COUPLING HYDROGEN AND WASTEWATER THROUGH OXYGEN

What?

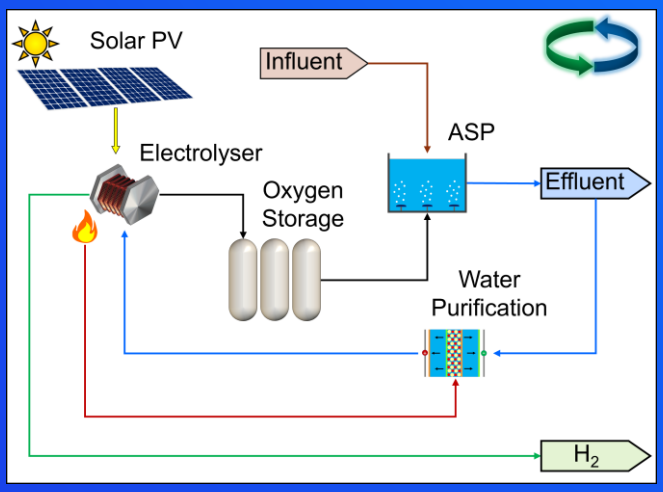
Co-locating an integrated renewable hydrogen production facility at a WWTP.

Why?

- Green hydrogen for sale or internal use. Fuel cell → electricity (i.e. battery); industrial use – ammonia, ironmaking.
- Valorises byproduct oxygen by using it in the activated sludge process (ASP).
- Minimises water security concerns when wastewater is used for electrolysis.

How?

Heat **O**xygen **W**ater



High Purity Oxygen (HPO) for ASP

Has HPO been used in ASP?

Yes, early testing carried out in the 1950s followed by full-scale implementation, mostly in the 1970s and 1980s in North America.

Was HPO successful?

Claimed as successful for energy and sludge savings, but some benefits were disputed.

How was HPO historically used?

Generally, surface aeration in oxygen-rich atmosphere using enclosed head space over bioreactor or over surface aerator.

Why didn't HPO become popular?

Several reasons. While it met BOD reduction objectives of that era, CO_2 in head space reduced nitrification rates that became important for wastewater treatment in 1980s and beyond. The cost of producing HPO also increased with energy prices.

What is different now?

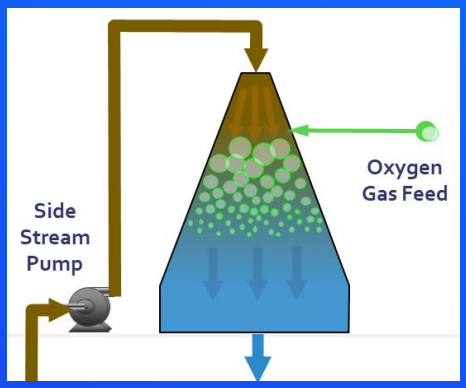
Green hydrogen initiatives are producing lots of surplus oxygen and new high efficiency aeration technologies have become available.

What are the key HPO benefits?

Using HPO with new aeration technologies can increase αSOTE, providing a pathway for operating at higher MLSS with smaller bioreactors: reduced CAPEX or capacity extension. Compressed HPO storage for energy shifting to align with solar PV profile.

Aeration processes for HPO

- Speece cone
- Supersaturation
- MABR
- Nanobubbles



What is required to bring it to reality?

Full scale testing of HPO in municipal ASP with operating electrolyser. Lab scale tests show promising boost in αSOTE; simulation modelling identifies opportunity for energy shifting and higher renewable electricity utilisation.

Jacobs

Challenging today.
Reinventing tomorrow.