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# Solvay in China

## 索尔维在中国

**UBS investor trip**  
*Shanghai, May 13, 2018*

# Agenda

- Solvay in China  
*Leo Sun*
- Specialty Polymers in China  
Focus on batteries  
*Chuanqi Tao*
- Peroxides in China  
Focus on water purification  
*Gary Zhao*
- Lab visit



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# Agenda

- Solvay in transformation  
*Geoffroy Raskin*
- **Solvay in China**  
***Leo Sun***
- Specialty Polymers in China  
Focus on batteries  
*Chuanqi Tao*
- Peroxides in China  
Focus on water purification  
*Gary Zhao*
- Lab visit



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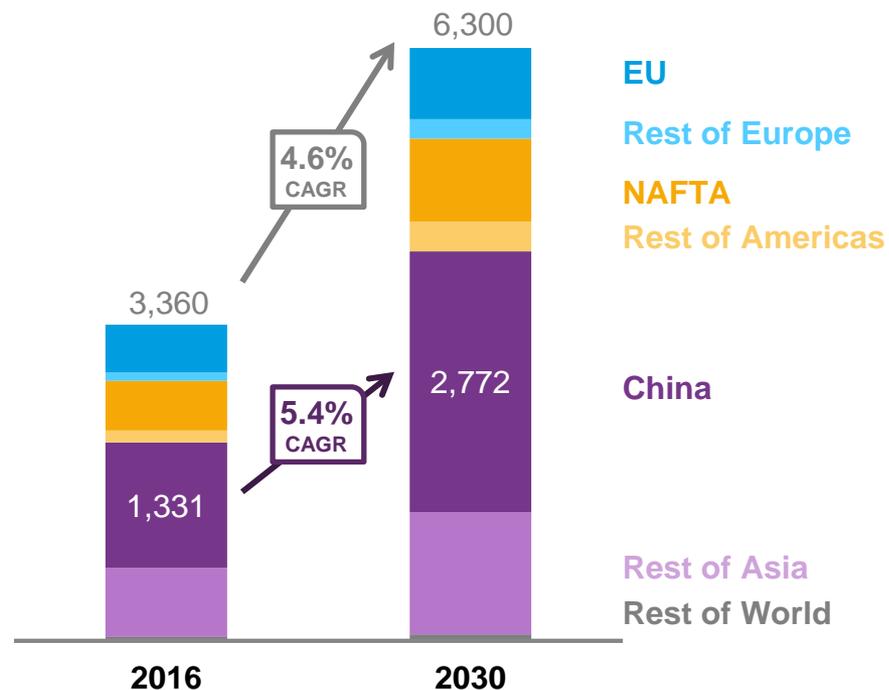
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# Global chemical demand growth driven by megatrends... and China

## Global market drivers drive Asian growth



## Long term global chemical demand (in € bn)



Source: CEFIC

# Solvay: well-balanced geographic footprint

## With strong and fast growing presence in China

### Solvay

€10.1 bn

Net sales

**+8%**

vs GDP +3%

**~24,500**

employees

**124**

Industrial sites

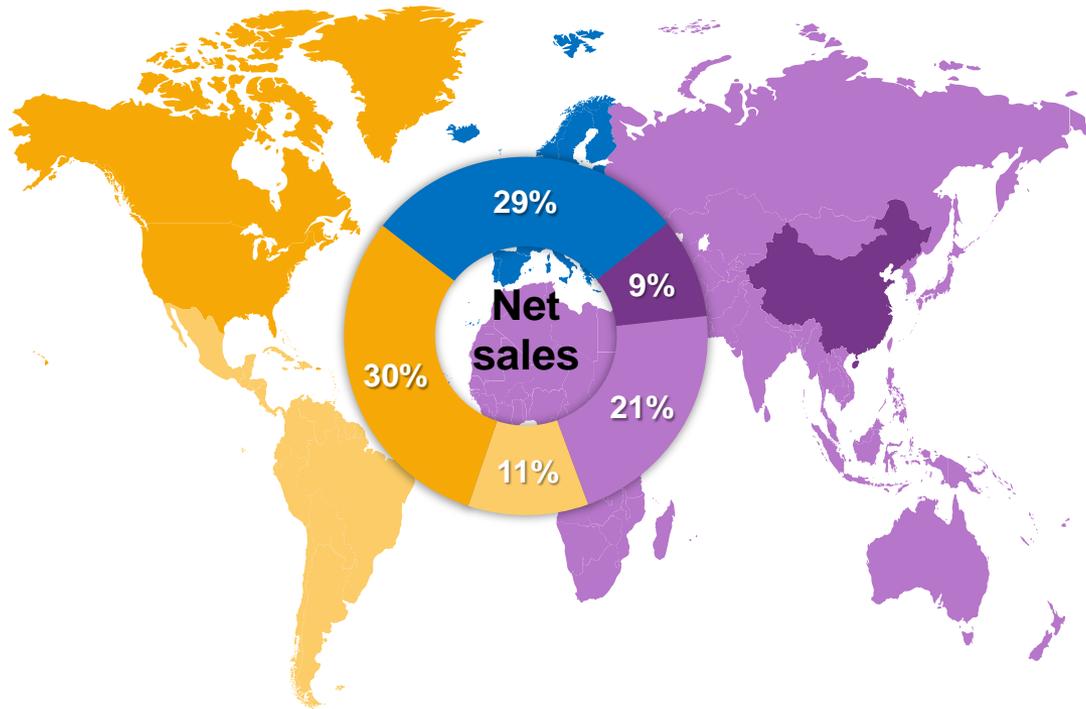
**21**

Major R&I centers

All figures for 2017 continuing operations

% figures represent  
% of net sales by destination

+% figures represent  
YoY net sales growth  
adjusted for scope, & forex



### Solvay China

€0.9 bn

Net sales

**+20%**

vs GDP +7%

**~2,500**

employees

**15**

Industrial sites

**1**

Major R&I center

**Well placed  
to benefit  
from growth  
in China**

# ~40 years of experience in China

- 1980** First Rep. Office set up in Beijing (Rhône-Poulenc)  
中国第一个代表处1980年在北京成立
- 1993** First Industrial Investment in Qingdao – Silica Plant  
在中国的第一家工厂1993年在青岛成立，生产白炭黑
- 1994** First Solvay Representative office in Beijing  
1994索尔维北京代表处成立
- 1996** First Solvay Representative office in Shanghai  
1996年索尔维上海代表处成立
- 1997** Opening of Solvay Technology Park in Xingzhuang.  
1997年索尔维上海科技园成立
- 2011** Rhodia integrated into new Solvay  
索尔维2011收购罗地亚2015收购氟特公司成立新的索尔维
- 2015** Cytec integrated into new Solvay  
索尔维2011收购罗地亚2015收购氟特公司成立新的索尔维

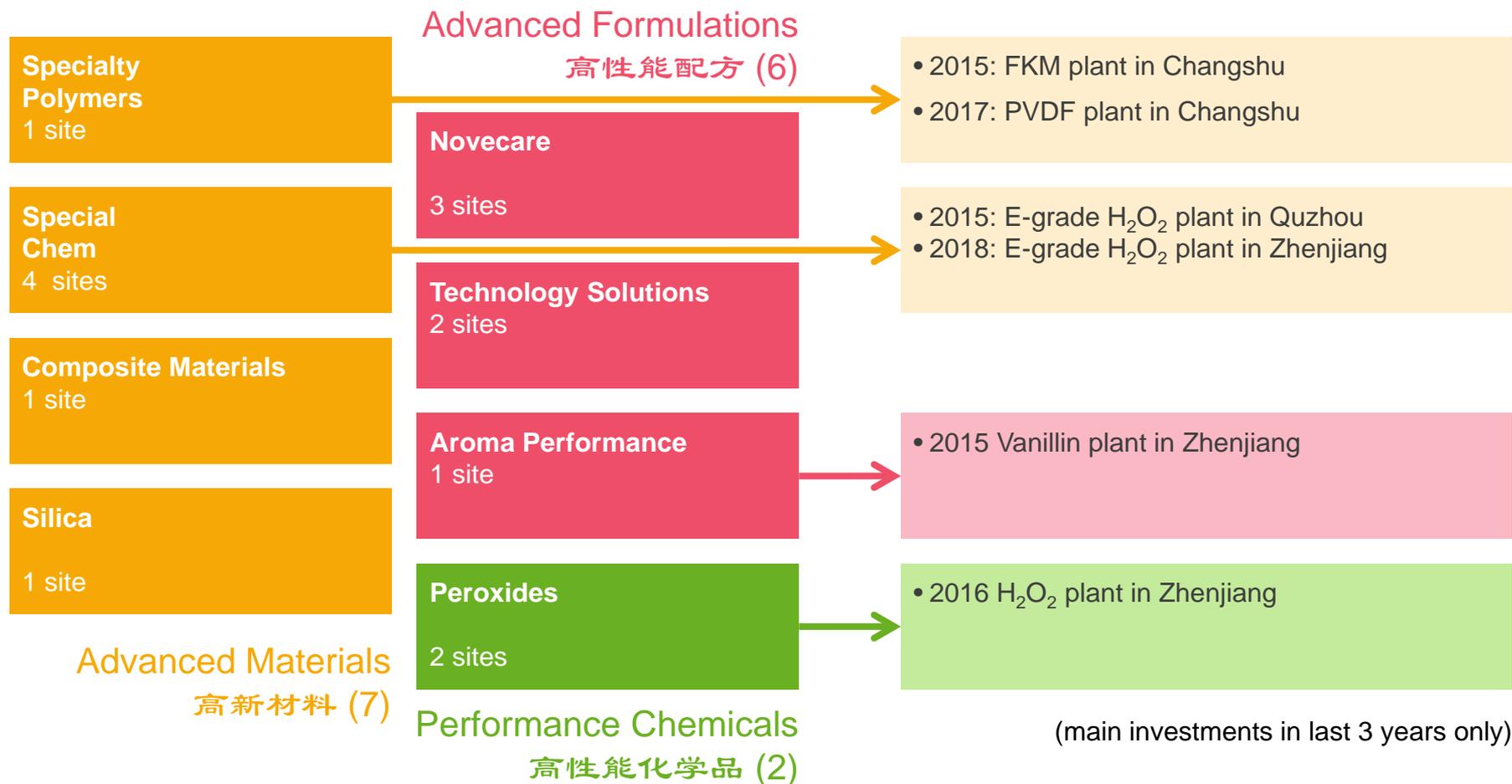
## Solid foundation for further growth

- Leading player in specialty chemicals
- Strong relationship with stakeholders
  - Reliable partner to expanding multinational customers
  - Local authorities
  - Successful partnership with Asian industrials
- Capable industrial footprint
  - 40 years of industrial presence in Asia
  - Regional engineering expertise
  - Adapted to local circumstances
- Substantial innovation power
- Loyal manpower base (low employee turnover)

# Solid industrial presence in China

15 sites in China ...

... with continued investment



# Solvay Technical Park: Greater China and regional HQ

## 索尔维科技园及索尔维亚太区总部

### Regional Headquarters

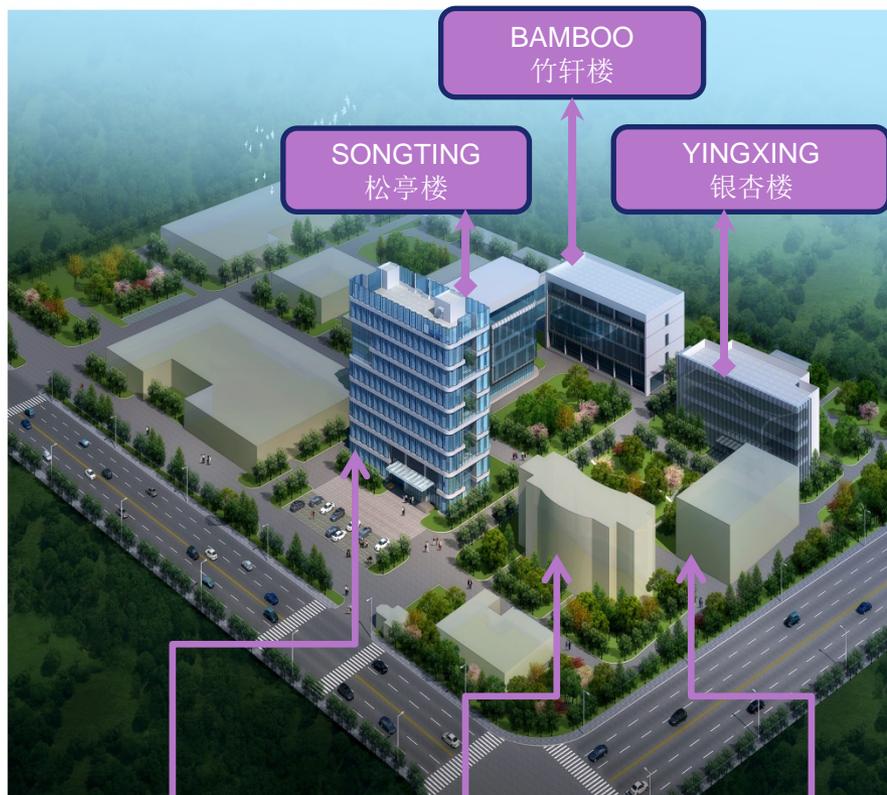
Silica  
Aroma  
Specialty Polymer  
Performance Polymer

### GBUs & China Management

Special Chem  
Peroxides  
Novecare  
Composite Material  
Technology Solution

### R&I Center

150 scientists  
Corporate & GBU R&I  
E2P2L Lab



### Regional & Corporate Functions

Legal, HR, SBS  
Industrial and GEC  
COM. GPA, Treasury  
Internal Audit...

### Historical Events

- 1997 - Opening of STP in SXIP
- 2003 - Greater China headquarters  
- Revamped Lab to R&I Center
- 2006 - Corporate R&I Center
- 2013 - Songting and Gongjiang  
- Zhangjiang integrated
- 2016 - Junyao integrated

GONGJIAN  
弓箭楼

ADMINISTRATION  
行政楼

COMMERCIAL  
商务楼

Headcount: 730  
员工总人数: 730

# Shanghai: Solvay's 3<sup>rd</sup> largest R&I center

## Model of Open Innovation



145

Employees in RICS



57

New patent in past 3 years



13

Collaboration project with local university or institute

- Recognized as “Foreign R&D Center”, “Shanghai Company Technical Center”
- Set up of R&I partnerships with Chinese Universities and Institutes (> 30 collaborations)
- Set up united laboratory in Shanghai with ECNU, French CNRS, ENS, Fudan Uni. and Lille Uni.
- Focused on Eco-Efficient Product and Process.
- GBU R&I labs focus mainly on application development and product support
- Corporate R&I labs focus on new product & process development, environment & safety and analytical services



# Key takeaways



## China is an important growth engine

- Chemicals industry to grow at faster pace than world average
- Focus on more sustainable growth, respecting environment



## Solvay to continue to benefit

- Established footprint and long experience
- Focused investments in specialty and advanced materials



## Local R&I support

- Supporting regional developments
- Collaborating with local partners

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# Specialty Polymers at a glance

Diversified end markets with superior growth potential



Aerospace



Automotive



Batteries



Consumer & Construction



Electrical & Electronics



Healthcare



Industrial & Environment

~25%

Net sales



**Americas**

9 production sites

2 R&I centers



€2.0 bn

Net sales

~35%

Net sales



**Europe**

6 production sites

3 R&I centers



~3,600

employees

~40%

Net sales



**Asia & RoW**

2 production sites

4 R&I centers



17 production sites

9 R&I centers

2017 data

# Specialty Polymers presence in China

## 特种聚合物事业部在中国

### Specialty Polymers 特种聚合物事业部



Solvay Specialty Polymers (Changshu)  
Co., Ltd.  
索尔维特种聚合物（常熟）有限公司

#### WFOE:

- Polymist site opened in 2008
- Compounding site opened in 2012
- FKM site opened in 2015
- PVDF site opened in 2017

#### Main products:

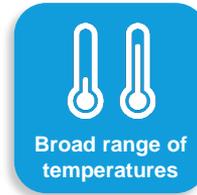
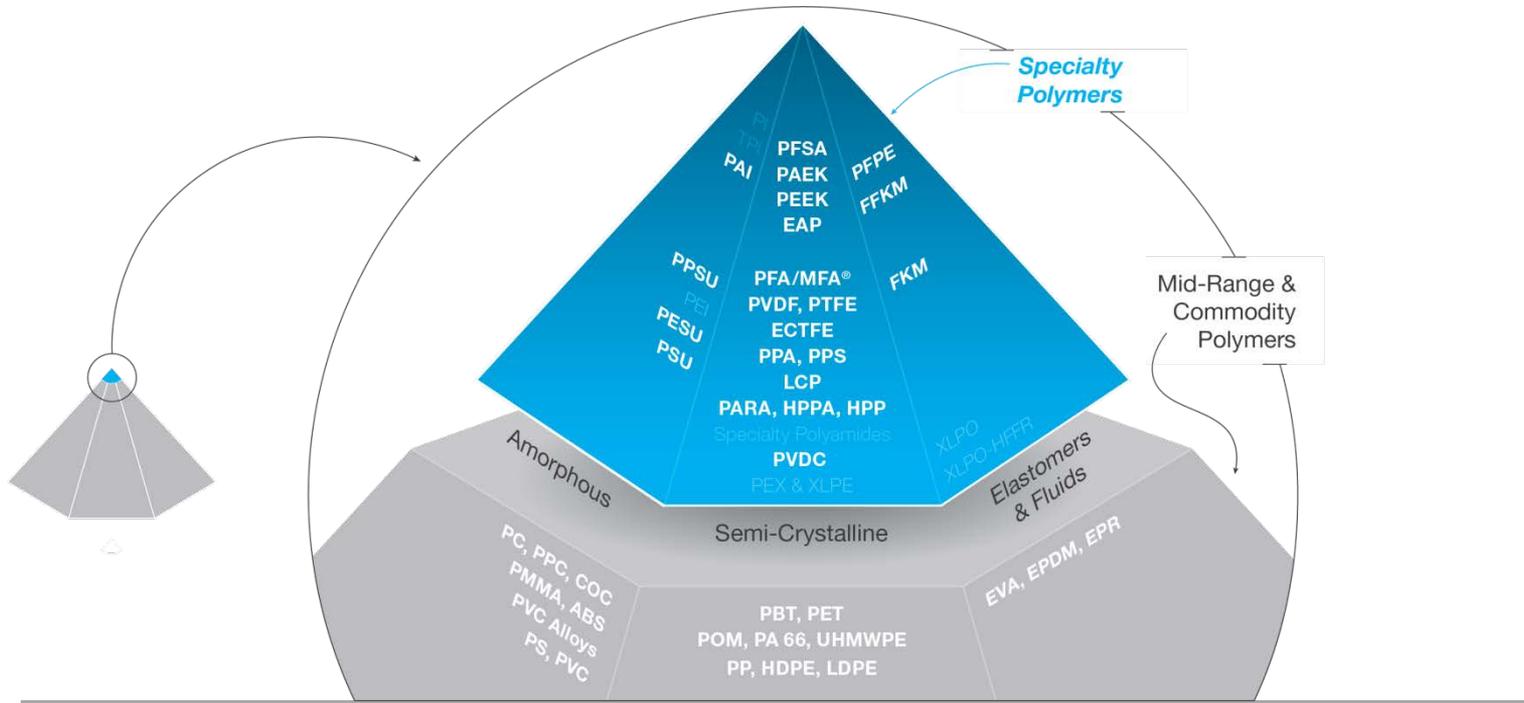
- Algoflon® and Polymist® PTFE
- FKM fluoro-elastomer
- PVDF
- Compounding site (Amodel® PPA, Ixef® PARA, Kalix® PARA blends and Avaspire® PAEK®)

Headcount: 255

聚偏氟乙烯、聚芳醚酮  
聚四氟乙烯、氟橡胶等

WFOE = Wholly Foreign-Owned Enterprise

# Specialty Polymers comprehensive portfolio through continuous research and innovation



Key performance factors

# A unique solutions portfolio

## Unmatched in the industry

	Aromatics					Fluoropolymers					Barrier polymers	
	LCP	HPPA	PPS	PAEK*	PAI	PSU	PTFE	PVDF	PFA	FKM	PFPE	PVDC
 SOLVAY asking more from chemistry®	●	●	●	●	●	●	●	●	●	●	●	●
 ARKEMA		●		●				●				
 BASF The Chemical Company		●				●						
 DAIKIN						●	●	●	●			
 DUPONT	●	●				●		●	●	●	●	
 dyneon						●	●	●	●	●	●	
 EMS		●										
 Celanese	●		●									
 DSM		●										
 vicat				●								
 TORAY Innovation by Chemistry			●									
 AGC						●		●				
 KUREHA			●				●					●
 EVONIK INDUSTRIES		●		●								

\* Includes PEEK and PEKK

# A Unique Solutions Portfolio

## Through Continuous Research and Innovation

	Aromatics					Fluoropolymers					Barrier Polymers	
	LCP	HPPA*	PEEK*	PAI	PSU	PPS	PTFE*	PVDF*	PFA	FKM*	PFPE	PVDC
Aerospace	●	●	●	●	●	●	●	●	●	●	●	
Automotive		●	●	●	●	●	●	●	●	●	●	●
Batteries			●		●	●		●		●	●	
Consumer and Construction	●	●	●	●	●	●	●	●	●	●	●	●
Electrical / Electronics	●	●	●	●	●	●		●		●	●	
Healthcare		●	●		●						●	●
Industrial and Environment		●	●	●	●	●	●	●	●	●	●	●

\* Currently produced also in Asia

# Solvay material solutions: Various energy storage systems



Consumer Electronics



Electric Vehicle



Energy Storage



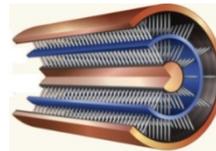
## LiB Technology

- Electrode Binder
- Separator Coating
- Cell Gasket
- Electrolyte Additive



## Battery Module/Pack

- Structural Component
- HV Component
- Cooling Agents



## Super-Capacitor

- Electrode Binder



## Re-dox Flow & Fuel Cell

- PEM Membrane

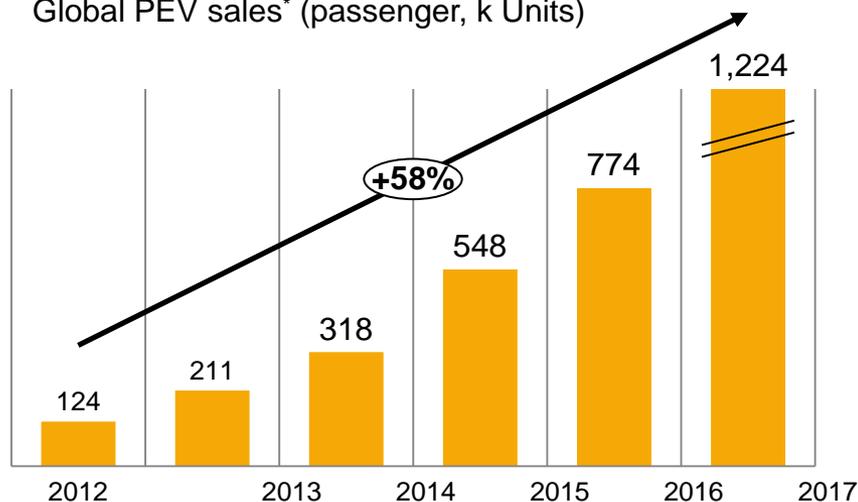


## PV

- Frontsheet
- Backsheet

# Global PEV Sales: High growth & regionally concentrated

Global PEV sales\* (passenger, k Units)



- ❖ From 2012, the global PEV market paced into the fast lane with annual CAGR >50% up to 2017 with the sales of 1.2M units.
- ❖ The PEV penetration rate firstly hit 1% of the global passenger vehicle market in 2016 & above in 2017.
- ❖ China, EU, US and Japan takes up to 95% of the global PEV market.



Total Sales 2017

600,174

306,143

199,822

55,945

% of total

49%

25%

16%

5%

YoY Growth 16-17

↑ 71%

↑ 38%

↑ 26%

↑ 150%

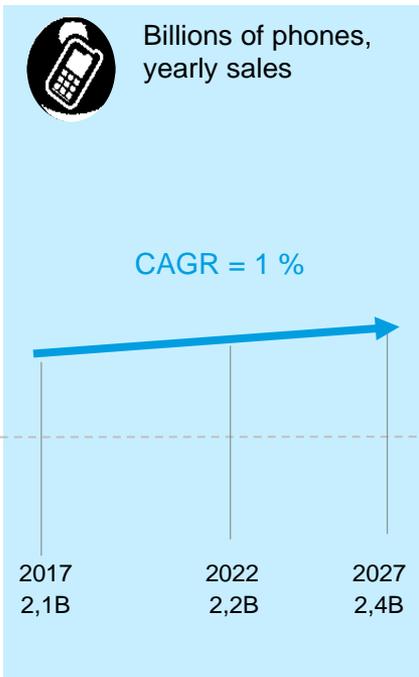
\* PEV = Plug-in hybrid or full Electric Vehicle  
Source: EV sales, world round data

# Car electrification: game changer for the battery industry !

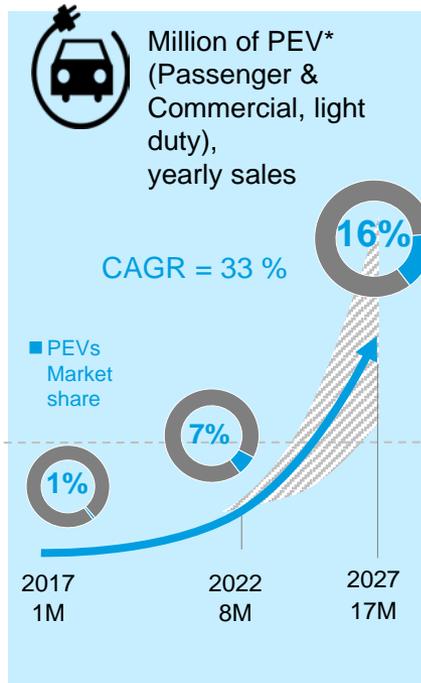
## EVOLUTION OF SOME KEY MARKET INDICATORS

(illustrative, base scenario)

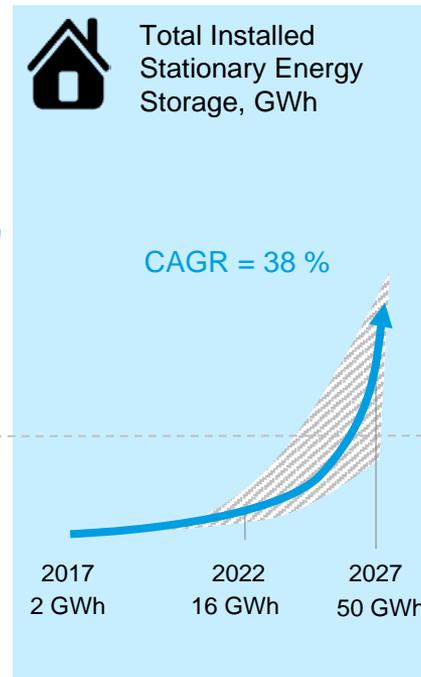
## GLOBAL Li-ion BATTERY MARKET SIZE



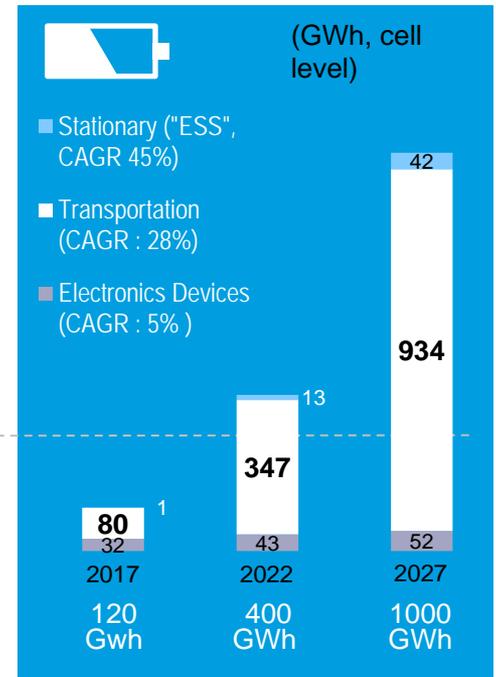
Li-ion (and Advanced Li-ion) is and will remain the dominant technology



Li-ion (and Advanced Li-ion) is and will remain the dominant technology  
Next contender : Fuel Cell



Li-ion (and Advanced Li-ion) will be a key technology taking market share also from lead acid.  
Next contender : redox flow



Transportation is by far the largest opportunity for Growth, driven by demand of Passenger EVs. Stationary energy storage emerges as new market driven by Automotive Li-ion capacity. Consumer electronics is a mature market although new applications are emerging

Source : IdTecEx, IHS,

Source : LMC 2018, Solvay

Source : Lux Research

# Automotive market needs strong improvements in performance & safety and reduction of cost

## CRITICAL CRITERIA AND LEVERS TO DEVELOP xEV MARKET

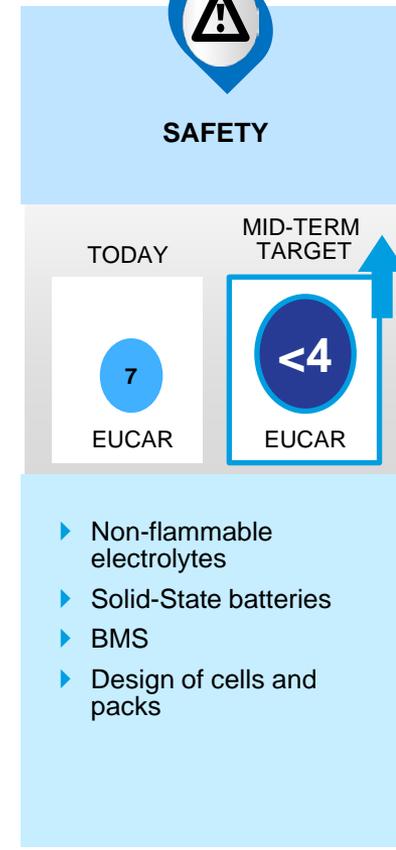
UNMET NEEDS



**COST**



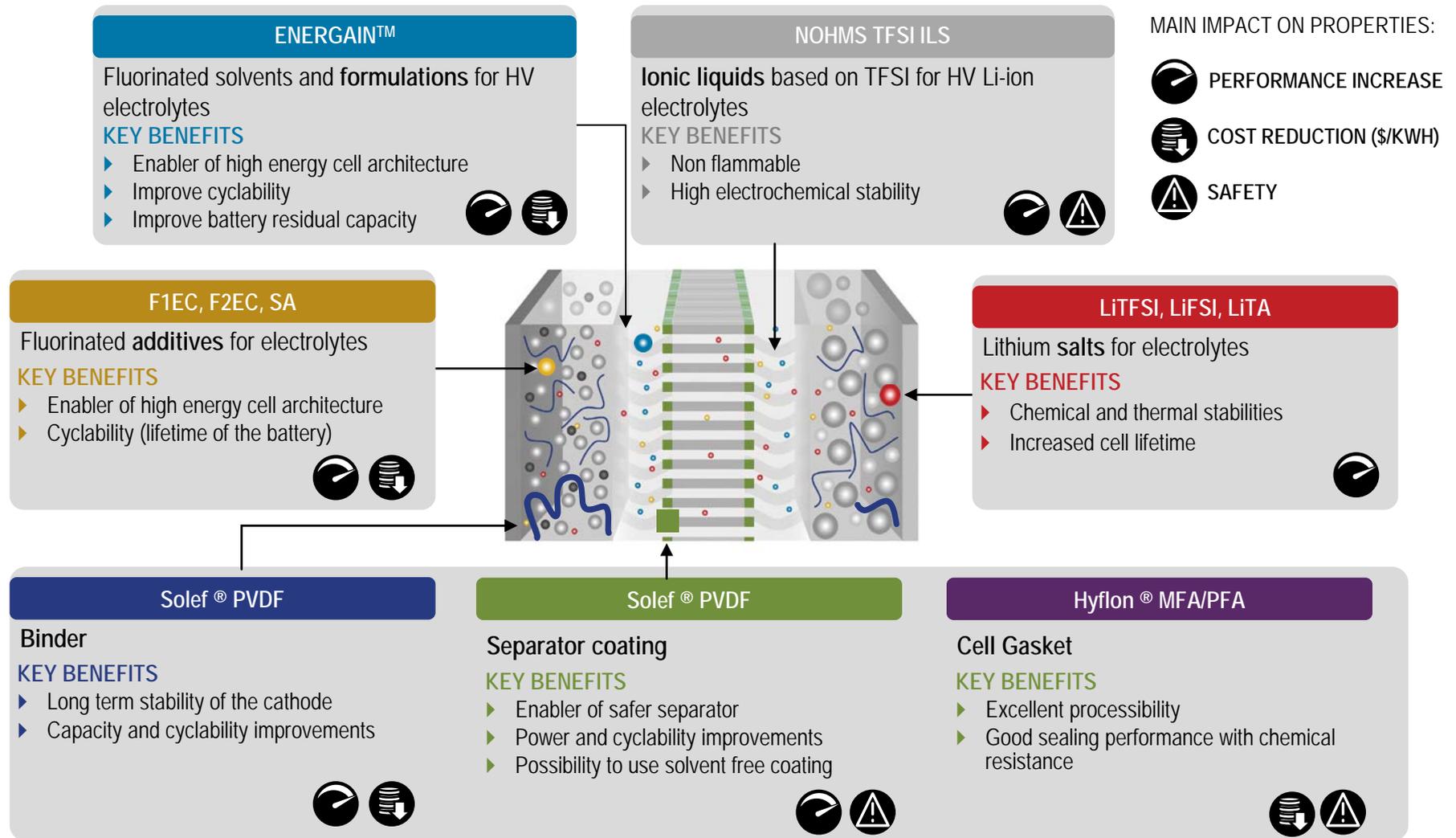
**SAFETY**



NB: Figures provided at cell level

EUCAR: Safety standard

# Solvay well placed to serve battery industry today



# Battery pack: Solvay offers lighter, safer and higher performance solutions

## STRUCTURAL METAL REPLACEMENT



### KEY BENEFITS

- ▶ **Less Weight**
  - Reduces Energy Consumption
- ▶ **Ability to consolidate parts**
- ▶ **Reduced corrosion (vs. metal design)**

### SOLVAY MATERIALS

**Amodel®  
& Ryton®**  
Aromatic  
polymers

## COOLING



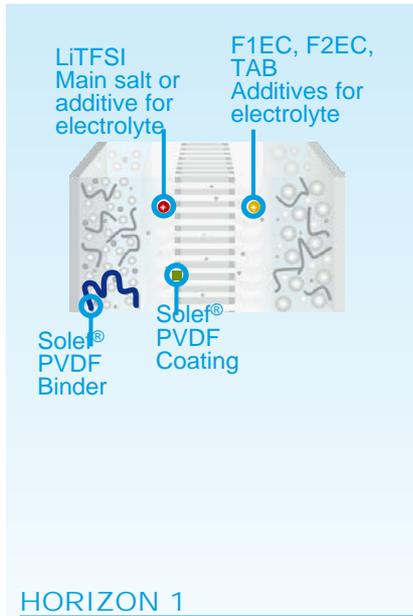
### KEY BENEFITS

- ▶ **No Corrosion**
- ▶ **Ability to immerse electronics into coolant**
- ▶ **Safety**
  - Non-flammable
  - Non-toxic

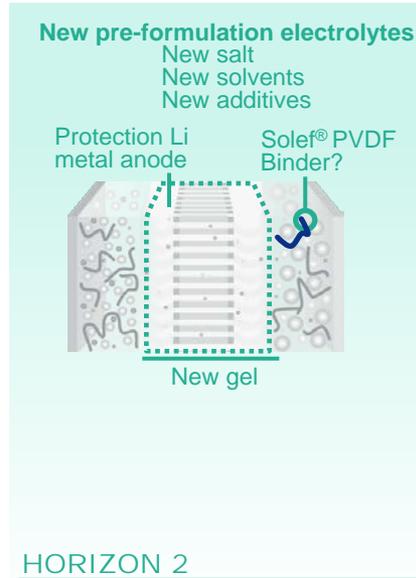
### SOLVAY MATERIALS

**Galden®**  
fluorinated  
fluids

# Technology Roadmap: From Li-ion to Solid-state, LiS



- ✓ Binder for cathode
- ✓ Coating for separators
- ✓ Polymer solutions for Battery pack/modules, gaskets

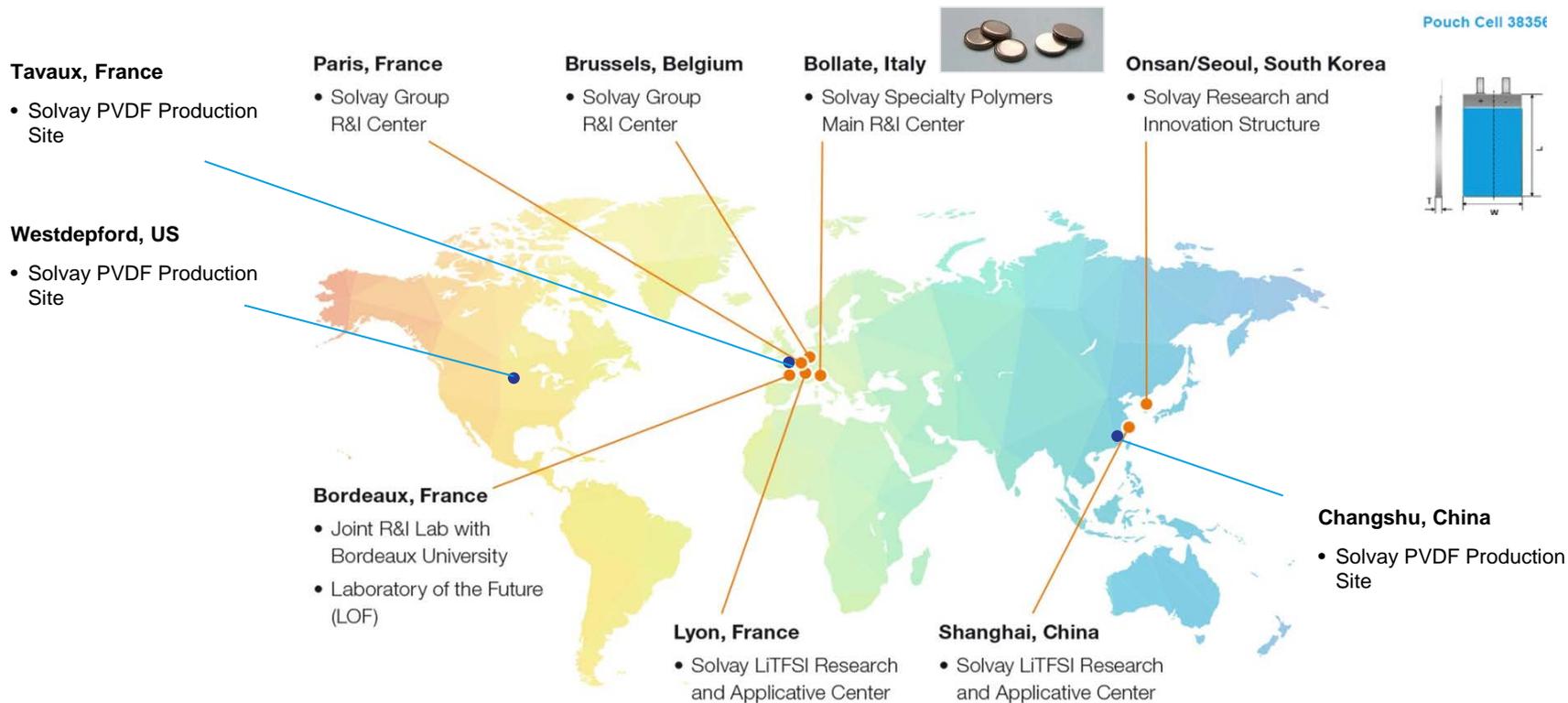


- ✓ New ingredients, Blends for High Voltage (HV) electrolyte
- ✓ Protection Li metal anode
- ✓ New Gel Electrolyte



- ✓ Technologies for LiS
- ✓ Solid Polymer Electrolyte
- ✓ Solid inorganic elect

# Solvay global footprint for Li-ion Battery Technology



## We are able to support customers globally and locally

Market needs quickly transferred to R&I and Innovative product and solution introduced to market

**Partnership with leading institutes: EWHA (Korea), DoE in USA, FP7 H2020 in Europe, and CEA in France.**

# Key takeaways



## Industry leader in high performance polymers

- Unmatched portfolio breadth, technology and innovation capabilities
- Wide industry coverage with intimate customer relationship



## Position in China to support regional developments

- Expanding industrial footprint and Growing R&I presence
- Strengthening Marketing & Sales regional network



## Solvay's specialty materials & technologies offer solutions to the challenges of battery industry

- Comprehensive material solution provider for Chinese customers
- Innovation driven with intimate customer engagement

# Agenda

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Focus on batteries  
*Chuanqi Tao*
- **Peroxides in China**  
**Focus on water purification**  
*Gary Zhao*
- Lab visit



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# Peroxides at a glance

## Global market and technology leader



\*HPPO = HP (Hydrogen Peroxide)  
for PO (Propylene Oxide)

**~20%**  
Production  
capacity



**Americas**  
4 production sites  
1 R&I center



**€0.6 bn**  
Net sales 2017

**~30%**  
Production  
capacity



**Europe**  
9 production sites  
2 R&I centers



**~900**  
employees

**~50%**  
Production  
capacity



**Asia & RoW**  
6 production sites  
1 R&I center



**19** production sites  
**4** R&I centers

2017 Data

Production capacity & sites include all JVs

# Peroxides presence in China

## 过氧化物事业部在中国

### Peroxides

#### 过氧化物事业部



Shandong Huatai Interlox Chemical Co.Ltd.  
山东华泰英特罗斯化工有限公司

#### Joint Venture (50%)

- Established in 2010

#### Main products:

- Hydrogen peroxide (technical & food grades)
- Peracetic Acid (PAA)

Headcount: 118

工业和食品级双氧水  
过氧乙酸



Solvay (Zhenjiang) Chemicals Co., Ltd.\*  
索尔维 (镇江) 化学品有限公司

#### WFOE:

- 60k tonnes in 2016

#### Main products:

- Hydrogen Peroxide  
(concentration 27.5%~70%)

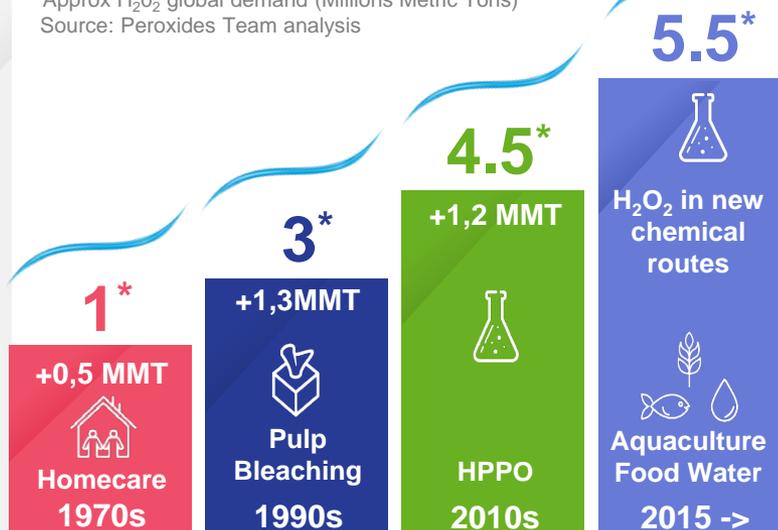
Headcount: 43

浓度在27.5-70%双氧水

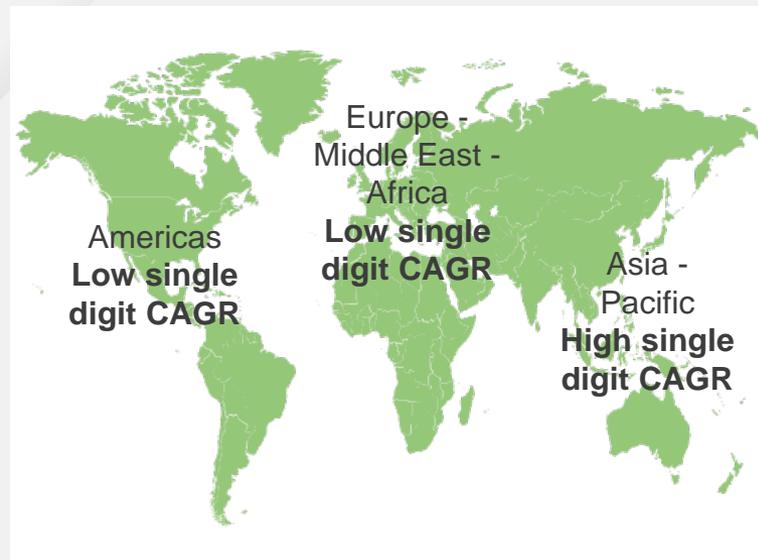
# H<sub>2</sub>O<sub>2</sub>, growth driven by sustainability

## Market ruptures

\* Approx H<sub>2</sub>O<sub>2</sub> global demand (Millions Metric Tons)  
Source: Peroxides Team analysis



## Demand dynamics



**Fast growth in Asia driven by:**

- HPPO (Thailand, Korea and China)
- Chemicals (China)
- Pulp (China and Indonesia)
- Food/Aqua-culture (Region)

# Solvay: market and technology leader for H<sub>2</sub>O<sub>2</sub>

## Global market leader



Pulp  
bleaching



HPPO



Food and  
Aquaculture

## Technology leader

- **Fit-for-purpose on-site technologies**
  - High productivity process for H<sub>2</sub>O<sub>2</sub>: mega plants to serve PO customers  
➔ **>70% market share**
  - Reviewed H<sub>2</sub>O<sub>2</sub> production process to allow for tailor made customer solutions
- **Process efficiency improvements**
  - Specific consumptions
  - Energy management

## Supported by innovation capability

### Applications

- **Aquaculture:**  
Anti-parasite for salmon farming
- **Environment :**  
Advanced oxidation for increasing environmental standards

### Technology

- **High Productivity** -> HPPO
- **New process design** -> "MyH<sub>2</sub>O<sub>2</sub>"
- **Strong energy savings**

# Water purification market in China

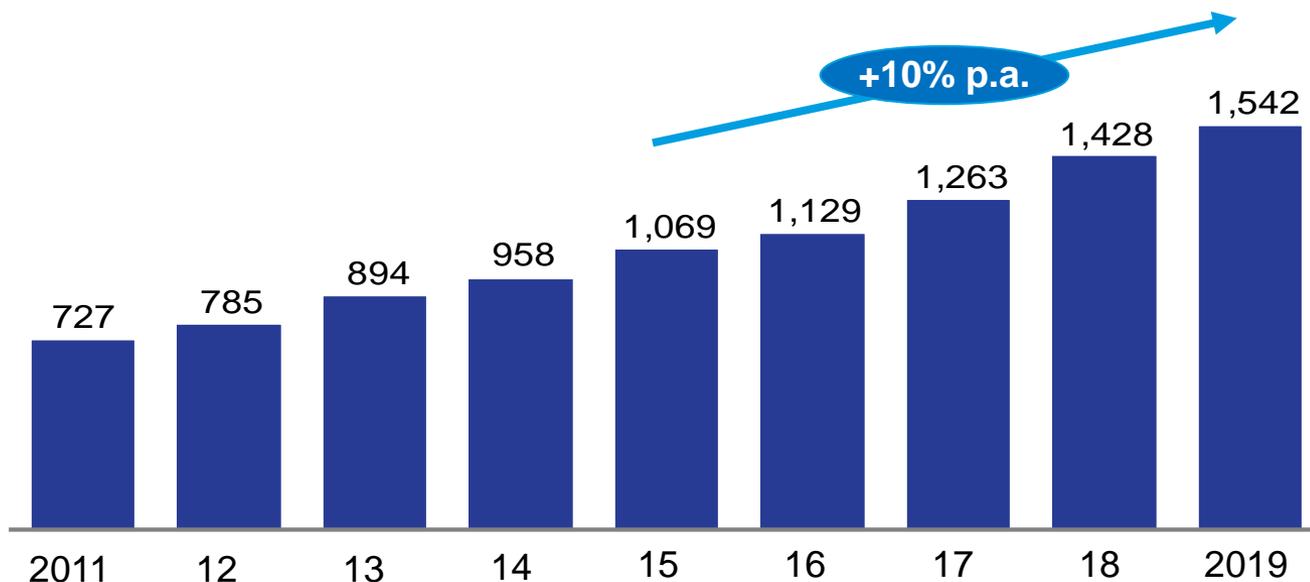
## Market size

The industrial wastewater market in China represents a market of approximately USD 1.1 billion in 2015 and is growing attractively at ~10% CAGR

The market is relatively fragmented with 8 key industries constituting ~80% of the industry sales

## Industrial wastewater market in China 2011-2019

(CAPEX – m\$)



- Overall market is small but growing
- Recent push on waste water management and **tighter discharge standards** is likely to push growth further

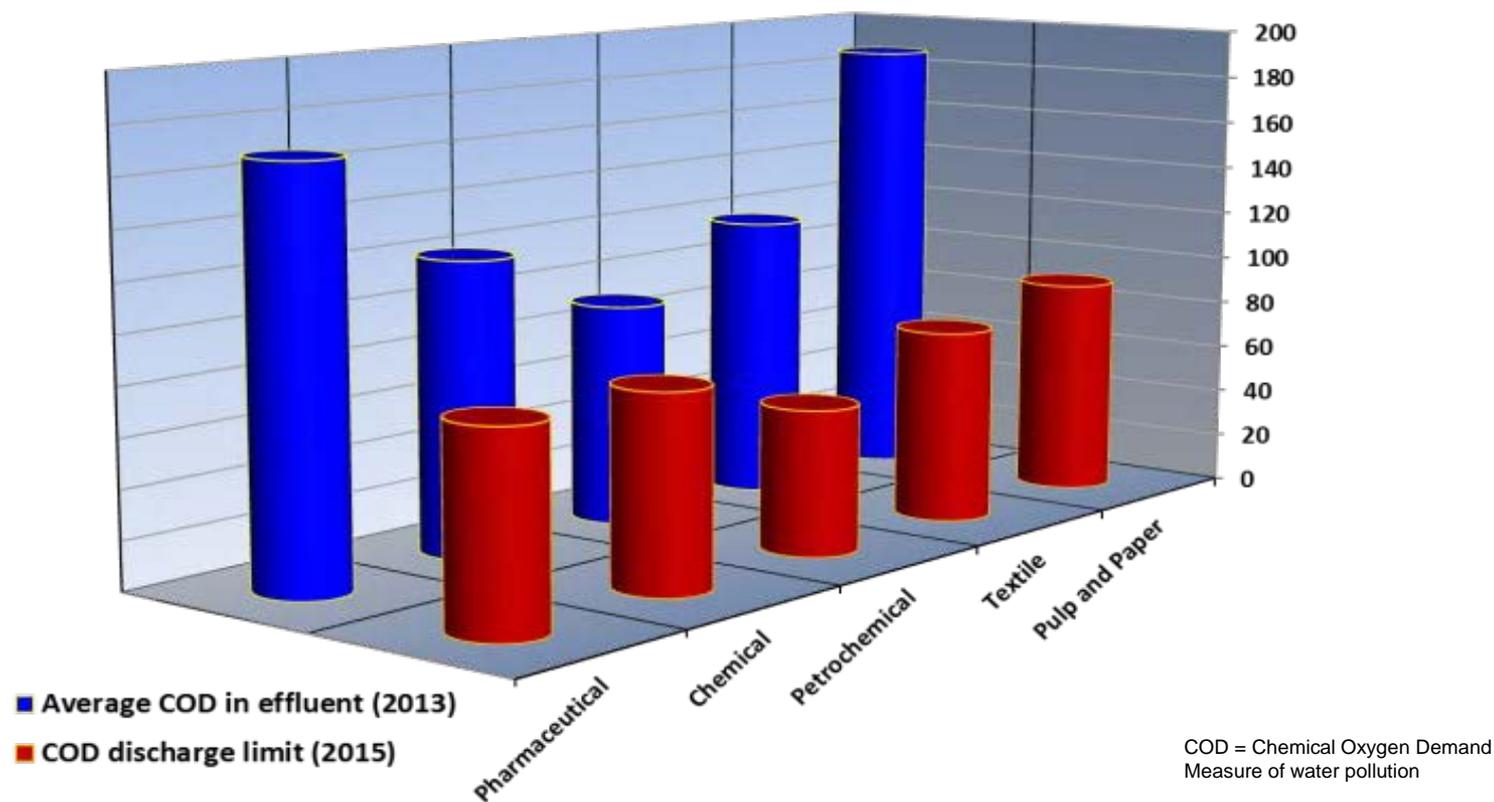
Source: Team estimation based on GWI, Global Water report 2015 (CAPEX for China industrial water market) and GWI, Industrial Industrial Water Technology Markets 2015 (Ratio water/wastewater by industry )

# Regulations

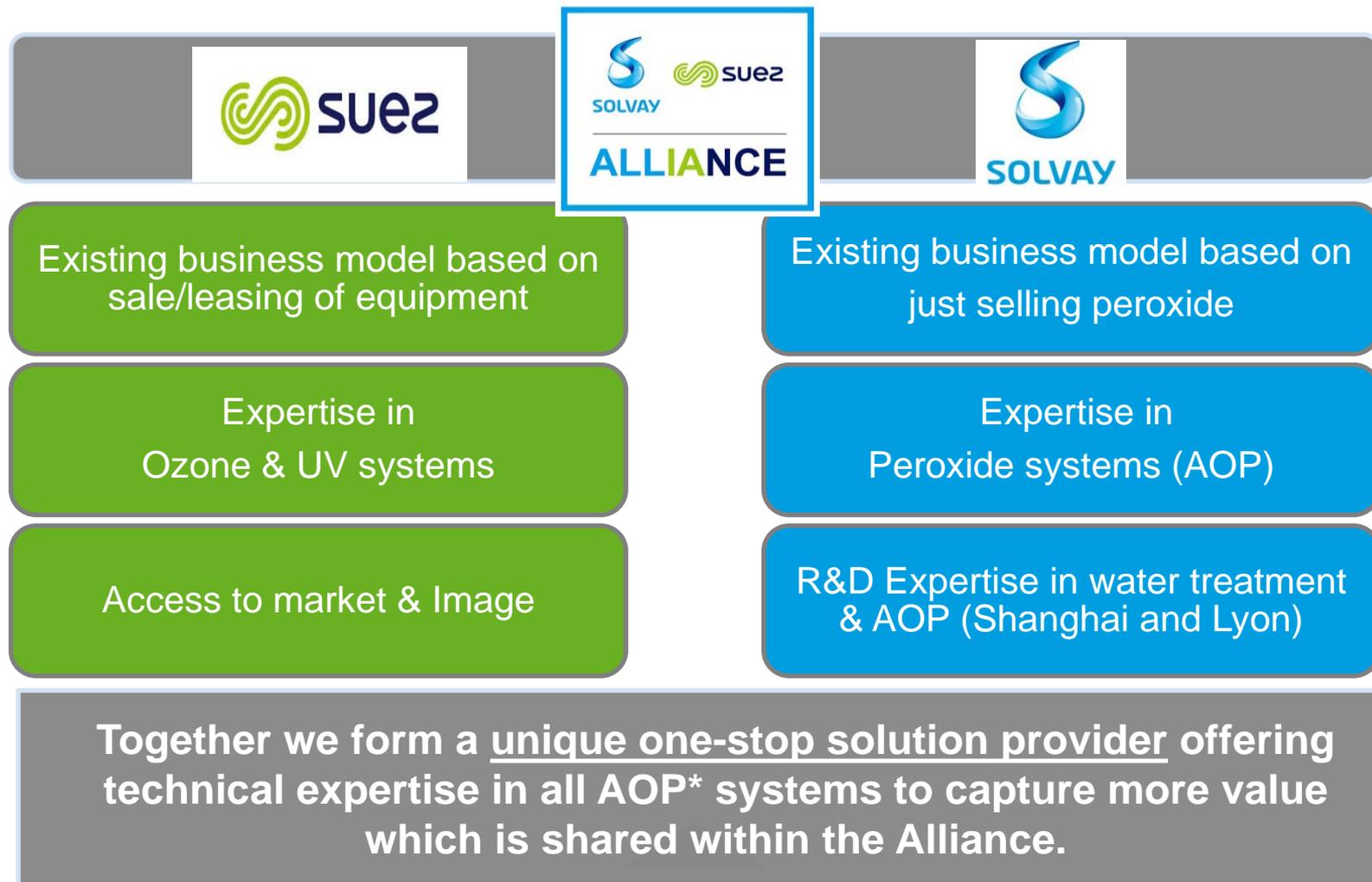
## Regulation

The MEP recently decided to reinforce waste water treatment standards and control, starting enforcement early 2015, e.g., pthis market

These standard are implemented and enforced by local authorities (provincial and city level)

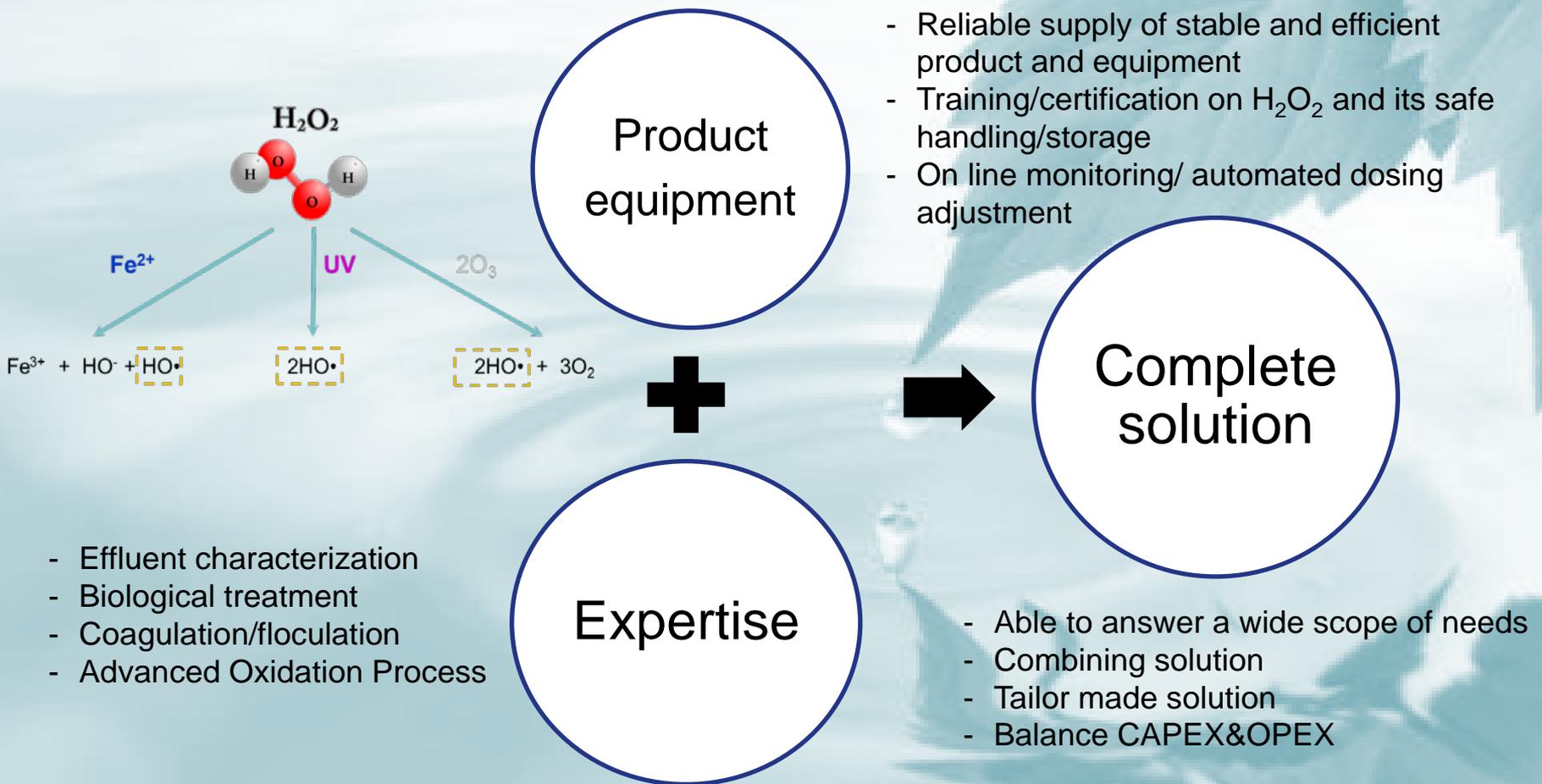


# New business model to capture more of the value chain



AOP : Advanced Oxidation Process

# Solvay/Suez Alliance: complete solution for hard COD removal in industrial wastewater treatment



# 2 key approaches for commercial targets

	H2O2 supply and expertise	Equipment & AOP technology offering	Value-added services
<b>Description</b>	<ul style="list-style-type: none"> <li>Analyze wastewater to define the right solution</li> <li>Run tests on samples in lab in China</li> <li>H2O2 supply</li> <li>Training for safe storage and handling of H2O2</li> </ul>	<ul style="list-style-type: none"> <li>Equipment supply and installation</li> <li>OPEX &amp; CAPEX estimation</li> </ul>	<ul style="list-style-type: none"> <li>Continuous on-line monitoring</li> <li>Automated dosing adjustment</li> <li>Performance improving</li> <li>OPEX and CAPEX optimization</li> <li>Operations &amp; Maintenance</li> </ul>

## 1 “Chemicals + Equipment”



- AOP pilot on-site
- Offer equipment for the whole spectrum of AOP technologies

## 2 “One-stop shop AOP solution provider”



Fenton Pilot

UV/H2O2 pilot

O3/H2O2 pilot

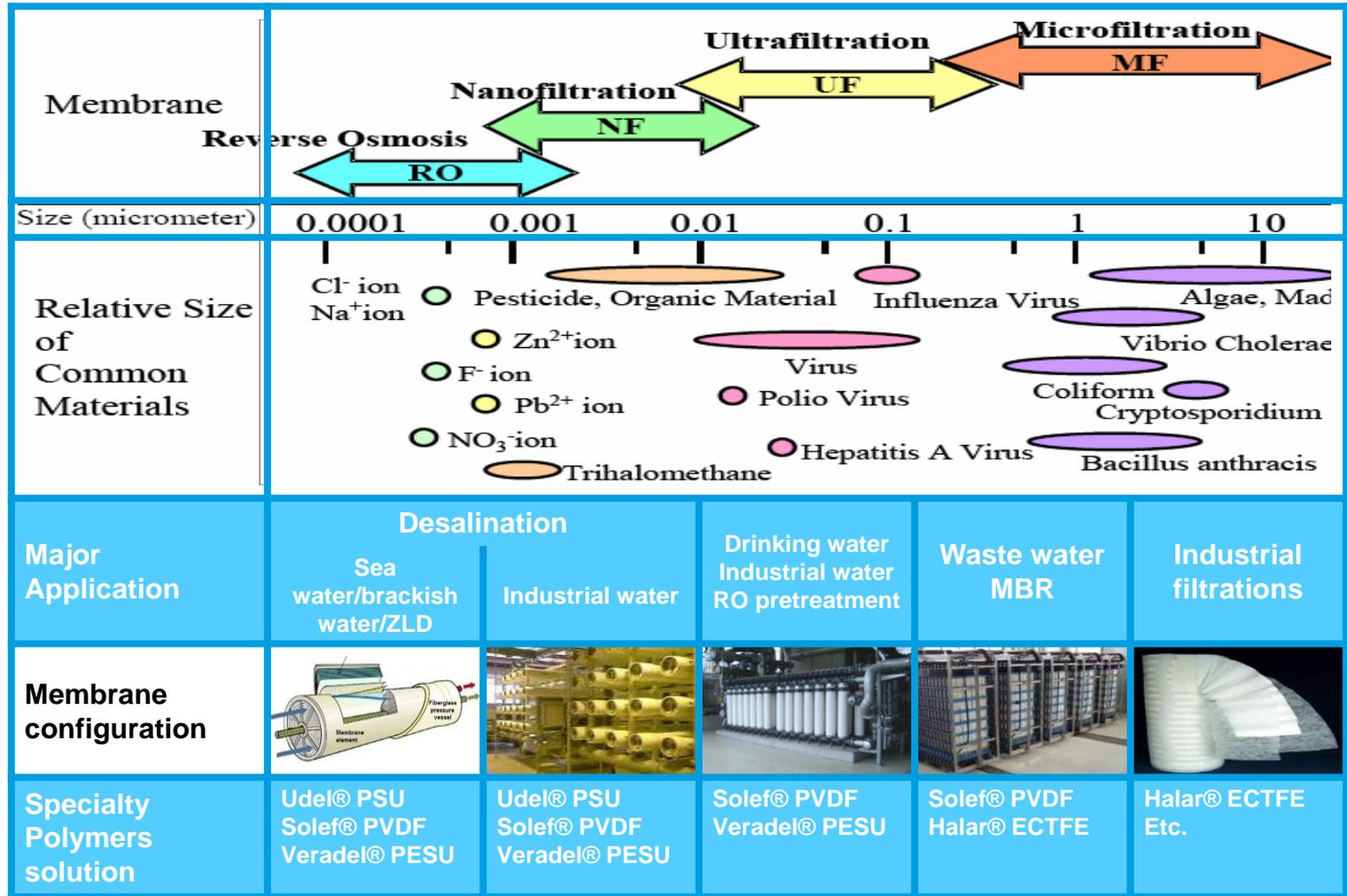
- Stronger lock-in and wider service offering for all AOP technologies with equipment supply
- Added value captured

We established lab to support this Alliance while we get technology support about design and engineering for WWT from Suez on our solution.



# Solvay covers the whole spectrum of water purification

## Filtration Spectrum



## Application & Solvay Specialty Polymers' Solutions

# Key takeaways



## **H<sub>2</sub>O<sub>2</sub> markets growing faster than GDP**

- New applications in food, aquaculture and water purification
- HPPO



## **Solvay global market and technology leader in H<sub>2</sub>O<sub>2</sub>**

- Partnerships with key customers
- Strong push for innovation in technology and applications



## **Solvay has broad offer for water purification**

- Peroxides for water purification
- Membrane technology for water filtration

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*let's create*  
more future

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