

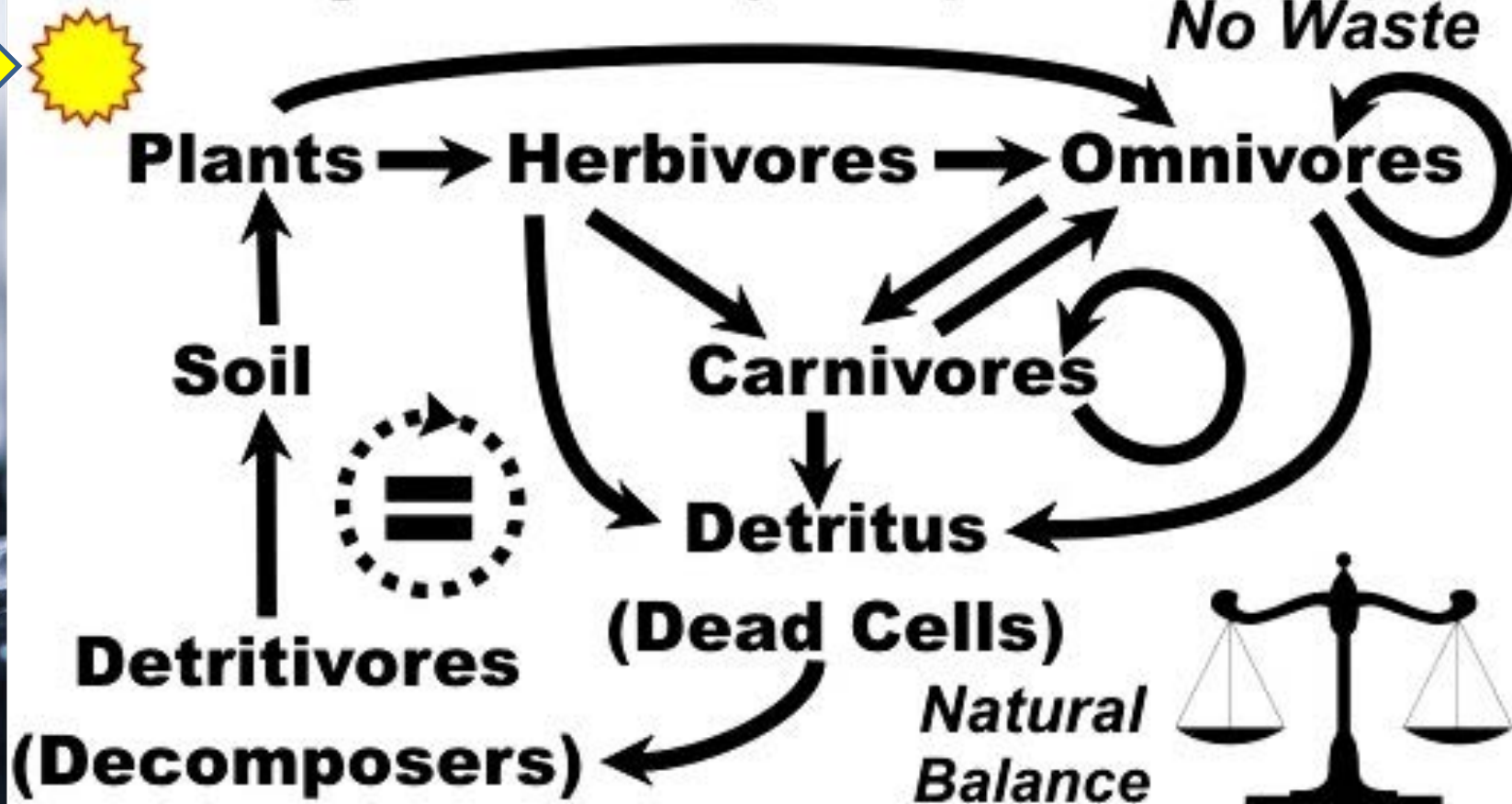


# **CIRCULAR ECONOMY A BUSINESS CASE FOR THE SALT INDUSTRY**

*PARK CITY 2018*



# Food Cycle - *Every Output Is An Input* *No Waste*





# The Industrial Revolution











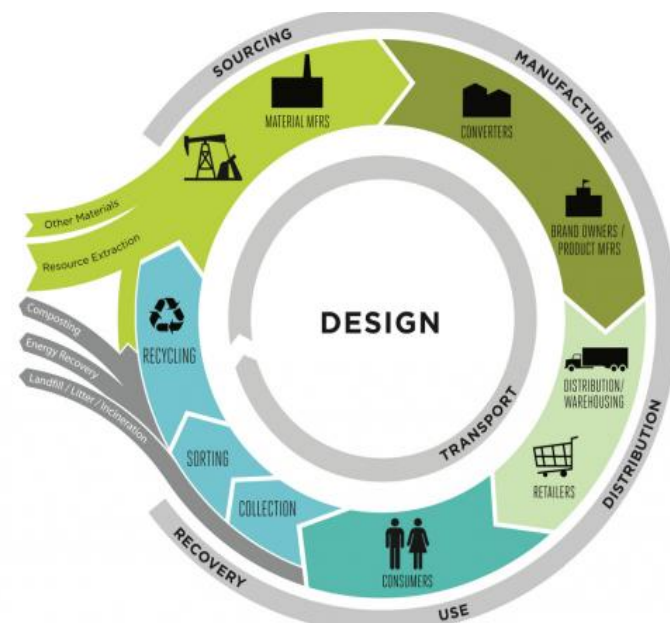
From a linear...

LINEAR MODEL



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...to a circular economy







European  
Commission

# Circular Economy

Closing the loop –  
An EU Action Plan for the  
Circular Economy

# Key action areas

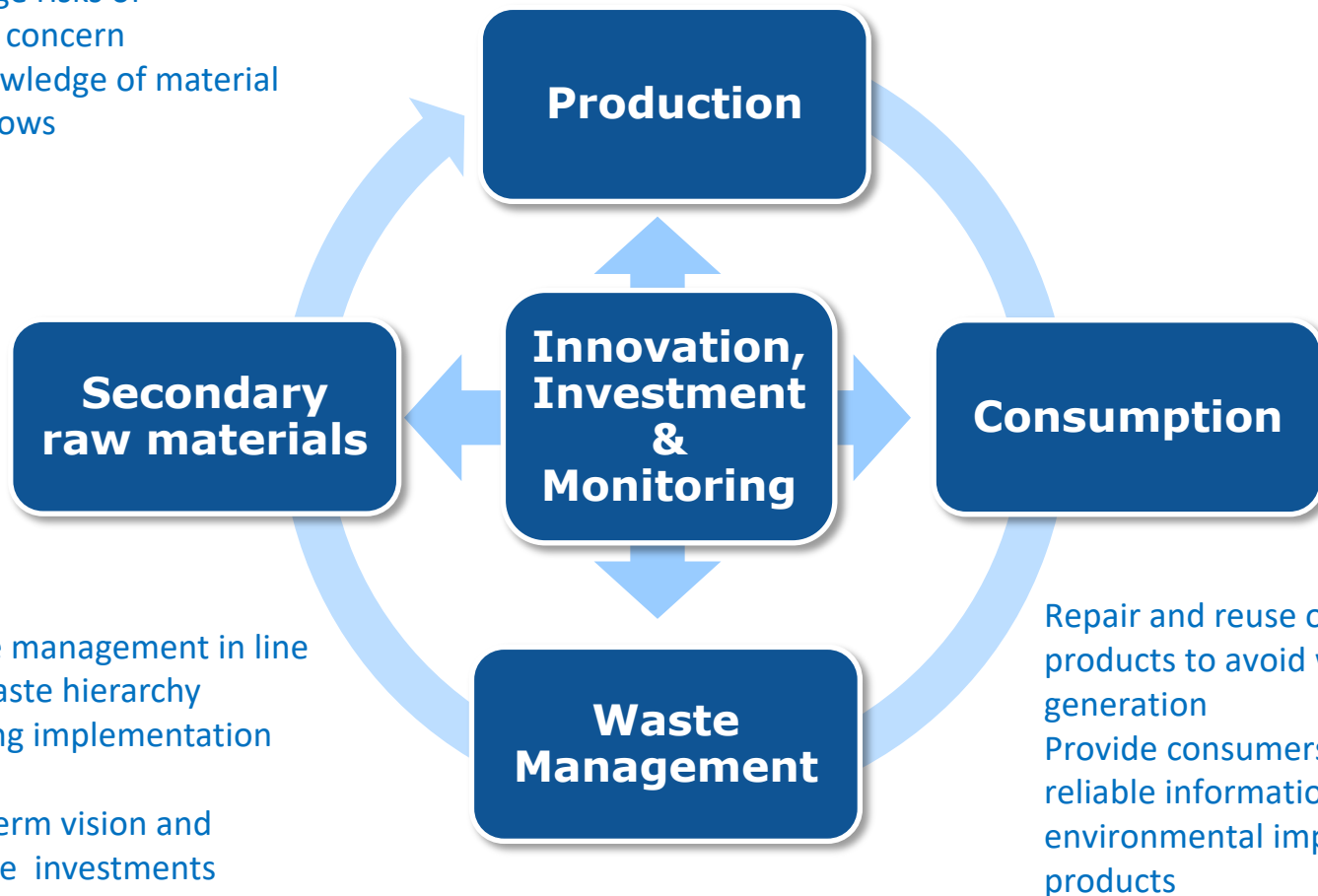
Increase the use of secondary raw materials

Increase the use of recycled nutrients and the reuse of treated wastewater

Safely manage risks of chemicals of concern

Improve knowledge of material stocks and flows

Provide incentives to boost circular product design  
Innovative and efficient production processes





# The Leading Plan for Circular Economy (2016-2020)

- Following and requested by 13<sup>th</sup> Five - Year Plans for National Economic and Social Development of China
- Drafted by NDRC
- Now this Plan just finished its consultation stage and expected **to be implemented at the end of 2016** to lead the circular development in the following half-decade



## Chapter 43: Promoting Resource conservation and intensive use

### Section V: Vigorously Develop the Circular Economy - To implement *The Leading Plan for Circular Economy*

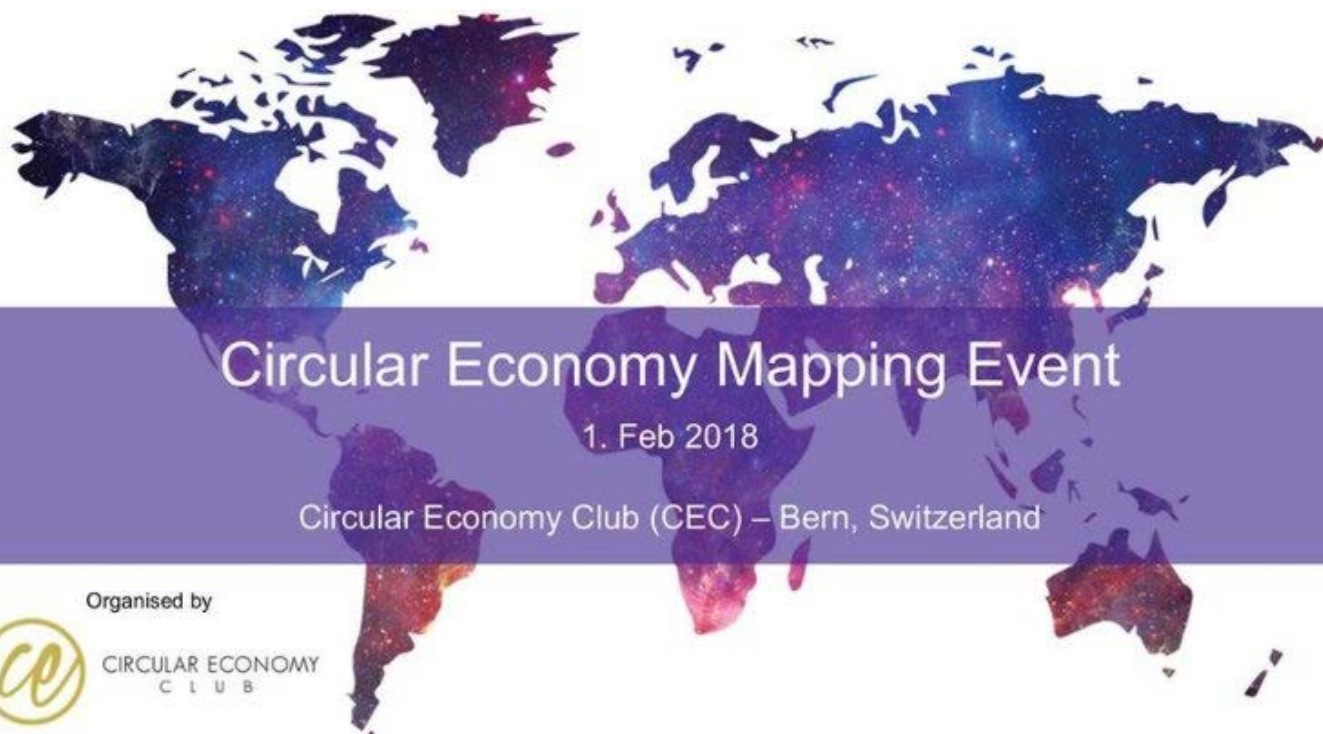
13<sup>th</sup> Five -Year Plans for National Economic and Social  
Development of China



## The Leading Plan for Circular Economy (2016-2020)

### 循环发展引领计划

- 一、总体要求
  - (一) 指导思想
  - (二) 基本原则
  - (三) 主要目标
- 二、调整优化产业结构
  - (一) 推动企业兼并重组
  - (二) 促进资源循环利用
  - (三) 推动产业转型升级
  - (四) 推动企业绿色发展
  - (五) 推动企业清洁生产
- 三、加强城市环境综合整治
  - (一) 加强城市环境综合整治
  - (二) 加强城市环境综合整治
  - (三) 加强城市环境综合整治
  - (四) 加强城市环境综合整治
  - (五) 加强城市环境综合整治
- 四、推动资源循环利用
  - (一) 推动资源循环利用
  - (二) 推动资源循环利用
  - (三) 推动资源循环利用
  - (四) 推动资源循环利用
  - (五) 推动资源循环利用
- 五、强化制度保障
  - (一) 强化制度保障
  - (二) 强化制度保障
  - (三) 强化制度保障
  - (四) 强化制度保障
  - (五) 强化制度保障
- 六、推动循环发展
  - (一) 推动循环发展
  - (二) 推动循环发展
  - (三) 推动循环发展
  - (四) 推动循环发展
  - (五) 推动循环发展
- 七、加强政策保障
  - (一) 加强政策保障
  - (二) 加强政策保障
  - (三) 加强政策保障
  - (四) 加强政策保障
  - (五) 加强政策保障
- 八、加强组织实施
  - (一) 加强组织实施
  - (二) 加强组织实施
  - (三) 加强组织实施
  - (四) 加强组织实施
  - (五) 加强组织实施



# Circular Economy Mapping Event

1. Feb 2018

Circular Economy Club (CEC) – Bern, Switzerland

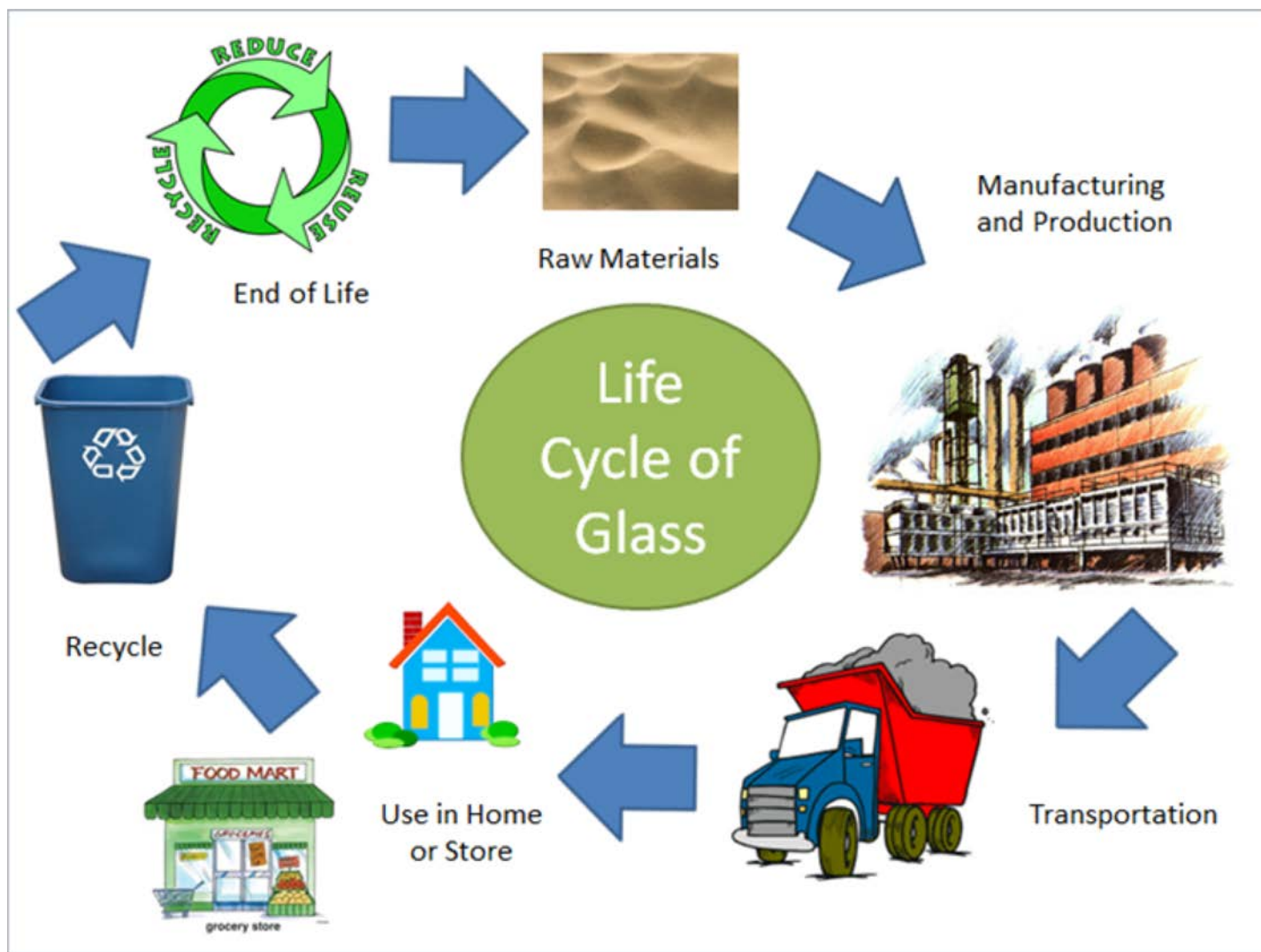
Organised by

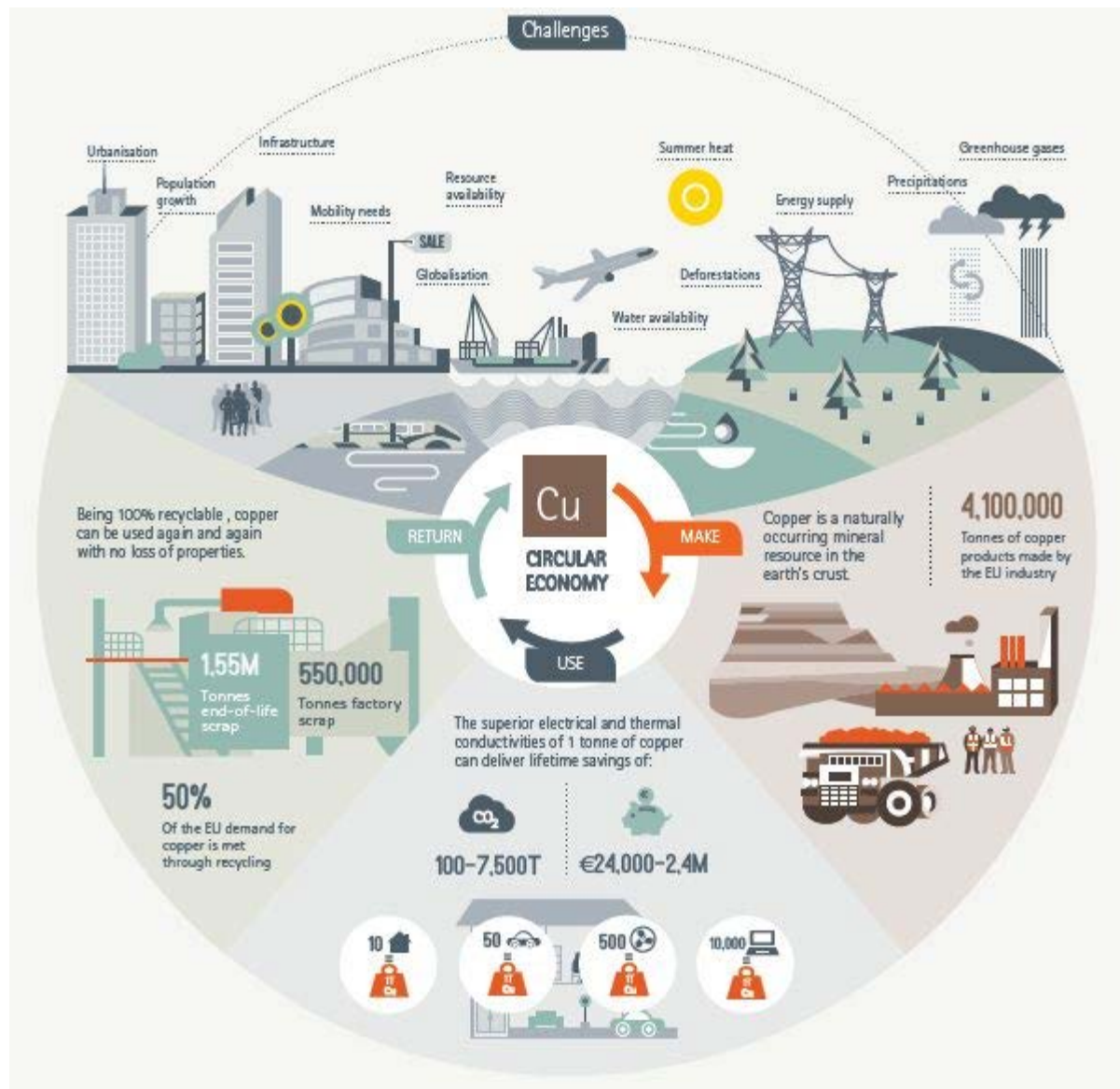


CIRCULAR ECONOMY  
CLUB





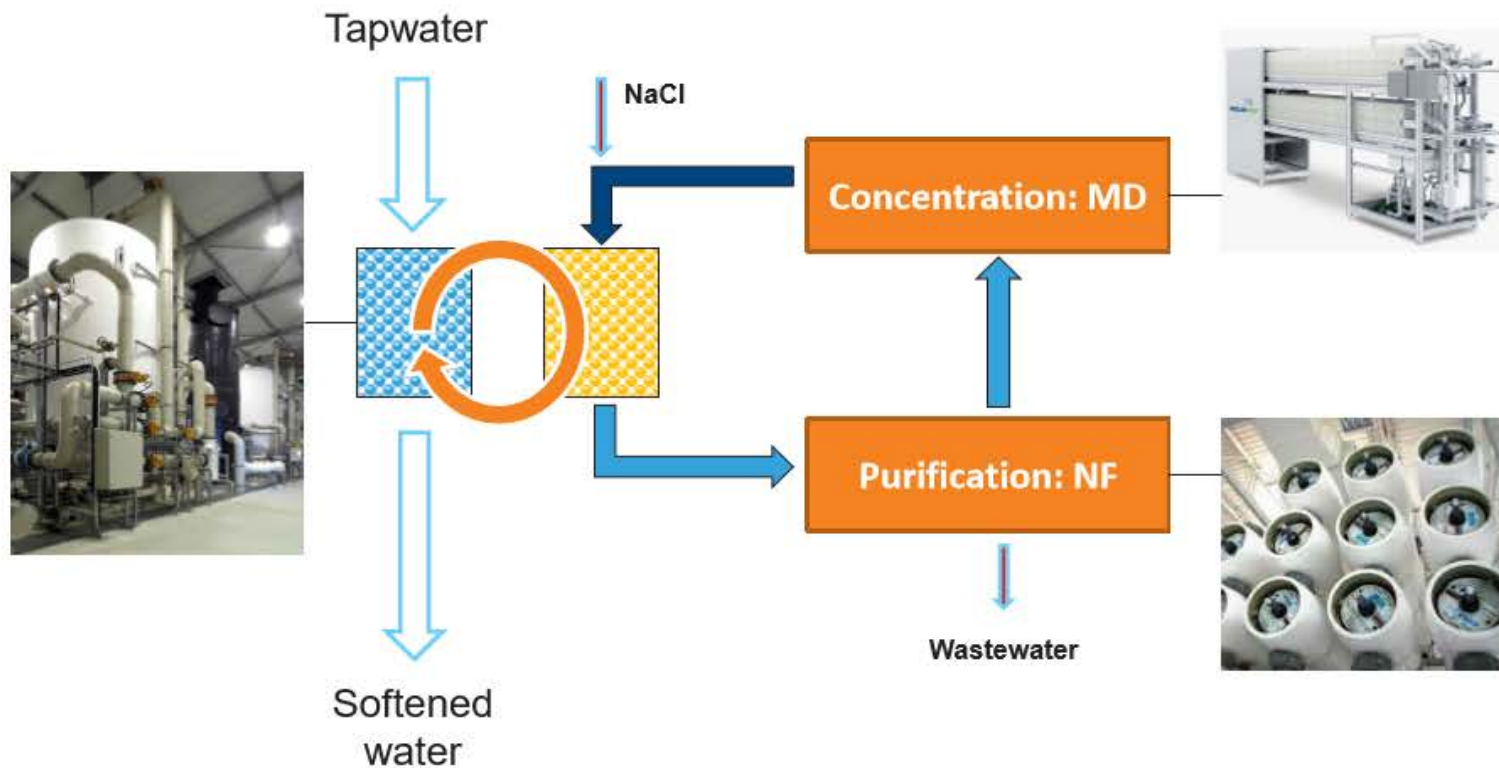








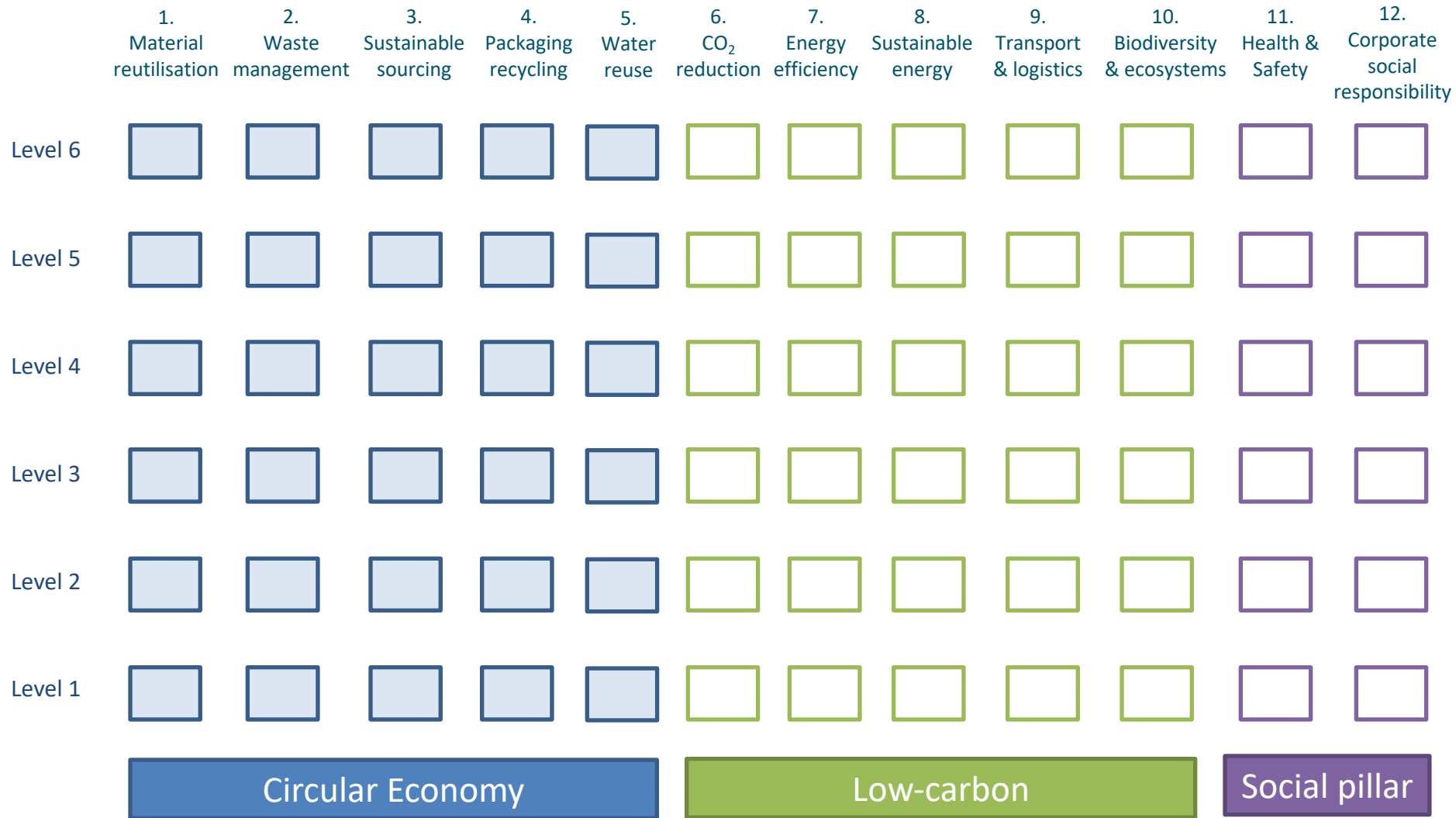
## NF –MD for local reuse of IEX regenerate





The Salty CE model provides guidance and tools to the salt industry for how to move towards excellence in the context of the EC CE action plan

## The Salt Sustainability House



## PEKELMEM - Cheese



**Wisconsin Dairy: de-icing roads with cheese brine**



## THE SECRET TO SNOW REMOVAL IS PICKLE JUICE AND CHEESE BRINE



After a destructive weekend, all the snow from Winter Storm Jonas is now plowed to the periphery of streets across the Eastern seaboard. The accumulation sparled





#### Pilot Projects

Water Plant I Netherlands

Coal Mine I Poland

Silice Industry I Spain

Textile Industry I Turkey



## Water Plant I Netherlands

The Demineralized Water Plant (DWP) in the Botlek area owned by EVIDES is a large-scale demonstration of the ZERO BRINE project using the technology Ion exchange and membrane technology. The DWP consists of a combination of ion exchange and membrane technology: Dissolved Air Flotation (DAF), Reverse Osmosis, Mixed Bed Ion Exchange. For both brine streams that are generated in this process, a circular economy solution will be developed in this WP.

The aim is to demonstrate the Nanofiltration – Evaporation concept for the treatment of ion exchange (IX) regenerate and RO concentrate at large industry scale as well as to demonstrate the Anionic Ion Exchange (IX) – Nanofiltration (NF) – Evaporation – Eutectic Freeze Crystallization (EFC) concept at demonstration scale. Part of the energy for the brine treatment comes from waste heat. Waste heat and wastewater streams will be combined in a multi-company site environment eliminating brine effluent (target: zero liquid discharge) of the industrial water supplier, recovering high purity magnesium products (target: magnesium purity >90%), NaCl solution and sulphate salts and recycling streams within the site (target: >70% internal recycling of materials recovered).

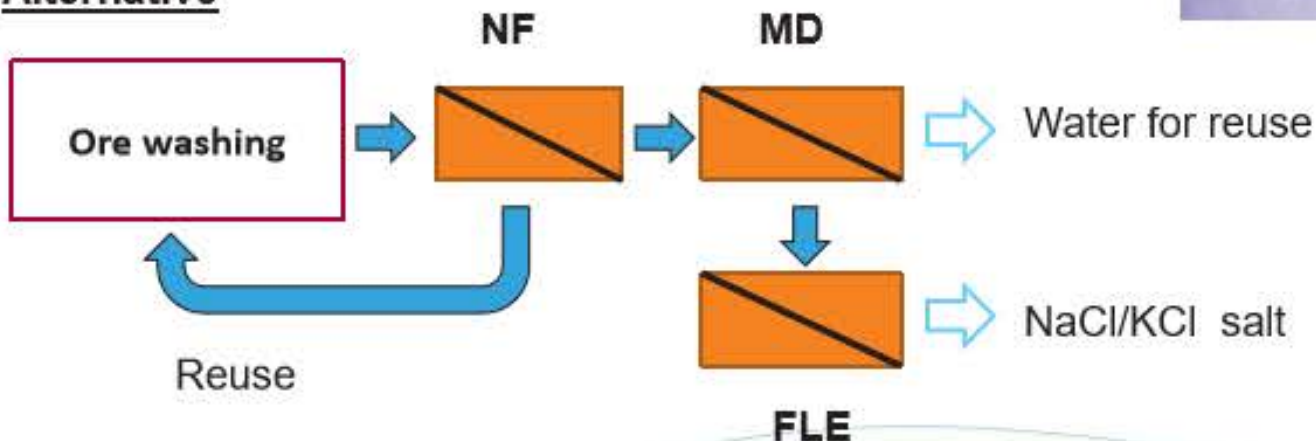


## Case 2: Ore refinery wastewater

### Current



### Alternative







Located in Súria, the facility is being used for tableting and packing high purity salt, which is a co-product of ICL's potassium mine. AkzoNobel will market and sell the full volume of salt specialties produced, allowing it to serve new markets in the Mediterranean region.

### Opening a salt factory in Súria, Catalonia

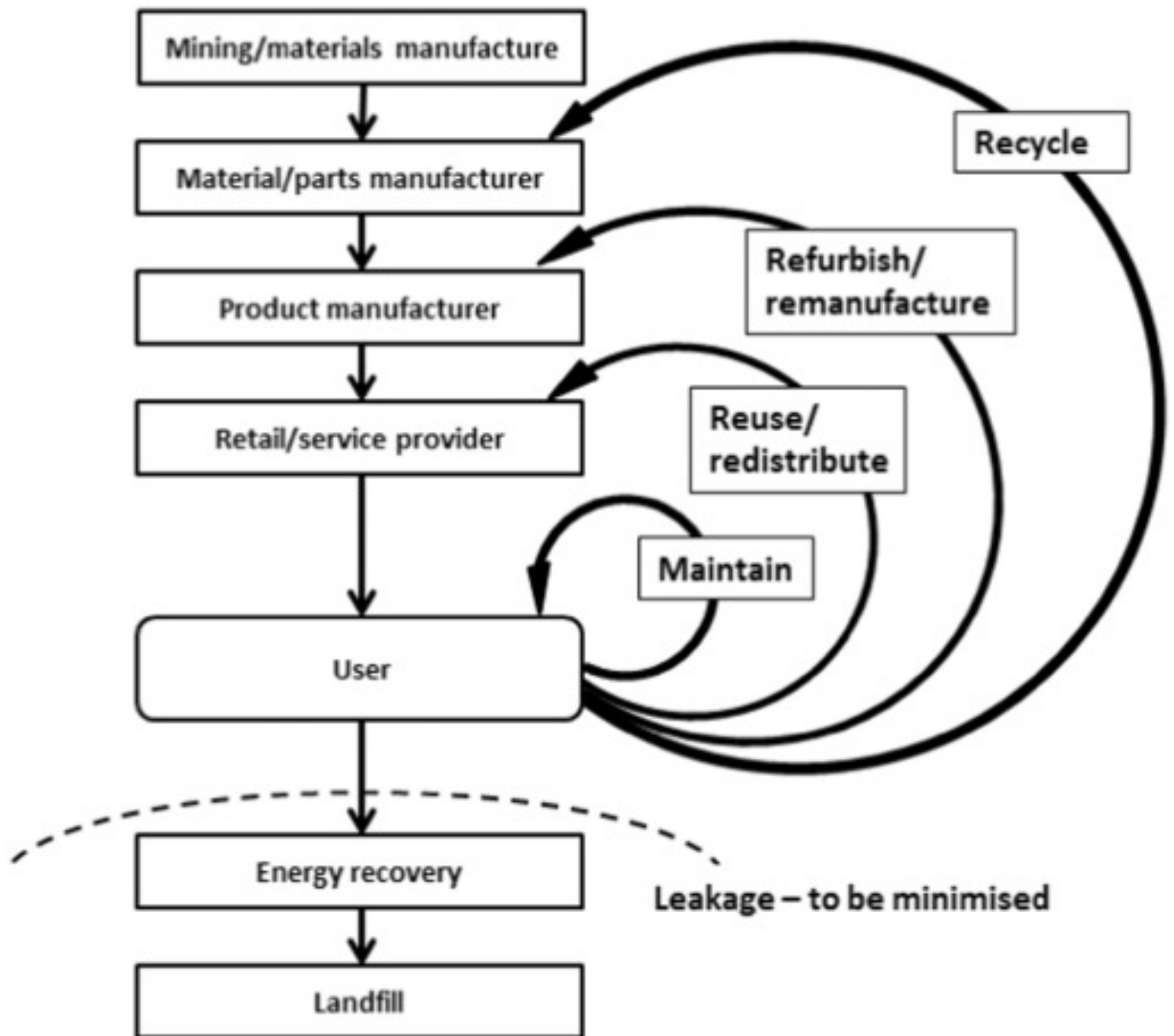


In Súria, Catalonia, the process of mining potassium chloride produces salt as a by-product. But this salt could only be discarded – until now. Now, we are working with ICL Iberia to turn it into the purest salt in the world (99.97%), for both industry and consumers.





















A perfect example of AkzoNobel's **Planet Possible strategy** to do "more with less"

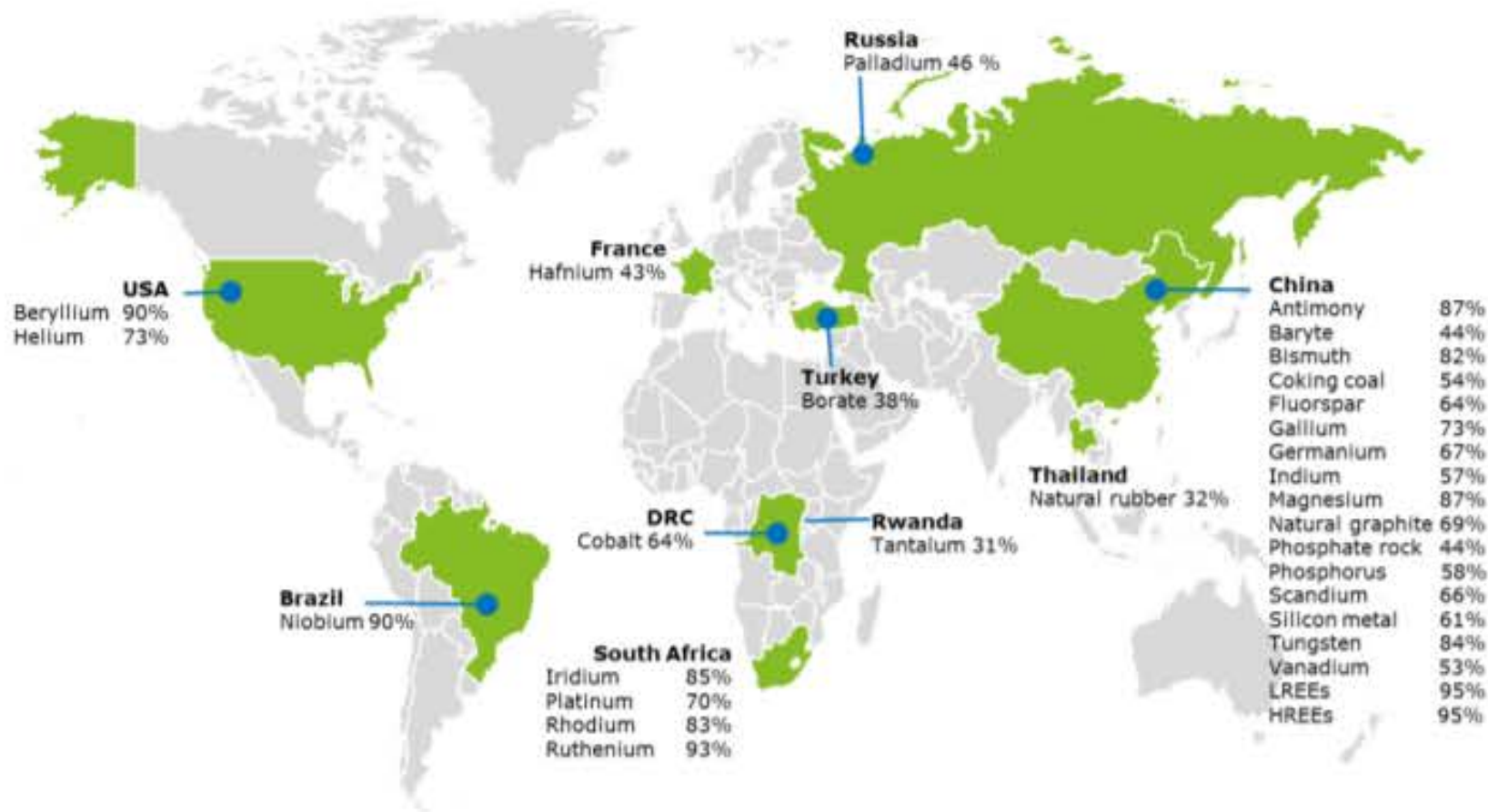


SALT IS LIFE





|   |  |   |   |
|---|--|---|---|
|     |     |     |     |
| Antimony<br><a href="#">Read More</a>   | Barytes<br><a href="#">Read More</a>   | Beryllium<br><a href="#">Read More</a>  | Borates<br><a href="#">Read More</a>  |
|    |    |    |    |
| Cobalt<br><a href="#">Read More</a>   | Coking Coal<br><a href="#">Read More</a>   | Fluorspar<br><a href="#">Read More</a>  | Gallium<br><a href="#">Read More</a>  |
|    |    |    |    |
| Germanium<br><a href="#">Read More</a>  | Heavy Rare Earths<br><a href="#">Read More</a>                                       | Indium<br><a href="#">Read More</a>   | Light Rare Earths<br><a href="#">Read More</a>  |
|   |   |   |   |
| Magnesite<br><a href="#">Read More</a>  | Magnesium<br><a href="#">Read More</a>   | Natural Graphite<br><a href="#">Read More</a>   | Niobium<br><a href="#">Read More</a>  |
|  |  |  |  |
| PGMS<br><a href="#">Read More</a>   | Phosphate Rock<br><a href="#">Read More</a>  | Silicon Metal<br><a href="#">Read More</a>  | Tungsten<br><a href="#">Read More</a>   |



**Figure 1: Contribution of primary global suppliers of critical raw materials, average from 2010-2014**

Articles

# Integrated production of fresh water, sea salt and magnesium from sea water

Andrea Cipollina, Angelo Misseri, Giacomo D'Alì Staiti, Alessandro Galia, **Giorgio Micale** ✉ & Onofrio Scialdone

Pages 390-403 | Received 25 Mar 2012, Accepted 29 May 2012, Published online: 21 Jun 2012

Download citation <https://doi.org/10.1080/19443994.2012.699340>

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## Abstract

Seawater desalination is becoming an important source of fresh water in several countries all around the world. One of the main drawbacks of desalination processes, however, is related to the disposal of large quantities of concentrated brine, which is an always-present by-product of the process. An integrated production of fresh water and salts may be achieved using the discharge brine from a desalination plant as a feed for conventional salt ponds, with the advantages of using brine more concentrated than sea water and, in the case of thermal desalination plants, warmer than sea water. By doing so, the process is faster as a consequence of the enhancement of evaporation rate on the surface of ponds. The above concept has been proposed already several

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## Over 40 minerals and metals contained in seawater, their extraction likely to increase in the future



107 APRIL 2016

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BY [DR. THEO LAMMERS](#)

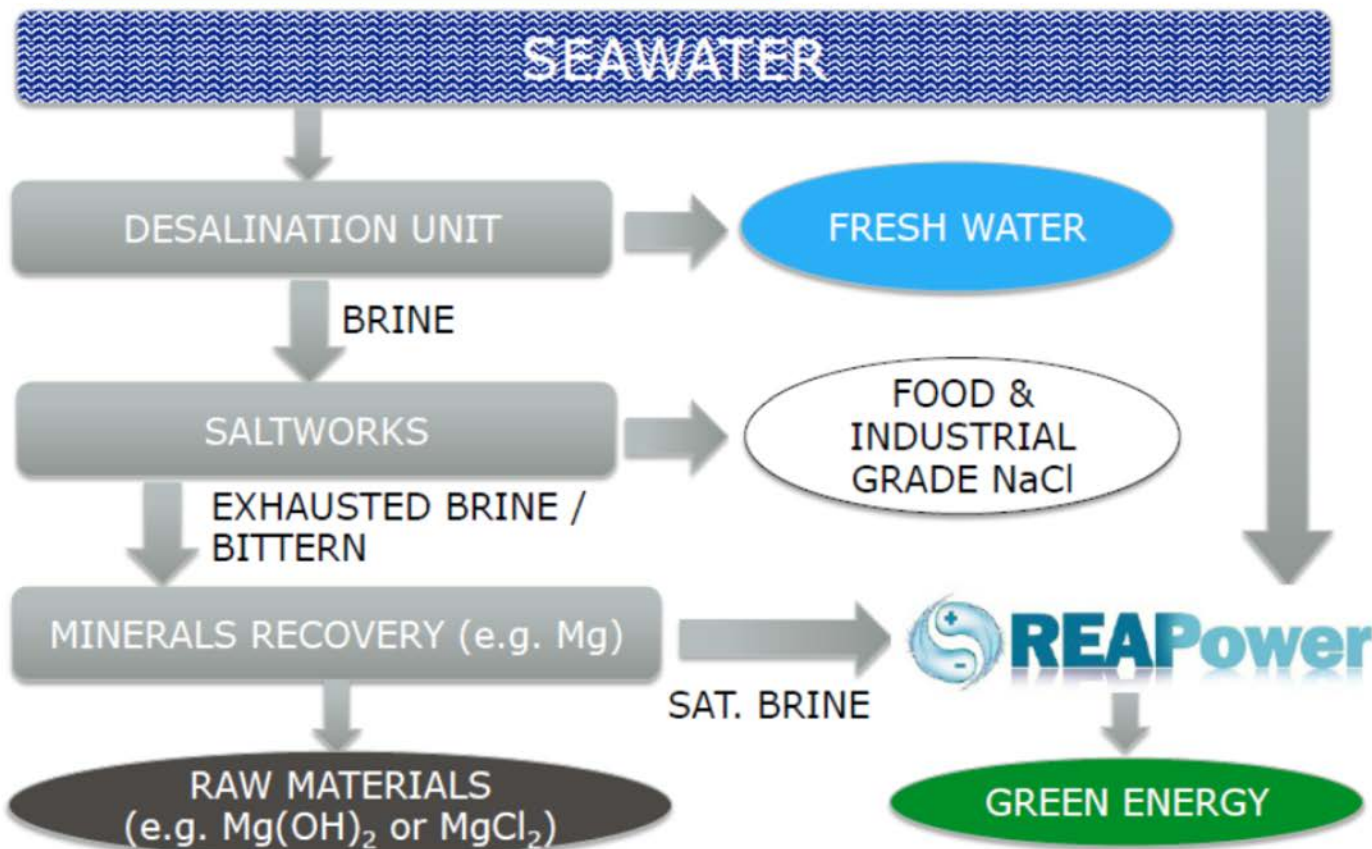
LEADER OF POLICY SERVICES DEPUTY EDITOR

FONT SIZE: [+](#) [-](#)

**I**t is generally known that many minerals and metals exist, dissolved in seawater and in the waters of briny lagoons and salt lakes.

According to Stanford University, in the US, seawater contains 47 minerals and metals. Starting with the most abundant and proceeding to the least abundant, these are chloride, with a concentration of 18 980 parts per million (ppm) in seawater, sodium (10 760 ppm), magnesium (4 120 ppm), sulphur (884 ppm), calcium (400 ppm), potassium (380 ppm), bromine (65 ppm), inorganic carbon (38 ppm) and strontium (13 ppm). Then follow boron (4 6 ppm), silica (4 ppm), organic carbon (3 ppm), aluminium (1 9 ppm), fluorine (1 4 ppm), nitrogen in the form of nitrate (0 7 ppm), organic nitrogen (0 2 ppm), rubidium (0 2 ppm), lithium (0 1 ppm), phosphorus in the form of phosphate (0 1 ppm), copper (0 05 ppm), barium (0 05 ppm), iodine (also 0 05 ppm), nitrogen in the form of nitrite (also 0 05 ppm) and nitrogen in the form of ammonia (once more 0 05 ppm). Thereafter, we have arsenic (0 004 ppm), iron (0 00 ppm), organic phosphorus (0 006 ppm), zinc (0 004 ppm), manganese (0 004 ppm), lead (0 003 ppm), selenium (0 004 ppm), tin (0 003 ppm), cesium (0 000 ppm), molybdenum (also 0 000 ppm) and uranium (0 0006 ppm). Then come gallium (0 0005 ppm), nickel (also 0 0005 ppm), thorium (also 0 0005 ppm), cerium (0 0004 ppm), vanadium (0 0003 ppm), lanthanum (also 0 0003 ppm), yttrium (also 0 0003 ppm), mercury (once more 0 0003 ppm), silver (also 0 0003 ppm), bismuth (0 0002 ppm), cobalt (0 0001 ppm) and, finally, gold (0 000008 ppm). Altogether, there are some 30 quadrillion tons (that is, 30 000 000 000 000 000 t) of minerals and metals dissolved in all the world's seas and

## The idea of an integrated cycle





### *Moins de sodium, toujours autant de saveurs*

La Baleine Essentiel est le parfait équilibre entre un goût non altéré et une faible teneur en sodium.

La Baleine Essentiel est la première solution réduite en sodium d'origine marine avec le même pouvoir salant que du sel classique. C'est une innovation, constituée de sels minéraux marins obtenus par cristallisation naturelle d'eau de mer.

Le sodium est un élément indispensable pour notre organisme lorsqu'il n'est pas consommé en excès. La Baleine Essentiel aide à réduire de 50% la consommation de sodium en le remplaçant par le magnésium, le calcium et le potassium, 3 minéraux issus de la mer, essentiels à notre organisme.

En cuisine comme à table, il relèvera tous vos plats en toute sérénité.



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