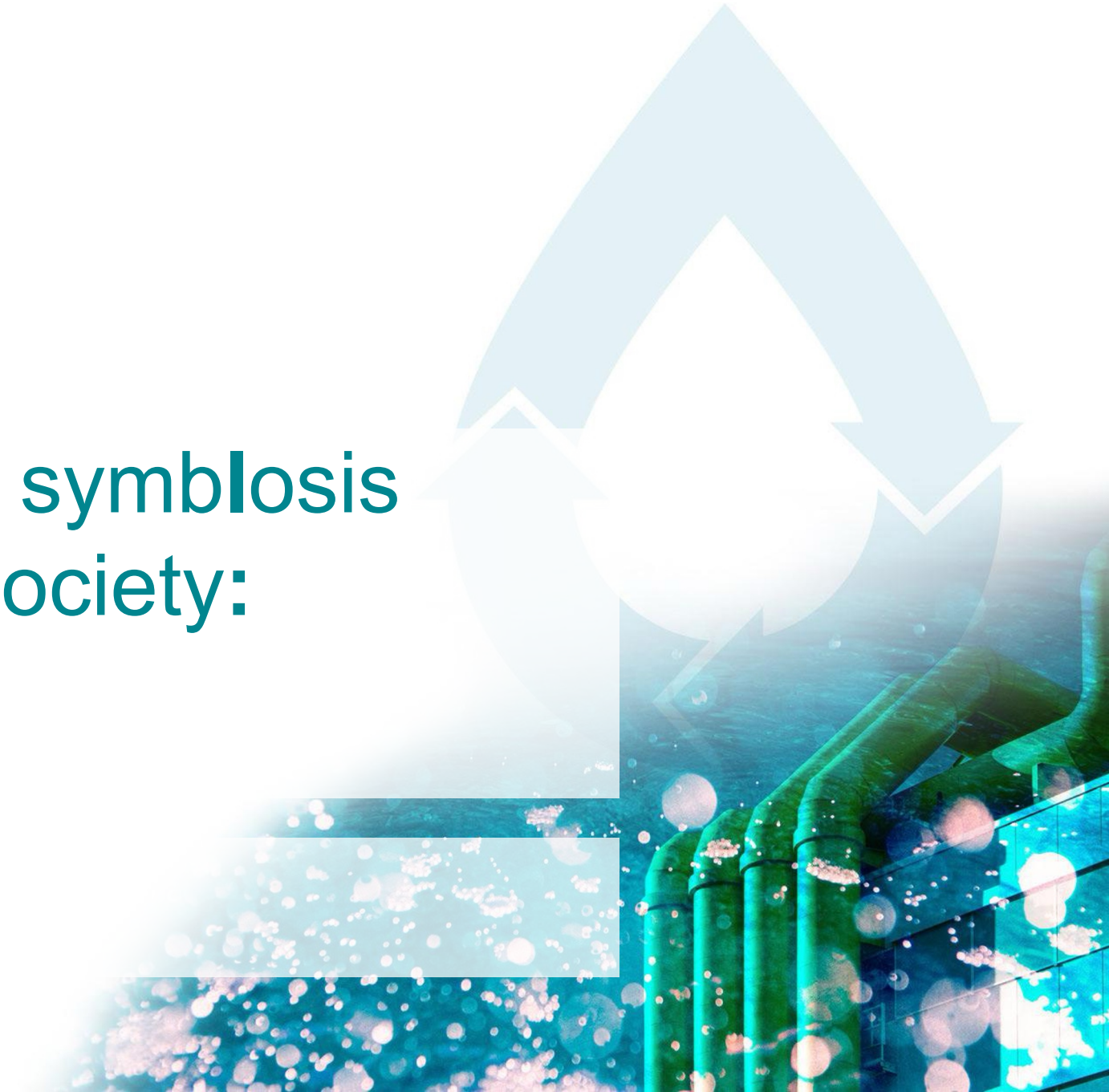
ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

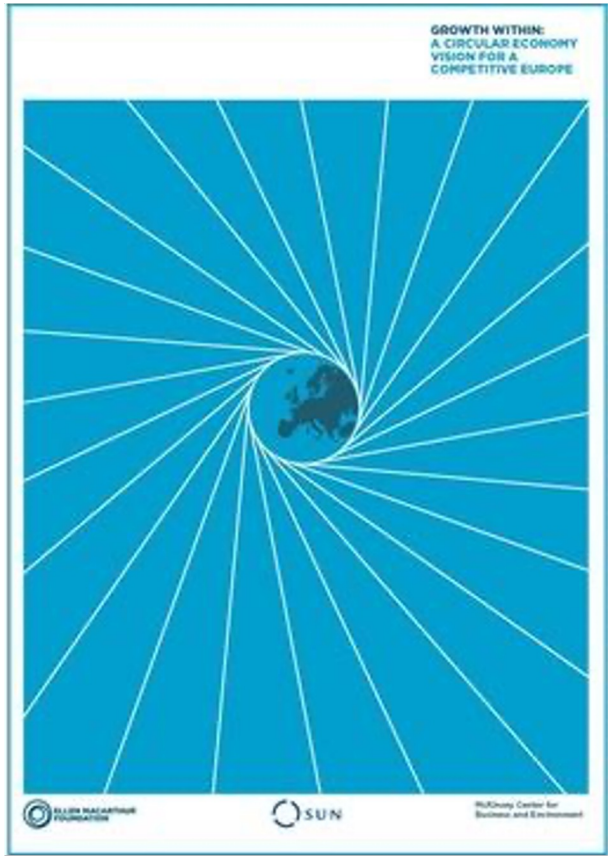
indUstry water-utiLiTy symbIosis for a sMarter wATEr society:



Alexandros Kritikos (NTUA)

The rationale: a transition from a linear to a Circular Economy (CE)

- Linear **production-consumption-disposal** chains make Europe (and its Industries) **vulnerable**:
  - to **climatic changes** due to (e.g. water) resource depletion
  - to fierce **industrial/commercial competition** worldwide, for limited resources and hence to volatile raw materials and energy.
  - to **environmental degradation** unless significant treatment and pollution control investments are (continuously) available.
- Solving each problem **on its own** is actually very difficult…
- What if, by moving to a CE paradigm that extracts and valorises water, energy, nutrients and high added-value compounds, from wastewater **we could solve all three problems at once**?
- **Future-proof** European industries, **climate-proof** European society and **safeguard** the environment.



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So, we have been working to fulfil our ambitious aim:

[…] to become a catalyst of a particular type of industrial symbiosis – henceforth termed "Water Smart Industrial Symbiosis" (WSIS) – in which ***water/wastewater*** *plays a key role both as a* ***reusable resource*** *per se but also as a* ***vector for energy and materials to be extracted****, treated, stored and reused within a dynamic socio-economic and business oriented industrial ecosystem.*

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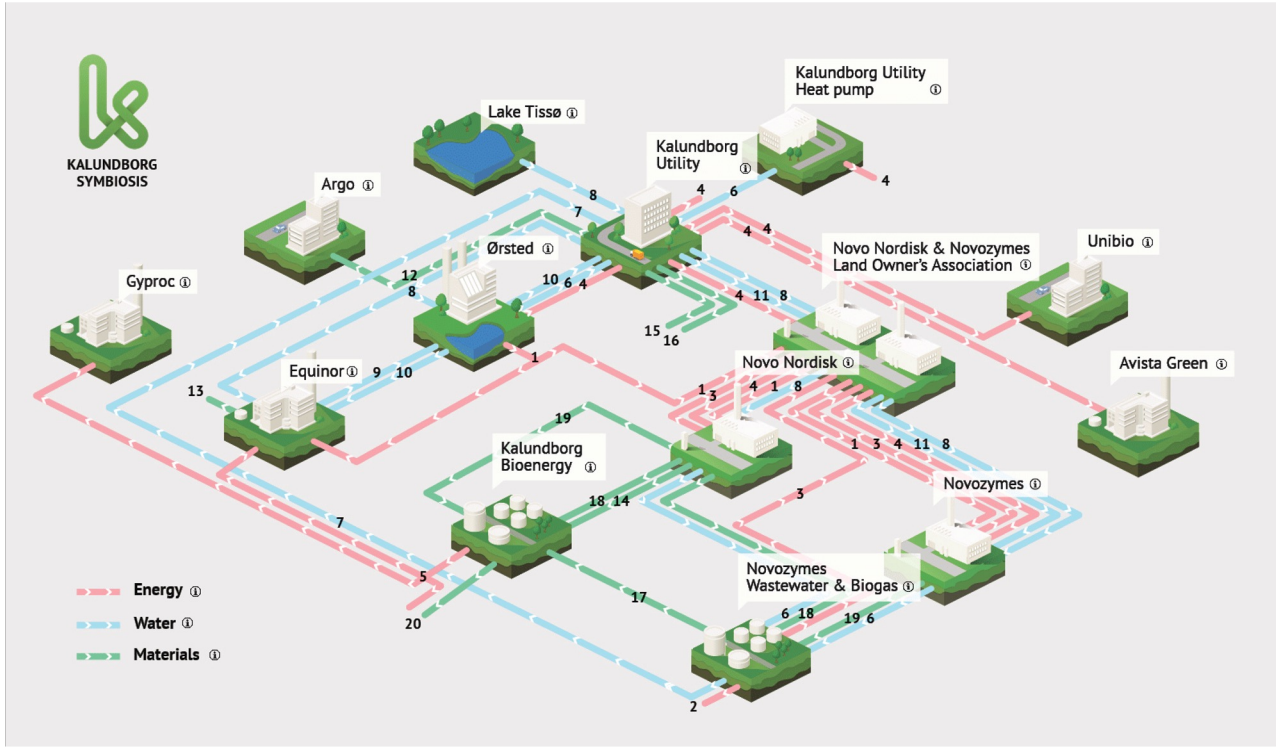
Enter Industrial Symbiosis (IS)

- Systematically looks **to reuse waste** between industries as raw materials.
- Limits the impact of current waste management and import dependency and can provide **cost-competitive resources and diversification of supply** for European industries.
- Contributes towards **low environmental impact, economic growth** and job increases from the rejuvenation of local, national and regional economic activity:
- Creates **local, non-relocatable direct and indirect jobs,** and local economic development for European territories.
- Promises benefits from lower costs as well as **new types of revenues**, exploiting 'waste' management not only as a legal obligation but **as a new business opportunity.**

KALUNDBORG SYMBIOSIS



European Commission (2018). *Cooperation fostering industrial symbiosis: market potential, good practice and policy actions*. Brussels, Belgium

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Building towards 6 objectives:

1. Showcase, promote and learn from ***successful high profile WSIS Cases***.
2. Develop, optimise and demonstrate multi-layered water-related (water-energy-materials) resources ***reuse technologies and solutions*** within key industrial sectors
3. Assemble, further develop and apply ***digital support tools*** to identify symbiotic opportunities, improve the design, control and operation of industrial symbiotic schemes, as well as their medium- and long-term assessment
4. Develop and demonstrate novel exploitation/valorisation schemes (value chains) for these resources, through a range of ***business models*** and symbiotic arrangements and link them to ongoing investments and plans of industries and water utilities.
5. To design, promote and accelerate business transformation to WSIS, through active ***stakeholder engagement and innovation co-creation***, by drawing on transdisciplinary knowledge and capacities from Art, Technology and Digital Humanities, for business-to-business, citizen and Living Lab engagement.
6. Reduce existing barriers for recovery, reuse and commercial exploitation of valuable water-related resources (incl. requirements and standards for reuse) through WSIS novel ***governance approaches*** and ***best practice guidelines*** supporting the transition to CE, the implementation of EU policies and UN SDGs.

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leveraging much more than “just’ technologies to achieve these objectives!

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We work on the ground

In high profile **Water Smart Industrial Symbiosis (WSIS) cases** where we started developing, testing and demonstrating multi-layered water-energy-materials reuse approaches, complying with strict health and safety requirements while showcasing novel governance arrangements and business models:

i. Partnerships between industries and municipal water utilities looking for symbiotic gains.

ii. Co-ownership of water service providers by co-located industries to catalyse symbiosis.

iii. WSIS service provision to industries by commercial companies of various scales: from niche SMEs to multinational corporations.

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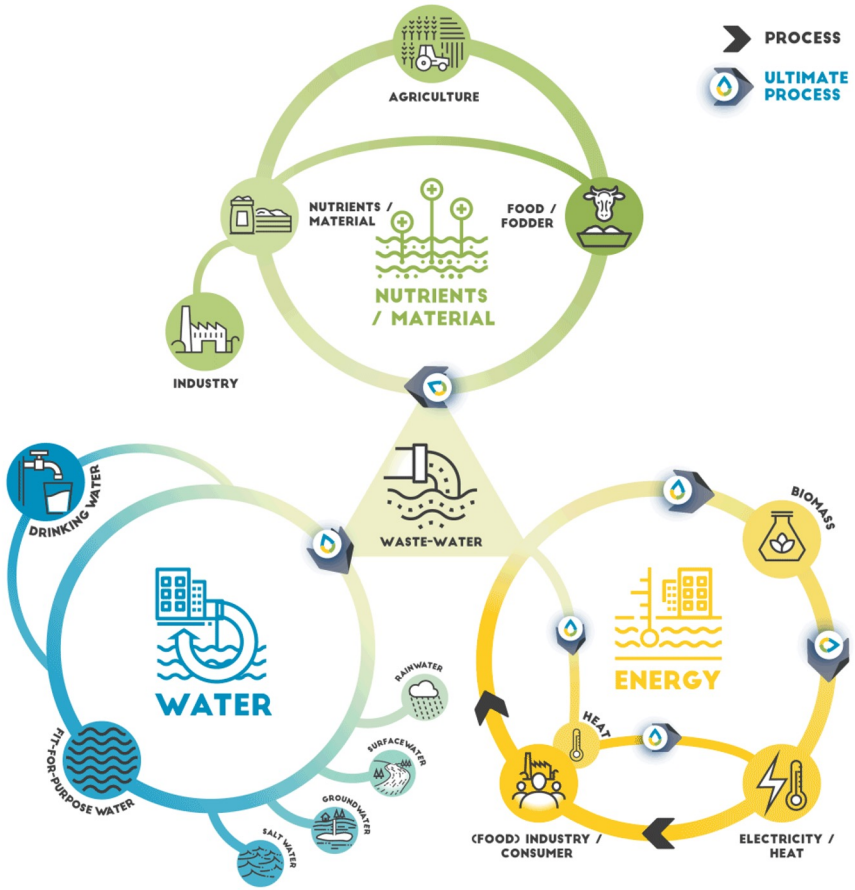
New value chains exploiting new technologies and digital solutions



WSIS applies technologies for

- **Water reclamation and reuse** (recovery, refining, and reuse of municipal and industrial wastewater
- **Exploitation of energy and heat** (extraction of energy, combined water-energy management, water enabled heat transfer, storage and recovery of heat)
- **Nutrient and material recovery/reuse** (nutrient mining, extraction/reuse of high-added value exploitable compounds)

and develops **digital technologies** to optimize and improve Circular Water solutions.

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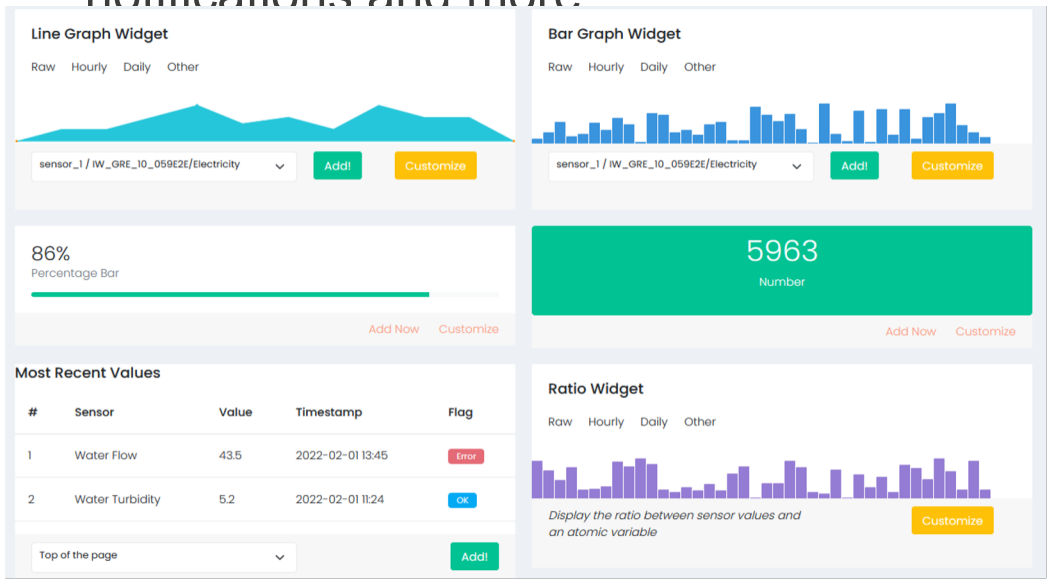
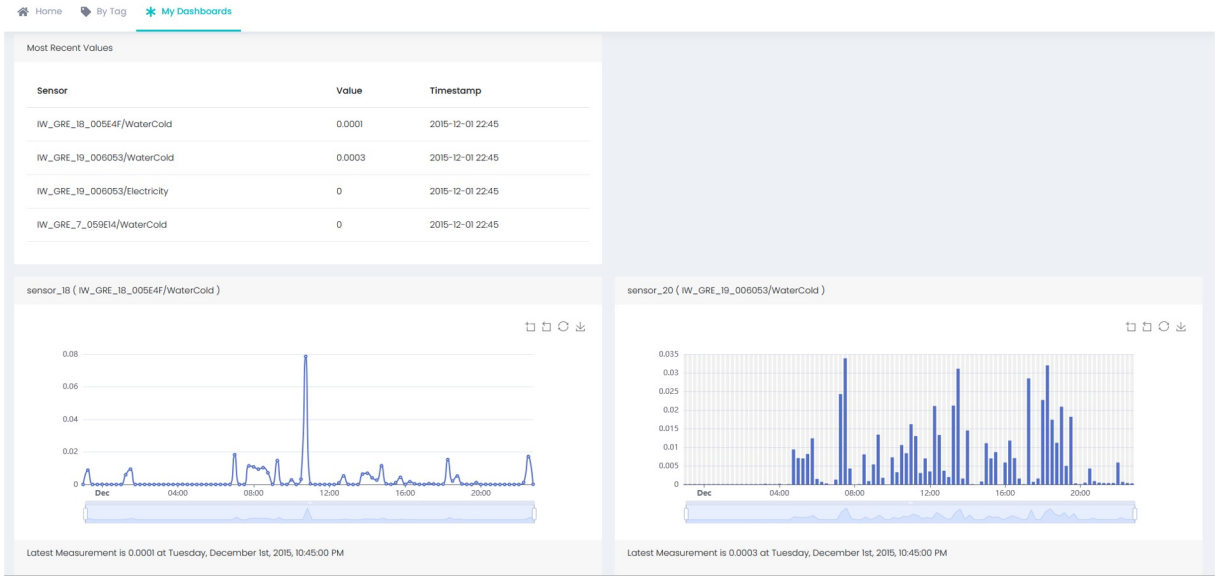
Some (of our) digital tools pt.1

KPI tool

- **Digital platform:** remotely accessible
- **API connectivity:** based on our proprietary **Nessie** engine, API is used to communicate with the user side (e.g. sensor data retrieval)
- **Customisable dashboards:** case-by-case user-friendly dashboard design, variety of visual widgets
- **Additional features:** historic values, graph comparisons, manual data input, custom variables, notifications and more





"All-in-one" sustainability monitoring for individual units and i-parks

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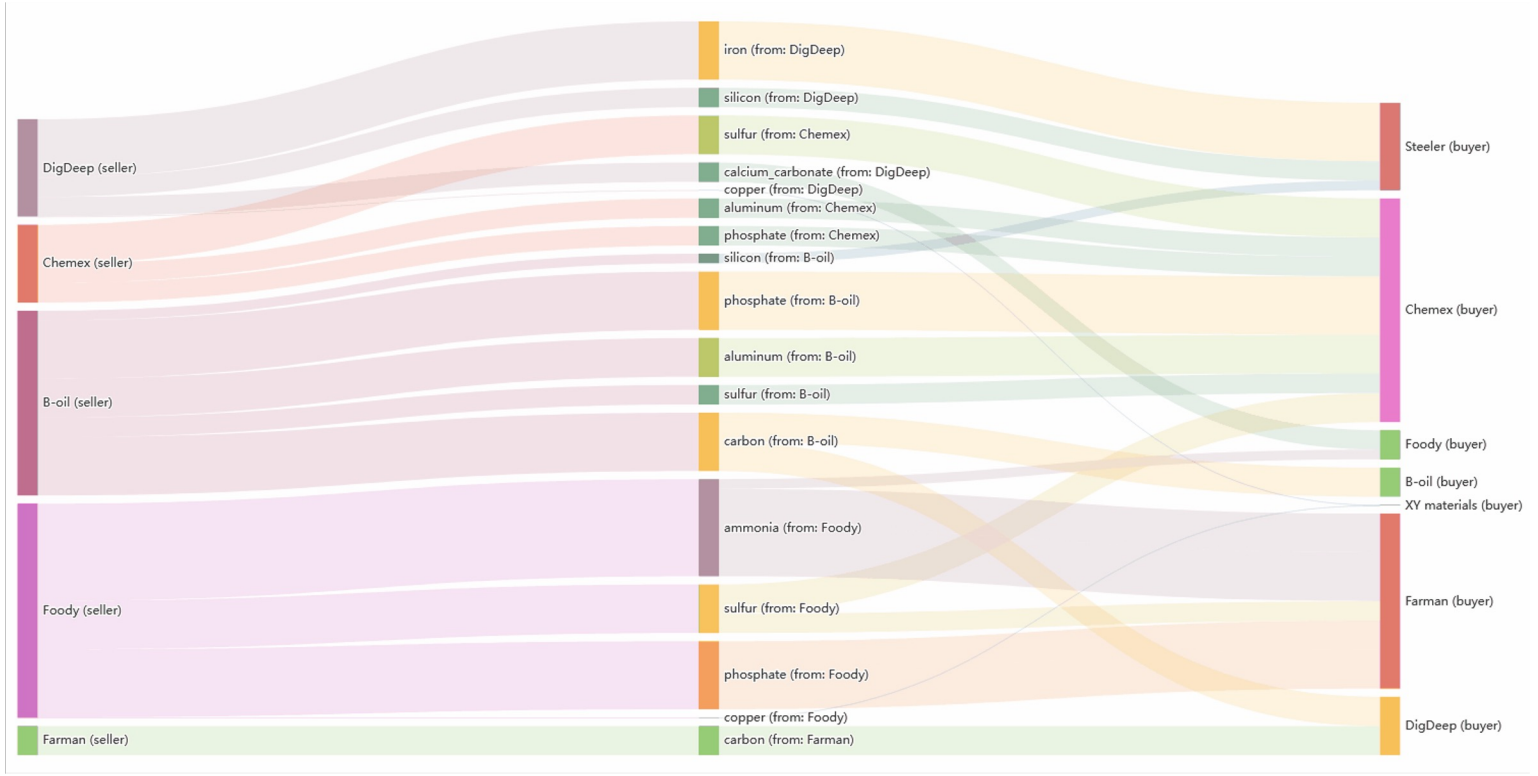
Some (of our) digital tools pt.2

Industrial Wastes MatchMaking tool

- **Digital platform:** remotely accessible
- **Single Industry or Ecosystem creation:** users can add a single industry to existing regional database or create a standalone ecosystem (e.g. industrial park)
- **Multi-parameter simulation:** compatibility, physical distance, veto/preferences, subsidies/penalties etc.
- **Matchmaking and financial results:** identification of by-product to material-input matches among industries and calculation of recovery-cost / selling-price through **Sherwood Plot** methodology



- **Multiple simulation modes / uses:** individual industry results, "global" ecosystem assessment, sensitivity analysis…

Valuable in field-assessments ("as-is") & in-silico experiments ("what if")

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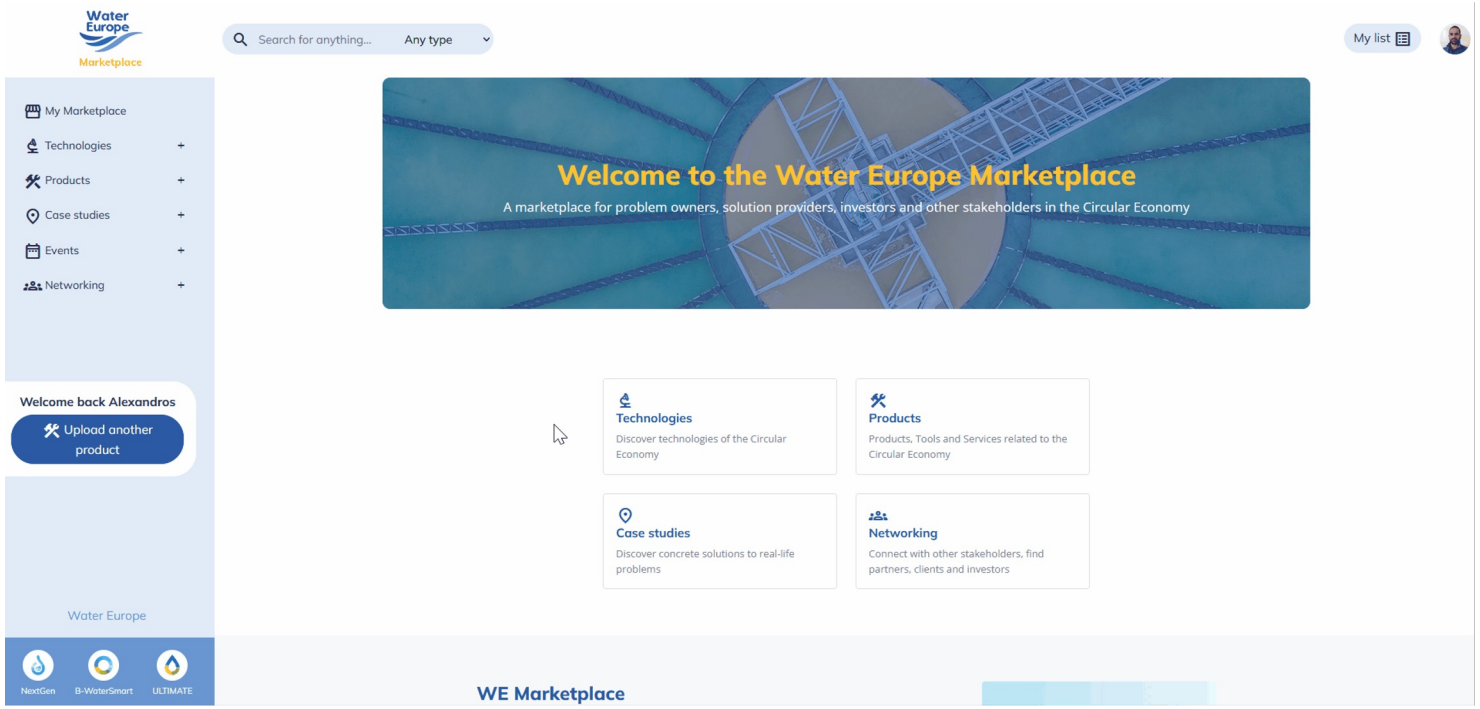
Some (of our) digital tools pt.3

Water Europe Marketplace

- **Fully mature:** publicly released, ready to sign up and browse
- **Diverse database:** already containing input from multiple EU projects & individuals, and still growing
- **Smart design:** intricate information architecture, allowing for effective organisation and highly-accurate suggestions
- **Diverse appeal:** from technologies (research), to products (pilot), to case studies (commercial); across the Water-Energy-Material Nexus; it is effectively a hub of vertical and horizontal integration of CE stakeholders



- **Impact-oriented:** emphasis on the “marketplace” aspect, incorporating functions that promote collaborations and transactions

Goal: the first come-to-mind destination for CE-related issues

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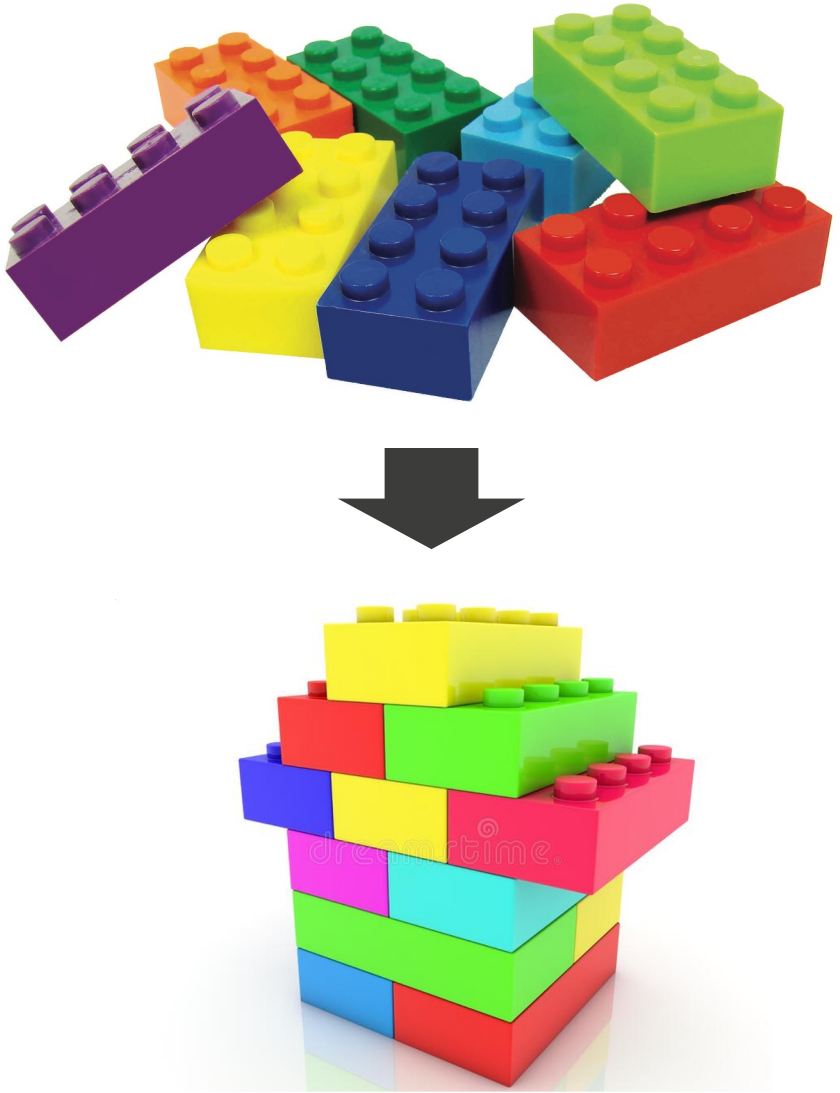
Importantly, ULTIMATE hasn't been working in a vacuum

There is a **critical mass of projects** (and associated research and innovation) being assembled to really push CE and WSIS forward in the next few years – we are at the heart of this – and **this momentum is already being leveraged to make WSIS a reality**.

- **NextGen**, **Hydrousa** and **SmartPlant** (previous call)
- **WaterMining**, **BWaterSmart** and **WiderUptake, REWAISE**
- **ICT4Water Cluster** (cross-calls!)
- **Water Europe** (not only as a dissemination partner)



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So watch this space!

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