## Create an Innovative Solution

Next, your team will design a solution to the problem. Any solution is a good start. The ultimate goal is to design an **innovative** solution that adds value to society by improving **something that already exists, using something that exists in a new way, or inventing something totally new.**

Ask your team to think about:

- What could be done better? What could be done in a new way?
- How can you reimagine the way we clean, transport, use, or dispose of our water?
- Could your solution balance the needs of people, the planet, and prosperity?

Ask your team to think of your problem like a puzzle. Brainstorm! Then turn the problem upside down and think about it in a completely different way. Imagine! Get silly! Even a "silly idea" might inspire the perfect solution. Encourage team members to try one idea (or more), but be prepared that each idea may need some improvements.

Make sure your team thinks about how they could make their solution a reality. Try asking them questions like:

- Why would your solution succeed when others have failed?
- What information would you need to estimate the cost?
- Do you need any special technology to make your solution?
- Who would be able to use it?

Remember, your team's solution does not need to be completely new. Inventors often improve an idea that already exists or use something that exists in a new way.

## Share with Others

Once the team has designed a solution, the next step is to share it!

**Ask your team** to think about who your solution might help. How can you let them know that you have solved their problem?

- Can you present your research and solution to people who transport, clean, collect, or use water?
- Can you share with a professional or someone who helped you learn about your problem?
- Can you think of any other people who might be interested in your idea?

It might help to present your solution to someone who can give profound feedback. Accept good proposals and implement improvements is part of a process that every inventor passes. It is also okay to discard an idea because of the feedback of an expert.

When your team plans their presentation, encourage them to use the talents of team members. Teams often explore creative presentation styles, but it is also important to keep the focus on your team's problem and solution. Sharing can be simple or elaborate, serious or designed to make people laugh while they learn.

No matter what presentation style your team chooses, remember to infuse fun wherever you can!

## Present your solution at a tournament

Any inventor must present their idea to people who can help them make it a reality, such as engineers, investors, or manufacturers. Like adult inventors, the Project presentation is your team's chance to share their great Project work with the Judges.

As long as your team covers the basic Project information, they may choose any presentation style they like. Think of the talents your team members have. Could you perform a skit? Create a website? Make a comic book? Rap? Write a poem, song, or story? Your presentation can include posters, slideshows, models, multimedia clips, your research materials, and more. Be creative, but also make sure you cover all the essential information.

To be eligible for Project Awards and advancement, your team must include the following basic Project information:

1. Identify a problem that meets this year's criteria.
2. Explain their innovative solution.
3. Describe how they shared with others prior to the tournament.
4. Show different types of research resources (offline, online, experts, etc.)
5. Meet the presentation requirements:
  - All teams must present live. The team may use media equipment (if available) only to enhance the live presentation.
  - Include all team members. Each team member must participate in the project judging session.
  - Set up and complete the presentation in 5 minutes or less with no adult help.

Do you have questions about the Research Presentation? Send an e-mail to [fill@hands-on-technology.org](mailto:fill@hands-on-technology.org). Important answers to your questions will be published in the Q&A section under [www.first-lego-league.org/en/faq/fragen.html](http://www.first-lego-league.org/en/faq/fragen.html).

You can find interesting links, possible experts and background information about the research topic for "HYDRO DYNAMICS<sup>SM</sup>" online – go to: [www.first-lego-league.org/en/fll/research-project.html](http://www.first-lego-league.org/en/fll/research-project.html).