A Framework to Approach Shared Use of Mining Related Infrastructure: Power

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VALE COLUMBIA CENTER
ON SUSTAINABLE INTERNATIONAL INVESTMENT
A JOINT CENTER OF COLUMBIA LAW SCHOOL AND
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

Background: Power in Africa

Power Supply in Africa

- Generation capacity of the 48 Sub-Saharan African countries (pop.800 million) ≈ Power generation capacity of Spain (pop.45 million).
- Power consumption is only a tenth of the consumption in other developing countries
- Level of power consumption is equal to each person using one 100Watt light bulb for three hours a day.

Power Demand of Mines

- Power is a critical input to mining processes
- The mining sector in Sub-Saharan Africa required 7,975MW in 2000 and 15,704MW in 2012.
- Mining demand for power could treble from the 2000 level and reach 23,192 MW by 2020.

Source: WB- VCC database

Infrastructure Financing Gap: Power

- Infrastructure funding gap in power is the biggest of all infrastructure sectors

SSA Infrastructure Funding Gap by Sector (2008):

	US$ billion per year		
	Capital expenditure	Operations and maintenance	Total spending
ICT	0.8	1.1	1.9
Irrigation	0.7	—	0.7
Power	23.2	19.4	42.6
Transport	10.7	9.6	20.3
WSS	2.7	7.3	10.0
Total	38.1	37.4	75.5

Source: 'Overhauling the Engine of Growth: Infrastructure in Africa, AICD Sept 2008

Scope of Framework

- **PURPOSE: Leveraging the mining industry's power demand and its capital investments in power infrastructure for the development of the national power system**

STEP 1: Assess the Current Situation – What is at Stake?

STEP 2: Identify Operational Synergies

STEP 3: Verify Necessary Pre-conditions

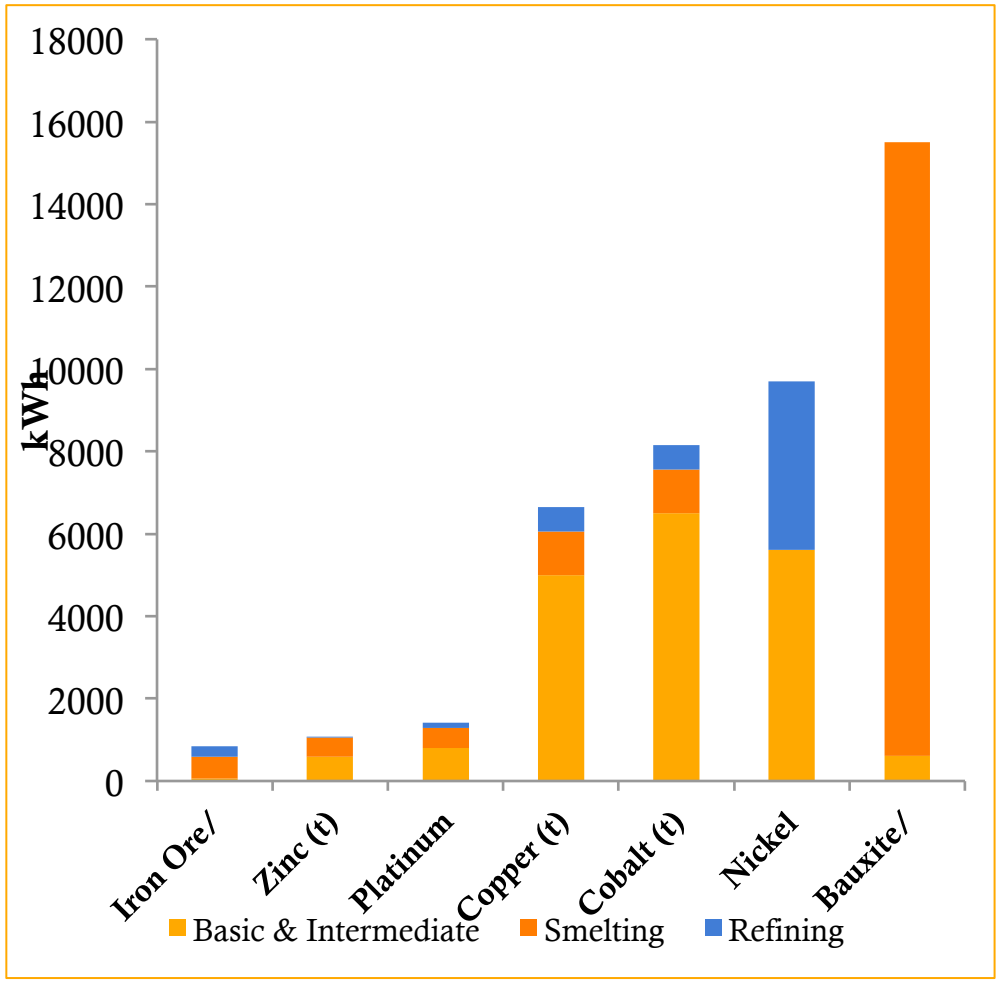
STEP 4: Negotiation Points

STEP 1: Assessing the current situation

- What determines the mine's power arrangement?

Adequacy of National Supply	• Depending on stage, commodity and type of operations, mines require a large amount of power
Reliability of Supply	• Power is crucial to mining operations - mines need reliable power access
Cost of Grid Power	• Power intensity of mining operations means that profit margins are highly sensitive to power costs
Extent of Transmission Infrastructure	• Transmission network must extend to mines or cost of extending network must be economical

STEP 1: Assessing the current situation



Source: Power of the Mine, VCC-WB report

- The power sourcing arrangement will depend on the commodity and level of processing
- Power costs will often constitute between 10% and 25% of operating costs
- The more power-intensive the operation, the more it will look for cheap power sources

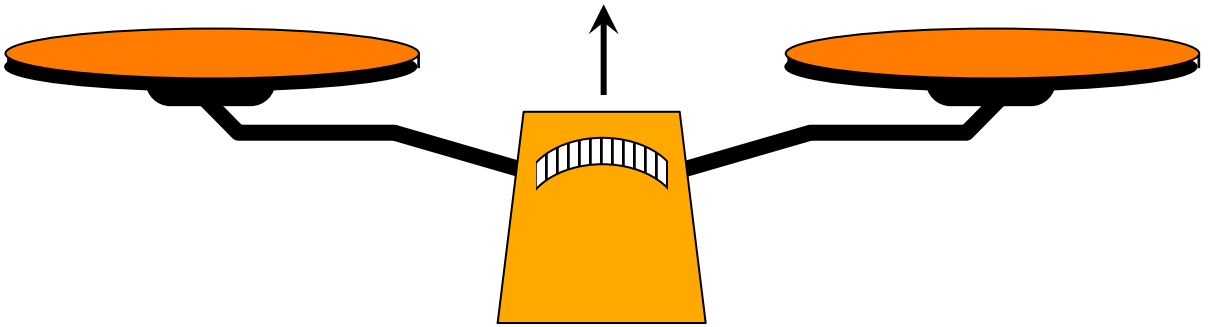
STEP 2: Identifying Power-Mine Synergies

Benefit for country:

- Develop the national power generation facilities and electricity transmission systems
- Strengthen the utility
- Increase access to electricity in remote areas.

Benefit for mine:

- Effective coordination results in cost-savings
- Maintain social licence to operate



STEP 2: Identifying Power-Mine Synergies

Power-Mine Arrangement	Example
a. Mine generates power for its own needs	Sierra Leone, Liberia
b. Mine provides power to communities	Sierra Leone, Guinea
c. Mine sells excess power to grid	Mozambique
d. Mine serves as anchor customer for Independent Power Producer (IPP)	Sierra Leone, Mauritania
e. Mine sources power from grid	Mozambique, Zambia

Mine supplies power to communities

- Where the distance to the grid is too large to warrant investment in transmission infrastructure

Off-Grid Solutions

Example: Sierra Leone

Sierra Rutile has installed solar street lights in the townships of Moriba and Mogbwemo near its mining site

RES - based Mini-Grid

Example: Guinea

Rio Tinto and Infraco initiative near the Simandou mine:

- 1 MW hydro power plant on the Cessou river
- 20 km 20kV transmission to Beyla
- Upgrade of existing distribution system

- Assists the government in meeting rural electrification goals
- Helps the mining company's social license to operate

Mine sells excess power to grid

- Where mining companies generate their own power, extra power could be sold back into the grid.

Example- Mozambique:
- Low quality thermal coal in Moatize
- High transportation costs to market
- Domestic and regional power demand

→ Commercial incentive for mines to build thermal coal power plants both for their own consumption and to sell excess power to grid

e.g. **Vale's Moatize plant:**
- Initial phase net 270MW plant capacity. Mine will consume 220MW, with the remainder to be sold to EDM, transmitted via the Northern Grid.

Source: The Guardian

Mines sell excess power to grid: Coordination

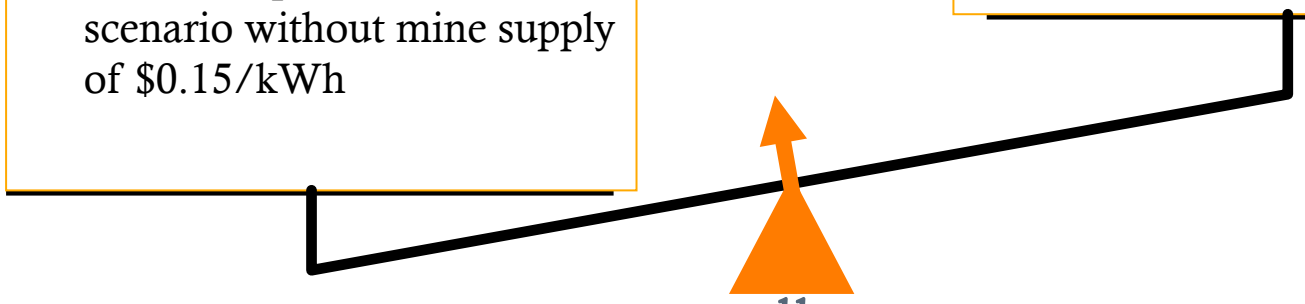
- Economies of scale in coordinating investment among mines
- World Bank analysis of Liberian power sector:

Individual Thermal Plants

- Mines generate power through coal-fired plants
- 700MW generated to serve the mines, and 160MW of excess supply to the grid
- Average cost of power for the country = **$0.12/kWh** by 2030, compared to a base scenario without mine supply of $0.15/kWh

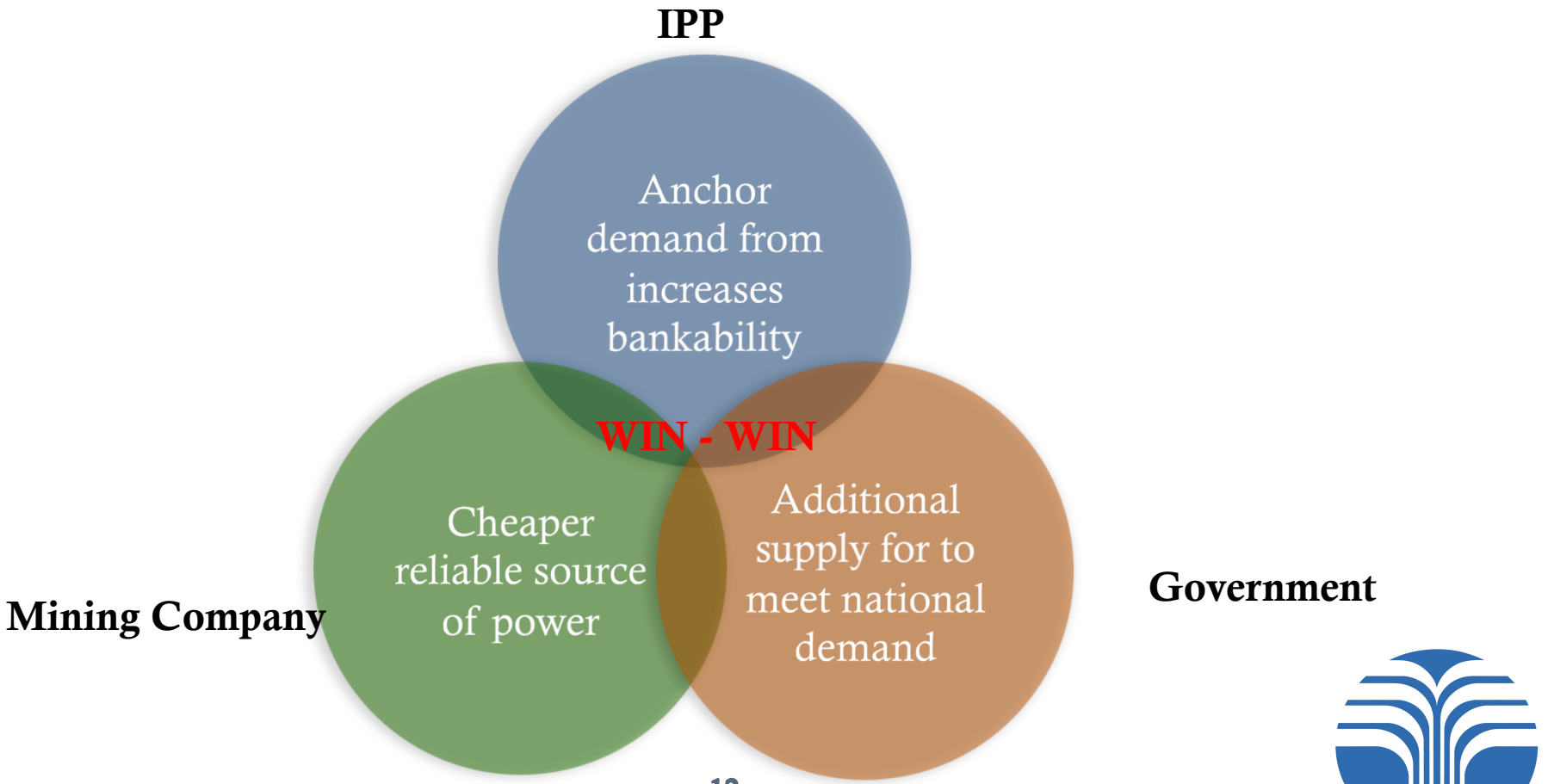
Coordinated Thermal Plant

- Average cost of power in Liberia by 2030 would fall to **$0.08/kWh.**
- Saving to Mines: $1.4 billion over a 20 year period (or US $70 million annually)
- Saving to LEC: $0.2 billion over a 20 year period (or US $10 million annually).



Mines serve as anchor for IPPs

- Given their large power needs, mines can also be used as anchor customers for IPP generation investments.



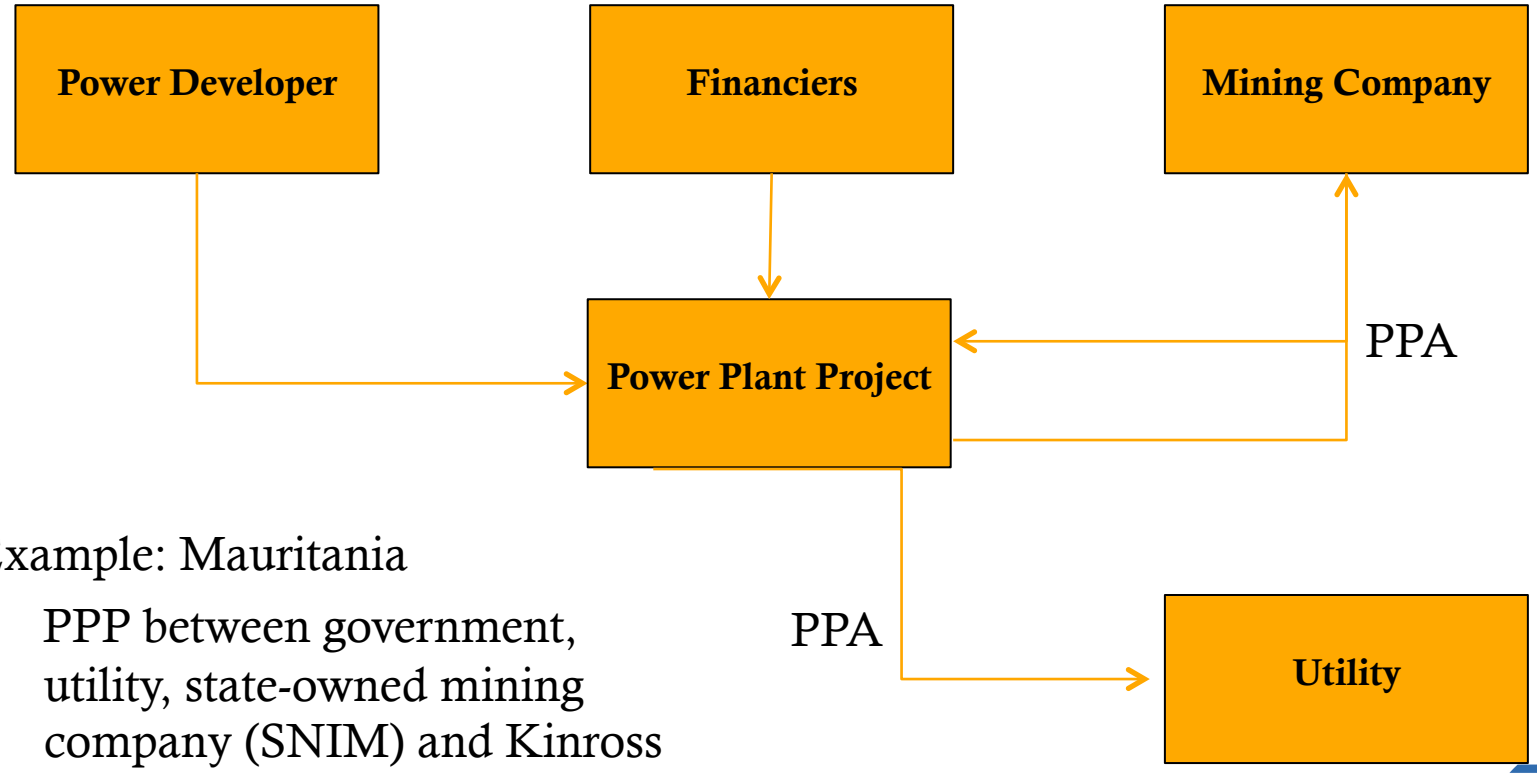
Mines serve as anchor for IPP: Sierra Leone

- Current plans for Joule Africa (IPP) to carry out expansion phase of Bumbuna Dam from 50 MW to 372MW.
- Projected cost post-transmission to be between $0.08-0.14/kWh.
- London Mining interested as a power off-taker. Current marginal cost of HFO power ($0.18/kWh)

Source: Renewbl.com (Top)
Renewable-Technology.com (Bottom)

Mines serve as anchor for IPPs

- Depending on the situation, mines may choose to play a more active role in the IPP investment as part of a joint venture.



- Example: Mauritania
  - PPP between government, utility, state-owned mining company (SNIM) and Kinross Gold Corp to develop 350MW gas power plant

Mines source power from grid

- Mine extends transmission infrastructure
- Mine contributes to additional generation capacity and gets priority access
- Mine pays higher tariff to finance utility investment

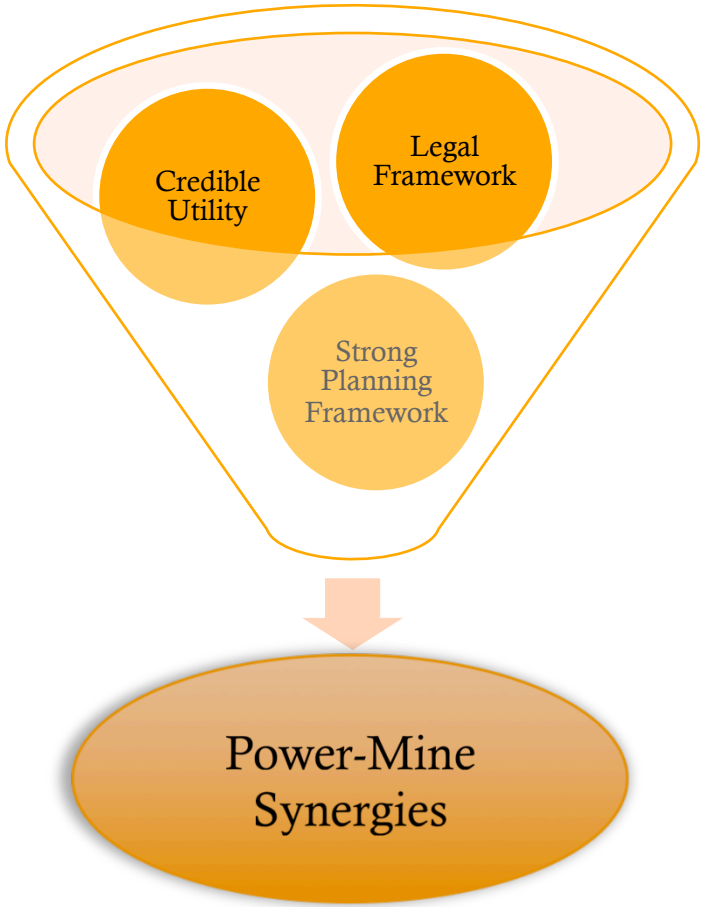
Mines source power from grid

Scenario	Description	Example
Mine extends transmission infrastructure	• Ownership of infrastructure transferred to utility, and mine is compensated through repayment by utility, in cash (often with interest) or through discounted power tariffs • *When economically feasibility, mining companies of the same mining basin should share the transmission infrastructure to improve the utility's financial health*	• Extension of **Burkina Faso's** transmission infrastructure to Semafo's Mana gold mine. • Sonabel, the national power utility company repays it over 8 years following commissioning.
Mine invests in generation infrastructure	• Mines get priority access in exchange for investment in emergency power infrastructure	• In **Ghana**, four mining companies built a 80MW thermal power plant in Tema. • Ownership transferred to public utility company VRA • Plant serves as a back-up for the mines in case of energy shortage
Mine pays higher tariff	• Mine pays higher tariff for investment to be carried out by the utility company	• In **Zambia**, Zesco (electrical supply company) has increased its industrial/ bulk supply tariffs by 30% to support new investments in generation

STEP 2 Summary: Power-Mine Synergies

Scenario	How can the power sector leverage the mining energy demand?	Benefit for the mine	Increased welfare for the host state
Grid : Too remote **Mine: Builds its own generation**	Mine supplies power to communities	Social license to operate	Rural electrification
Grid: Too expensive or unstable **Mine: Builds its own generation**	Mine sells excess power to the grid Mines build bigger collective power plant Mine serves as anchor for IPPs	Additional revenues Diminished costs of energy	Additional sources of generation Fall in cost of generation
Grid : Hydro-based (gas-based) and cheap **Mine: sources power from the grid**	Mines participate in upgrading power generation and transmission infrastructure	Stable access to cheap electricity Opportunity for additional revenues	Utility company can gain efficiency Infrastructure upgrading Avoid saturation of the grid

STEP 3: Verify the Preconditions



- Sufficiently liberalised market with trusted legal framework and regulatory oversight
- Public utility company as a credit-worthy partner
- Comprehensive planning framework that incorporates mining power demand and investment

STEP 3: Pre-conditions for Power-Mine Synergies

Power-Mine Synergy Category	Pre- Conditions	Policy Instruments
Mine supplies power to communities	Trusted and stable legal framework	• Well-drafted contractual requirement • Government and company coordination • Reorienting of social tariff subsidies to support to RES mini-grid
Mine sells excess power to the grid Mines build bigger collective power plant Mine serves as anchor for IPPs	Public Utility as a viable and credit-worthy Partner	• Strong and efficient mutually beneficial PPA and IPP framework • Efficient regulatory system adapted to the country
Mines participate in upgrading the grid (generation and transmission)	Integrating mining growth and plans into the power master plan	• Suitable commercial arrangements between the utility and the mining partner • Supply–side and demand-side management

STEP 4: Negotiating Points

Mines Supplies Communities	• Parties to be involved (government, utility, donors, NGOs)? • Responsibilities of each party? • Provisions for post-mine closure?
Mine Sells Excess Power to Grid	• Scope for coordination among mines? • Terms of the PPA between mine and utility company? • Quality of the utility? Are extra guarantees necessary? • Responsibility for transmission?
Mine Serves as Anchor for IPP	• Role of mine i.e. off-taker or joint venture partner? • Alignment of timing ? Provision for delays? • Terms of the PPA? • Quality of the utility/company? Extra guarantees necessary? • Responsibility for transmission of power?
Mine Sources Power from Grid	• Commercial arrangement for transmission infrastructure? • Ownership of transmission infrastructure? • Design for smaller users to tap into grid supply? • How to avoid saturation of the grid?

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