CHALLENGE 3: Low-cost sensors in the pipe network

1. Aim

The specific aim of the project is to introduce low-cost sensors that allow for the rapid and efficient:

- Localisation of leaks in the distribution network.
- Location of other NRW losses (e.g. illegal acquisition, inaccurate measurement values, fire brigade consumption, etc.)

2. Current approach and limitations

The main focus in Flanders is the reduction of water loss caused by leaks in the pipes.

In doing so, we mainly use the classical division into recording areas (DMA = District Metered Areas) using flow rate meters that allow for the drinking water supplied to be monitored accurately per area. Intelligent algorithms are already being implemented to monitor these areas for any calamities. Where the analysis indicates that a calamity is occurring in an area, a leak detection team should be dispatched to the site. Acoustic detection techniques are mainly used for this.

Limitations of the approach are:

- Reliability: can the increased consumption within an area be put down to a leak or to a different cause? Our data on the water consumption of household customers, industrial customers, the fire brigade, network flushing, etc. (although this is expected to improve with the roll-out of the digital water meter) remains limited or non-existent.
- Accuracy:
    - The information on the size of the leak(s) only concerns the extent and is dependent upon the size of the area. The larger the area, the less sensitive the current software is. A calamity, then, will only be picked up when it reaches a certain point.
    - In order to trace smaller leaks, the present strategy is to divide up the network into far smaller recording areas. This requires capital-intensive investments based on the techniques currently in use.
- Time: It remains necessary to go and trace the calamity in the area. In the case of a large area, this will still take a lot of time with techniques that also have their limits as to accuracy.
- Limited input: the data sources currently in use are limited to the inflow and outflow rates, sometimes accompanied by pressure measurements.
- The conventional leak detection techniques (acoustic) are not always effective enough.

3. Desired solution

The known factor is the DMAs, through which the flow rates and specifications of the pipe network are known.

1) Leak localisation

   Ideally, sensors will be added whose data input can be used to significantly improve leak localisation and efficiency. This may or may not be a source for an algorithm that will use this data (see challenge 1). The sensors should be as easy as possible to fit.

2) Other NRW losses

In addition, it will be necessary to detect and, if possible, geolocate the other NRW losses. These losses are:

- Fire brigade consumption via fire hydrants
- Flushing losses via fire hydrants
- Inaccurate measurement (customer meters, DMA meters, etc.)
- Illegal acquisition

In the first instance, we are aiming for detection of the NRW consumption here. In the second, we can look at the volumes of this consumption. The latter is dependent upon the extent of the NRW proportion (e.g. leakage losses can be perfectly well identified in terms of quantities and can be obtained using a sensor on this activity).

Besides sensors fitted directly to the drinking water network, are there any other sensors in the area that could supply some useful information?

The leak detection team making use of leak detection algorithms will use this sensor data to improve the NRW detection. In order to achieve this, the data input needs to be compatible with the systems used. A standard approach is preferred here.

Concrete KPIs still need to be drawn up for the determination of requirements so as to be able to compare the solutions offered objectively.

4. **Specific preconditions**
   The infrastructure is immense. The challenge lies in making the most efficient use possible of new sensors so the investment impact will remain minimal. The major risk in the business case for a new sensor is the quantity needed in order to achieve sufficient benefit.

5. **Known research and development projects or pilot projects**
   ICON project (De Watergroep) https://www.imec-int.com/en/what-we-offer/research-portfolio/smartwatergrid

6. **Why do the existing (partial) solutions not fully meet our needs?**

   Usually either labour-intensive to fit and/or not cost-efficient.