Development and deployment of UNFC – The AMREC Case Study

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AMREC Technical Working Group
Outline

1. Introduction

2. How AMREC relates to UNRMS

3. A Generalized approach to Application of AMREC

4. The Case Studies
Introduction

Overview

- A comprehensive system for sustainable management of Africa’s minerals and energy resources.
- Aligned to Africa Mining Vision (AMV), Agenda 2063 and the Sustainable Development Goals (SDGs).
- Based on United Nations Framework Classification for Resources (UNFC) Principles, Generic Specifications and Guidelines.
- Includes the Pan Africa Reporting Code (PARC).
## Key sustainability considerations in AMREC (AMV, Agenda 2063, SDGs)

<table>
<thead>
<tr>
<th>No.</th>
<th>Critical Controlling Factors</th>
<th>Key Focus</th>
<th>Examples</th>
</tr>
</thead>
</table>
| 1.  | Project milestones and decision gates             | Smooth project planning and operation across the full project life-cycle,  | Transparency in licensing  
|     |                                                   | gap analysis targeted to a specific milestone rather than attempting to  | Project feasibility study  
|     |                                                   | cover the whole life-cycle at once.                                       | Environmental & social impact  
|     |                                                   |                                                                           | assessment etc.                                                          |
| 2.  | Value addition and beneficiation                  | Assesses the full economic viability and benefit of a mineral resource     | Value addition policy  
|     |                                                   | including, downstream, up-stream and side stream linkages                | License requirement?  
|     |                                                   |                                                                           | Bottlenecks to value addition                                               |
| 3.  | Economic diversification                          | Focus on a resource sector that optimizes Africa’s finite mineral         | Diversification policy  
|     |                                                   | resource endowments incorporating high value and lower value              | Other economic activities  
|     |                                                   | resources at both commercial and small-scale levels.                     | How livelihood of people are affected                                      |
| 4.  | Comprehensive resource recovery                   | Managing resources in an integrated, multi-targeted manner than a         | Access to minerals information  
|     |                                                   | management strategy that targets a single resource.                      | Other minerals than primary                                               |
| 5.  | Zero waste concept                                | Consistent with the principles of the waste hierarchy emphasizing that     | Zero waste policy  
|     |                                                   | at the end of the mineral processing cycle, there should be zero waste    | Application of waste hierarchy?  
|     |                                                   |                                                                           | Who handles the waste                                                       |
### How AMREC relates to UNRMS

**In pursuit of integration**

#### Principle 1. State rights and responsibilities in the management of resources cuts across

<table>
<thead>
<tr>
<th>AMREC Critical Controlling Factors</th>
<th>UNRMS Fundamental Principles</th>
</tr>
</thead>
</table>
| 1. Project milestones and decision gates | Principle 2. Responsibility to Planet  
Principle 4. Social Contract on Natural Resources  
Principle 9. Health and Safety  
Principle 11. Transparency |
| 2. Value addition and beneficiation | Principle 7. Value Addition |
| 3. Economic diversification | Principle 3. Integrated Management of Resources  
Principle 5. Service Orientation  
Principle 10. Innovation  
Principle 12. Continuous Strengthening of Core competencies |
A Generalized Approach to application of AMREC

The four-stage approach

Stage 1. Resource Estimation
- Apply industry standard technique
- Respect to each resource type

Stage 2. Resource Classification
- Apply UNFC
- Need for Capacity building

Stage 3. Sustainability Test
- The critical controlling factors
- Alignment to AMV, Agenda 2063, SDGs
- Does the project pass sustainability test?
- If yes develop, if no re-classify

Stage 4. Re-Evaluation
The Case studies
Malingo Oil Project

Overview of Malingo Oil Project

- Located in Albertine Graben in Western Uganda
- Two lobs (3-way dip structure) separated by a syncline
- Main lob penetrated by three wells all encountering oil, Northern lob has no well
- OWC hypothesis at 2400 mTVD
- Recoverable volume estimated using the volumetric method and supported by analogues ($OIP = A \times h \times \Phi \times \frac{1-S_w}{F_{VF}}$)
- Has a production license but not yet producing
- Western potential lie in shallow water lake
- Predominant activity of local community is fishing

<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Recoverable Volume (MMBBL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waterflood recovery (Main lob)</td>
<td>153</td>
</tr>
<tr>
<td>2</td>
<td>Waterflood recovery (Northern lob)</td>
<td>37</td>
</tr>
<tr>
<td>3</td>
<td>Polymer Incremental (Main+Northern)</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Western prospects</td>
<td>320</td>
</tr>
</tbody>
</table>
The Case studies
Malingo Oil Project – Main Lob Example

Degree of Confidence (G-Axis)
- Sandstone reservoir in fluvial-deltaic environment
- Covered by 3D seismic
- Three (3) appraisal wells drilled, all successful
- OWC Penetrated at 2400 mTVD
- Very good reservoir properties ($\Phi > 0.25$, $K > 1000mD$)

Technical Feasibility (F-Axis)
- Waterflood feasibility study successful
- Development strategy approved by Government
- Project sanction anytime but less than 5 years

Environmental-Social-Economic Viability (E-Axis)
- Commercial & Economic viability proven
- Environmental impact assessment report under review for approval

Classification

G-Axis: G1 (Quantities associated with a known deposit that can be estimated with a high level of confidence)

F-Axis: F1.3 (Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation)

E-Axis: E1.1 (Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions)
# The Case studies

## Malingo Oil Project

### Summary of Classification

<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Volume (MMBBL)</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>UNFC Class/Sub-Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Waterflood recovery (Main lob)</td>
<td>153</td>
<td>1.1</td>
<td>1.3</td>
<td>1</td>
<td>Justified for Development</td>
</tr>
<tr>
<td>2.</td>
<td>Waterflood recovery (Northern lob)</td>
<td>37</td>
<td>2</td>
<td>2.1</td>
<td>2</td>
<td>Development Pending</td>
</tr>
<tr>
<td>3.</td>
<td>Polymer Incremental (Main+Northern)</td>
<td>25</td>
<td>2</td>
<td>2.2</td>
<td>3</td>
<td>Development on hold</td>
</tr>
<tr>
<td>4.</td>
<td>Western Prospects</td>
<td>320</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
<td>Exploration project</td>
</tr>
</tbody>
</table>

### UNFC Classes Defined by Categories and Sub-categories

<table>
<thead>
<tr>
<th>Produced</th>
<th>Sold or used production</th>
<th>Production which is unused or consumed in operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class</td>
<td>Sub-class</td>
</tr>
<tr>
<td></td>
<td>Total Products</td>
<td>Known Sources</td>
</tr>
<tr>
<td></td>
<td>Viable Projects</td>
<td>Potential Sources</td>
</tr>
<tr>
<td></td>
<td>Non-Viable Projects</td>
<td>Potential Sources</td>
</tr>
<tr>
<td></td>
<td>Remaining products not developed from identified projects</td>
<td>Remaining products not developed from prospective projects</td>
</tr>
</tbody>
</table>

- **E**: Expected Net Recovery (ENR)
- **F**: Factor of Risk (FoR)
- **G**: Grade Factor (GF)
The Case studies
Minerals Project

Projects studied
- Gold Mining in Tiira, Busia, Eastern Uganda (500,000 ounces)
- Gold Mining in Kassanda, Mubende, Central Uganda (5 million ounces)
- Tin Mining in Isingiro, Western Uganda (2.5 million tons)
- Salt Mining in Lake Katwe, Kasese, Western Uganda (12.6 metric tons)

Sustainability test
- Each project was assessed on how they conform to the critical controlling factors.
  - Project Millstone & Decision gate
  - Value addition and beneficiation
  - Economic diversification
  - Comprehensive resource recovery
  - Zero waste concept

Criteria
- Meets Expectation = greater than 70% conformity
- Average = at least 50% conformity
- Below Expectation = Less than 50% conformity
The Case studies
Minerals Project – Tin Example

Project Milestone & Decision gate (Meets Expectation)
- Project conforms and has an approved ESIA with a mine closure plan, feasibility with a long-term plan was also approved

Value Addition & Beneficiation (Below Expectation)
- Separation of tin from mined rubble is the highest notable value addition, extracted tin is exported as an unprocessed raw material, lack of tin smelting blamed on huge electricity requirement

Economic Diversification (Below Expectation)
- Remains limited, activities restricted to tin mining only although some support like pipe water is given to the community

Comprehensive Resource Recovery (Meets Expectation)
- Plausible evidence, in addition to tin, iron is also harvested during the separation process. Importantly, the non-mineralised rocks are washed and separated into aggregates of gravel and sand used in other construction works

Zero Waste (Average)
- Satisfactory, the only waste output is muddy water, which drains into the River Kagera, part of this “wastewater” is re-used for repeated phases in the ore separation process.
These results guide classification on the E and F axis of the UNFC.

<table>
<thead>
<tr>
<th>Critical Controlling Factors</th>
<th>Project A</th>
<th>Project B</th>
<th>Project C</th>
<th>Project D</th>
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</thead>
<tbody>
<tr>
<td>1. Project milestones and decision gates</td>
<td>Below expectations</td>
<td>Meets expectations</td>
<td>Average</td>
<td>Below expectations</td>
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<td>5. Zero waste concept</td>
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<td>Average</td>
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# The Case studies

Re-evaluation of projects (illustration)

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<td><strong>Is it still Development on Hold?</strong></td>
<td><strong>Is it still a Prospective Project?</strong></td>
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<td>G</td>
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Conclusion

- UNFC remains the classification system capable of universal application
- But it is no longer enough to just classify projects
- The tenets of sustainable development must be at the heart of any resource management system
- Africa has made progress but more needs to be done to achieve global aspirations.
Thank you!

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Member, AMREC Working Group

UNECE
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