

FAQ

Over the years we have received a great number of questions about our system and how it functions. We have gathered them all in a single document to explain all you need to know about SmartHydro.

Let's start with the most important one of all, what is SmartHydro?

SmartHydro is a system that automatically takes water level measurements in remote places. Highly accurate sensors are connected to a central hub, the MicroHub. The sensor makes a measurement and the MicroHub sends the measurement wirelessly via LoRa to a central gateway or satellite. From here on data gets forwarded to our cloud servers which power our project dashboards. Through our dashboards, clients have a real-time insight into the water levels in their concession or project 24/7 and allow clients to make timely adaptive management decisions.

LoRa and LoRaWAN

What is LoRa?

LoRa is a modulation technology that allows you to send data wirelessly. Modulation is a fancy way of saying how data should be transmitted over radio waves. You can imagine LoRa as low power WiFi. The difference between LoRa and WiFi is that you can send much more data via Wifi, but it costs much more power to do so. LoRa is optimized for low data rates and low power. Ideal for IoT (Internet of Things) devices like SmartHydro to run for a long time without any interference.

What is the range of LoRa?

This is often the first question we receive. And although there are amazing distances recorded with LoRa (700+ KM), these tend to be optimized or unique scenario's. On average you can think of a range between 5KM to 10KM. It is highly dependent on the landscape that we are working in and the signal attenuation (how much a signal is blocked). We always recommend doing an on-site study before installment to get the real range of the LoRa sensors.

<https://www.thethingsnetwork.org/article/lorawan-distance-world-record>

What is LoRaWAN?

LoRaWAN is a protocol built on top of LoRa. If we would use a metaphor for LoRa and LoRaWAN, you can see LoRa as the agreement between two people to use English to communicate. LoRaWAN is the protocol we agree upon. For example, there is only one person at the time talking or no one is talking for more than a minute. LoRaWAN in essence is the protocol to allow devices to speak as efficiently, clearly and securely as possible over LoRa.

What are the data costs of LoRaWAN?

LoRaWAN is free of charge, just like WiFi you don't pay for its use. You pay for the equipment but not for data. There are providers out there that have LoRaWAN as a service, in which case you pay a small monthly fee and they take care of the infrastructure. In Indonesia no such providers are available and as such Sustainability Tech installs its own hardware on site in order to transmit data.

What encryption does LoRaWAN use?

Use LoRaWAN advanced end-to-end encryption technology for optimal security (EAS-128). Read the white paper for a more in depth explanation.

https://lora-alliance.org/sites/default/files/2019-05/lorawan_security_whitepaper.pdf

Terrestrial vs Satellite based LoraWAN, which one to use?

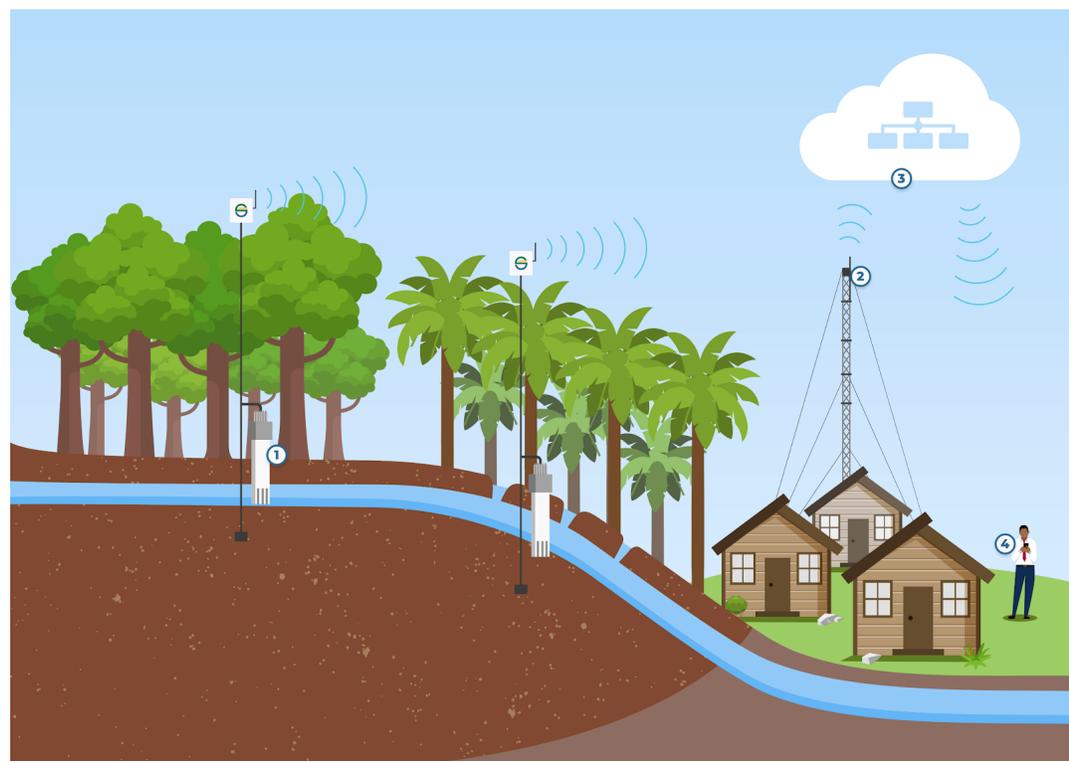


SmartHydro via satellite

- 1) The MicroHub collects data from the connected sensors and transmit the measurements to a low orbit satellite on scheduled times
- 2) Low orbit satellite receive the messages and relay it to strategic base stations
- 3) Base stations around the world forward the data to the Sustainability Tech cloud servers
- 4) End users have near real-time insights in their concession on any device

Terrestrial SmartHydro

- 1) The MicroHub collects data from the connected sensors and transmit the measurements to the gateway
- 2) The gateway relays the data to the Sustainability Tech cloud servers
- 3) The cloud servers process the data.
- 4) End users have near real-time insights in their concession on any device



Pro's and con's for each SmartHydro system

SmartHydro via satellite ¹

Pro

- Lower initial costs, no need for gateways, antenna masts, backhaul and simpler installation
- Greater range, as the MicroHub does not need to connect to a central gateway. Virtually global connectivity
- More failure robust. There is no central gateway that needs to collect all messages so there is no single point of failure
- MicroHubs and sensors are less conspicuous as there is no need for antenna masts. The units can be hidden.

Con

- Yearly fee per sensor to transmit data (prices are not set but expect \$20 per unit per year)
- There is a delay that can take up to a couple of hours for data to be relayed from the satellite to base stations

Terrestrial SmartHydro

Pro

- No running costs, as transmitting data is free once the system is in place
- Can deploy right now, all elements are in place for deployment
- Real time with microseconds of latency as there is direct communication between the gateways and the internet.

Con

- Setup costs slightly higher as the system requires more components

We advise Terrestrial SmartHydro for smaller projects and areas where sensors are clustered closer together.

¹Plans are to have SmartHydro via satellite commercially available in 2021

The MicroHub

What is a MicroHub?

The MicroHub is a proprietary device built by Sustainability Tech that is connected to all the sensors. It is the brain of any sensor system. It makes sure that the right sensor makes a measurement at the right time. It collects all those measurements and sends it via LoRaWAN to the gateway or satellite.

What batteries does the MicroHub use?

The MicroHub uses three standard AA batteries. We specifically opted in to use a battery that is easily available, even in the most remote villages, is reliable and can withstand extreme weather.

How long will the batteries last?

It depends on the measurement interval but you can expect to have battery life between 1 to 2 years. We are currently working together with a company from The Netherlands to implement a brand new type of battery. A technology to harvest electrical energy from living plants and bacteria to generate carbon-negative electricity. If this pilot works well we will have battery life up to 10 years without any use of dangerous or rare chemicals.

How many sensors can be connected to the MicroHub?

The MicroHub can connect up to 4 sensors.

What sensors can be connected to the MicroHub?

Currently we are mainly focusing on water level sensors, but it is possible to connect any type of sensor that runs between 3.3V and 5V. Used UART, IC2 or SPI. Possible sensors can be soil moisture, humidity, temperature, barometric pressure, rain gauges, dendrometer, soil salinity, etc...

What is the size of the MicroHub?

The dimensions of the MicroHub are 10x10x4 cm. The MicroHub comes with mounting brackets and clamps for easy installment.

How weatherproof is the MicroHub?

The MicroHub is rated as IP67 and includes a venting plug to withstand harsh conditions. Cable and cable connectors have seal rings as does the LoRa antenna. This allows it to work through extreme climatic conditions such as



those encountered in the equatorial tropics. .The water level sensor

What type of sensor do you use for water level measurements?

We use ultrasonic sensors to measure the water levels. These sensors are temperature compensated so that they will adjust for changes in atmospheric pressure and the time that sound travels. The main advantage of these types of sensors is that there is no element of the sensor in contact with the water, which often can have a detrimental effect on material, particularly in acidic peat swamp conditions.

How accurate is the water level sensor?

The sensor can measure within a margin of 5mm of the actual measurement. The range of the sensor is up to 4m. We have done extensive research and testing to make sure that the sensors work in conditions that are compatible with the concessions where we work.

Does the sensor fit on a standard dipwell?

Yes, our enclosure is made out of standard pvc elements that we assemble and build before shipping. There are some reasons for this:

- *Compatibility*, it is easy to buy standard 4 inch PVC which are used for dipwells in the most remote places and having sensors that can fit this is a must.
- *Costs*, the components for the enclosure keep the unit price of the sensor low.
- *Replaceability*, as we use standard parts, we can replace them often without the need to send specific parts to the site as they are readily available.
- *Inconspicuous look*, as the materials don't give the sense that there are expensive components inside, it helps against theft.

The gateway

What is a gateway?

A gateway is a device like the WiFi router. It collects all the messages and requests from each MicroHub surrounding it. It takes all these requests and relays them to an endpoint, in our case the Sustainability Tech Cloud servers.

How high does the gateway need to be installed?

As the gateway needs to be able to “hear” all the MicroHubs that are surrounding the gateway it is important that it is installed in the most optimal spot. For radio signals this often means a clear line of sight, which translates to “as high as possible”. In our current projects we have the gateway installed on an antenna mast about 30m high, this is also the height (or higher) we advise for new projects.

Can the gateway run on solar?

Yes, we can supply clients with complete kits that make it possible to have the gateway work off the grid.

Does the gateway need to be connected to the internet?

Yes, as the Gateway needs to relay messages, it needs the internet, or as it is often referred to as *the backhaul*. It can use both Ethernet or LTE. The gateway has a connection both for an ethernet cable to plug in and an option to insert a SIMcard and an antenna to connect to standard mobile phone networks.



Installing SmartHydro

Do you do on site land analysis to determine the best sensor locations?

Yes, and we advise one of our experts to test the potential range on site before we install the complete SmartHydro system. This way we can be sure that we have steady signal. The use of fit for purpose antenna masts for the MicroHub is also possible which can improve signal strength for individual micro hub units..

How long does it take to have the SmartHydro system ready for installation?

Depending on stock. This can take from anywhere between 1 to 3 months as we are slowed down by the current pandemic.

How long does it take to install the SmartHydro system?

Once we have all the materials shipped to the location this will likely take between a couple of days to a week. It highly depends on concession area and ease of access to the dipwells.

Do you have a team to install the SmartHydro system on location?

Yes, we provide experts that help you make sure that the system is running optimally.



The dashboard

Can I see the map of my project area?

Yes, we have a page dedicated to your project area. Not just the water level measurements but fire hotspot information and many more custom layers are available. This gives you a single overview of the state of your project.

Are there notifications available?

Yes, we have notifications both via email and push. The system allows you to trigger these notifications on different events that might be happening. Low or high water levels for example.

I need to generate a report, can this be done?

Yes, you can make your own reports based on any given time period. It will automatically calculate the most important indicators for you. Water level, weather data, fire risk profiles. All generated as a PDF for you to use.

I have my own systems for monitoring, can I integrate the sensor data?

Yes, we have a complete API available that allows you to take the raw data and use it in any system that you need.

I already am making measurements, can I import those into the dashboard?

Yes, we have a simple import tool that allows you to import historic measurements into the dashboard in a single place that displays all your data.

Can I view the dashboard on different devices?

Yes, we have made the dashboard available on desktop, tablet and mobile devices.

