Identifying Green and Sustainable Remediation Potentials: Case Study from a Complex Former Industrial Site in Brazil

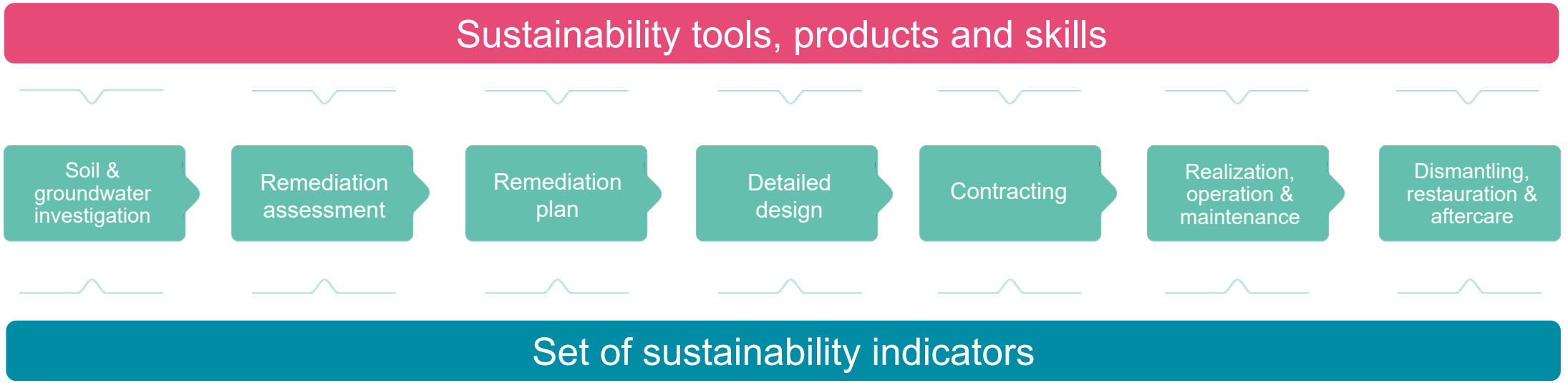
T. Schöne, P. Jacobs, R. Engelhardt (TAUW)

Pedro Aquino (Grupo EPA)

Jesse Overgord (Philips)

Battelle Chlorinated Conference, 06.06.2024

Considering sustainability offers opportunities and advantages



Sustainability tools, products and skills

Soil & groundwater investigation → Remediation assessment → Remediation plan → Detailed design → Contracting → Realization, operation & maintenance → Dismantling, restauration & aftercare

Set of sustainability indicators

Set of sustainability indicators

At every phase check sustainability indicators to optimize People / Planet / Prosperity

People (social)

- Health & safety
- Nuisance
- Community involvement
- Aesthetic impact of works
- Uplift in public value of site
- …

Planet (environmental)

- Air, water and soil quality
- Biodiversity
- Use of energy
- Greenhouse gasses emission
- Use of resources
- Production of waste
- Uplift in environmental value of site
- …

Prosperity (economic)

- Cost of remediation works
- Uplift in land values
- Land use restrictions
- Cost of temporary business interruption
- Financial project risks
- Impact on reputation and brand value
- …

What is presented?

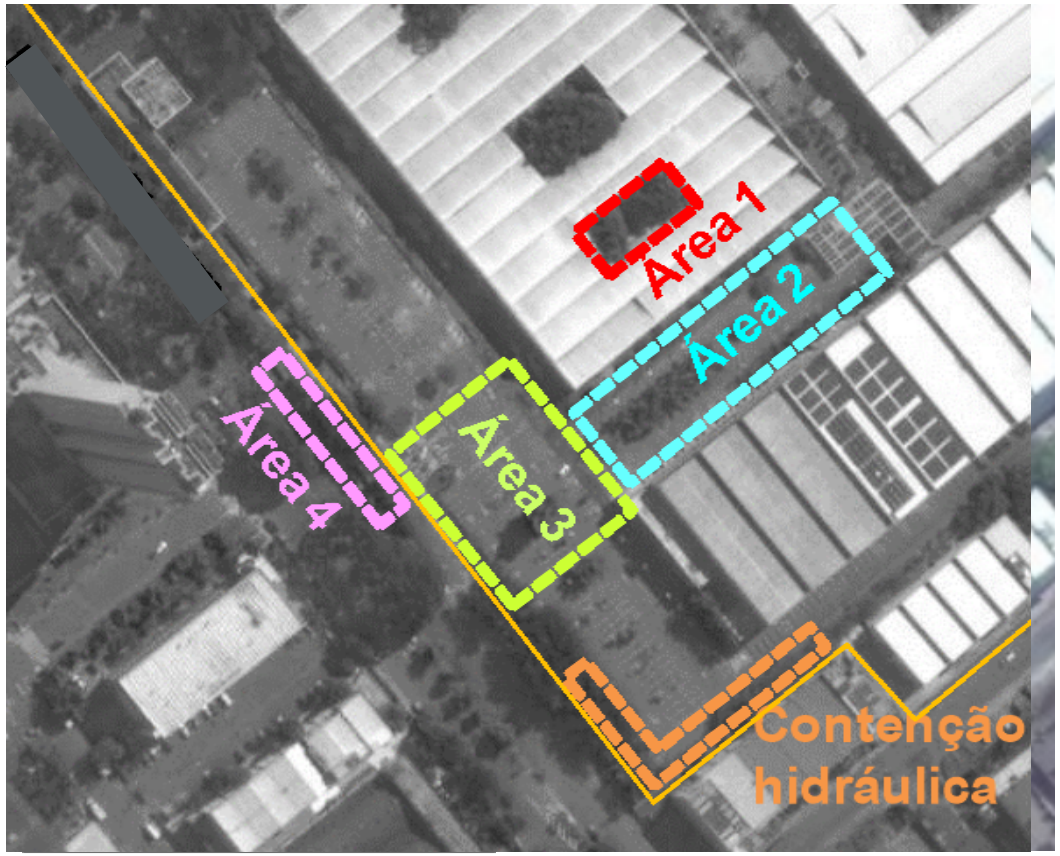
- **Part 1:** Sustainability Indicators
- **Part 2:** Site background information
- **Part 3:** GSR application examples
- **Part 4:** Sustainability beyond remediation

Part 2: Site background information

Former industrial site located in São Paulo, Brazil

Large-scale contamination with CVOC in four source zones

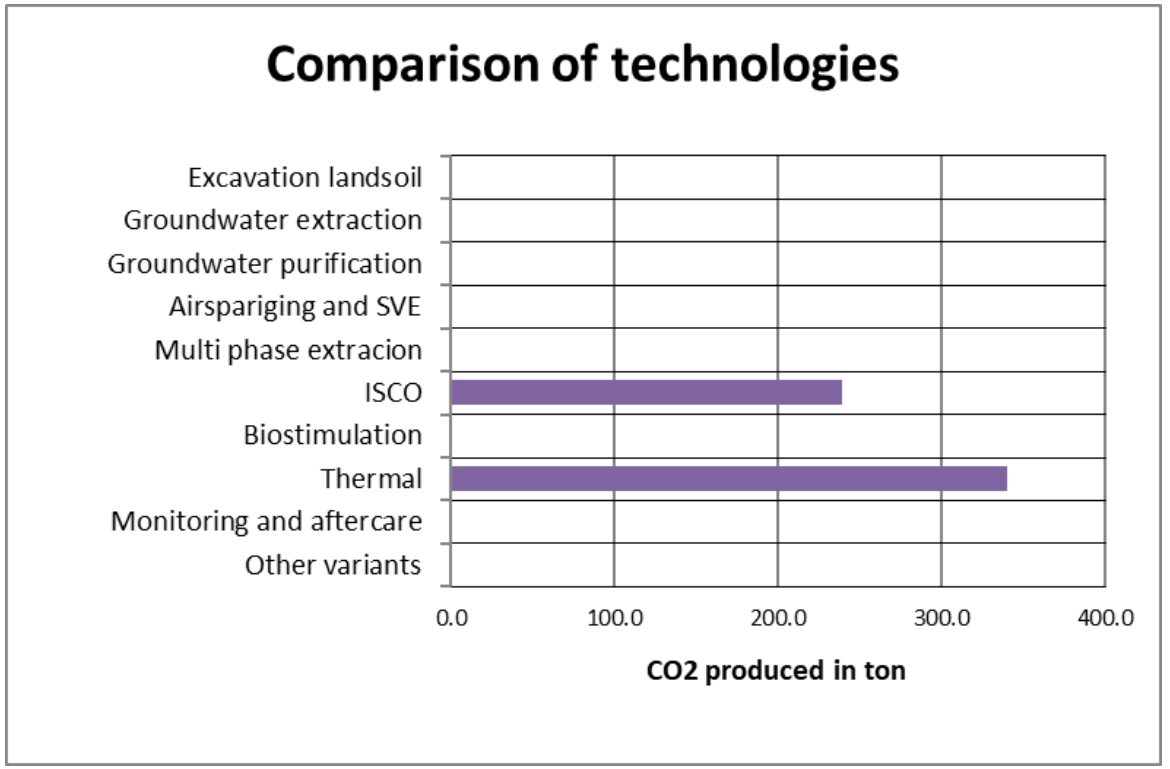
- **Area 1:** former electroplating area
- **Area 2:** former degreasing area
- **Area 3:** Leakage in sewer line assumed
- **Area 4:** Discharge of industrial effluents



Part 3: GSR application examples

Multi-criteria analysis and CO2 tool support decision-making

- In situ remediation ISCO
  - Construction ISCO system
  - Maintenance ISCO system
  - Transport for supply of materials
- In situ remediation Biostimulation
- In situ remediation Thermal
  - Construction system
  - Maintenance Thermal system
  - In situ oxidation reaction
  - Transport for supply of materials
- Monitoring and aftercare
- Other variants



Cost of remediation works, use of resources and energy, production of waste, health & safety, nuisance, Greenhouse gas (GHG) emissions etc.

Remedial technologies with best cost-benefit ratio were selected

- **Area 1:** ISCO recirculation
- **Area 2:** Large-hole drilling excavation and ISCO direct push injections
- **Area 3:** ISCO recirculation
- **Area 4:** ISCO recirculation
- **Southern site boundary**: Hydraulic plume containment

Excavated soil used in solid waste processing instead of disposal

Benefits

- Soil could be reused in metal beneficiation industry
- More cost effective waste stream
- Improved remedial efficiency by fine-tuning drilling locations

Cost of remediation works, use of resources, production of waste

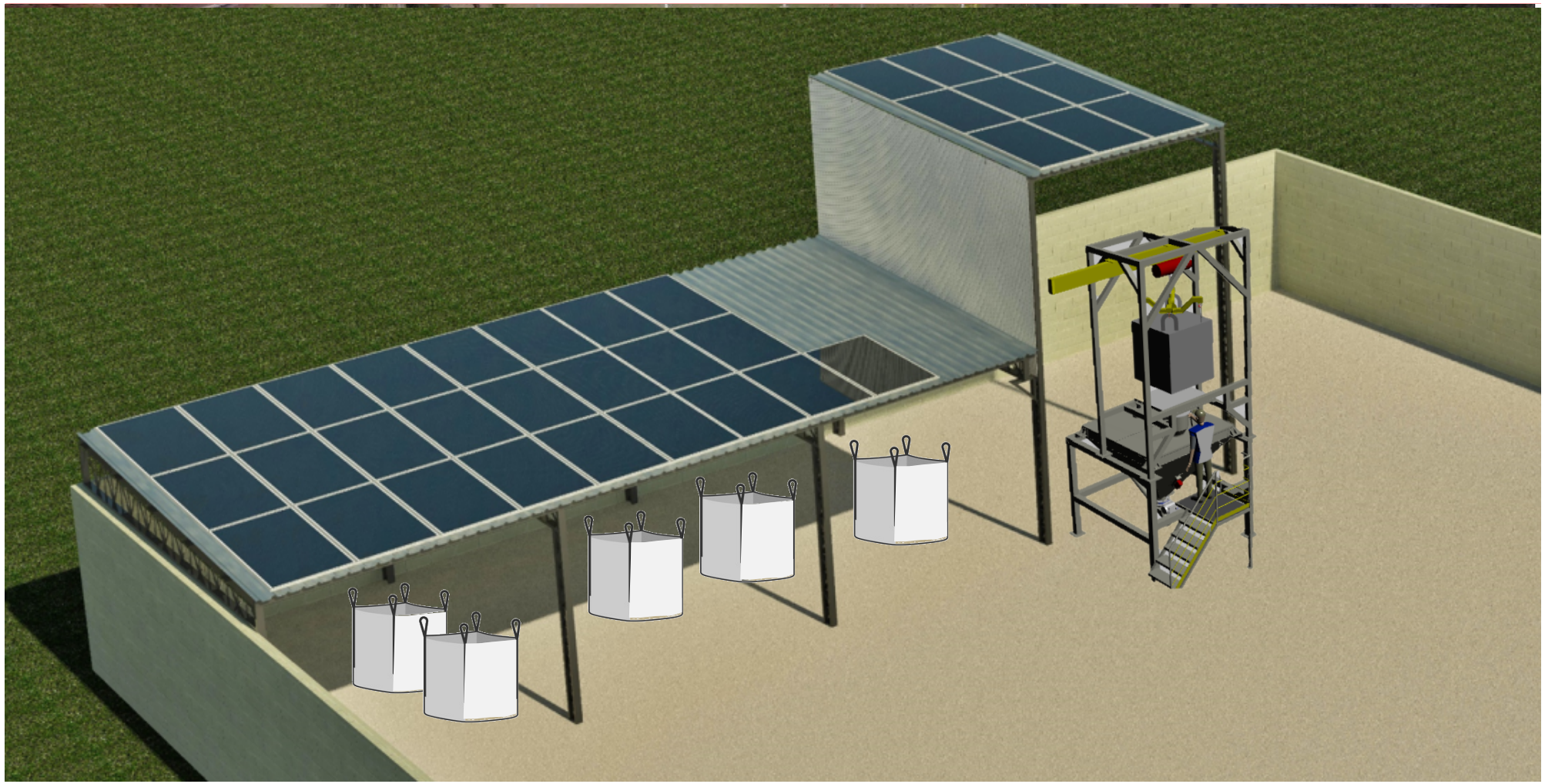
Treated water is re-used in remediation processes

Benefits

- Upgrade to more energy efficient and robust treatment system
- Potential re-use of functional components in other projects
- Re-use of treated water for (1) oxidant solution preparation and potentially (2) irrigation purposes

Use of resources and energy, production of waste, cost of remediation works

Photovoltaic system will support power demand of treatment plant



Automatic oxidant solution preparation saves time and costs

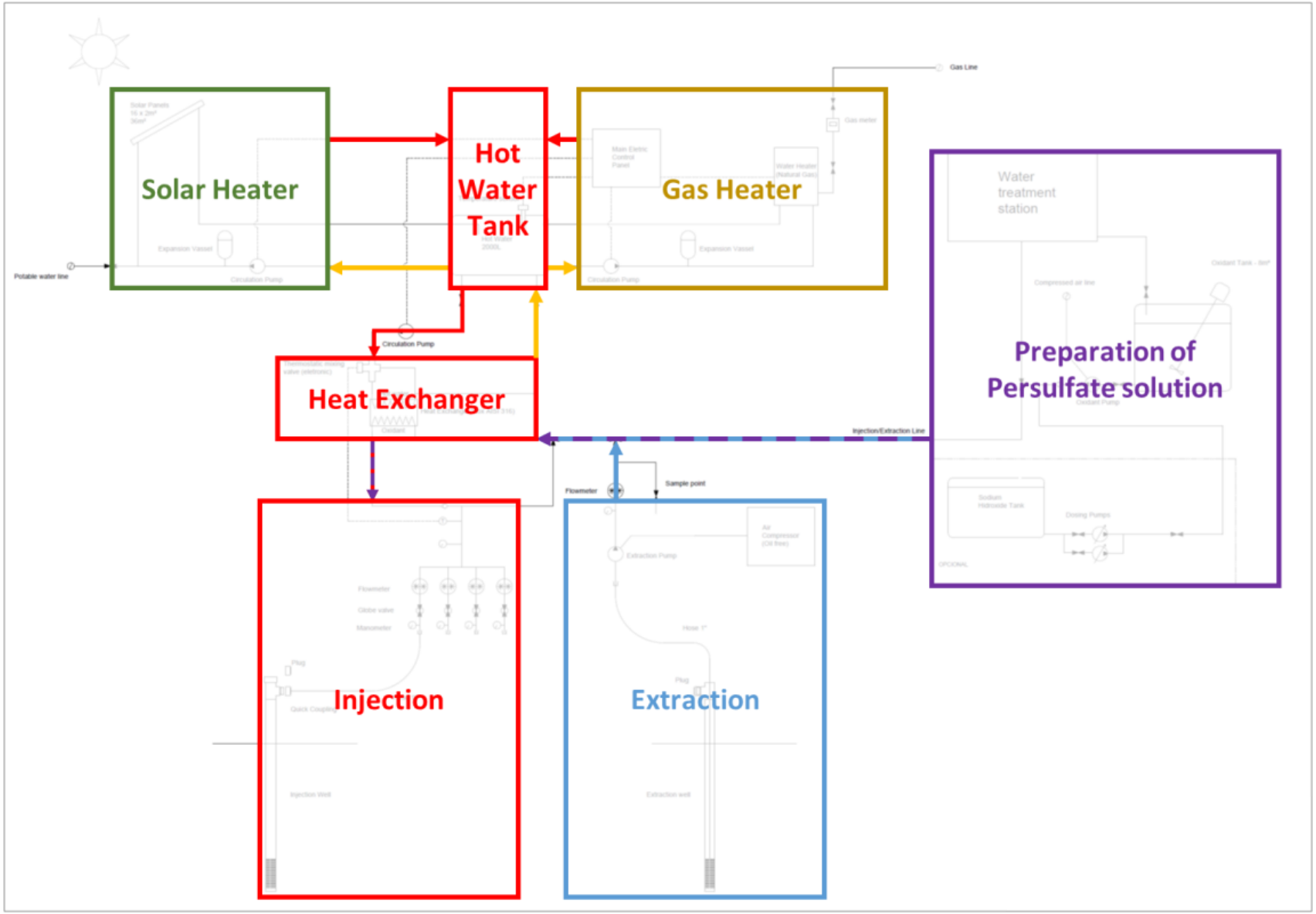
Benefits

- Process optimisation
- Less manual labor
- Improving Health & Safety conditions
- Optimized schedule

Health & Safety, Cost of remediation works

Reduction of required operating time by 30%

Use of solar energy to activate persulfate for ISCO treatment

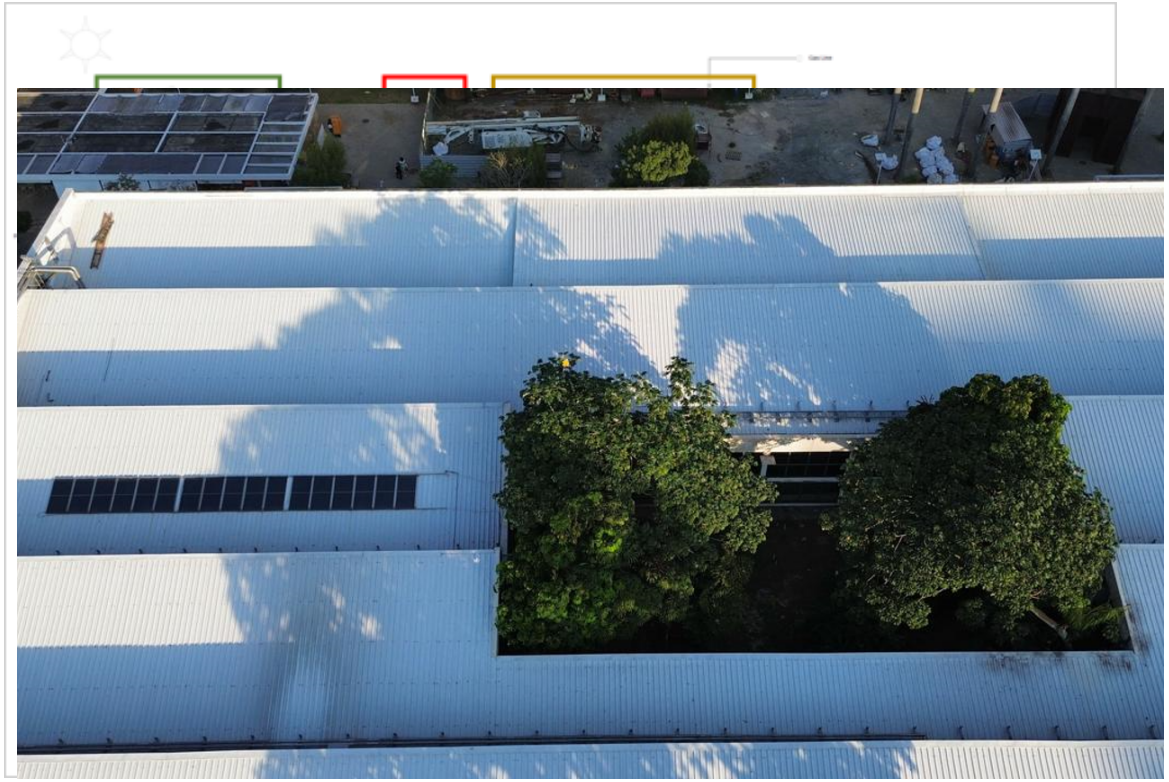


Use of solar energy to activate persulfate for ISCO treatment

Benefits

- Minimized persulfate demand
- No additional chemicals required
- Green energy solution

Cost of remediation works, use of resources and energy, production of waste, GHG emissions



Part 4: Sustainability beyond remediation

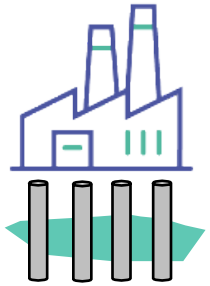
Site development needs to address climate change

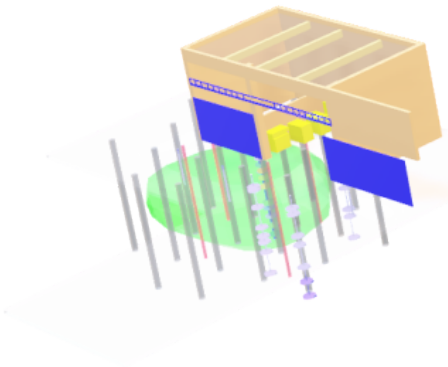
www.cbsnews.com

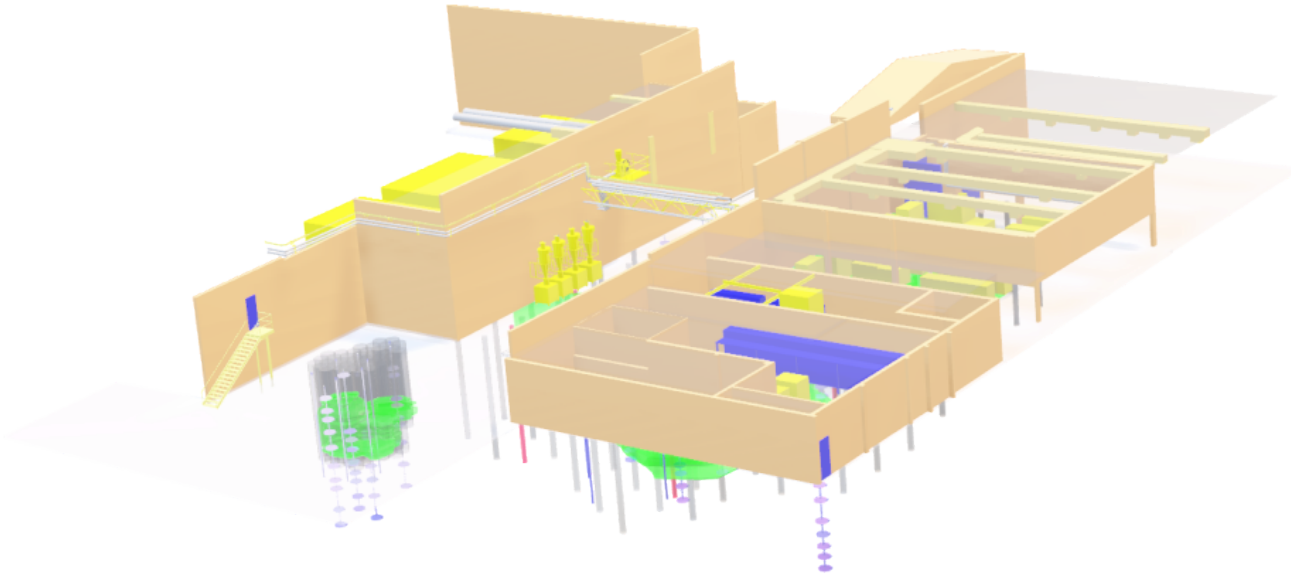
www.theneweuropean.co.uk

Planning basis and evaluation tools

3D-CSM

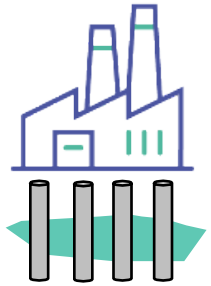




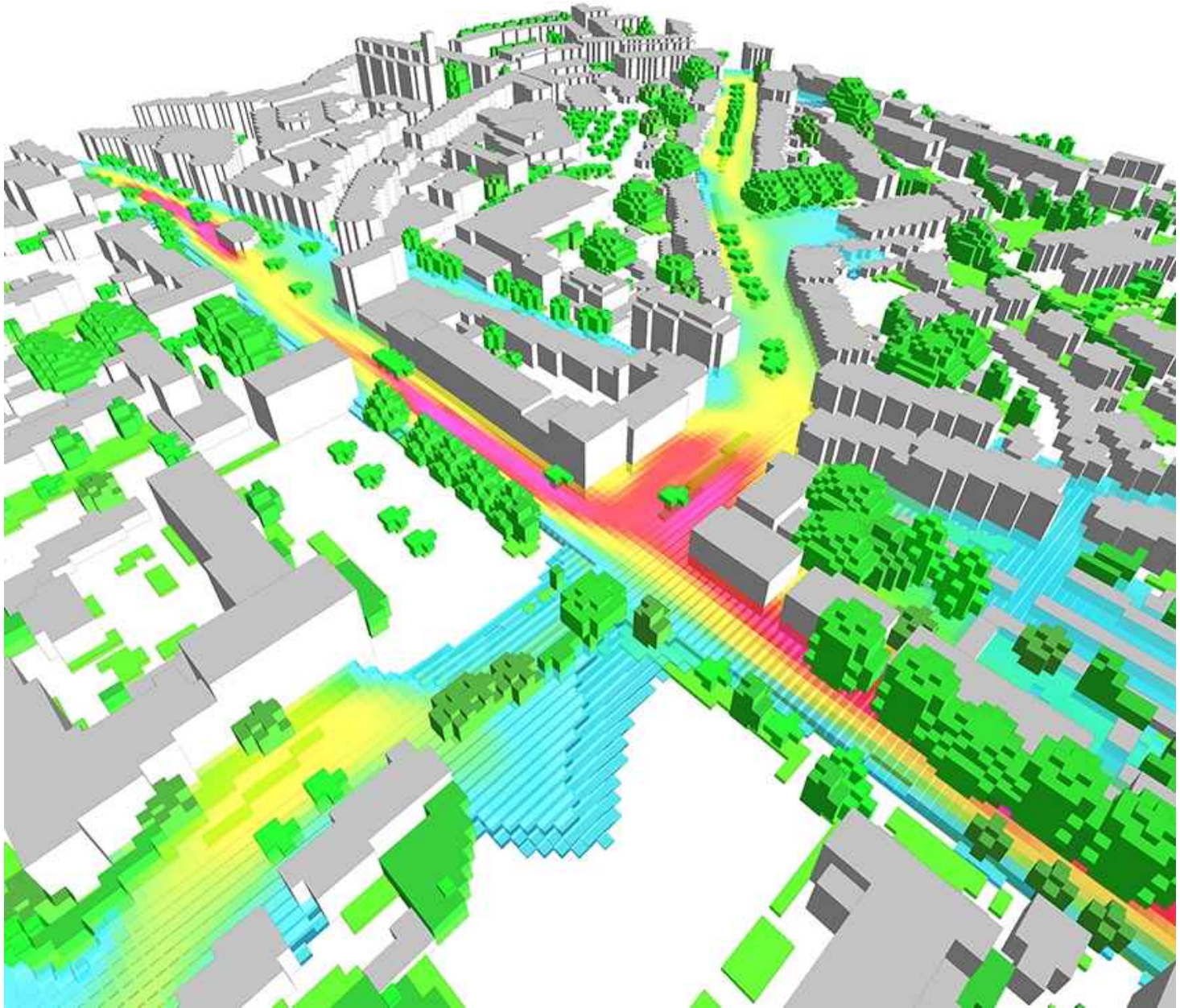


Planning basis and evaluation tools

3D-CSM

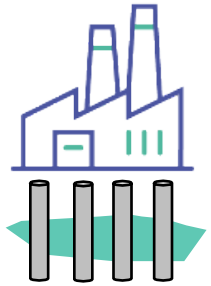


Microclimate analysis



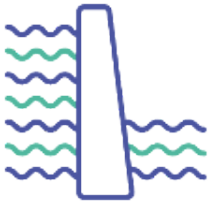
Planning basis and evaluation tools

3D-CSM



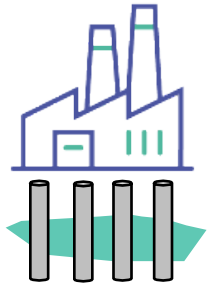
Microclimate analysis

Flood risk analysis



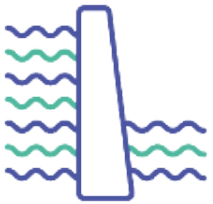
Planning basis and evaluation tools

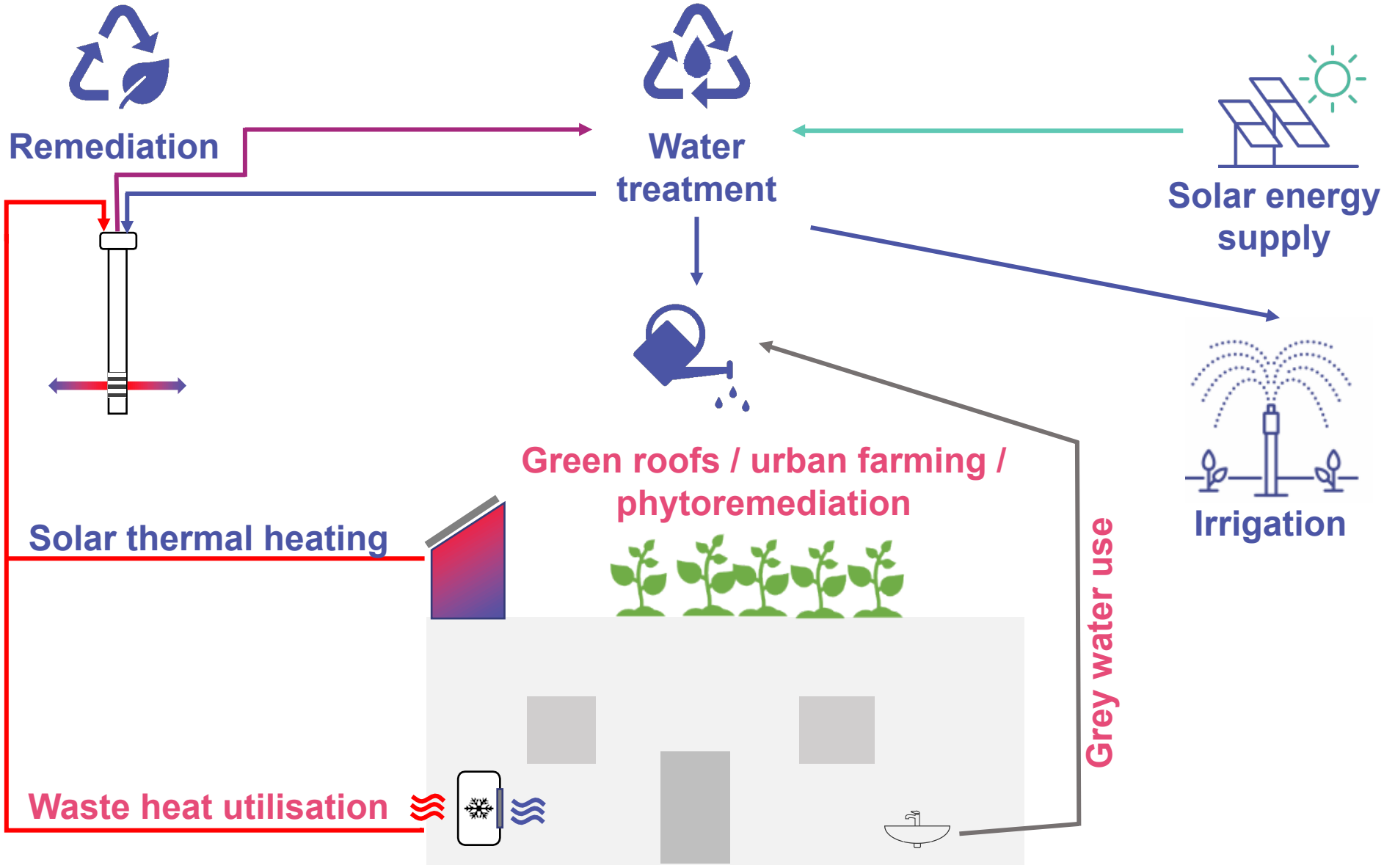
3D-CSM

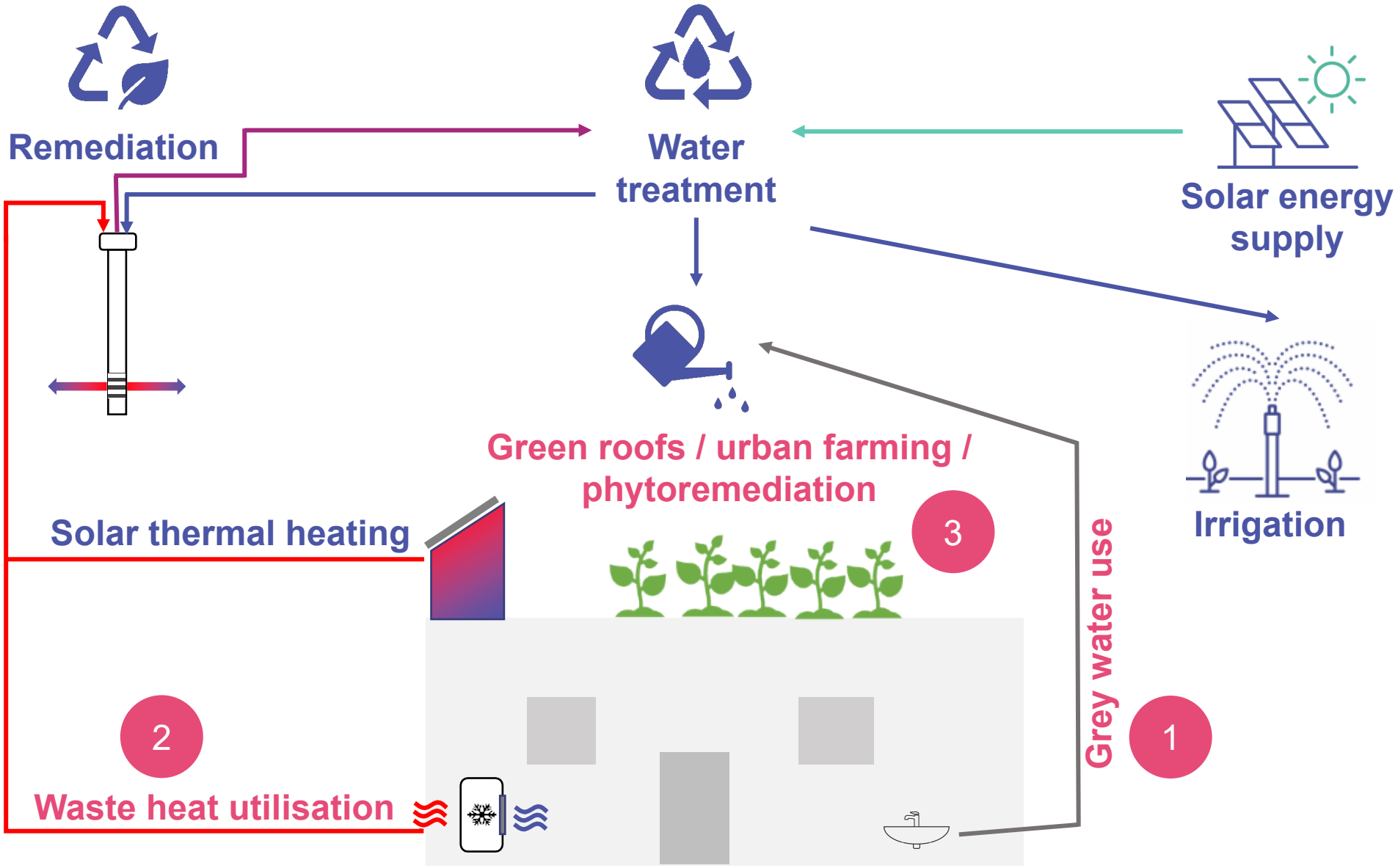


Microclimate analysis

Flood risk analysis







Sustainability indicators involved

1. Production of waste
   Use of resources
2. Use of energy
3. CO2 fixation
   Cooling
   Air quality
   Biodiversity
   Aesthetic impact
   Community involv.

TAUW | a living ambition

Tim Schöne

+49 1520 939 56 41

tim.schoene@tauw.com

www.tauw.com