

CETEM's Strategic Plan 2017-2021  
and Areas for Cooperation

## EU-Latin America Dialogue on Raw Materials: consolidating the co-operation

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*Fernando A F Lins*  
**Director**

MINISTÉRIO DA  
CIÊNCIA, TECNOLOGIA,  
INOVAÇÕES E COMUNICAÇÕES



**CETEM**  
CENTRO DE TECNOLOGIA MINERAL



# SUMMARY



- **CETEM (39 years)**
- **CETEM'S STRATEGIC PLAN 2017-2021**
- **AREAS FOR COOPERATION WITH EU**

Conception 1973  
Ministry of Mines and Energy (MME)

**CETEM 1978**

CPRM/DNPM: Special Project for Construction of CETEM



1989: MME >>> MCTIC



**CETEM 2017**



A large light gray circle on a dark blue background contains a map of Brazil. The CETEM logo is placed over the southern part of the map, and a photograph of the CETEM building is placed over the eastern part. The text 'Rio de Janeiro' is written in red below the building photo.

**CETEM**  
CENTRO DE TECNOLOGIA MINERAL

Rio de Janeiro

The only public research  
institute in Brazil with focus on  
Mineral Technology





**HEADQUARTERS: RIO DE JANEIRO –CIDADE UNIVERSITÁRIA**  
**60.000 M<sup>2</sup> (21.000 M<sup>2</sup> BUILT AREA)**  
**4 PILOT PLANTS, 18 LABORATORIES, SPECIALIZED LIBRARY**  
**340 STAFF**  
**(70 RESEARCHERS, 40 TECHNICIANS)**

# Activities of R,D&I and Services

- . Technological characterization of ores, gems and materials

- . Mineral Processing

- . Dimension Stones

- .SMEs in Mineral Clusters

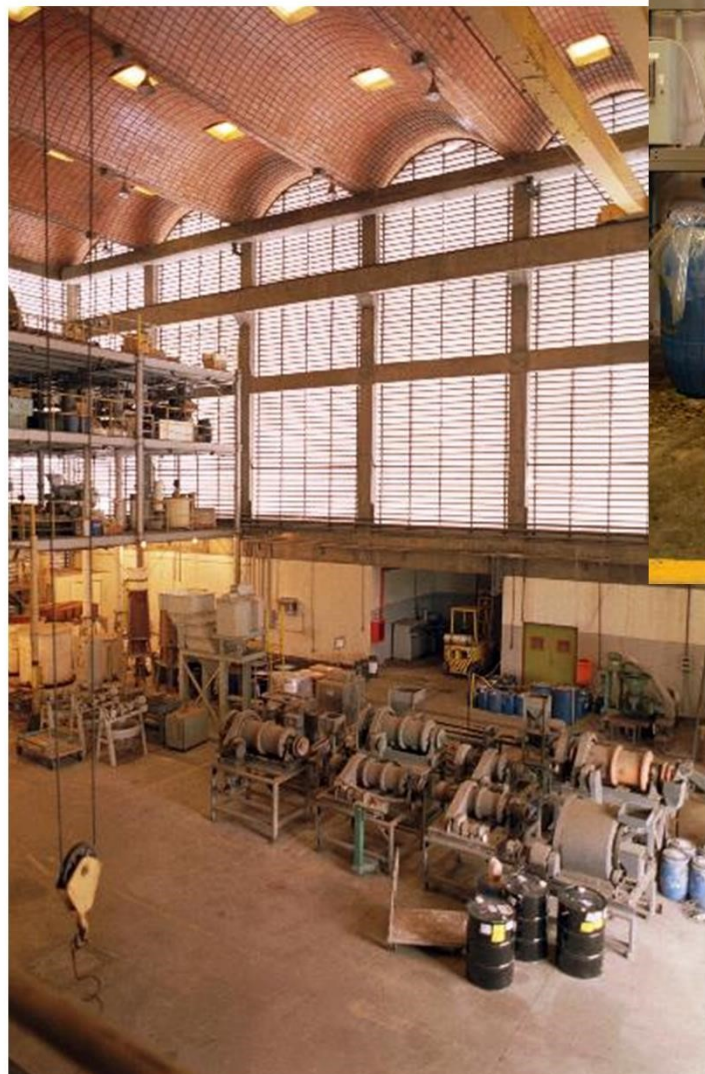
- . Metallurgical Processing

- . Environmental Technology

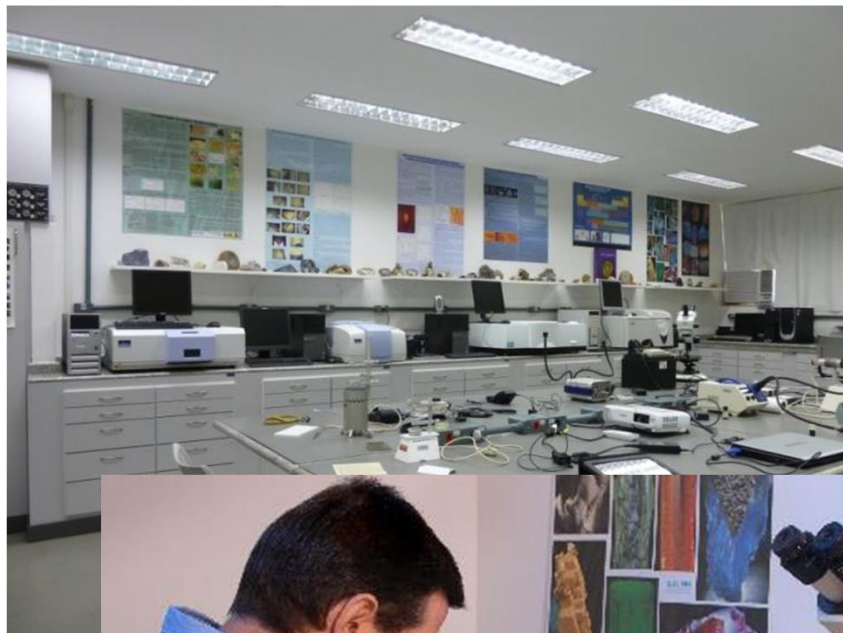
- . Sustainability Studies

- . Production of certified reference materials















Inauguration in 2014

Dimension Stone Characterization

Mineral Processing Technology

Technical Services

Industrial Applications for Residues



40 personnel  
1500 m2

First Regional Subsidiary of CETEM [ES State]



Specializing in  
Dimension Stones  
[main cluster of production  
and export of the country]

Export of US\$ 1.3 Bi

# CETEM's STRATEGIC PLAN 2017-2021

It counted on the direct participation of more than **50 employees of CETEM**, through individual interviews, application of questionnaires and more than **30 workshops** that yielded around **200 hours of discussion** and decision making.

Also contributing to the preparation of the Plan **were 20 representatives of the Center's stakeholders**, among them industry experts, advisers and ex-advisers of CETEM and **representatives from Government and Private Companies**.

**National Strategy of Science, Technology and Innovation 2016-2022 (MCTIC)**  
**National Plan of Mining 2030 (MME)**





## CETEM's STRATEGIC PLAN 2017-2021



**MISSION:** *"To develop innovative and sustainable technologies and mobilize skills to overcome national challenges of the mineral sector"*

**VISION 2021:** *"Being the center of excellence in RD&I in mineral technology, recognized for its strategic contribution to the Country"*

## CETEM's Strategic Plan 2017 -2021

FINAL OBJECTIVES

### CONTRIBUTE TO OVERCOMING THE NATIONAL CHALLENGES OF THE MINERAL SECTOR

#### WATER, WASTE AND ENERGY

**Develop technologies** and disseminate relevant knowledge for the Mineral Sector

#### AGROMINERALS

Contribute to the formulation of **Public Policies** for the sustainable development of the Mineral Sector

#### DIMENSION STONES

Contribute to increase the **competitiveness of Brazilian companies** in the mineral sector through technology transfer

#### RARE EARTHS

Diagnose and propose solutions to prevent and **mitigate the environmental impacts** associated with productive activities

# PROGRAM: Water, Waste and Energy

## Thematic:

1

**Characterization and evaluation of impacts: diagnosis and evaluation of mitigating measures and technologies**

2

**Treatment of effluents and waste**

## Projects

Characterization of emissions, effluents and waste

Environmental impact analyses

Diagnostics of polluted areas and potential polluters

Evaluation of mitigating measures

Reprocessing of tailings from coal mining

Bioremediation of multicontaminated soil with petroleum and metals

Studies of adsorbents of metals in effluents (Palygorskita et al.)

Production of paste tailings

Biological treatment of effluents



# PROGRAM: Water, Waste and Energy

Thematic:

3

**Efficient use of water  
(reduction of consumption  
and use)**

Projects

Technologies for tailings  
dewatering (reduction of  
consumption and  
improvement of water quality  
for recirculation)

4

**Reduction of energy  
consumption**

Study of energy efficiency  
in cominnution

# PROGRAM: Water, Energy and Waste

## Thematic:

5

**Use of waste and tailings  
(reprocessing)**

## Projects

Use of dimension stone  
waste in construction and  
infrastructure

Metal recovery of urban  
and industrial waste

Use of rock and industrial  
mineral waste in polymers

Concentration of iron ore  
from slimes

Concentration of  
pyrochlore from apatite  
flotation tailings

Gold solubilization study  
using thiosulphate  
produced by  
biotechnological route

Influence of different  
mineral processing  
techniques on the bio-  
extraction of metals

Use of kaolin tailings mica  
for the production of fabrics

# PROGRAM: Agrominerals

## Thematic:

1

**RD&I in new mineral sources  
and development of new  
routes to obtain phosphorus  
and potassium**

2

**Technological  
improvements of  
conventional routes for  
potash production**



## Projects

Development of new  
processing routes  
(chemical and biological)

Production of certified  
reference material

Development of processing  
routes for producing KCl in  
the presence of carnalite



# PROGRAM: Agrominerals

## Thematic:

3

**Technological improvements of conventional routes of phosphorus production**

4

**Support for the development of new fertilizers**

## Projects

Evaluation of processing routes for new deposits

Development of processing routes for minerals containing dolomite

Assessment of the potential use of new inputs for the production of slow release fertilizers and remineralizers

Implementation of granulated fertilizer production processes

# PROGRAM: Dimension Stones

Thematic:

1

**Technological  
Characterization**

2

**Alteration and  
Conservation of Heritage**

Projects

Standardization of tests

Development of methods /  
equipment and reference  
materials

Mobilize human resources  
and develop partnerships

Define experimental  
procedures needed to  
support restoration work in  
partnership with IPHAN-RJ

Dissemination of  
knowledge

## PROGRAM: Dimension Stones

Thematic:

3

Mining

4

Processing

Projects

Optimization of mining

Environmental monitoring

Life cycle assessment

Development of new  
products

Innovation in processes  
and equipment



# PROGRAM: Rare Earths

Thematic:

1

**Chemical analysis**

2

**Technological  
characterization**

Projects

Mastery of classical  
analytical techniques for  
REE

Development of novel  
analytical techniques for  
REE

Technological  
characterization for  
samples of ores containing  
REE

# PROGRAM: Rare Earths

Thematic:

3

Mineral Processing

4

Hydrometallurgy

Projects

Tests of ore comminution and characterization of the product(s).

Concentration tests of the product(s).

Confirmation of traditional REE leaching routes

Leaching routes for new REE ores

Innovative Routes for Comminution and Concentration of REE Ores

Study of U and Th separation from leach liquors of RRE or new products

Confirmation of traditional routes of separation of REE

Development of innovative routes of separation of REE

# PROGRAM: Rare Earths

## Thematic:

5

**Aspects of Sustainability**

6

**Molecular Modelling**

## Projects

Development of Life Cycle Assessment methodology in the productive chain of REE

Application of Life Cycle Assessment in the REE magnets productive chain

Study of extractants for REE by Molecular Modeling

Development of new extractants

Dynamic Modeling and Circular Economy of the Brazilian REE market

## PROGRAM: Rare Earths

Thematic:

7

**Ecotoxicity**

Projects

Evaluation of the effects of physical-chemical parameters t on the bioavailability of REE in aquatic and terrestrial organisms.

Evaluation of the effects of REE solutions, acids and extractants on aquatic and terrestrial organisms



## INTERNATIONAL COOPERATION WITH EU

- **USEFUL WASTE** : Extraction of value from solid mine waste
  - **BIO REART** : Recovery of rare earth elements from spent fluorescent lamps
  - **ZERO WASTE** : Recovery of valuable materials from tailings
  - **CIRCULAR ROCK** : Use of rock from processing wastes
  - **NO GAP** : Circular economy in the construction of buildings
- **NIOBIUM CIRCULAR ECONOMY**
  - **REGINA** : RE Global Industry and New Applications



## Horizon 2020 [Call H2020 –SC5\_14\_2017] [to be supported by Europe Union]

### **USEFULLWASTE: Extraction of value from solid mining waste and production of an environmentally inert final material for alternative end-use applications**

The main objective of this project is to demonstrate and scale-up a cost-effective, continuous and differential mineral beneficiation process by integrating updated technologies such as sorting, biotechnology, flotation cells, modelling, monitoring and process control for extraction of market products (minerals and metals) from mining solid waste.

*Project Coordinator: Dr* **Maria Sanches Gonzalez**      Oulu Mining School -University of Oulu - FINLAND

#### *Partners:*

Centre for Mineral Technology (CETEM) – Dr Marisa Monte

Norwegian University of Science and Technology - NTNU

Luleå University of Technology LTU

Kinross Paracatu (Brazil)

Krukunga Mining

Keliber Mining

Universidad Técnica Federico Santa María - UTFSM (Ecuador)



**ERA MIN 2 [Deadline May 5<sup>th</sup> 2017] [to be supported in Brazil by FINEP]**

**BIORAREARTH: Recovery of rare earth elements from spent fluorescent lamps using biohydrometallurgical process**

The objective of this project is to design an original recycling chain of REE from spent fluorescent lamps by suitable combination of biohydrometallurgical methods comprising the use of microorganisms in bioleaching and biosorption process.

**Project Coordinator: Dr Ellen C. Giese - Centro de Tecnologia Mineral (CETEM) (Brazil)**

*Partners:*

**Universidade Estadual de Londrina (UEL) (Brazil)**

University of Genova (UG) (Italy)

Universidade do Minho (UM) (Portugal)

Universidad de Sevilla (US) (Spain)

**AGQ Mining & Bioenergy S.L. - Large Enterprise (Spain)**



## **ERA MIN 2 [Deadline May 5<sup>th</sup> 2017] [to be supported in Brazil by FINEP]**

### **ZEROWASTE: Zero waste approach to recovery of valuable materials from mining and processing tailings**

Create the ZERO WASTE circular economy methodological approach for mining wastes and, at the same time, develop new secondary raw material based construction products, validate this approach on six selected case studies with different type of mining/extraction and processing waste: from natural stone and aggregate extraction and production (North Sweden, Brazil), from polymetallic deposits mining (Slovenia, Chile, South Africa) and from processing industries, such as different slags (Slovenia).

#### *Project Coordinator:*

**Robert Šajn** - Slovenian Geological Survey

#### *Partners:*

Centre for Mineral Technology (Brazil) - Eng. Nuria Castro

Slovenian National Building and Civil Engineering (Slovenia)

Centro de Estudios Mineros (Chile)

RISE CBI Betonginstitutet AB (Sweden)

Council for Scientific and Industrial Research Natural Resources and Environment (South Africa)

University of Padova (Italy)





## ERA MIN 2 [*Deadline May 5<sup>th</sup> 2017*] [*to be supported in Brazil by FINEP*]

**CIRCULAROCK: New applications for the use of rock processing wastes in the Industrial Rocks sector. Towards zero residue through efficient planning**

Use of the different types of waste from the extraction and the transformation of industrial rocks into "resources", as cheap and abundant raw material, which, also, will contribute to a sustainable and balanced development of the rural areas. It is intended to promote activities that are the keys to accelerate the development strategies of the industrial rock sector, towards new models of advanced, environmentally friendly and efficient production and, developing products of greater added value throughout its cycle of life.

*Project Coordinator:* **Dr M<sup>a</sup> Isabel Mota** - Instituto Tecnológico De Rocas Ornamentales y Materiales de Construcción – INTROMAC (Spain)

*Partners:*

**Centre for Mineral Technology (Brazil) – Eng. Nuria Castro**

Universidade de Évora (Portugal)

Nine September University (Turkey)

Associação Cluster Portugal Mineral Resources (Portugal)

Consultores integrales nova s.l (Portugal)



## **ERA MIN 2 [Deadline May 5<sup>th</sup> 2017] [to be supported in Brazil by FINEP]**

### **NOGAP: Circular economy in the building construction: improving the recycling of construction and demolition waste**

**OBJECTIVE:** The project aims to deepen the knowledge about circular economy of the Brazilian civil construction sector and to create Life Cycle data of different scenarios of CDW End of Life

#### *Project Coordinator:*

Dr. Francisco Mariano S. Lima - Centro de Tecnologia Mineral (**CETEM**) (Brazil)

#### *Partners:*

Dr. Marilena Cardu -Politécnico de Torino- (POLITO) ITALIA

Dra. Alenka Pronjic- Slovenian National Building and Civil Engineering Institute -(ZAG) SLOVENIA



DIALOGUES EU- BRAZIL 9<sup>th</sup> call *[Deadline May 31<sup>th</sup> 2017] [to be supported by Europe Union]*

## **Circular economy opportunities and threats for critical materials: the case of niobium**

### **Objective**

To study the alternative or complementary circular economy routes niobium products may follow. For selected case studies, it will be evaluated the economic and social opportunities and threats for a ten year horizon. To incorporate social risks, seen as important sources of supply disruptions, providing alternative methodologies to Critical Raw Materials evaluation, such as the social-Life Cycle Assessment.

### **Project Coordinators:**

*Dr. Carlos Cesar Peiter (CETEM)*

*Dr. Giovanni Andrea Blengini (Unit 3, Land Resources, Directorate D, JRC )*

### **Partners:**

- Advanced Manufacturing Nucleus, University of São Paulo/ S.Carlos Campus (Brazil)
- Brazilian Institute for Science and Technology Information – IBCTI/MCTIC
- Secretary for Technology Development and Innovation – SETEC/MCTIC



CLIENT II (Germany)      € 3 millions each country >>> 3 years [to be supported in Brazil by MCTIC]

### *REGINA: Rare Earth Global Industry and New Applications*

The project aims to establish a domestic resource-based production of a high performance magnets (didymium-Fe-B ) from Brazilian RE-rich tailings. Sustainable and economically competitive magnets with performances similar to the Chinese benchmark will be produced but with a smaller ecological and social impact (green magnets). The rare earth separation step will be developed at CETEM.

*General Project Coordinator (Brazil):*

Prof. Dr. Paulo A. P. Wendhausen (Federal University of Santa Catarina – Brazil))

*CETEM Project Coordinator:* Dr. Ysrael M. Vera

### *Brazilian Partners:*

- Institute for Technological Research (**IPT**)
- Federal University of Santa Catarina (**UFSC**)
- Centers of Reference in Innovative Technologies (**CERTI**)
- Brazilian Metallurgy and Mining Company (**CBMM**)
- WEG



### *German Partners:*

- Fraunhofer Project Group Materials Recycling and Resource Strategies (**IWKS**)
- Helmholtz Institute Freiberg for Resource Technology (**HIF**)
- Technical University of Darmstadt of Darmstadt (**TUD**)
- Technical University of Darmstadt of Clausthal (**TUC**)
- Technische Hochschule Georg Agricola (**THGA**)
- Institute of Process Metallurgy and Metal Recycling at RWTH Aachen University (**IME**)
- Outotec
- KME Germany GmbH & Co (**KME**)
- Helmholtz Zentrum Dresden Rossendorf (**HZDR**)
- GMB Magnete Bitterfeld GmbH (**GMB**)





**THANK YOU!**

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