



# Outotec

## Outotec Electrochemical Water Treatment

Virtual Upscaling workshop Dec 16 2016

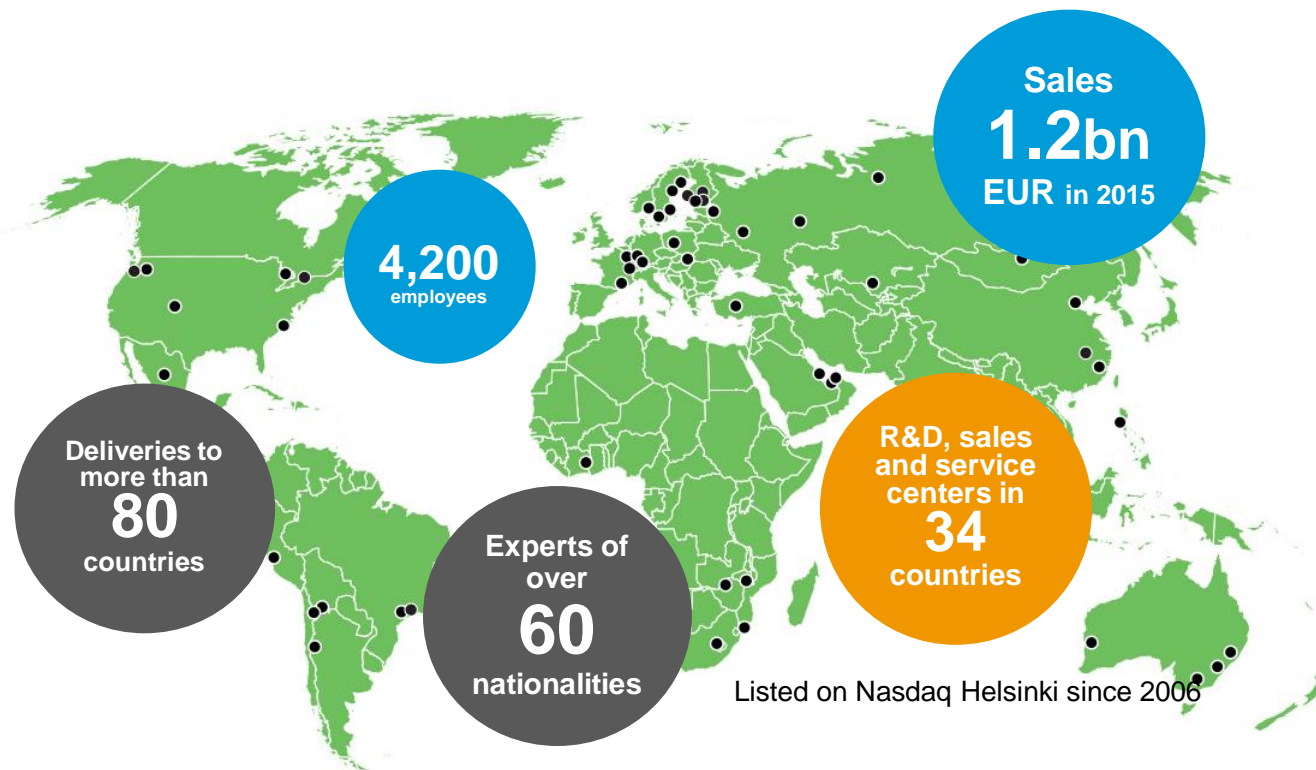
Kari Saloheimo

# Outline

- Outotec in two slides
- Introduction to electrochemical water treatment technology
- Virtual Upscaling case & expectations
- Discussion

# Outotec in numbers

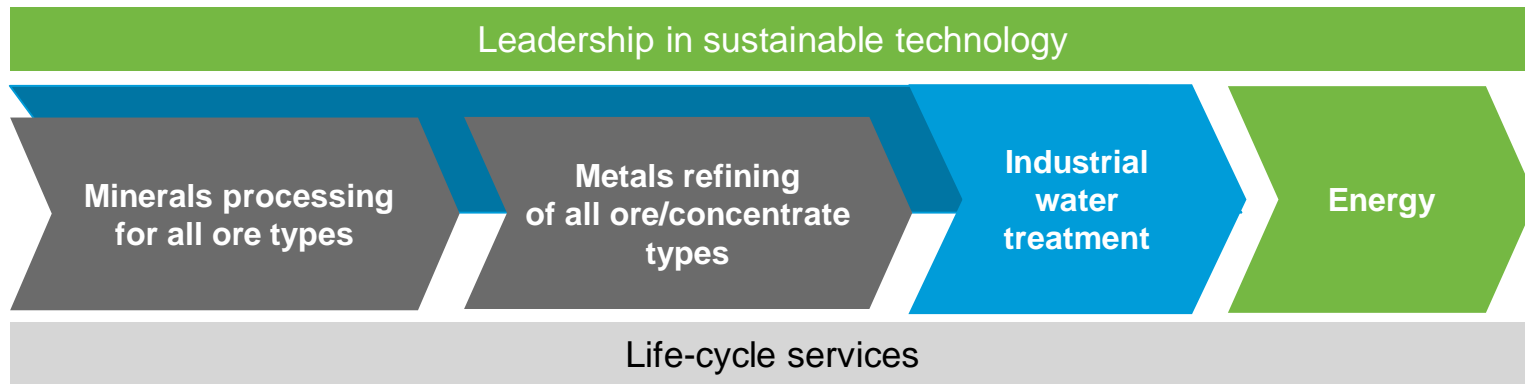
- Wide supplier network with established long-term relationships



# Focus in the value chain

The leading provider of sustainable minerals and metals processing solutions...

... and an innovative provider of sustainable energy and water processing solutions



Sustainable end-to-end solutions from feasibility studies to complete plants and life cycle services for virtually all ore types

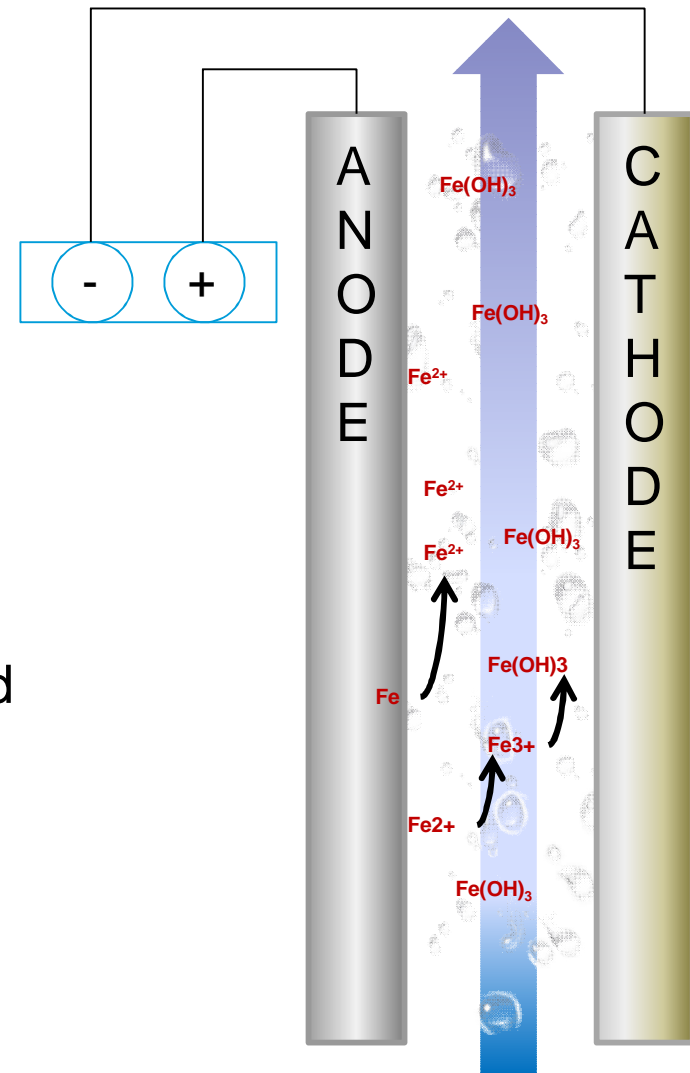
Extensive range of sustainable process solutions for virtually all types of ores and concentrates and sulfuric acid, turn-key delivery and life-cycle services

Solutions to produce water that meets environmental discharge standards, maximize water recycling and reduce water and energy consumption

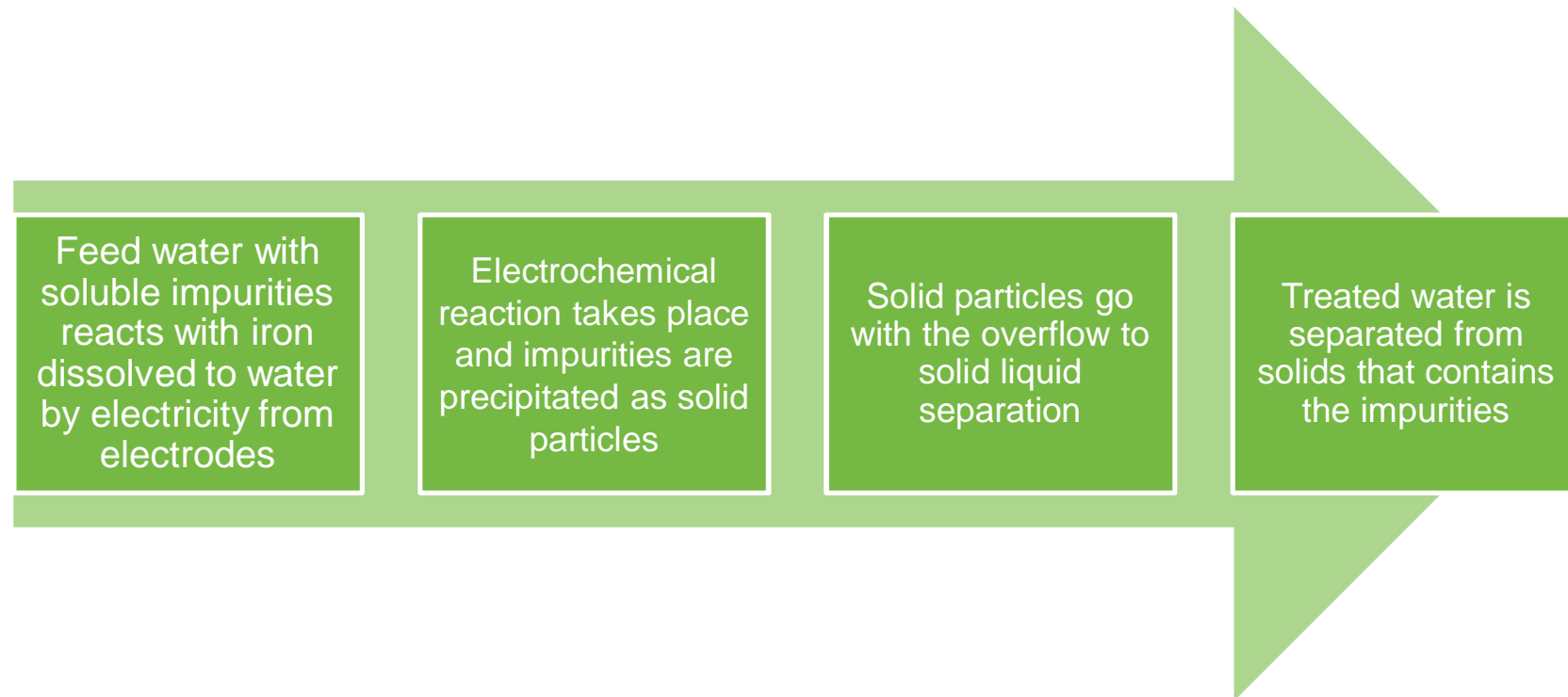
Innovative solutions for biomass, agricultural and municipal waste, industrial byproducts, as well as oil winning from oil shale

# Basics of electrochemical water treatment

- Water flows between electrodes
- Electricity dissolves metal from anode to the water
- Dissolved metal (for example iron) reacts with impurities in the water and with the water itself and forms solid particles
- Electricity with right electrode material generates oxidative and reductive conditions
- Electric field effects to the surfaces of solid particles enhancing the solids separation



# Main steps



# EWT-40 module and electrode pack



EWT Electrode pack – Outotec's Spare part

It is consumed in the process and needs to be replaced. Frequency depends on the application.

## One EWT - 40 module

One module can treat up to 40m<sup>3</sup>/h waste water

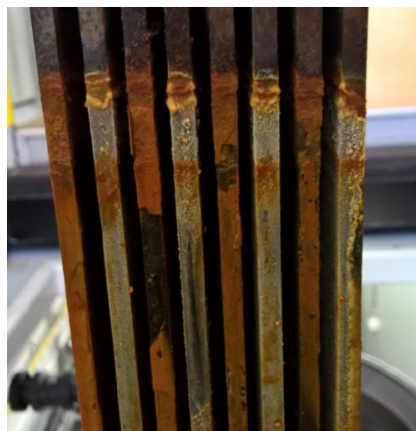
Outotec EWT-40 modules are the heart of the process. By combining different amount of modules one can have different treatment capacity m<sup>3</sup>/h



# Electrodes



EWT video



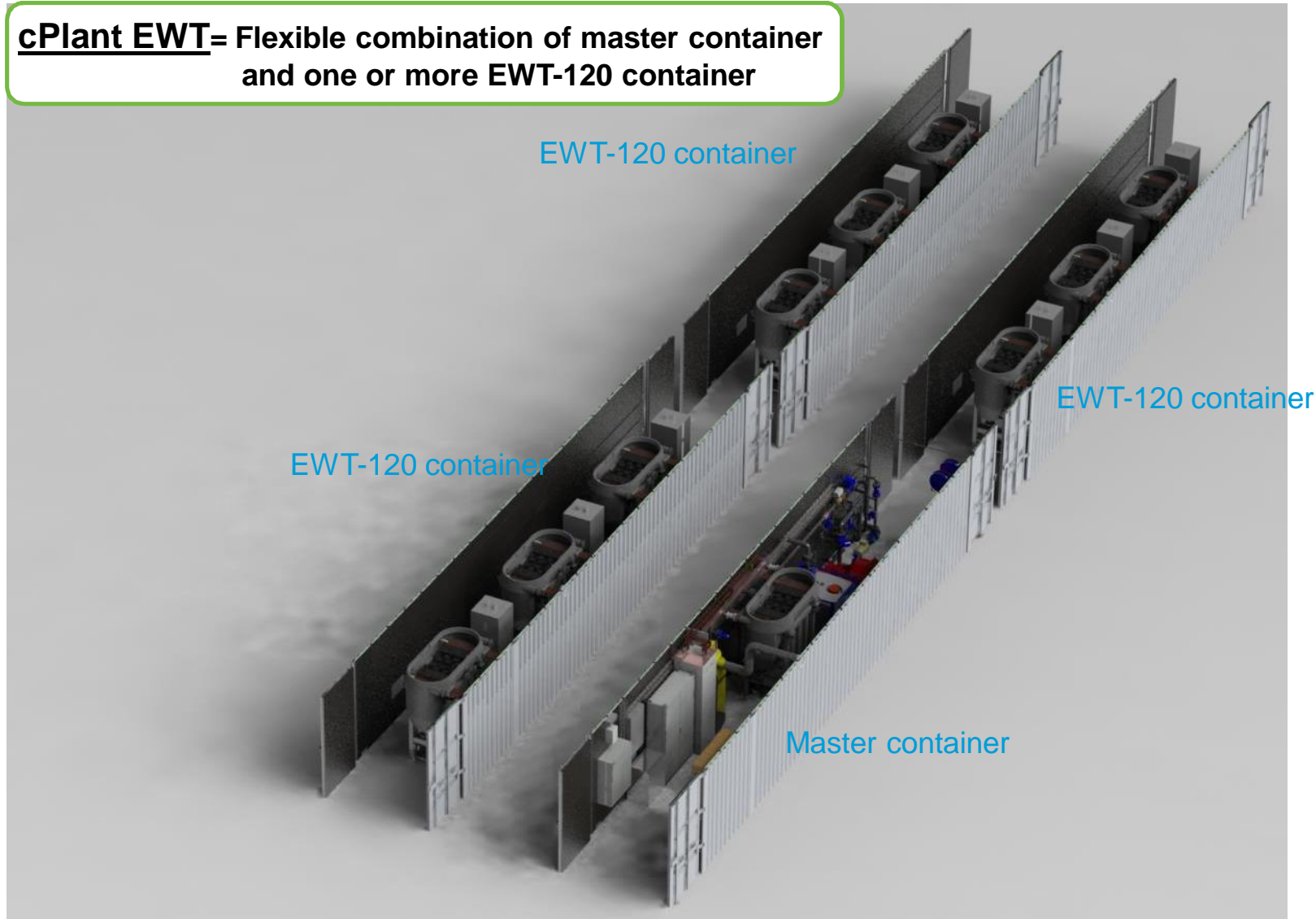


# Master container – The minimum cPlant delivery



# cPlant EWT – Scalable Water treatment Plant

**cPlant EWT** = Flexible combination of master container and one or more EWT-120 container

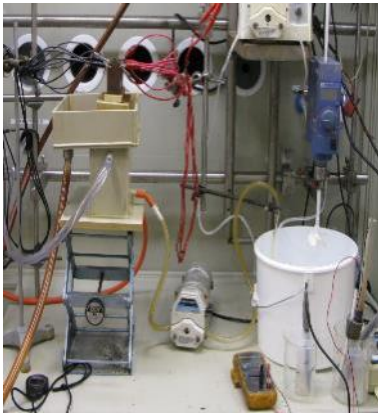


# Versatile solutions

- **Product & service models available**
  - cPlant EWT (c=containerized) as EP-S or EPC
  - Tailor made EWT based water treatment plant as EP-S or EPC
  - Operational support services
  - Maintenance and spare part services
  - Water treatment as a service
- **From test work to complete water treatment solution**
  - Laboratory scale test work, field test work, up to on-site piloting with full size cPlant EWT
  - Conceptual and feasibility studies
  - Basic engineering
  - Detailed engineering
  - Developing solution for the entire process

# Applications

- Water treatment needs in different industrial waters
  - Arsenic, selenium and antimony removal
  - Trace metals (Ni, Cu, Zn, Cd) removal, typically 10s of mg/L and below
  - Thiosulfate oxidation and removal
  - Organic residual removal
- New solutions and customer specific waters can be tested in lab, bench and real scale



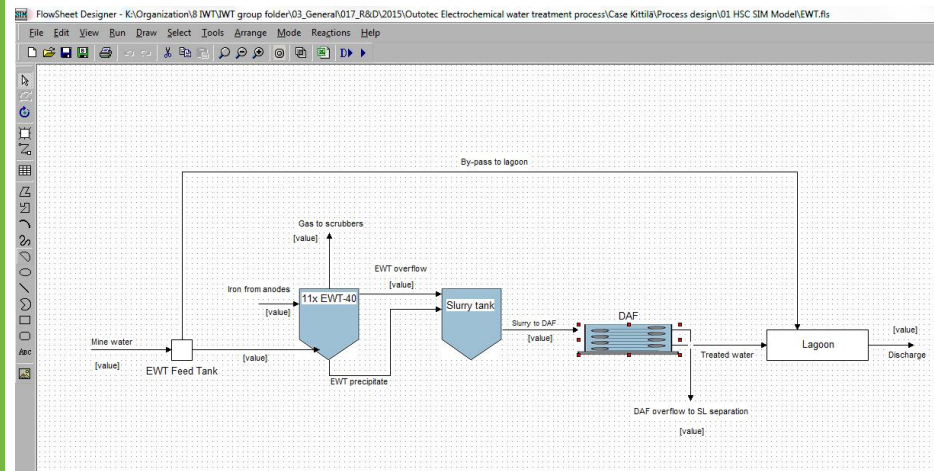
# Benefits

- Modular product to combine water treatment, process design, electrolysis & hydrometallurgy knowhow
- Purification of waste water based on electricity & right combination of electrode materials
- Easy & automated process allowing minimum presence of personnel with high quality & performance
- Modular & containerized plants are ideal for remote locations with minimum transportation and installation needs



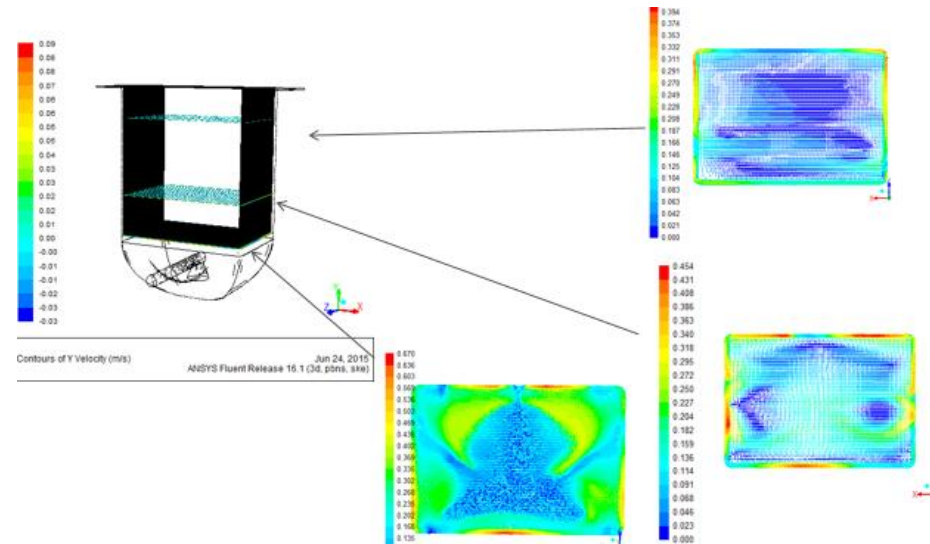
# Outotec Virtual Upscaling topics

- Upgrade process simulation model, including equipment sizing and design basis
  - Define relevant chemical equations to simplify the complex phenomena
  - Fine tune control setup
  - Link downstream logics to upstream EWT setup (e.g. Selenium)
- Goals
  - Better usability for process engineers
  - Process flowsheet development / mass balance calculations
  - Opex/Capex calculations
  - Empirical scale-up factors + other scale-up input
  - Integrated process design module to a plant configurator
  - Maintenance frequency (e.g. plate change) estimator
  - Modelling of dynamic power control
- What can we input from CFD?



# Virtual upscaling for EWT

- CFD mainly for flow simulation, is it possible to model further?
  - Electrode dissolution & dynamic change of flow
  - Local solid formation/particle growth
  - Electric field & electrochemical phenomena
- Feedback from CFD to process scale-up?
  - Dynamic retention time change
  - Threshold plate thickness for efficient flow
  - Gas hold-up times & its threshold values
  - Electrode thickness vs. electric power consumption
  - Other?
- How can we validate the CFD model using testwork results?



Outotec



Sustainable use of  
Earth's natural resources