



# Material recovery for circular economy

UNFC as enabler

Ulrich Kral

## VIRTUAL EVENT

International Conference on  
**Management of Naturally  
Occurring Radioactive  
Material (NORM) in Industry**

19–30 October 2020

#NORM2020



**Workshop on Phosphates for sustainable development:  
Fertilizers and phosphogypsum in the circular economy**

22 October 2020

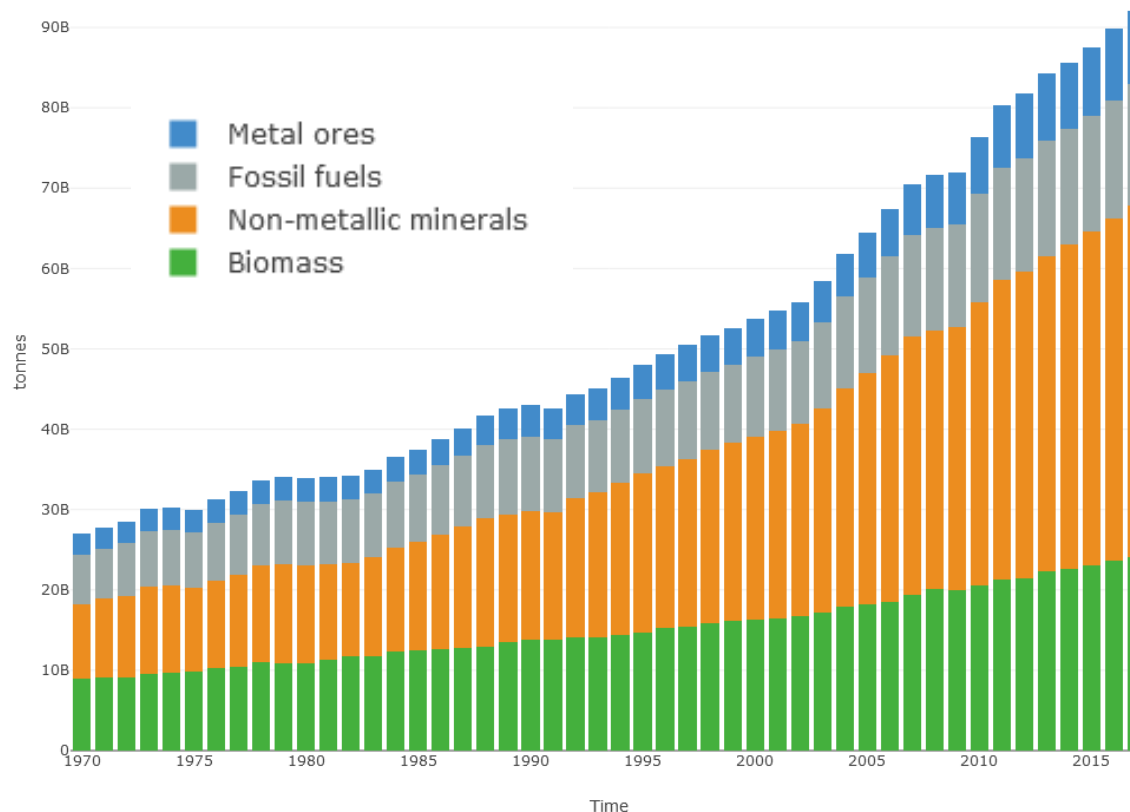
# Global extraction

Type Subtitle Here



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## Domestic extraction into use ...



WU Vienna (2020): Material flows by material group, 1970-2017. Visualisation based upon the UN IRP Global Material Flows Database. Vienna University of Economics and Business. Online available at: [materialflows.net/visualisation-centre](https://materialflows.net/visualisation-centre)

## ... and residues

### Phosphor

1 tonne Phosphoric Acid



4-6 tonnes Phosphogypsum

~ 200 Mio t/yr Phosphogypsum

IAEA (2013). Radiation Protection and Management of NORM residues in the Phosphate Industry. International Atomic Energy Agency (IAEA): Vienna. online: [https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1582\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1582_web.pdf)  
<https://www.essentialchemicalindustry.org/chemicals/phosphoric-acid.html>

# Recovery projects

convert resources into products

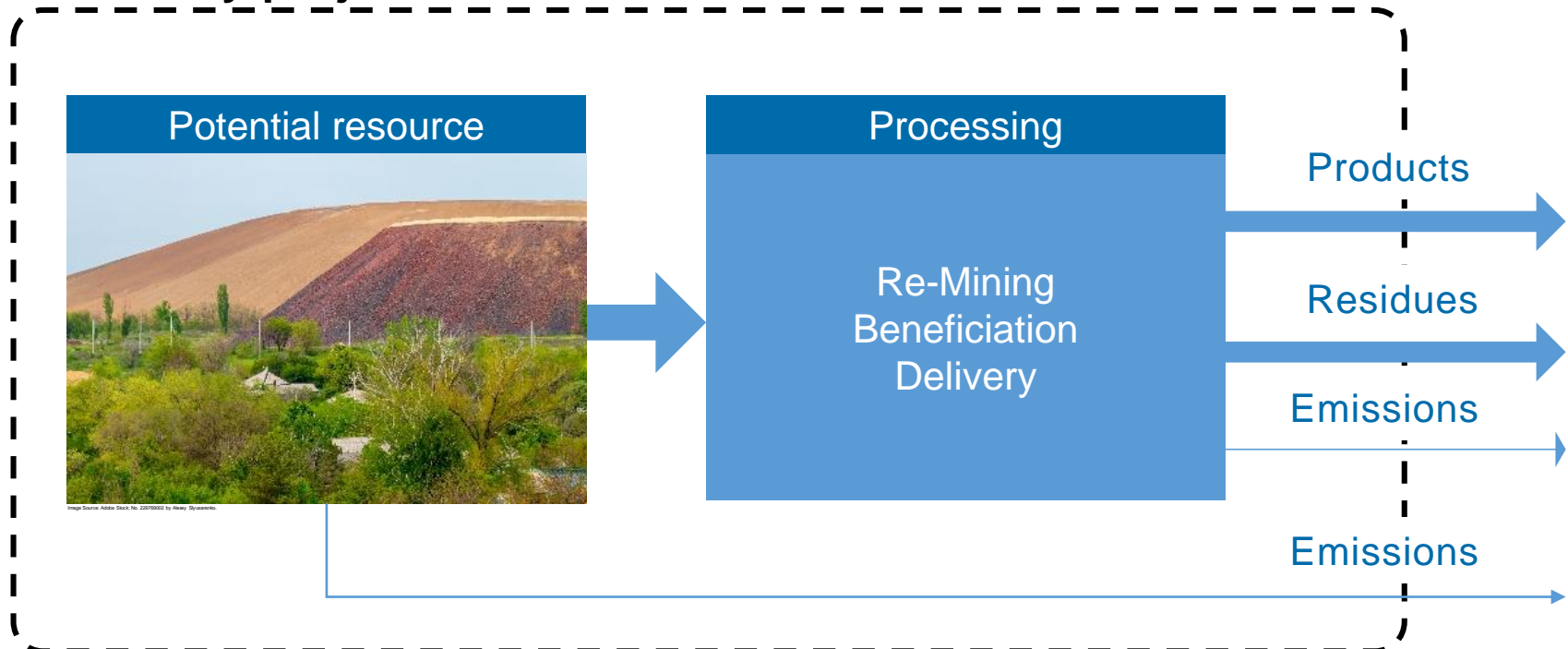


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## Boundary conditions

- Investors behavior regarding economic, social & environmental sustainability
- ...

## Recovery project



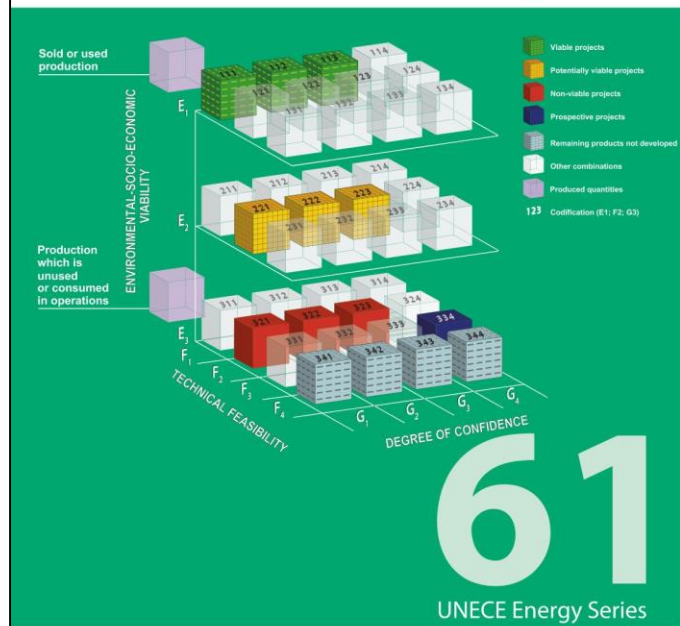
# Project viability

## communications based on UNFC

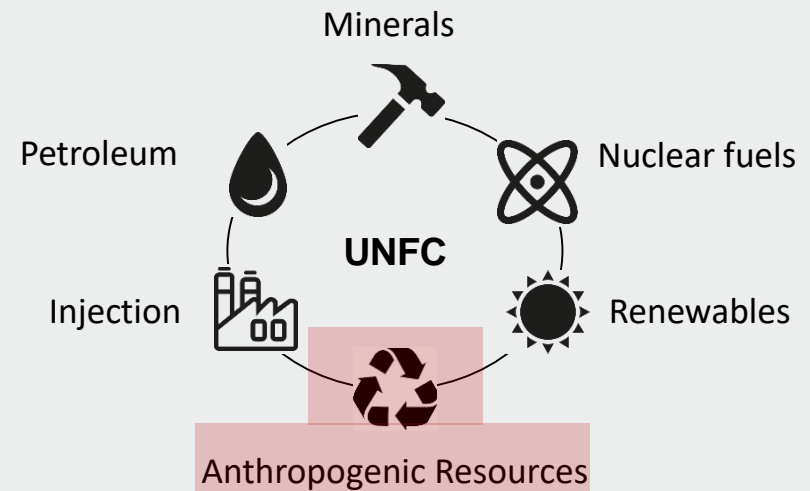


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### United Nations Framework Classification for Resources Update 2019



### Domains of application



### Examples

Residues from Waste  
Incineration



Residues in landfills



Residues from  
extractive industries



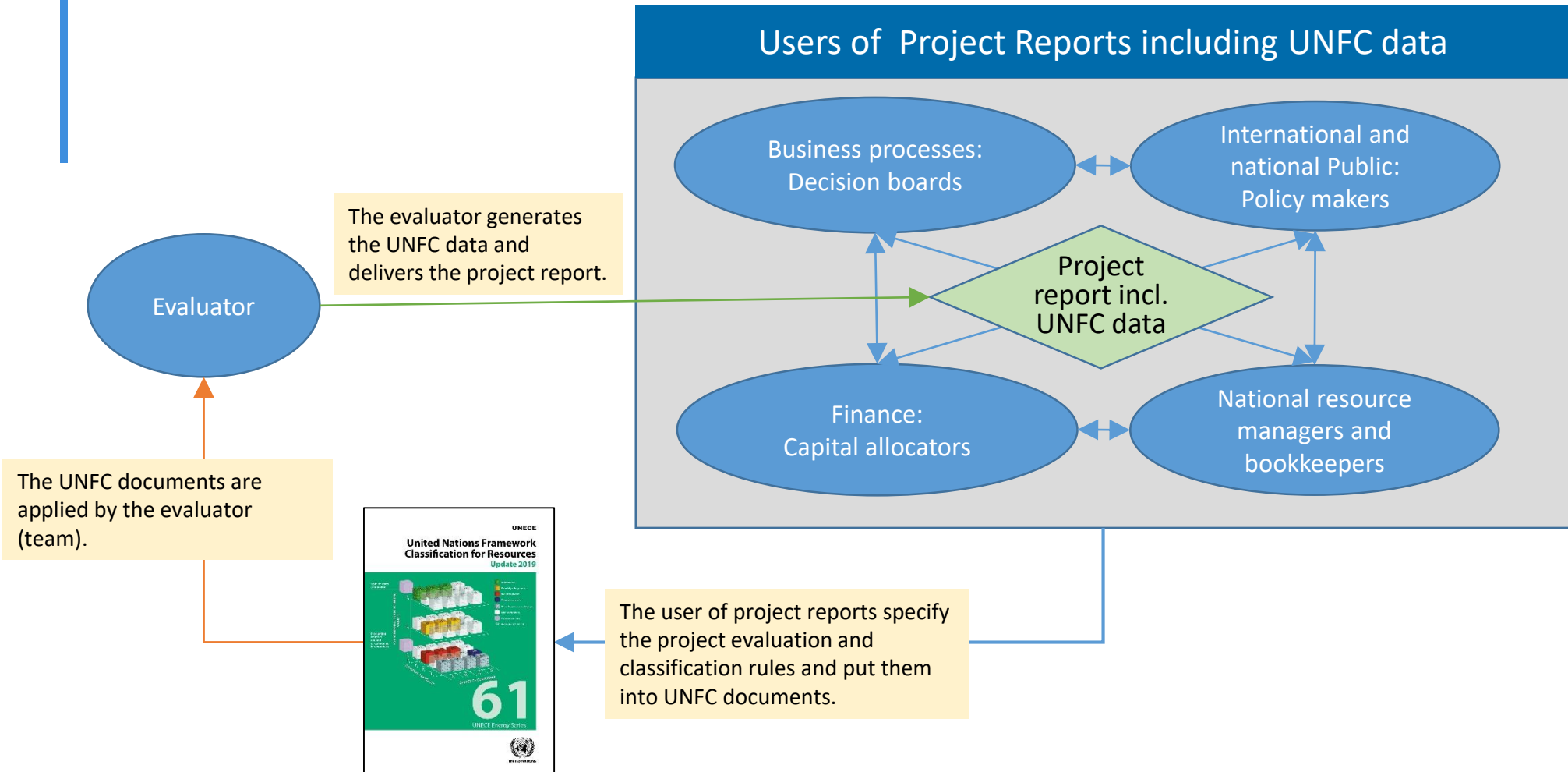
Image Source: Adobe Stock; from left to right: No. 163057800 by helmuvogler, No. 10242258 by kenzo, No. 336005879 by Penytskyj, No. 229769002 by Alexey Silyusarenko.

# UNFC role for users

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## Developing recovery projects



# Residues from Municipal Solid Waste Incineration



## Metals, Glass

# Project viability

## Turning barriers to enablers



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2003

14 years

2017

| UNFC Axis                                       | UNFC Categories | UNFC Sub-Categories | UNFC Classes        |                    |  |  |  |  |                            |                |  |  |
|---|-----------------|---------------------|---------------------|--------------------|--|--|--|--|----------------------------|----------------|--|--|
|   |                 |                     | Prospective Project | Non-Viable Project |  |  |  |  | Potentially Viable Project | Viable Project |  |  |
| <b>Degree of confidence</b>                     | G1              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |
|   | G2              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |
|   | G3              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |
| <b>Environmental socio - economic viability</b> | E1              | E1.1                |                     |                    |  |  |  |  |                            |                |  |  |
|   |                 | E1.2                |                     |                    |  |  |  |  |                            |                |  |  |
|   | E2              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |
|   | E3              | E3.1                |                     |                    |  |  |  |  |                            |                |  |  |
|   |                 | E3.2                |                     |                    |  |  |  |  |                            |                |  |  |
| <b>Technical feasibility</b>                    | F1              | F1.1                |                     |                    |  |  |  |  |                            |                |  |  |
|   |                 | F1.2                |                     |                    |  |  |  |  |                            |                |  |  |
|   | F2              | F2.1                |                     |                    |  |  |  |  |                            |                |  |  |
|   |                 | F2.2                |                     |                    |  |  |  |  |                            |                |  |  |
|   | F3              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |
|   | F4              | No Sub              |                     |                    |  |  |  |  |                            |                |  |  |

# Take-home messages



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- Material recovery projects are needed to run a circular economy.
- Project viability is communicated with UNFC.
- UNFC takes into account global policy changes and investor behaviors towards economic, social and environmental sustainability.



# Thank you

Ulrich Kral

Researcher

Chair of Anthropogenic Resource Working Group  
as mandated by UNECE EGRM

TU Wien



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