



ZERO BRINE

RE-DESIGNING THE VALUE AND SUPPLY CHAIN OF WATER AND MINERALS:

a circular economy approach for the recovery of resources from saline impaired effluent (brine) generated by process industries

Dr. Dimitris Xevgenos
Innovation Manager,
ZERO BRINE project

“Managements of concentrates in the context of Water Reuse”
Wave Online Seminar, 26 April 2021, Germany



ZERO BRINE project (www.zerobrine.eu) has received funding from the European Union's H2020 research and innovation programme under Grant Agreement No 730390.



Outline

- 1. Circular economy & water within H2020**
2. ZERO BRINE project
3. Technologies & framework agreement
4. Exploitation & follow-up projects

JYRKI KATAINEN

EUROPEAN VICE PRESIDENT FOR
JOBS, GROWTH, INVESTMENT &
COMPETITIVENESS

€1B

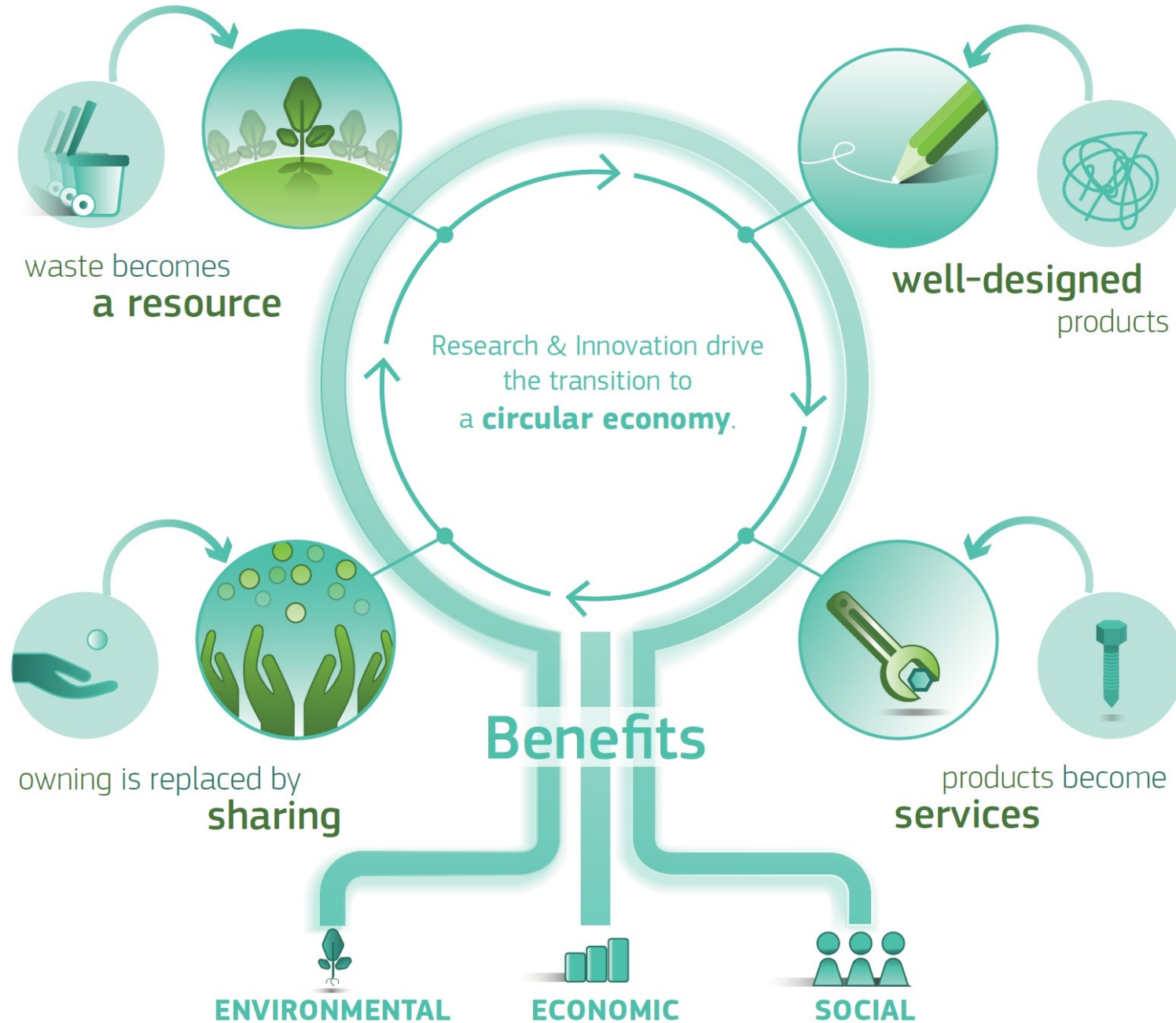
WP2018-2020
(H2020)

*“The **circular economy** needs more than traditional R&D or a piecemeal approach to technologies*

*it needs changes in entire systems and **joint efforts** by researchers, technology centres, industry and SMEs, the primary sector, entrepreneurs, users, governments and civil society. It needs enabling regulatory frameworks, and additional public and private investments”*

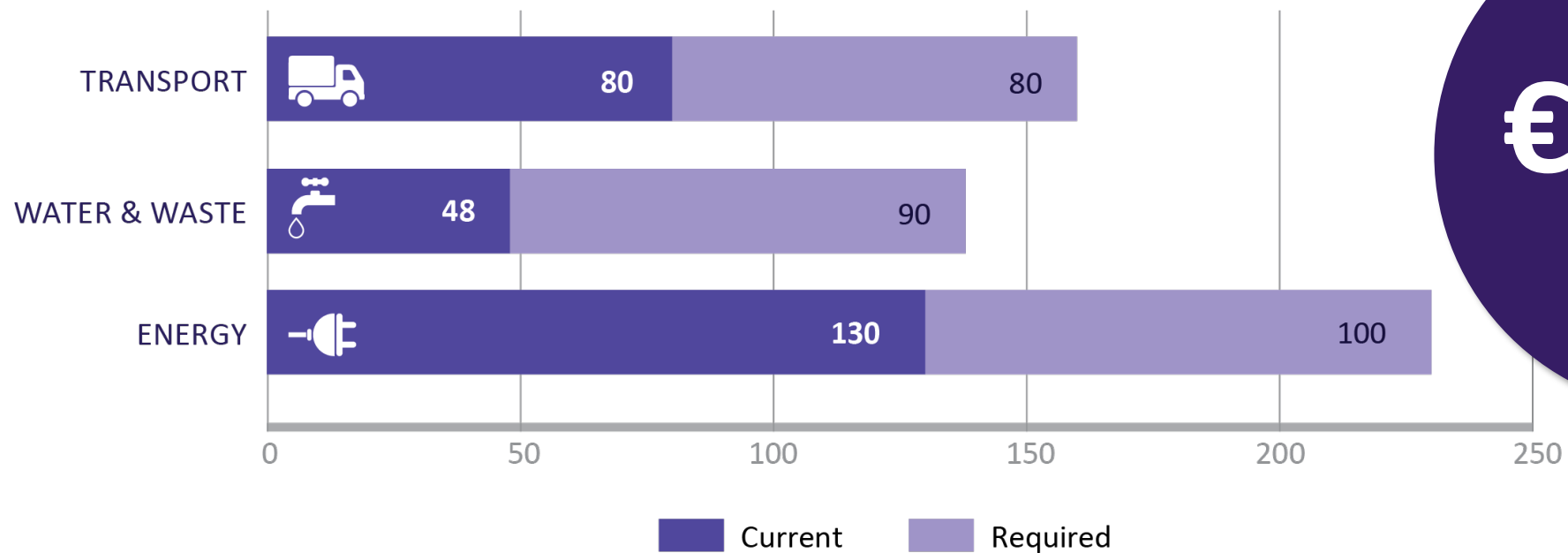


European
Commission





EU targets by 2030



€270B
PER YEAR

Annual investment needs for sustainable development in the EU (EUR BN)





2.1M
ENTERPRISES



17Mt
CHLORIDE RELEASES
2017





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**“Re-designing the value and supply chain
of *water* and *minerals*:
a **circular economy** approach
for the recovery of resources
from saline impaired effluent (*brine*)
generated by process industries”**

€10M
BUDGET



The **ZERO BRINE** project (www.zerobrine.eu) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Number 730390.



TOTAL BUDGET: 11,081,972.78 € with an EU contribution of 9.992.209,11 €



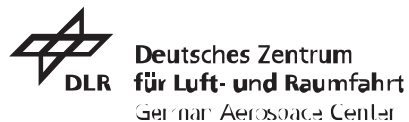
DURATION: 48 months (4 years) June 2017 – May 2021





22 CONSORTIUM PARTNERS from 10 COUNTRIES

arvia



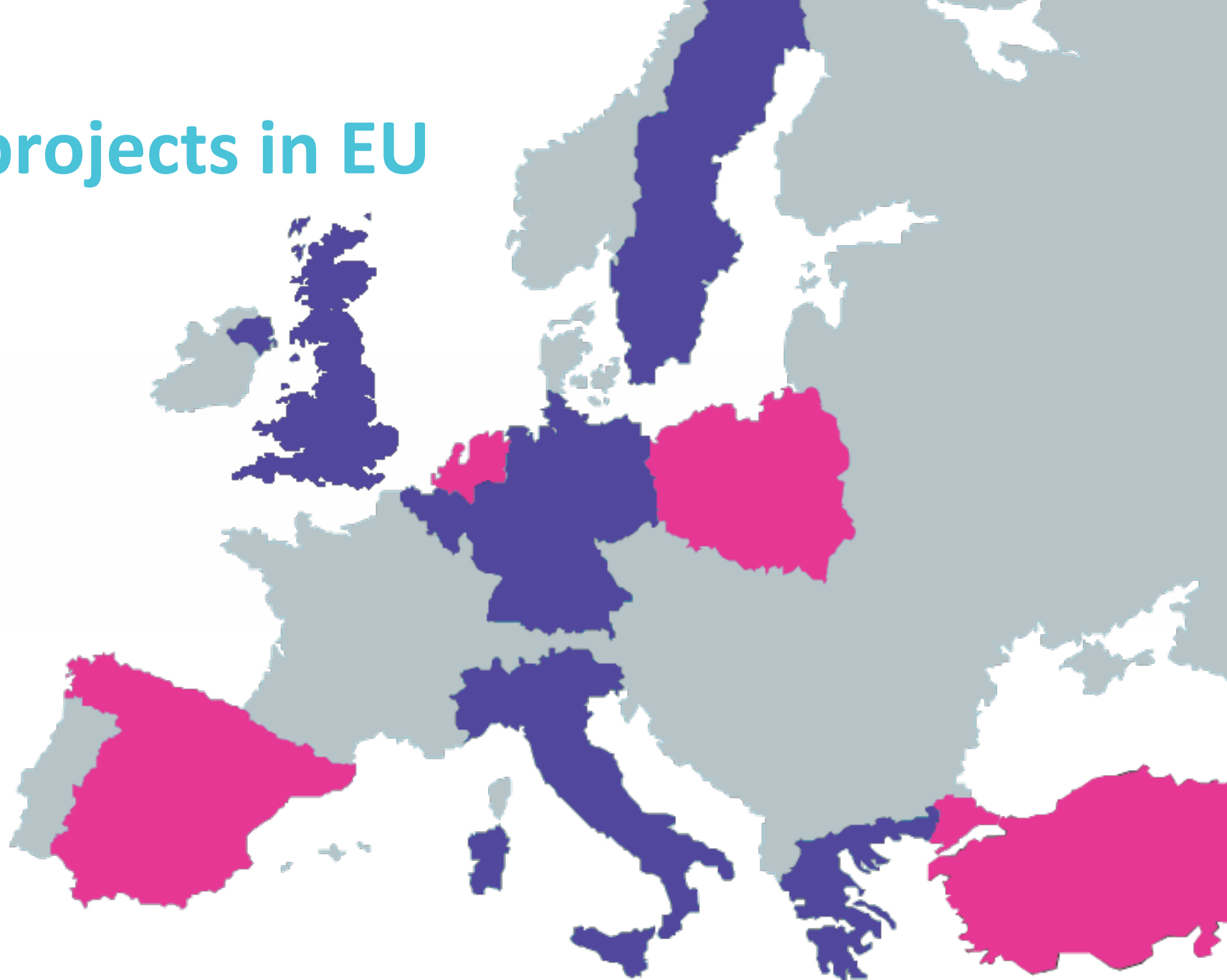
REVOLVE





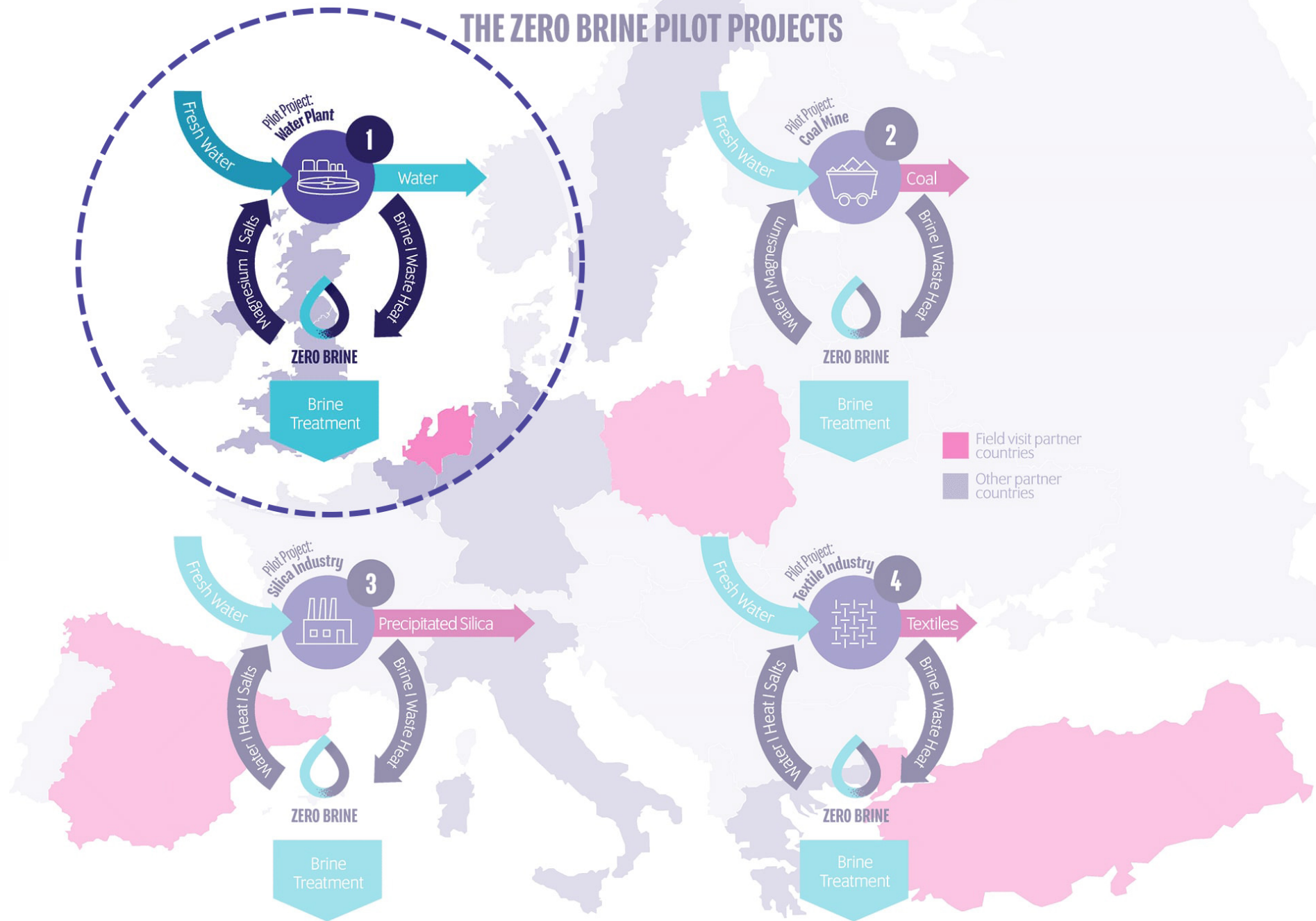
ZB pilot projects in EU

-  Pilot project partner countries
-  Other partner countries





THE ZERO BRINE PILOT PROJECTS

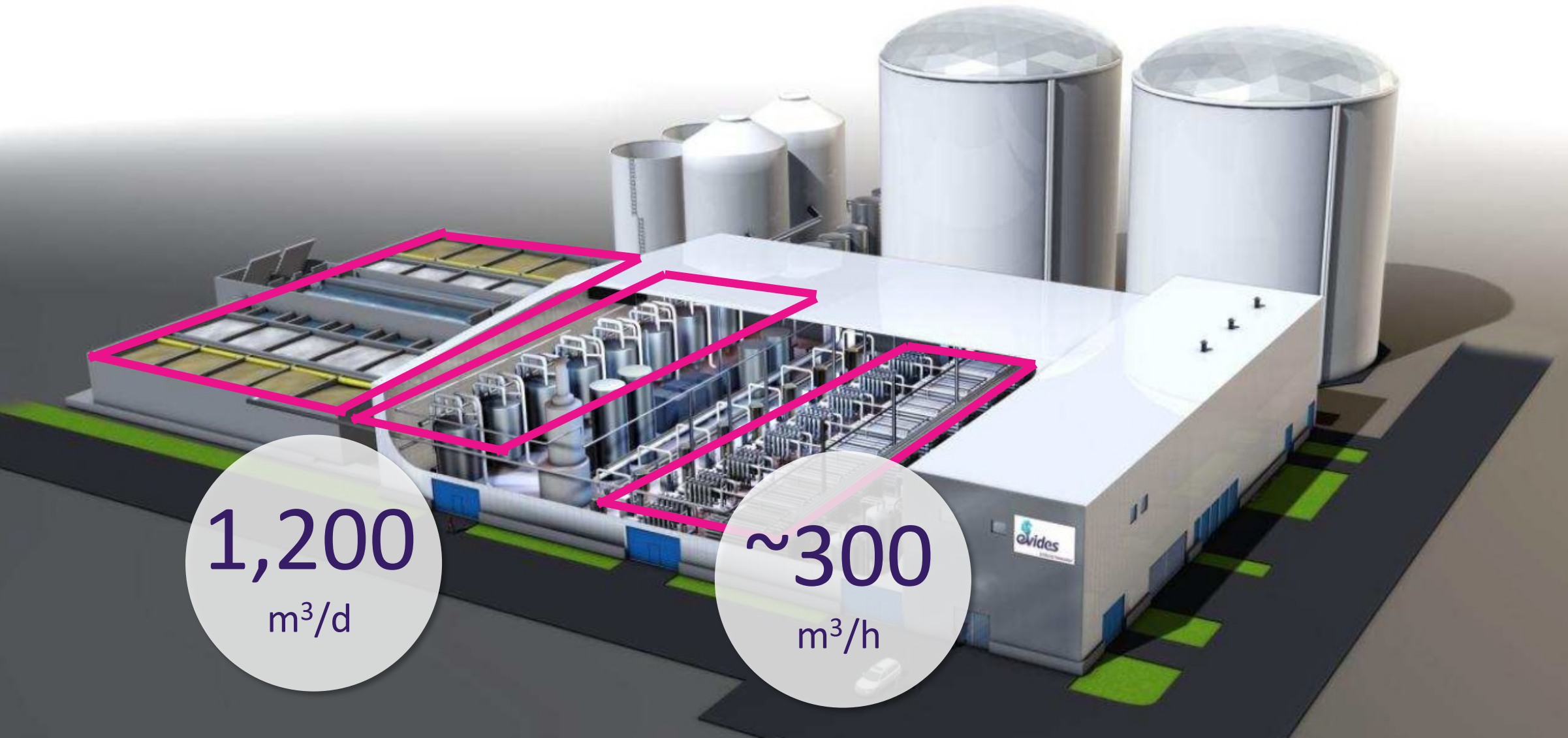




Demin Water Plant Botlek



Deminwaterplant (DWP)



1,200
m³/d

~300
m³/h

DUCOR
Petrochemicals

wilmar

vides

EUROGEN

AIR LIQUIDE

PLANT 1
one
Rotterdam B.V.

Lucite
International

INVISTA

TEBODIN
Consultants & Engineers

850,000 m²
(210 acres)



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T5.2: Technology groups

Technology Groups	BEC Code	Modules	Owner
Organics	OR-1	Adsorption with electrochemical destruction	ARVIA
	OR-2	Advanced oxidation	LENNTECH
	OR-3	Advanced oxidation	TUBITAK
	OR-4	MBR – aerobic	NTUA
	OR-5	MBR - anaerobic	NTUA
	OR-6	Aerobic Granular Sludge (AGS) reactor	TU DELFT
Brine purification / Ion Separation	BP-1	Nanofiltration / Reverse Osmosis	LENNTECH
	BP-2	Nanofiltration / Reverse Osmosis	EURECAT
	BP-3	Nanofiltration / Reverse Osmosis (pilot)	EURECAT
	BP-4	Nanofiltration / Reverse Osmosis	SUT
	BP-5	Nanofiltration / Reverse Osmosis	TUBITAK
	BP-6	Electrodialysis (EDB – EDBP)	EURECAT
	BP-7	ED (ED – EDR)	EURECAT
	BP-8	Ion Exchange (IX)	LENNTECH
	BP-9	IX	TUBITAK
	BP-10	Pilot membrane regeneration system	TYPSA
	BP-11	UF / NF / RO pilot system	EURECAT
	BP-12	Bench-scale membrane regeneration system	EURECAT
	BP-13	NF/RO	TUBITAK
Brine Concentration	BC-1	Electrodialysis reversal	SUT
	BC-2	Membrane distillation	TUBITAK
	BC-3	Forward-feed MED evaporator*	NTUA / SEALEAU
Brine Crystallization	BCr-1	Eutectic Freeze Crystallization (EFC)*	TU DELFT
	BCr-2	EFC	TU DELFT
	BCr-3	Crystallization with Ion Exchange membranes (CrIEM)*	UNIPA/ResourSEAs
	BCr-4	Crystallization with continuous stirred tank reactor	UNIPA/ResourSEAs
	BCr-5	Multiple Feed Pulg Flow Reactor, which is the bench scale	UNIPA/ResourSEAs
	BCr-6	Pilot scale crystallization module	UNIPA/ResourSEAs
	BCr-7	Heat pump vacuum evaporator/crystallizer	NTUA
	BCr-8	Continuous Stirred Tank Reactor (CSTR)	SUT
	BCr-9	EFC	EURECAT
	BCr-10	T-shaped impinging jet crystalliser	UNIPA

- A careful planning of the BEC modules is prepared and discussed also at the general assembly meetings.
- ZERO BRINE consortium partners own 28 BEC modules organized in 5 Brine Excellence Centers
- Main BEC : Netherlands & 4 satellite BECs:
 - Greece, owned by NTUA
 - Italy, owned by UNIPA
 - Spain, owned by EURECAT
 - Poland, owned by SUT



Dutch Brine Excellence Center





Polish Brine Excellence Center





Spanish Brine Excellence Center



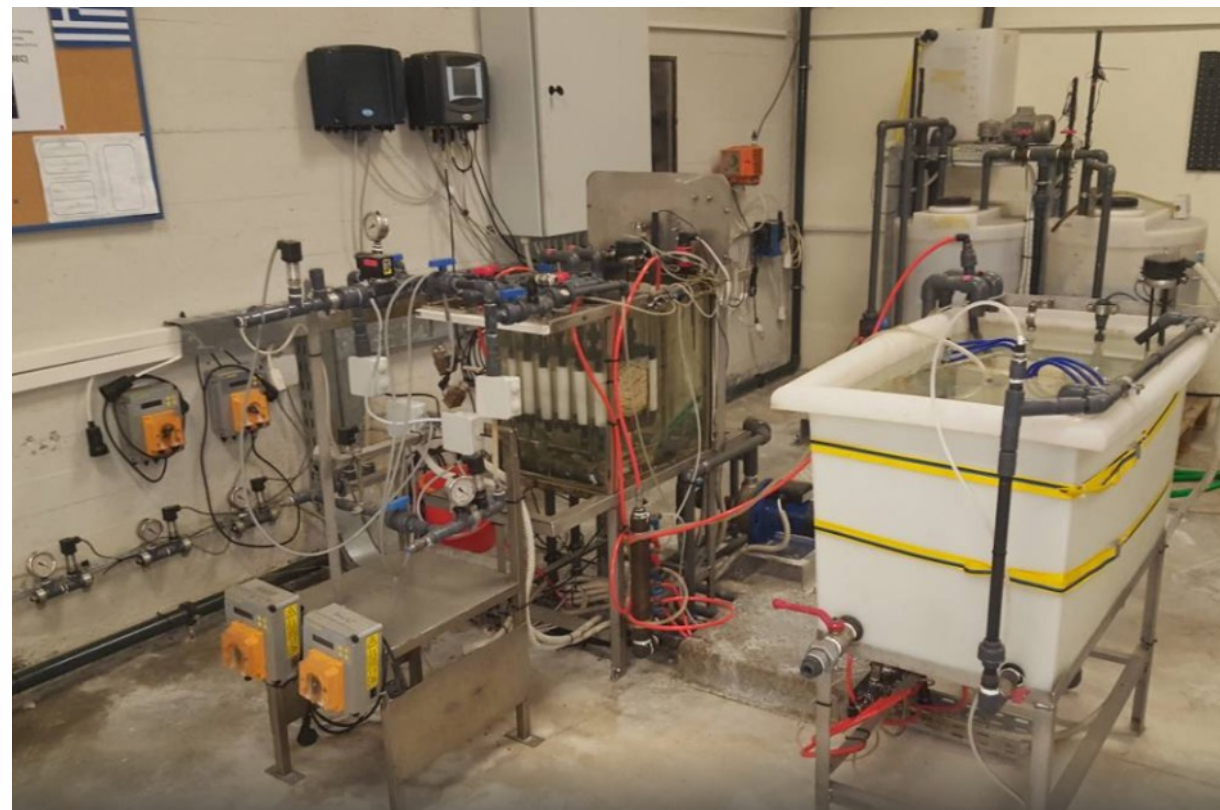


Italian Brine Excellence Center








Greek Brine Excellence Center







Legend

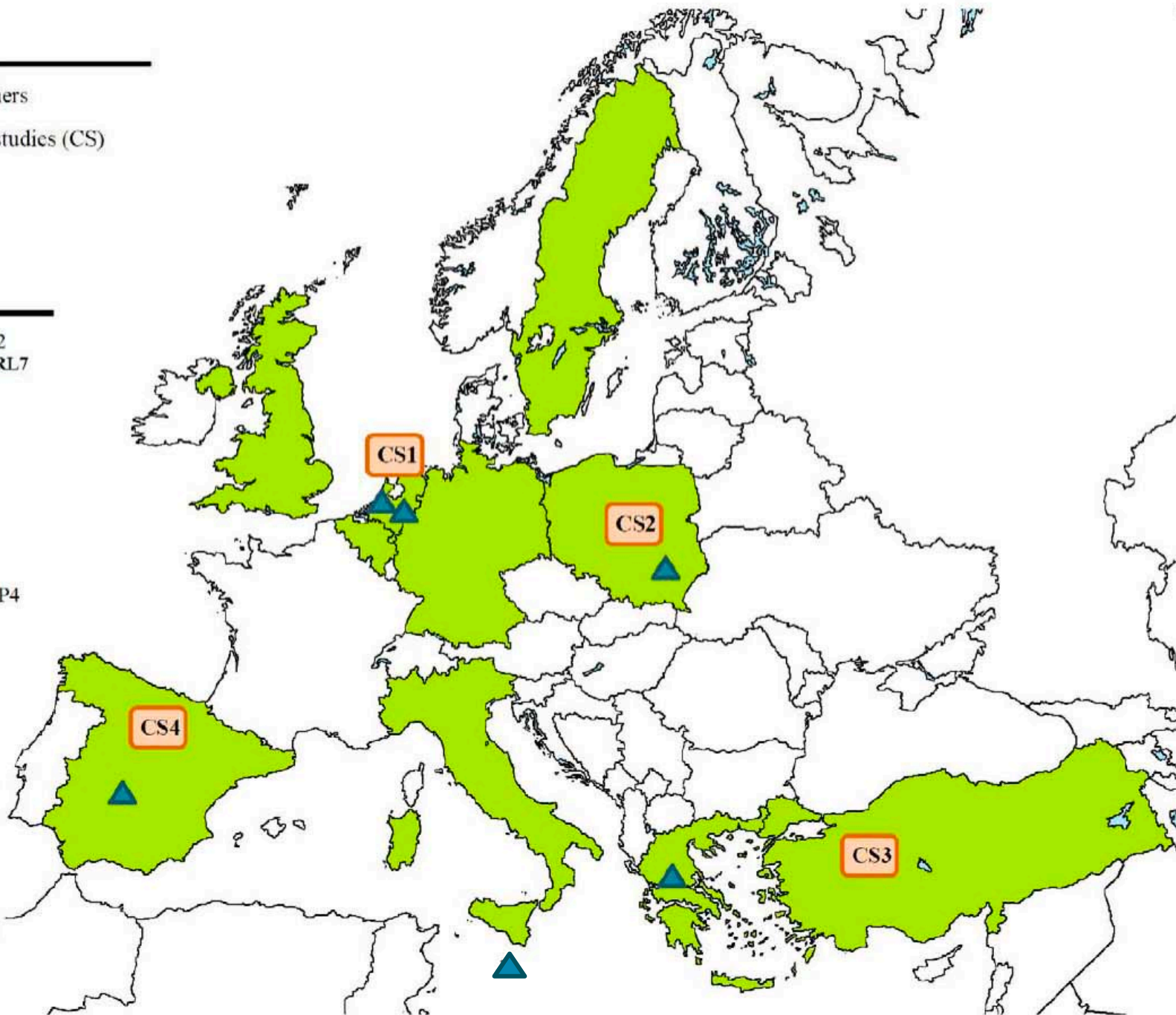
-  Countries of ZERO BRINE partners
-  Demonstration activities – Case studies (CS)
-  Replication activities

Demonstration activities

-  **CS1** Industry Water (NL) – see also WP2
Large-scale demonstration plant – TRL7
EVIDES, Rotterdam Port, NL
-  **CS2** Coal Mine – see also WP3
Large-scale pilot plant – TRL6
TAURON, Poland
-  **CS3** Textile Industry – see also WP3
Large-scale pilot plant – TRL6
Zorlu Textile, Turkey
-  **CS4** Precipitated silica (ES) – see also WP4
Large-scale pilot plant – TRL6
IQE, Zaragoza, Spain

Replication activities

-  2 replication activities in NL
-  1 replication activity in PL
-  1 replication activity in Greece
-  1 replication activity in Spain



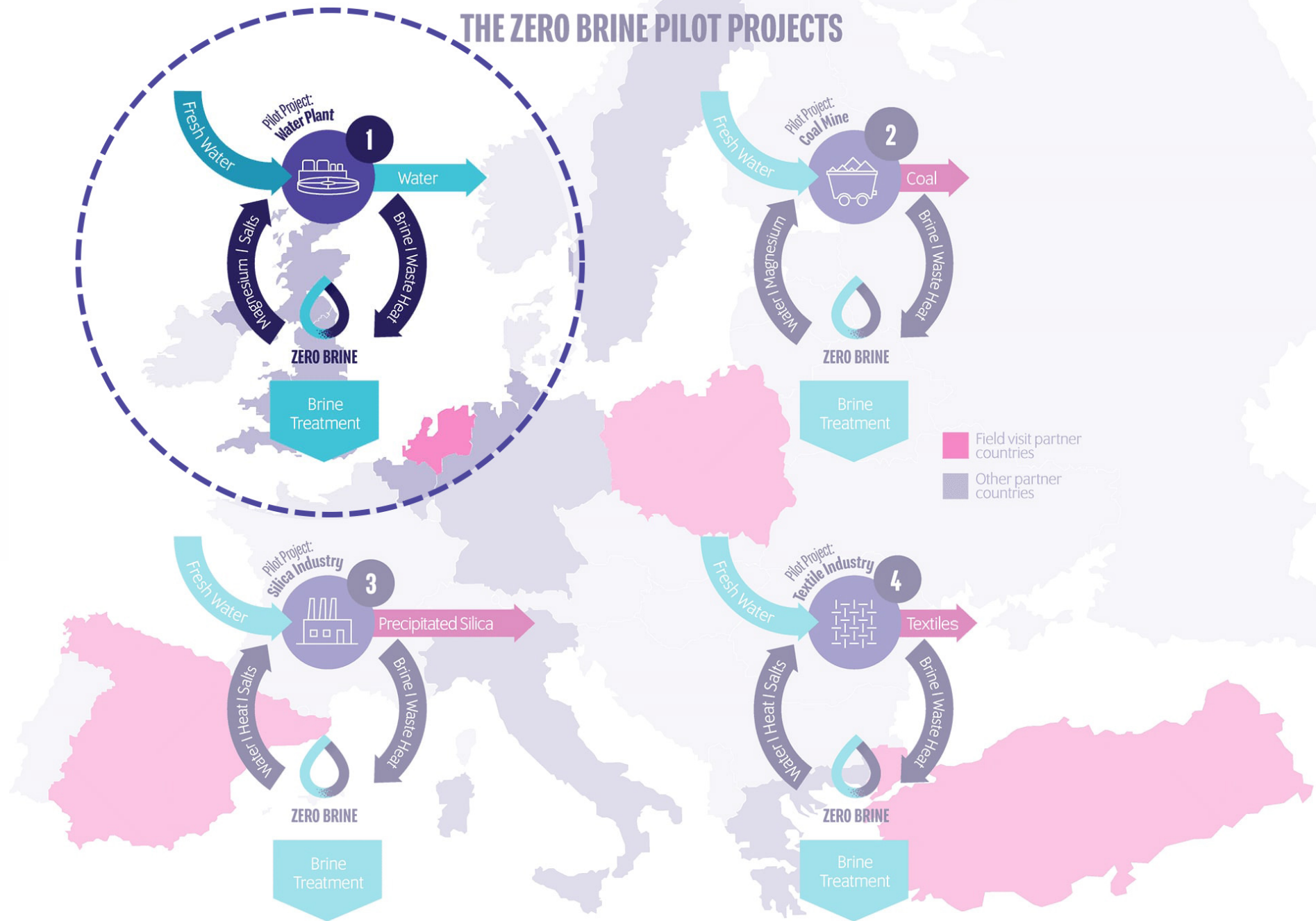


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THE ZERO BRINE PILOT PROJECTS





Emissieregistratie: Chloride releases



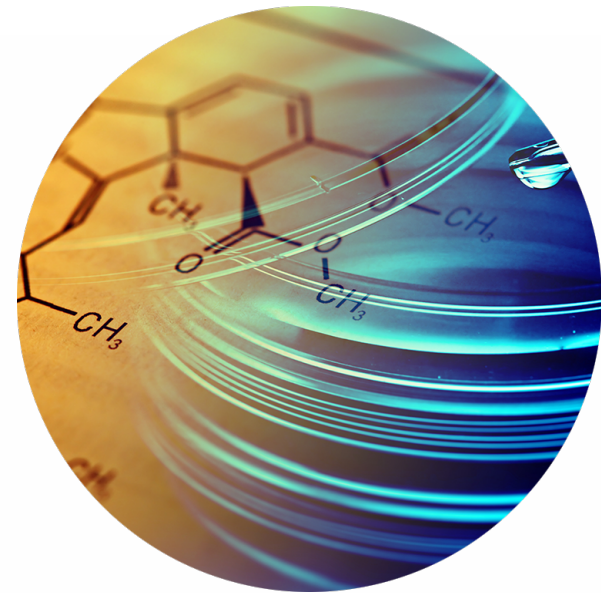
277
FACILITIES

870
KT CHLORIDES/YEAR



Chloride releases by main sectors

CHEMICAL INDUSTRY



61%

SALT MINING INDUSTRY



29%

FOOD SECTOR



5%

OTHER INDUSTRIES



5%



*“WATER-MINING: Next generation water-smart management systems:
large scale demonstrations for a **circular economy and society**”*



Grant Agreement No 869474



water mining

€19M

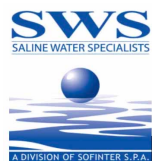
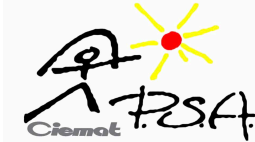
Budget



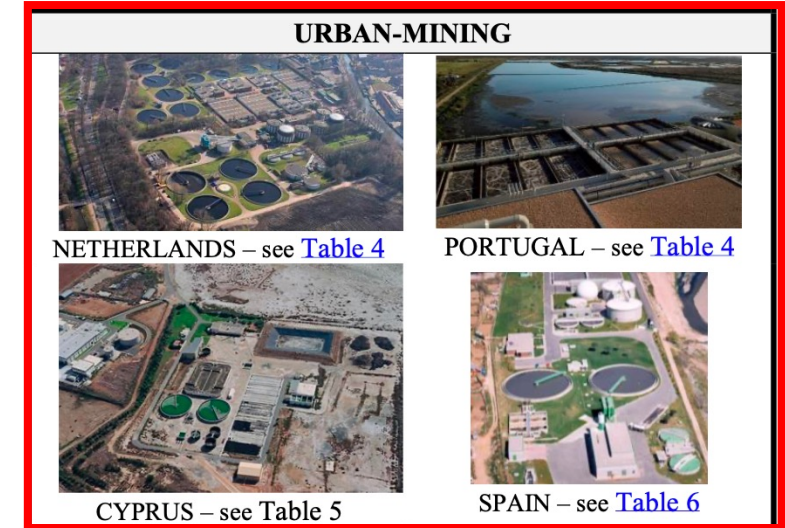
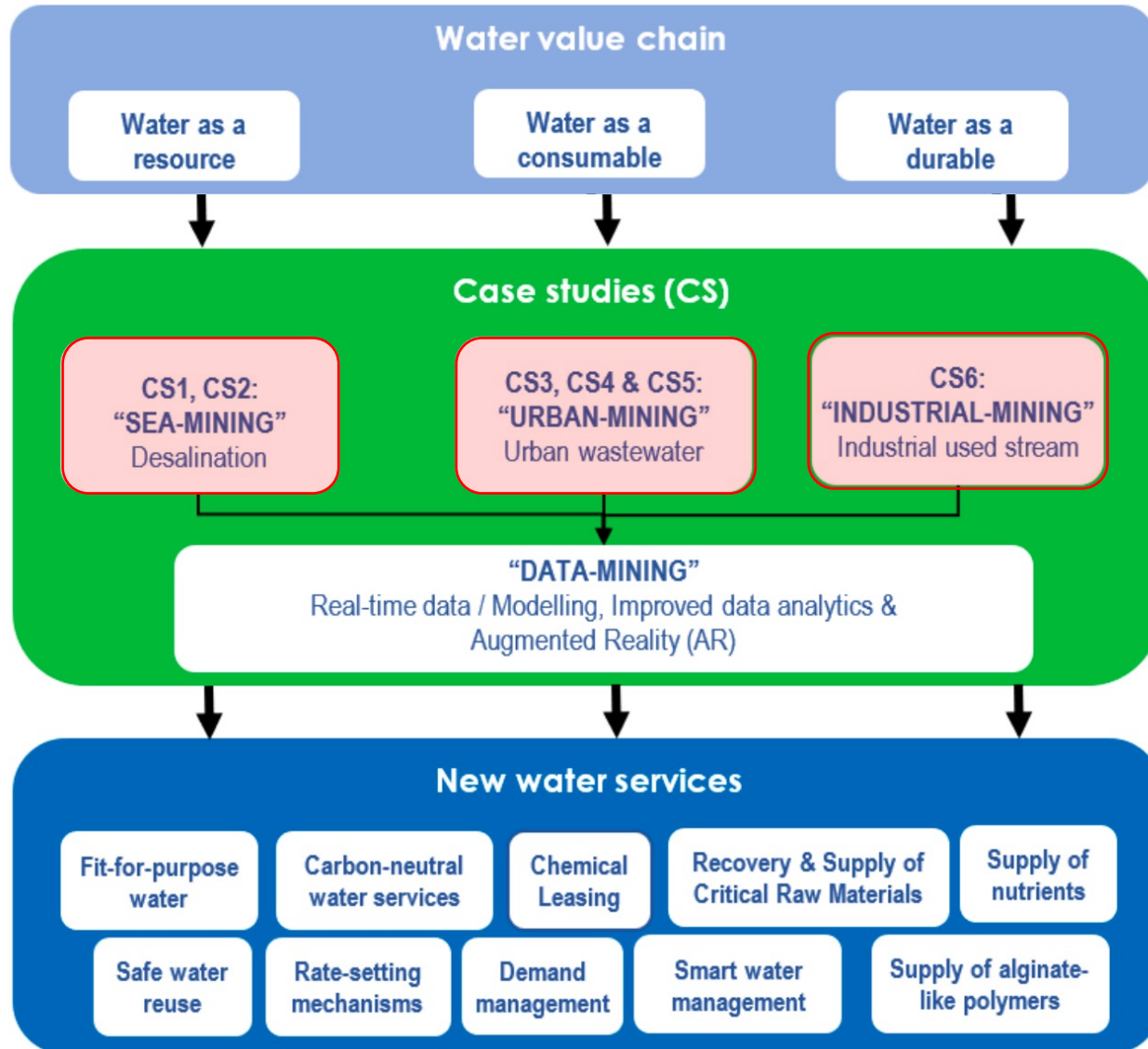
WATER-MINING: Overview

- ❖ **Partners:** 38 (from 12 countries)
- ❖ **Coordination:** TU DELFT (Applied Sciences faculty)
- ❖ **Project Budget:** 19,174,543.75 €
- ❖ **EC Funding:** 16,876,959.63 (~88% of total budget)
- ❖ **Duration:** 48 months (start date: 01/09/2020)

WATER-MINING: Partners



WATER-MINING: Concept





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