IMPROVING COOLING TOWER WATER EFFICIENCY WITH CAPACITIVE DEIONISATION - pilot testing

MATChING
MATERIALS & TECHNOLOGIES FOR PERFORMANCE IMPROVEMENT OF COOLING SYSTEMS IN POWER PLANTS

October 2,2018

Workshop

Rome, Italy

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HOW TO IMPROVE WATER EFFICIENCY IN CT'S?

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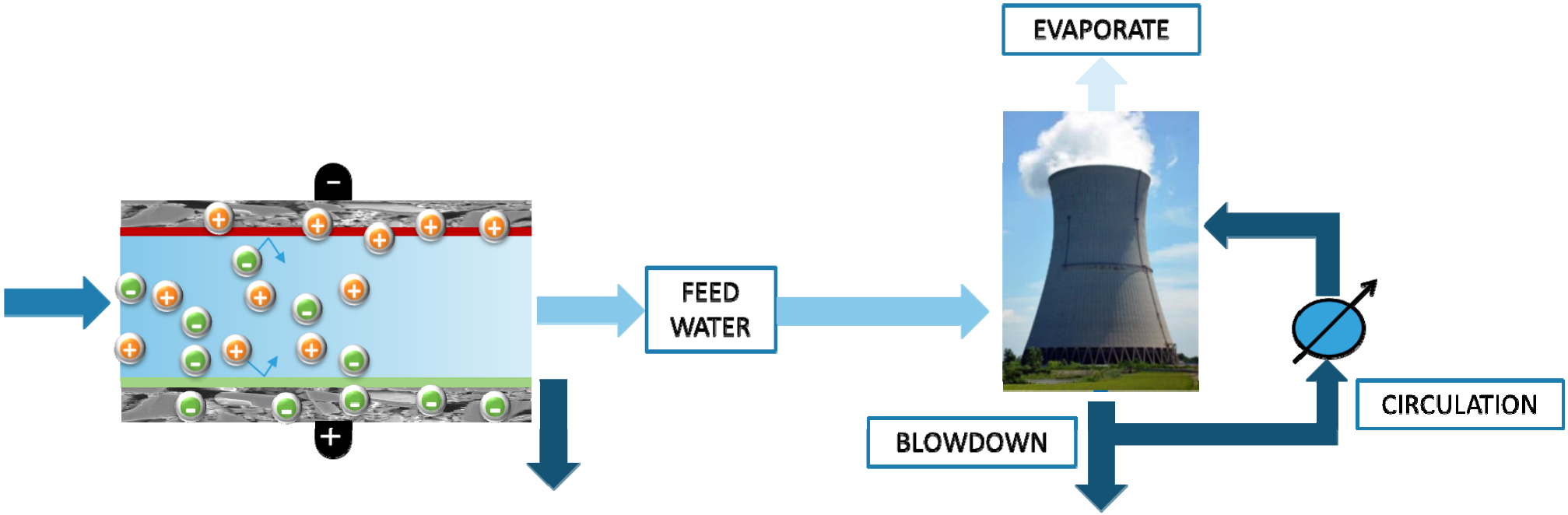
Many options e.g. change to dry cooling, alternative water sources, **CT optimizations**

Water use in CT's limited by concentration i.e. scaling, corrosion

⇒ Studied option: pretreat feed water with MCDI => target 30% reduction water uptake



CDI: TECHNOLOGY PRINCIPLE

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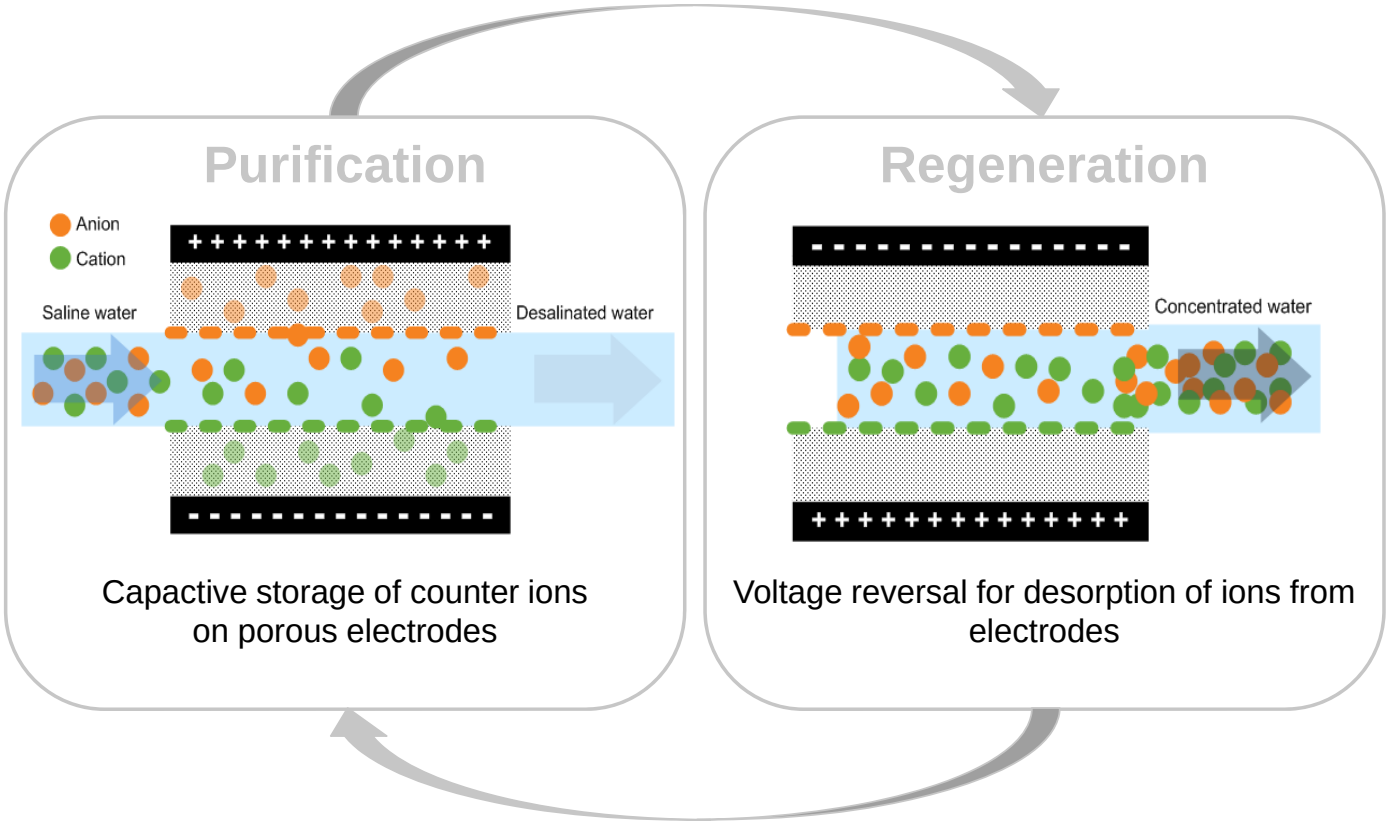

RESEARCH PLAN

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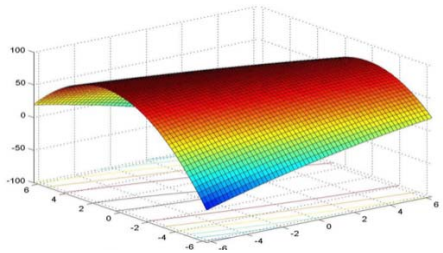
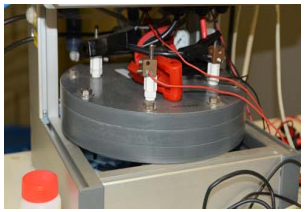
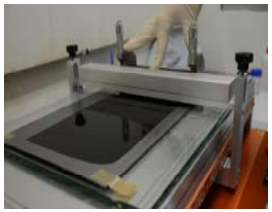
Task	Technology	Lead	Specific objective
6.1	MCDI	VITO	• minimize CT scaling/fouling issues, reduce CT blowdown

March 2016 — LAB Pre-Testing/ development — PILOT or module scale testing/development — April 2018 — REAL ENVIRONMENT TEST — July 2018







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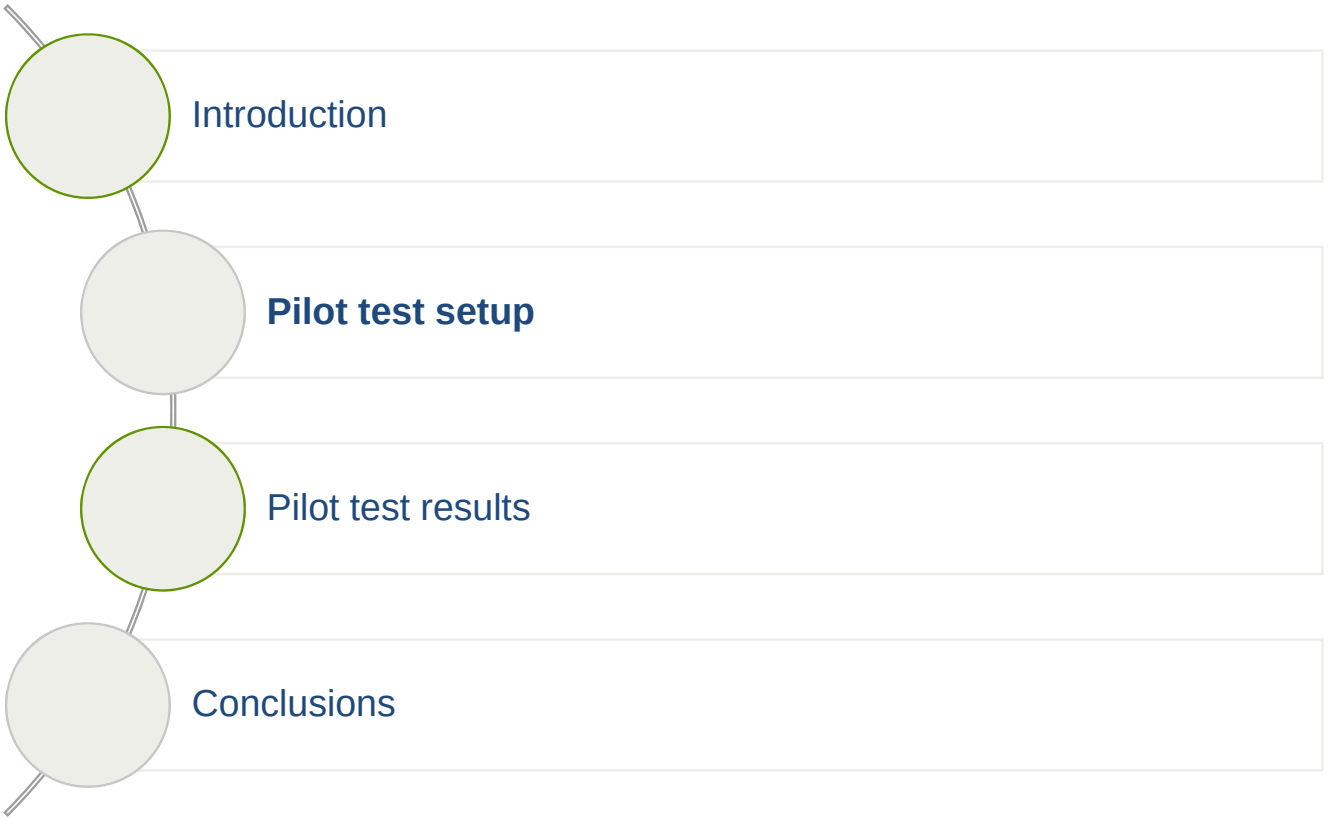

Pilot plant setup: overview

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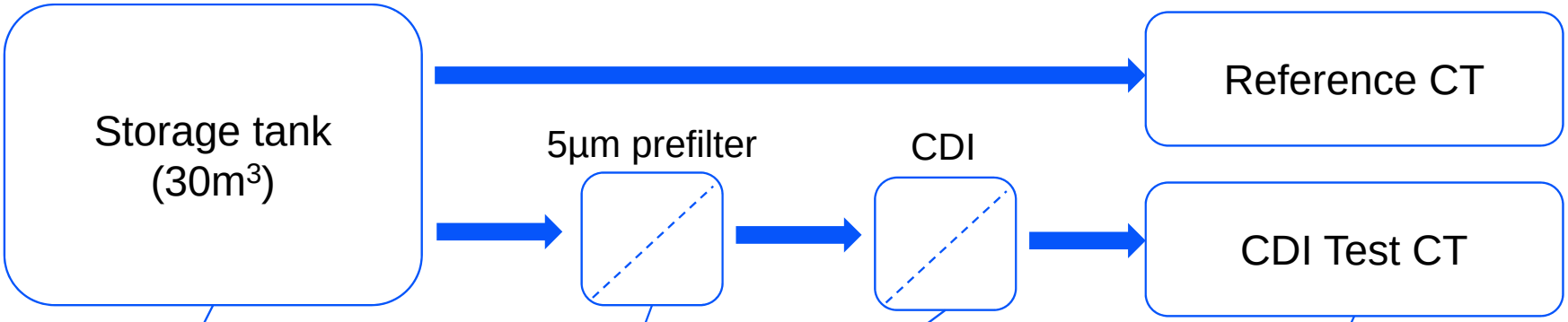

Pilot plant setup: CDI

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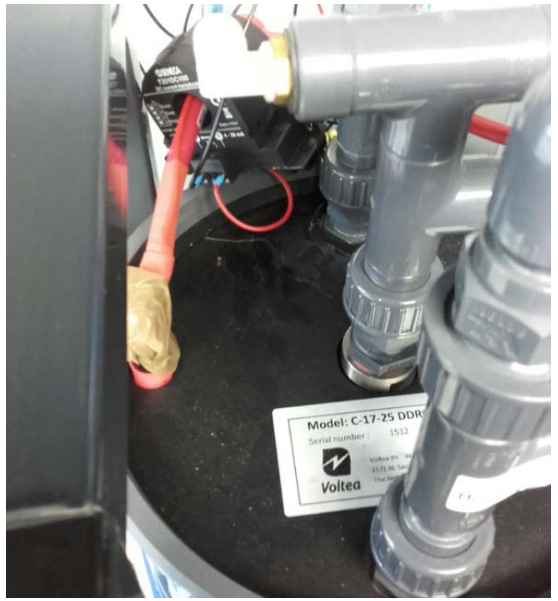
CDI pilot plant description

- Commercial system (Voltea CAP-DI IS2)
- 2 Commercial Voltea modules (10.5 m^2 E-surface each)
- flowrate 0,3 m^3 /h
- Automated and remotely controlled (additional improvements during test)
- Online monitoring for proces parameters



Pilot plant setup: Merades

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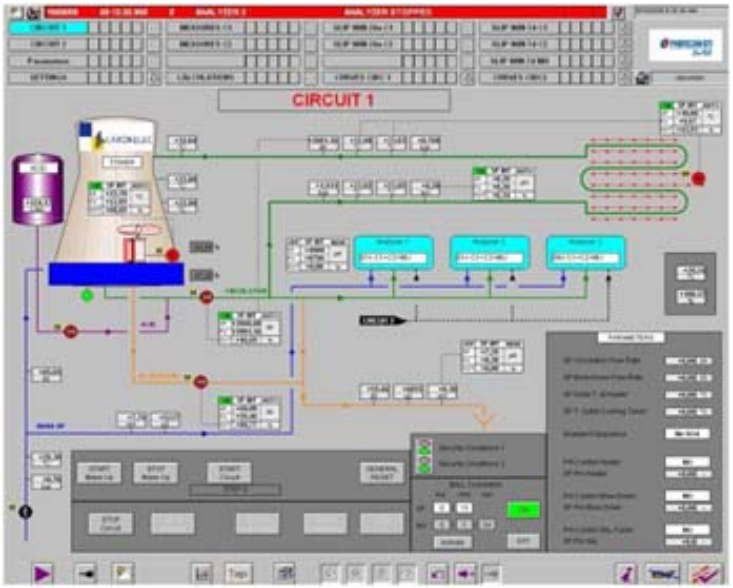
MERADES pilot plant description

- Mobile installation simulating semi-open cooling circuits
- 2 parallel and independent circuits → comparison (by corrosion monitoring) between different treatments under same conditions
- Fully automated and remotely controlled
- Online monitors for follow-up of physical and chemical parameters



Pilot test plan

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Description:

Intake Water: Water from Drogenbos Power Plant

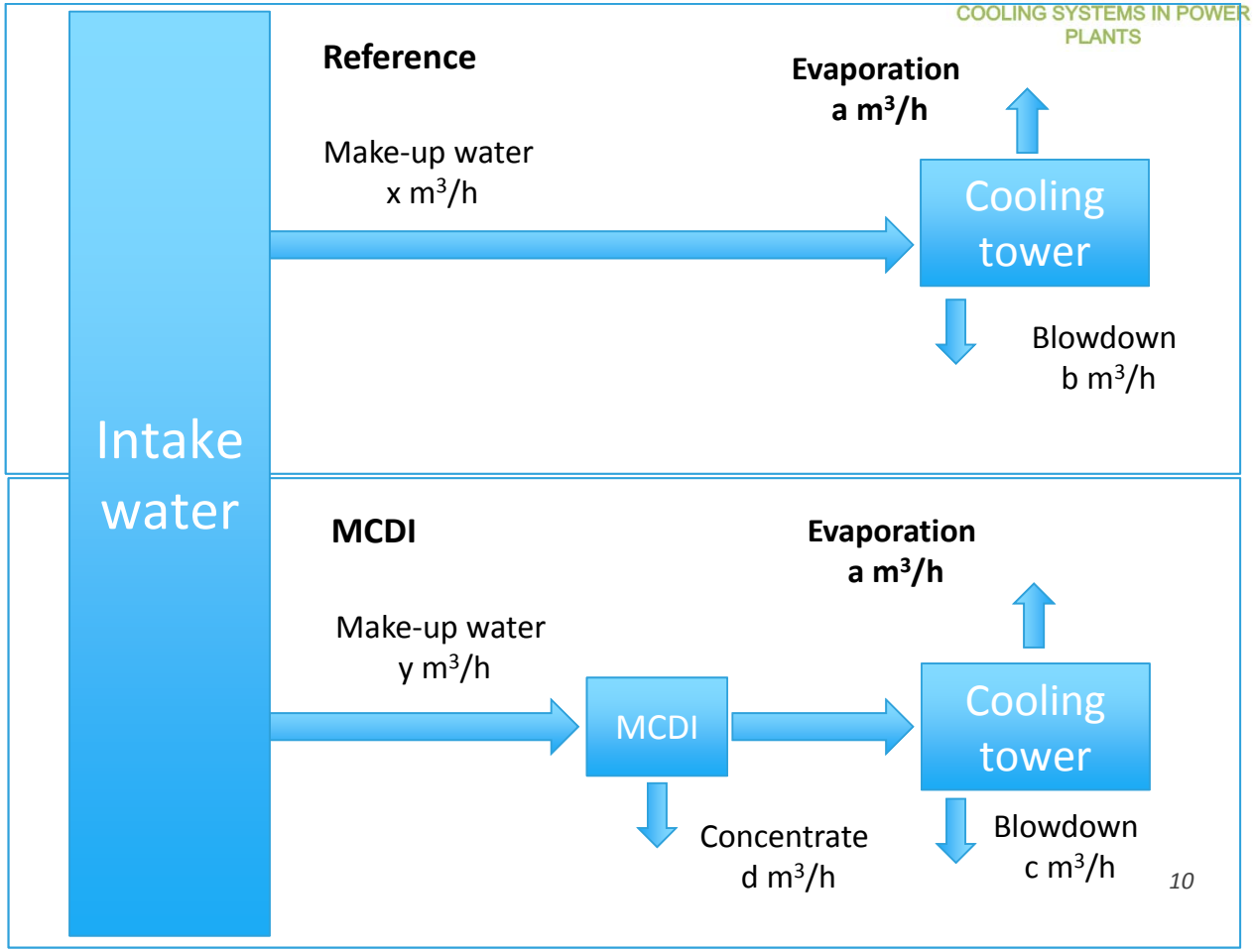
- pH 8.2, EC 0.99 mS/cm, TH ~20 °F
- Reference circuit: No pre-treatment
- MCDI circuit: filtration (5µm) + MCDI

Protocol:

- Increase COC and pH in the 2 circuits until scaling

Main outcome:

- Water and energy efficiency CDI
- COC, pH and ryznar index cooling tower (water use)
- Overall performance water use



Pilot test plan

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3 month testing, 1-2 weeks per case

Pilot test schedule:

Test number	from	till	setpoint conductivity reduction	average effective conductivity reduction
pretesting	11/04/2018	8/5/2018	-	-
test 1	08/05/2018	18/05/2018	25%	12%
test 2	19/05/2018	31/05/2018	25%	25%
test 3	04/06/2018	11/06/2018	50%	43%
test 4	12/06/2018	19/06/2018	25%	29%
test 5	20/06/2018	25/06/2018	50%	50%
test 6	03/07/2018	06/07/2018	50%	50%

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Result CDI on Pilot Plant

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MCDI allows to work with:

- Higher COC
- Higher pH

➔ Result are not directly comparable.

#Test	COC	pH	Ryznar
Reference	3.95	8.0	5.73
1	4.88	8.33	5.2
2	4.3	8.2	5.45
3	4.75	8.74	4.75
4	4.45	8.73	4.63
5	4	8.7	4.27
6	4.5	8.63	5.17

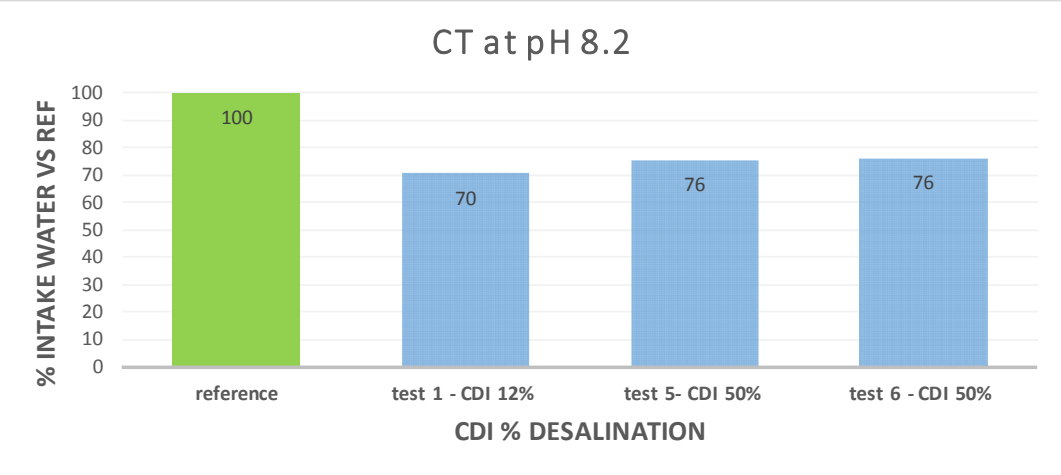
Simulation needed:

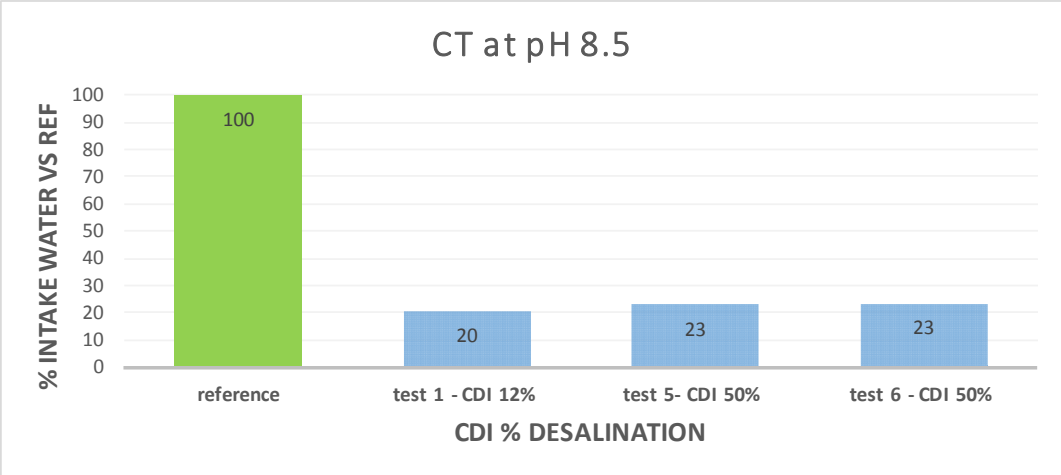
Ryznar index = reference

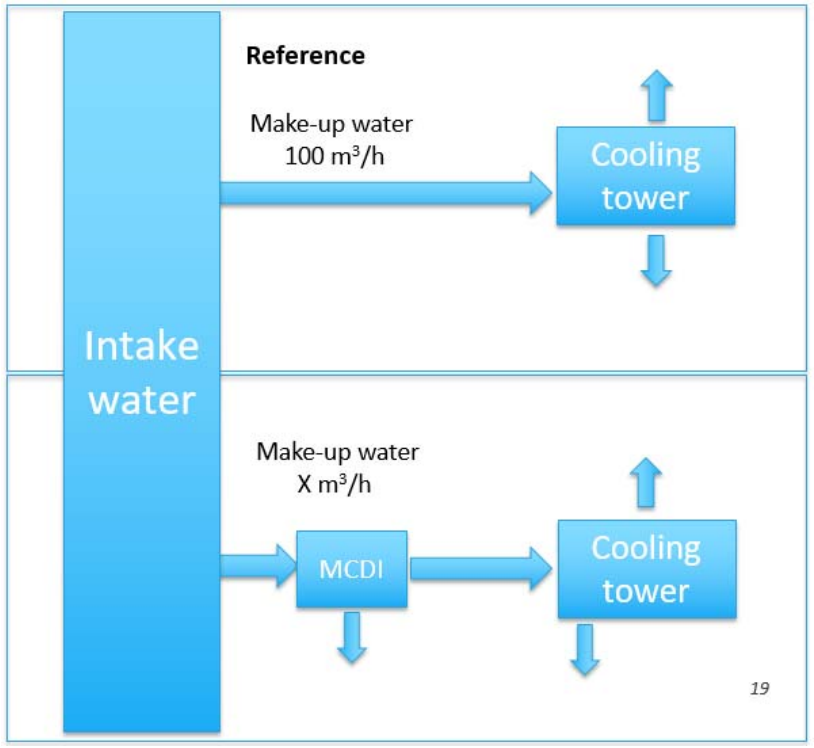
Fixed pH (8.2 and 8.5)

Simulations are done with LBE software CoolWAT

Result CDI on Pilot Plant: make up water







- Feed water reduction 20% - 80% depending on pH in CT
- Additional energy consumption of CDI: **0,05 - 0,1** kWh/m³ feed

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Conclusions CDI on makup water

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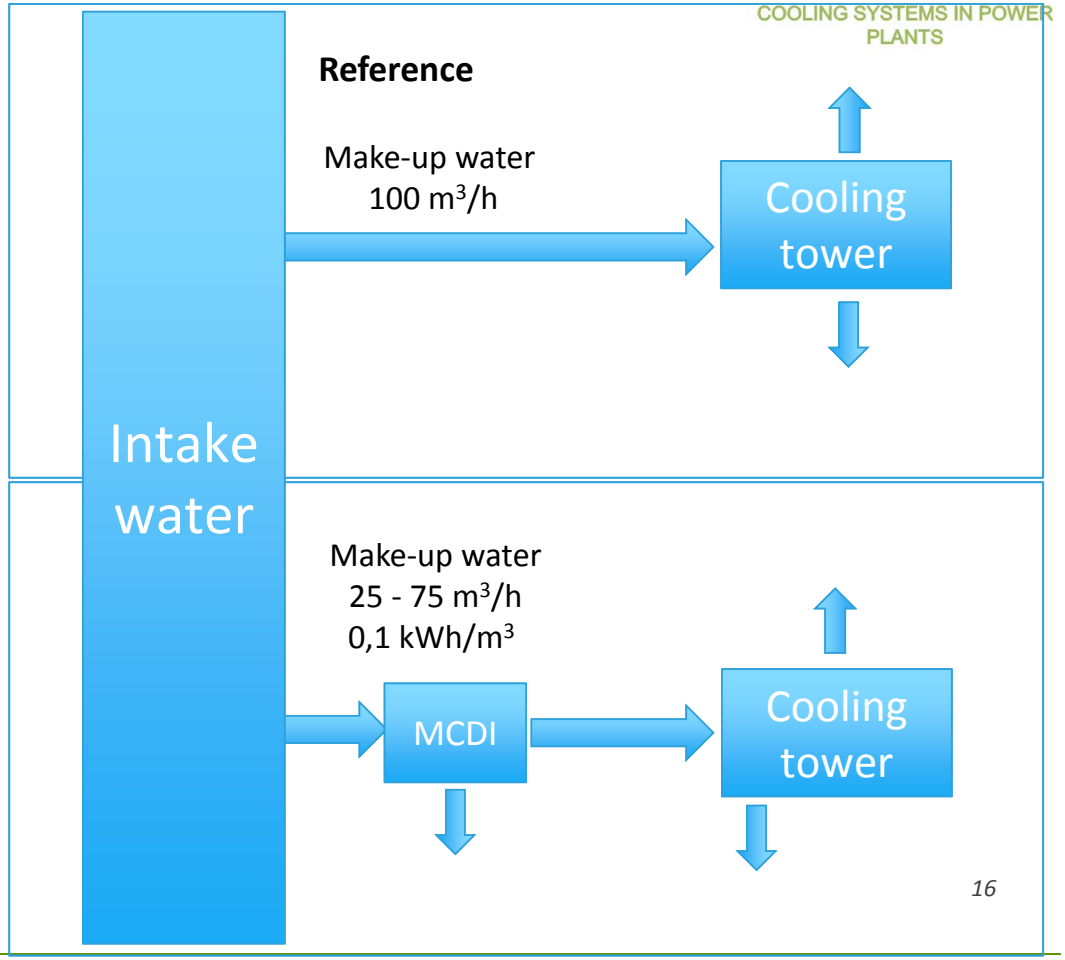
Feed pretreatment with CDI:

- decrease hardness
- decrease salinity of CT feed

Result pilot test:

- Reduction in feed water with 25-75%
- Or lower chemical use (working at higher pH)
- Low E-consumption
  - 0,1 kWh/m^3 for pilot case



Questions?

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