

## SECREETS CITIZEN LABS

### PUBLIC REPORT

14<sup>th</sup> January 2019 – Ellesmere Port (UK), Holiday Inn



*Figure 1 - Picture by Adrian Waine - Photography for Industry*

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## 1. About SecREETs

SecREETs is a project receiving funding from the European Commission Horizon 2020 programme for research & innovation, under the Executive Agency for Small and Medium-sized Enterprises (EASME) European Innovation Partnership on Raw Materials. It aims to establish a secure and stable supply of Rare Earth Elements (REEs) in Europe, using sustainable extraction methods from European apatite sources used in the production of phosphorous fertilisers. SecREETs partners are developing pilot processes for a circular and sustainable extraction, separation and transformation of REEs for application to areas such as electric vehicles, industrial motors, wind turbines, with replication potential in consumer products or medical equipment. The main objective of SecREETs is to set up a new integrated European value chain for extraction, refining and production of REEs.

SecREETs partners are:

- SINTEF AS – Norway – Coordinator
- Yara International ASA – Norway – Industrial pilot
- REEtec AS – Norway – Industrial Pilot
- Less Common Metals Ltd – UK – Industrial Pilot
- Vacuumschmelze GMBH & Co kg – Germany
- Quantis – Switzerland
- Institut National de l’Environnement et des Risques INERIS – France
- Prospex Institute asbl – Belgium



Please find all relevant information and latest updates on the project website:  
[www.secreets.eu](http://www.secreets.eu)

## 2. Citizen Engagement in SecREETS: methodology

As part of the SecREETS Public Engagement strategy, Prospex Institute organises yearly Citizen Labs, to consult local communities in areas where industrial partners are established. Through identifying civil society organisations, media groups, political parties and public authorities, Prospex Institute facilitates discussions between local communities and industrial partners to highlight challenges and opportunities related to SecREETS throughout the whole duration of the project. The outputs of these consultations will allow SecREETS to co-create a level of social acceptance and incorporate local stakeholders’ feedback into future developments.

The Citizen Lab which took place on 14<sup>th</sup> January 2019 in Ellesmere Port (UK) was the first of the SecREETS project. Together with Less Common Metals (LCM) and SINTEF, Prospex Institute introduced SecREETS to a group of local actors. The SecREETS team used interactive exercises based on presentations by LCM and SINTEF to help participants understand challenges related to REEs supply in Europe along with the role and impact of SecREETS both at European and local levels.

For this first event, Prospex Institute mapped the different stakeholders using the Prospex-CQI method for stakeholder analysis, which is part of the stakeholder integrated research or STIR approach<sup>1</sup>. Prospex-CQI stands for:

- C** - Criteria: Defining a set of criteria and categories for stakeholder groups that are or could either be affecting the topic of the consultation, be affected by it, or both;
- Q** - Quota: Setting specific minimum quotas for all categories and ensuring gender/generational/sectoral balances
- I** - Individuals: Identifying individuals that fit the categories, with the overall selection fitting the quotas set.

As a result of this analysis, Prospex Institute mapped a total of 88 individuals and organisations in Ellesmere Port and surroundings, using the categories in the first column of the table A below. After careful consideration, LCM and Propsex Institute agreed on the minimum quotas in the second column of the table A. Based on the earlier mapping and the quotas, Prospex Institute contacted a total of 64 individuals and organisations to invite to the Citizen Lab.

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<sup>1</sup> Marc Gramberger, Katharina Zellmer, Kasper Kok & Marc J. Metzger, 2014: Stakeholder integrated research (STIR): a new approach tested in climate change adaptation research. *Climatic Change* 128(3) 201-214.

*A - Categories and quotas for Ellesmere Port Citizen lab stakeholder mapping*

	Reference/ Quota
<b>Civil Society Organisations (30%min)</b>	
Spiritual organisations	1
Community-based associations	1
Hobby sport clubs	1
Heritage societies and museums	1
Academia and Education	1
Political Parties	2
<b>Local influencers (30% min)</b>	
Local Media	3
Local elected officials	3
Local councils and public services	3
<b>Business-related organisations (10%min)</b>	
Business organisations	2
Trade unions	1
<b>GENDER</b>	
Male	10
Female	10
Not specified / Other	0
<b>AGE</b>	
16-29	5
30-49	5
50 and older	5

Out of the 64 people contacted, 16 showed interest in joining the Citizen Lab. On the day of the Citizen Lab, 8 participants were present in addition to 7 members of the SecREETS team and a photograph invited by Less Common Metals. The table B below compares actual attendance quotas to reference quotas.

*B - Comparative table of reference and attendance quotas for Ellesmere Port Citizen lab stakeholder mapping*

	Reference Quotas	Attendance Quotas
<b>Civil Society Organisations (30%min)</b>		
Spiritual organisations	1	0
Community-based associations	1	2
Hobby sport clubs	1	0

Heritage societies and museums	1	0
Academia and Education	1	1
Political Parties	2	0
<b>Local influencers (30% min)</b>		
Local Media	3	0
Local elected officials	3	1
Local councils and public services	3	2
<b>Business-related organisations (10%min)</b>		
Business organisations	2	2
Trade unions	1	0
<b>GENDER</b>		
Male	10	5
Female	10	3
Not specified / Other	0	0
<b>AGE</b>		
16-29	5	0
30-49	5	4
50 and older	5	4

In accordance with the European General Data Protection Regulation, participants were required to fill in a registration form upon arrival, with personal information and consent for the sharing of their personal data among SecREETs partners and permission for us to take pictures and use them as part of SecREETs communication activities. To ensure transparency, participants were explained at the start of the Citizen Lab that the meeting is public and any information presented by the SecREETs team during the event can be shared externally.



Figure 2 - Picture by Adrian Waine - Photography for Industry

### 3. Introducing Rare Earth Elements

After presentation of the agenda and before talking about SecREETS itself, it appeared necessary to introduce the audience to Rare Earth Elements. Citizen Labs are designed to engage a broad community of local actors in a variety of environmental, economic or social fields. As a consequence, most participants did not have a scientific or engineering background, or their knowledge of REEs was limited.

As an ice-breaker, Less Common Metals used [The Elements Song](#), by Thomas Lehrer, before giving a broad definition of REEs:




## What are the Rare Earths?

Often referred to as the Lanthanide Series

No precise scientific definition Pm, Y, Sc


Can be 14, 15, 16 or 17 elements depending the definition used!



H																					He
Li	Be													B	C	N	O	F	Ne		
Na	Mg													Al	Si	P	S	Cl	Ar		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe				
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn				
Fr	Ra	Ac	Rf	Db	Sg	Bh															
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu						
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr						

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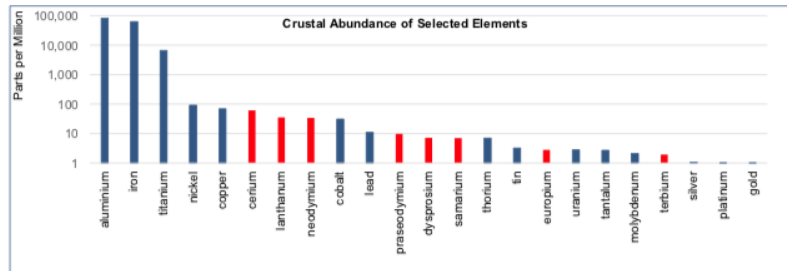
## Names of the Rare Earths



La Lanthanum	}	Referred to as the Light Rare Earths
Ce Cerium		
Pr Praseodymium		
Nd Neodymium		
Pm Promethium		Does not exist in nature
Sm Samarium	}	Referred to as the Intermediate Rare Earths
Eu Europium		
Gd Gadolinium		
Tb Terbium		
Dy Dysprosium	}	Referred to as the Heavy Rare Earths
Ho Holmium		
Er Erbium		
Tm Thulium		
Lu Lutetium		
Yb Ytterbium		

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## Rare Earths Are Not So Rare



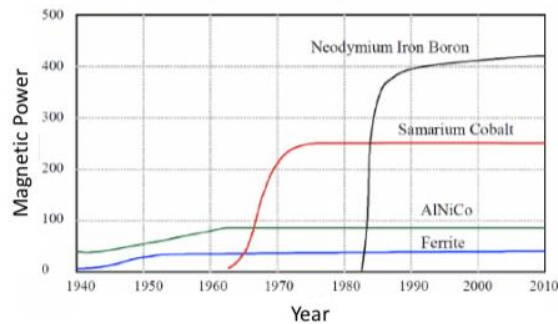
- Some are more abundant than lead or cobalt.
- Even rare earths regarded as “rare” are more abundant than tin.
- The least abundant rare earth elements Tm, Lu are 200 times more common than gold.
- “Hard to separate” earths would be a more accurate description.
- Often occur in nature in low grade deposits in association with other materials.



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## Why the interest in Rare Earths?

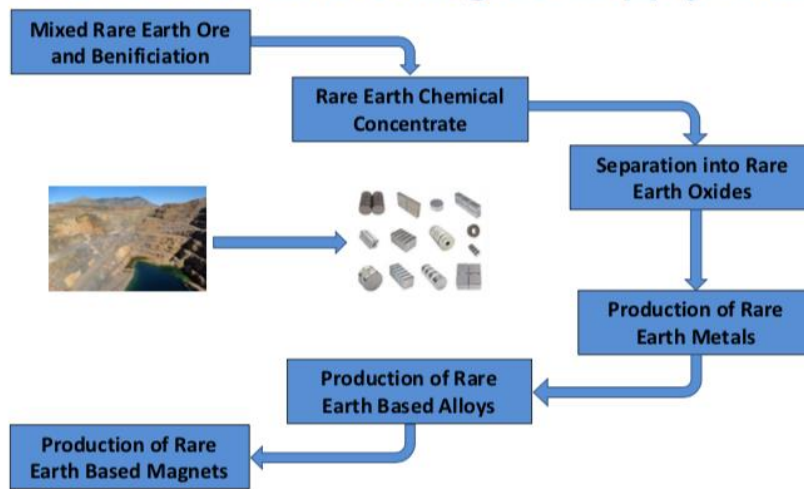
- Many and varied uses
- Often in high-tech industries
- Essential and irreplaceable in many everyday applications
- Permanent magnets are a perfect example



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## The RE Permanent Magnet Supply Chain



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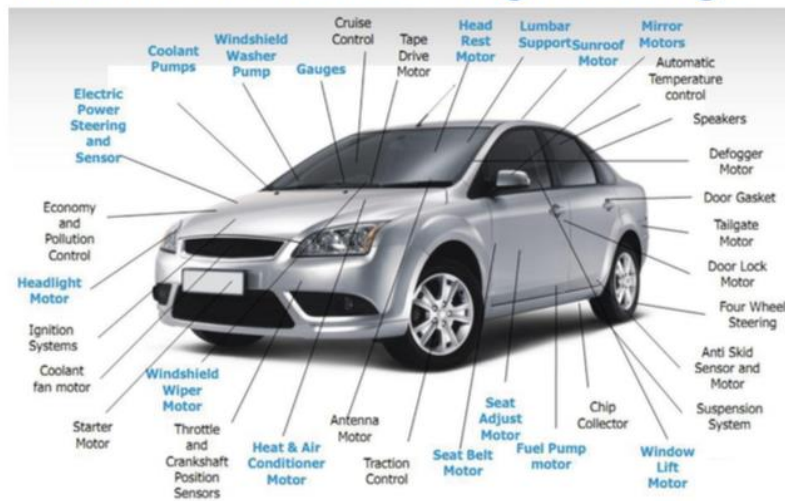
## Photo of a Toyota Prius



- Alloys based on the rare earth neodymium make the strongest magnets known to humankind
  - Orders of magnitude stronger than non-rare earth magnet systems
  - Each Toyota Prius contains 2.7kg of neodymium-based magnets
  - Neodymium-based magnet industry growing at 20% annually
- Each Toyota Prius contains many other rare earths. What are they there for?

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## Automotive NdFeB Magnet Usage



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## Horizon 2020 - European Funded Innovation

- The SecREETS project is funded under Horizon 2020, the biggest ever EU Research and Innovation programme with nearly €80 billion of funding available over 7 years (2014 to 2020).
- It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market thus securing Europe's global competitiveness.
- Seen as a means to drive economic growth and create jobs, Horizon 2020 has the political backing of Europe's leaders and the Members of the European Parliament. They agreed that research is an investment in our future and so put it at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs.
- Horizon 2020 is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly – and achieve results faster.
- In the event of a 'no deal' Brexit, the UK's departure from the EU would mean UK organisations may be unable to access funding for Horizon 2020 projects after exit day. However, the Chancellor announced in August and October 2016 that the government will guarantee funding for competitively bid for EU projects submitted before we leave the EU, including Horizon 2020 projects. This guarantee will cover all successful bids submitted by UK participants before the UK exits the EU, for the full duration of the projects.



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**No comments or questions from the audience at that point.**

## 4. How do we use Rare Earth Elements?

After this introduction, attendees, including SecREETS team, were asked to briefly introduce themselves. Then, as a way to help the audience relate to REEs and their common applications, participants were asked to reflect on the following question:



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**What do you own that contains REEs?**

Answers from the audience:

- Mobile phone
- Laptop
- Car key with battery

The audience was then introduced to more industrial and general consumption applications of REEs.

## Common Applications for Rare Earths (1)

- Aerospace
  - Magnets
    - Cabin pressurising system
    - Air conditioning
    - Ground taxiing motors
  - Thermal Coatings
    - Heat resistant engine components
  - Electrical ceramics
    - Communication systems
- Automotive
  - Magnets
    - Hybrid/ EV Drive
    - Seat / window motors
    - Compressor motors
    - Sensors
  - Chemicals (salts)
    - Catalytic converter
  - Glass
    - UV resistant materials
- Power generation
  - Magnets
    - Wind Turbines
- Chemical industry
  - Magnets
    - Pumps and couplings
  - Catalysts
    - Petroleum cracking



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LCM

## Common Applications for Rare Earths (2)

- Mobile Communications
  - Magnets
    - Vibration motors
    - Speakers
  - Electrical ceramics
    - Signal processing
- Medical Applications – MRI
  - Magnets
    - Image enhancement drugs
- Computing / IT
  - Magnets
    - Hard disk drive
  - Fibre optics
    - Dopants in optical fibres
- Domestic Applications
  - Magnets
    - Motors in white goods
    - Central heating pumps
    - Air conditioning compressors
    - Waveguides in microwave ovens
  - Glass
    - Coloured glass
    - High performance glass for optical applications
  - Ceramics
    - Colours for tableware and sanitaryware



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LCM

## 5. Why run a project on Rare Earth Elements?

Having made it clear what REEs are used for and their omnipresence in their everyday life, participants were asked two questions:

### ***What countries in the world do you think are the largest producers of REEs?***

*Answers from the audience:*

- China
- Australia
- Africa
- Cornwall
- Sweden
- Russia
- Canada
- South America

### ***What countries in the world do you think are the largest consumers of REEs?***

*Answers from the audience:*

- The UK
- Europe
- The US
- North America
- China
- Japan
- Korea
- South Africa
- Latin America (Brazil & Argentina)

Responses were collected using two different colours of sticky notes on a world map. The SecREETs team removed inaccurate sticky notes and left participants analyse the results:

### ***Looking at the map, what strikes you?***

*Answer from the audience:*

Consumers are very dependent on China.



Figure 3 - Picture by Adrian Waine - Photography for Industry

Once the global context of REEs production and needs was clear to everyone, the audience is presented with more information on the SecREETs project and the members of the consortium. Participants are presented with the main elements of the value chain and the pilot processes:

## Participants



-  **SINTEF** ■ SINTEF AS – Norway. Coordinator
-  ■ Yara International ASA – Norway – **Industrial Pilot**
-  ■ REETEC AS – Norway – **Industrial Pilot**
-  ■ LESS COMMON METALS LIMITED - United Kingdom – **Industrial Pilot**
-  ■ VACUUMSCHMELZE GMBH & CO KG - Germany
-  ■ QUANTIS - Switzerland
-  ■ INSTITUT NATIONAL DE L'ENVIRONNEMENT ET DES RISQUES (INERIS)  
- France
-  ■ PROSPEX INSTITUTE - Belgium





## Phosphorous Fertilisers



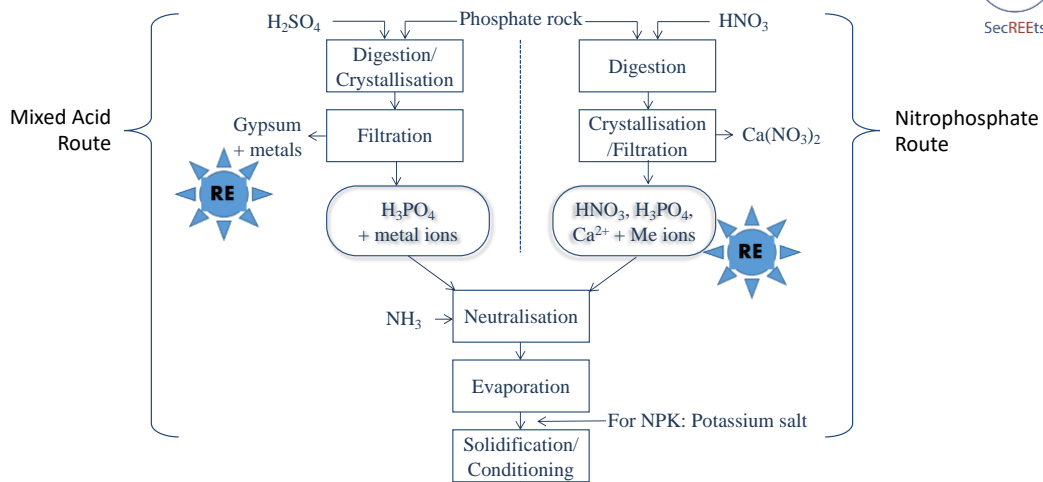
- Most important phosphorous source is apatite,  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH},\text{F},\text{Cl})_2$ , also called phosphate rock
- Mined from both igneous and sedimentary ores
  - Annual production in the range of **150 million tonnes**
- All apatite ores contain REEs
  - Igneous apatite contains significant higher levels than sedimentary ores
- Igneous ores are beneficial in the production of phosphate fertilisers as they contain less heavy metals and radioactive elements than sedimentary sources



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## NPK Fertiliser Production

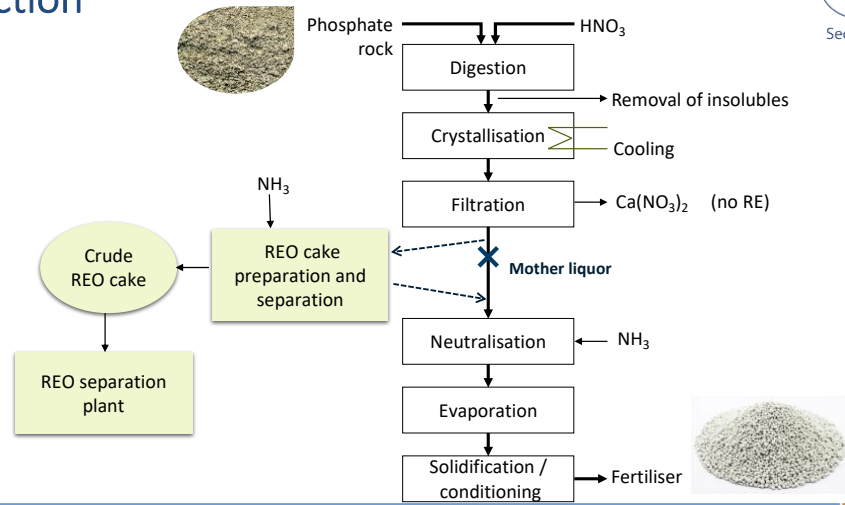


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## RE Extraction Concept



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## Separation of REE – Innovative, proven technology

### Equipment

- Proprietary separation method
- No liquid – liquid extraction

### Process

- High purity after single separation step
- Cost-effective



**Robust – no emissions – off-the-shelf equipment**

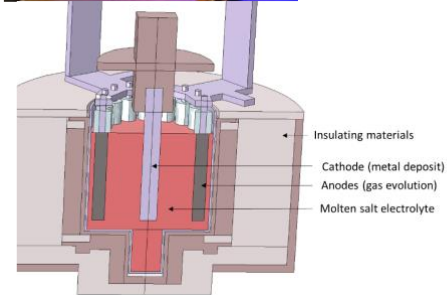


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## SecREETS Electrolysis Process

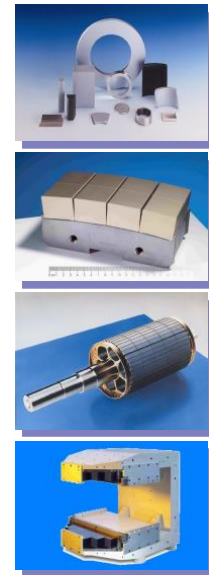
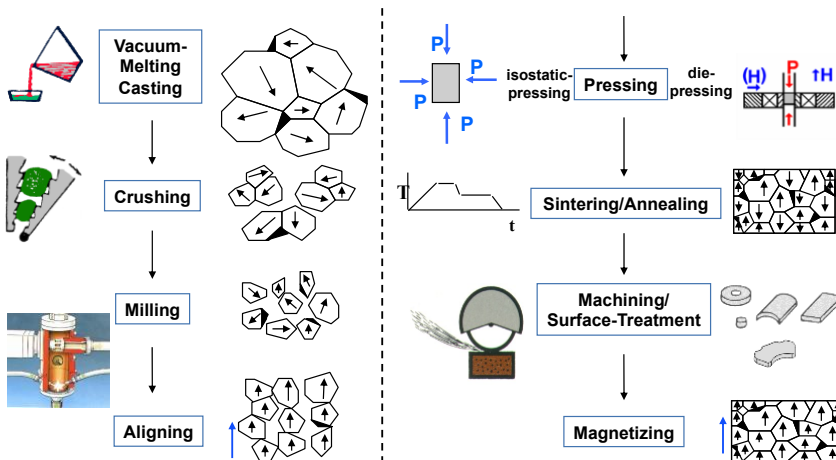
- NdPr and DyFe alloys
- State-of-the-art Electrolysis Cell
  - Industrial scale
  - Continuous feeding of oxides
  - High energy efficiency
  - Low emissions
- Strip cast, hydrogen decrepitated alloys for downstream magnet applications



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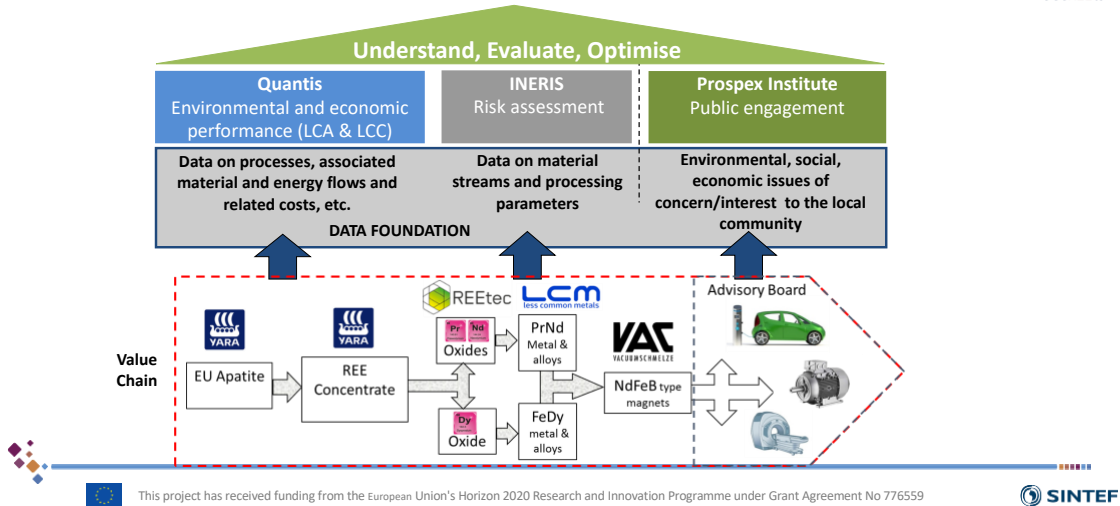
## Manufacturing of Rare Earth Magnets



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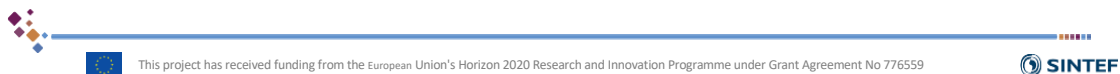
## Sustainability and Risk, and Public Engagement



## Wrap Up



- Pilot processes based on innovative extraction, separation and transformation of REEs
- Industrial implementation will provide at least 3000 tonnes annually of REEs
- Efficient use of European raw materials
- Complete value chain in Europe
- **Total Budget:** € 19,388,750  
EC Contribution: € 12,880,031
- **Duration:** 4 years  
(June 1, 2018 – May 31, 2022)



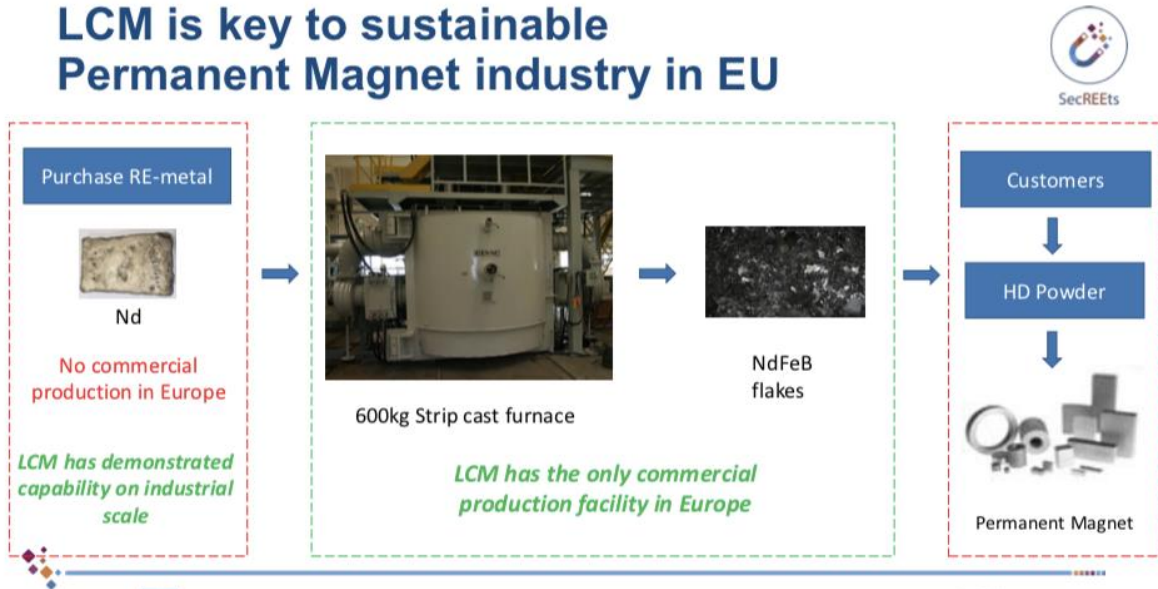
### Comments and questions from the audience:

- *Is there a possibility to use other sources than phosphate?*
- *Is the project happening all in one place and how is it different from China?*
- *Can REEs be extracted and used for other goals and/or at other points in the SecREETS value chain?*

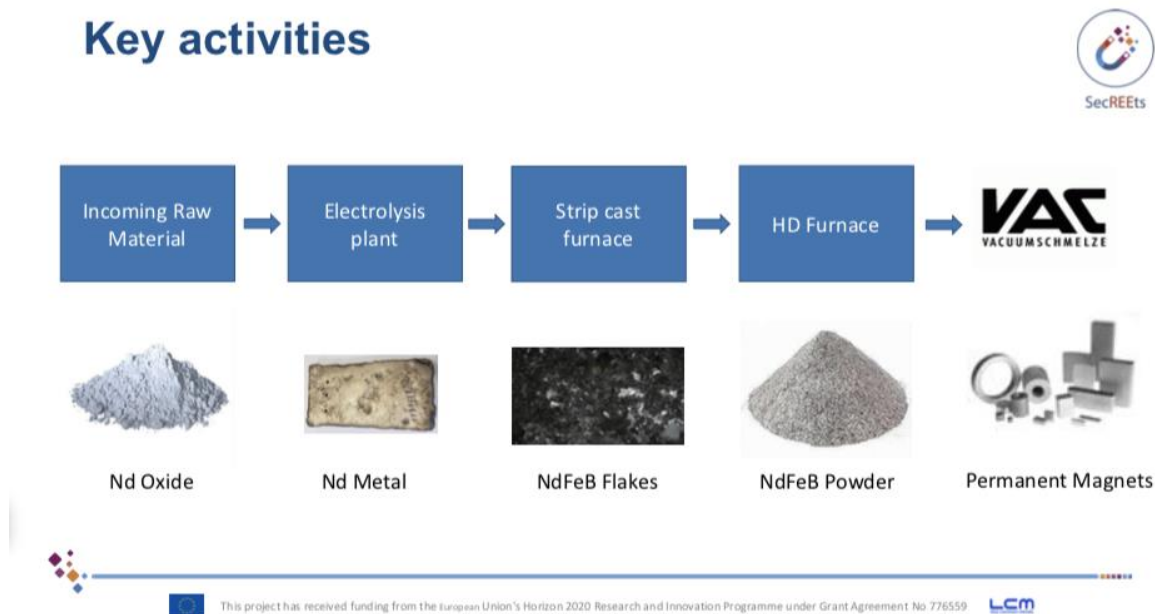
## 6. What happens in Ellesmere Port?

After a general presentation of the SecREETS project, the Less Common Metals team got into more details about their role in the consortium, the importance of REE supply in the UK and the local socio-economic impact of SecREETS for the region.

### LCM is key to sustainable Permanent Magnet industry in EU



### Key activities



## Industrial scale plant

- Two 6 kA molten salt electrolysis cells and integrated plant
  - NdPr Cell ca.55t/yr
  - DyFe cell ca.55t/yr
- Production of RE-Fluorides for electrolysis
- 300kg per batch Hydrogen Decepritation (HD) furnace



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## Introduction to Less Common Metals

- World class producer of rare earth-based alloys
  - Primarily for supply to global permanent magnet manufacturers
- Private company, established in 1992 and regarded as a Small-Medium Enterprise (SME) according to European Union classification
  - Employees 38
  - Turnover – over £14m in 2018
  - 99.7% of revenue was from exported materials in 2018
- Sales in 2018 to 16 countries / 4 continents
  - Germany 63%
  - Other EU 1%
  - Switzerland 27%
  - Japan 4%
  - Taiwan 3%
  - USA 1%
- Excellent reputation for business ethics and for operating to the highest practical standards of Quality, Environmental, Health and Safety stewardship



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## Reasons to manufacture REEs in UK / EU



- Global industry currently dependent on single source (China!)
  - China has already demonstrated willingness to use REE supply as a strategic weapon
  - Current supply imbalance restricts China's attempts to improve environmental and Health & Safety standards
    - Huge global demand encourages illegal / unlicensed processing
- Opportunity to pro-actively improve manufacturing standards in industry
- Strong and responsible manufacturing base essential for a successful economy



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LCM

## Local Impact of SecREETS Project



- SecREETS project supports the equivalent of 5½ full-time jobs in Ellesmere Port
  - 2 new appointments made directly as a result of project
  - In addition, one full time and one part time member of LCM staff now fully-funded by project
- Commercial exploitation of project could result in new metal making and alloy business creating 40+ new jobs
- All activities carried out under strict adherence to LCM's ISO14001 Environmental Management System
  - Committed to monitoring, controlling and reducing all emissions
- LCM's excellent Health & Safety culture extended to cover all aspects of SecREETS project



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LCM

## 7. Engaging with the local community

After the end of the presentation, participants were invited to give feedback on SecREETS, ask for clarification or raise any concern or opportunities.

### **Comments from the audience**

- *Are there any relationship with other industries in the UK? The local company CF Fertilisers could be an opportunity.*



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- *Some members of the audience did not fully understand the LCM process, especially the functioning of Hydrogen furnace – maybe SecREETS should find a way to explain this with easier words to the local community.*
- *Health & Safety – what are the steps needed with these new processes? What environmental impact assessment? Does it include supply in transports? Have there been planning applications, particularly for materials?*
- *Is the project adding to the local traffic? Are we getting notification locally?*
- *Are LCM’s manufacturing processes having an impact on the everyday life of the local community (in terms of environmental risk for instance)?*
- *Emergency plans – are the plans tested?*
- *Is it necessary to or has it been planned to have a limit on road planning?*
- *Ellesmere Port is a town that strongly relates to the industries, there are programmes of education with local schools (STEM) – is there a plan to engage with those kids? Potential future job opportunities? It is already happening at URENCO (local industry)*
- *Some of these processes are on the GCSEs – will schools be kept in the loop? Helsby high school would benefit from this.*

Participants were then put into groups of four to discuss the best ways of engaging the local community in the future. They were then required to fill in suggestion forms. They had to answer the following questions:

**1- Can you think of any SecREETS activities we can undertake with the local community?**

*Answers from participants:*

- All local comprehensive schools
- GCSE/A-levels – STEM engagement
- Cheshire Federation of Women’s Institute to be kept informed as they would be keen to make a visit or have a speaker
- Knutsford Science Bar is always looking for speakers relevant to modern science
- Would like to see a report on the first cell built in terms of noise levels, heat generation, emissions, waste products...
- Who have you tried to engage with so far?
- What is your coms & engagement plan?
- The local college is great.
- Social media
- What do you hope to achieve through consultation?
- Cheshire college – apprenticeship programme
- Mersey STEM – national organisation promoting STEM
- STEM organisation
- Science festival
- Energy Innovation district - engagement

**2- How would you prefer us to communicate to you evolutions of the SecREETs project?**

*Answers from the participants:*

- Newsletter (mentioned three times)
- Newsletter with links to website with regular progress reports. Take the social media model of the Mersey Crossing people
- May we have a timeline? When do you expect to be parching?
- Social media
- Email bulletin etc
- Internet blog would be interesting
- Email

**3- Who else in Ellesmere Port do you think we should contact and/or involve?**

*Answers from the participants:*

- Farming community would probably be interested in separation/conversion of fertilisers
- Please invite local Women’s Institutes groups for a look around the plan and a talk if possible.
- Tell the social media groups of electric car owners: to counter-balance the poor reputation of rare earth production
- Energy innovation district
- Cheshire & Warrington LEP
- Cheshire West & Chester Council – Environmental Health/Planning
- Potential for participation in future climate change agreements – current scheme runs to 2023
- Ellesmere Port Development Board
- Thornton Science Park



Figure 4 - Picture by Adrian Waine - Photography for Industry

## 8. Evaluations

Participants were handed evaluation forms to fill in at the end of the meeting. These evaluation are designed to help the SecREETS team get feedback on their public engagement policy and the Citizen Lab more specifically, in order to improve future engagement activities. The participants were asked to answer the following questions:

### 1. How do you rate the Citizen Lab in general?

<i>Please mark:</i>	Very good	Good	OK	Bad	Very bad	No opinion
<i>Number of answers</i>	3	4	0	0	0	0

*Comments*

- Very interesting concept (good)

### 2. Did this lab help you understand challenges related to Rare Earth Elements?

<i>Please mark:</i>	Very much	Much	Somewhat	Little	Very little	No opinion
<i>Number of answers</i>	3	2	1	0	0	0

*Comments*

- Highlighted the lack of European presence in Rare Earth market (very much)

### 3. Did this lab help you understand what the SecREETS project implies for the local area?

<i>Please mark:</i>	Very much	Much	Somewhat	Little	Very little	No opinion
<i>Number of answers</i>	2	4	0	0	0	0

*Comments -*

- All very interesting and well presented (very much)

**4. Were you satisfied with the offer and quality of the food?**

<i>Please mark:</i>	Very much	Much	Somewhat	Little	Very little	No opinion
<i>Number of answers</i>	0	2	0	0	0	0

**5. Would you sign up again for a similar event?**

<i>Please mark:</i>	Yes	Maybe	No
<i>Number of answers</i>	2	1	0