Exploring Possible Financial Payment Systems for Polymetallic Nodules

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Exploring Possible Financial Payment Systems: Framing the Analysis

What is the financial payment system?

The rules to determine … Amount & Timing of payments … from a contractor to the ISA to collect nodules.

Underlying philosophy of the analysis

Design a payment system that …

maximizes the return to the common heritage of mankind

while

providing **sufficient** revenue to motivate the construction and operation of a mine

Some Key ISA Decisions to Design the Financial Payment System

Basis of rate

- Should payments be based on value extracted, profits…?

Level of rate

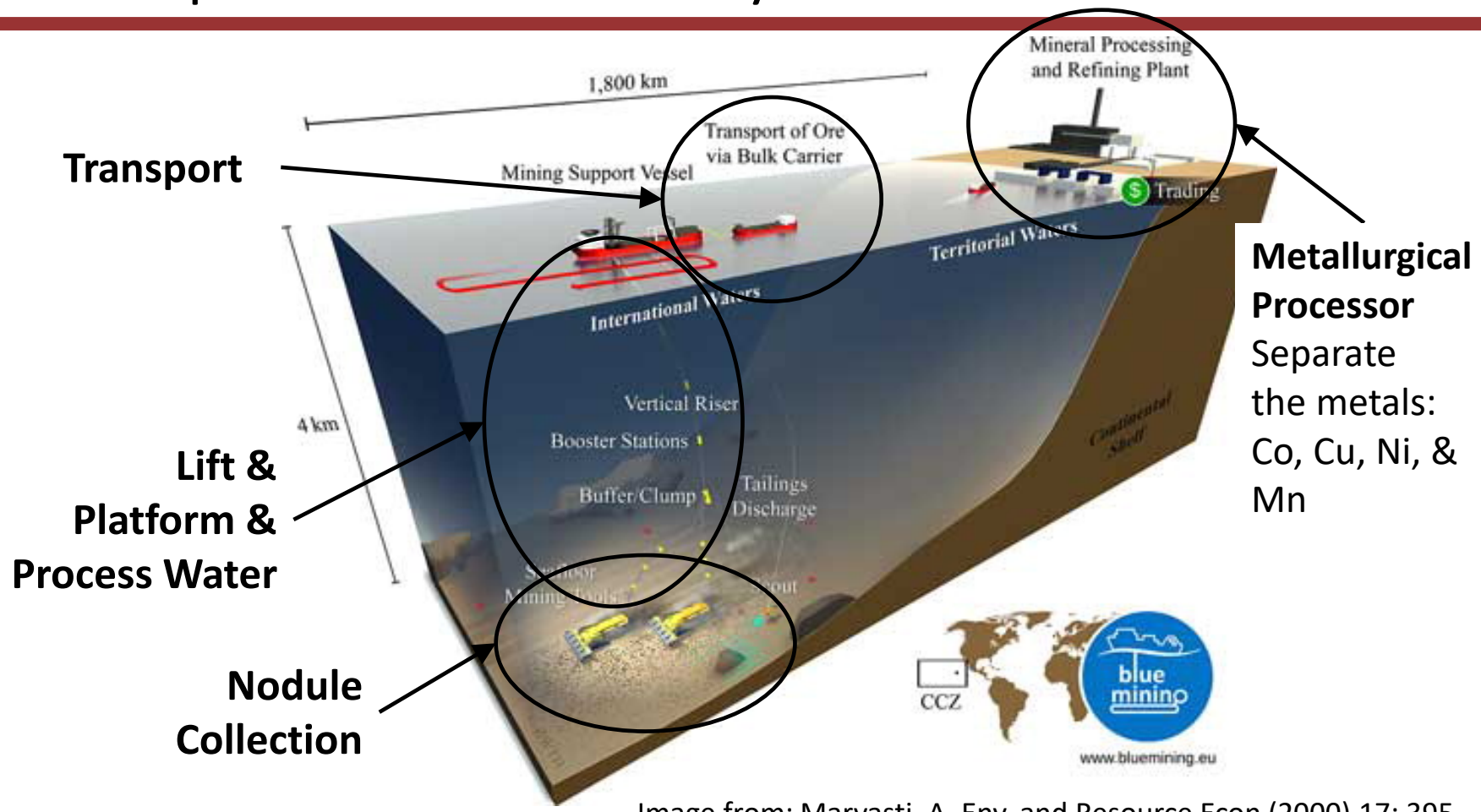
- Should the royalty rate be 2%, 5%, …?

Rate staging, timing, and trigger

- Should payments be lower at start of operations and rise later?

To Design an Effective System, We Model & Simulate Each Component of the System

- Process-based cost models of
  - Collector Operations
  - Environmental monitoring
  - Transport
  - Metallurgical processor
- Cash Flow Models
  - Costs
  - Revenues
  - Royalties
  - Taxes & fees
- Compute performance metrics
  - Present value (NPV) to ISA



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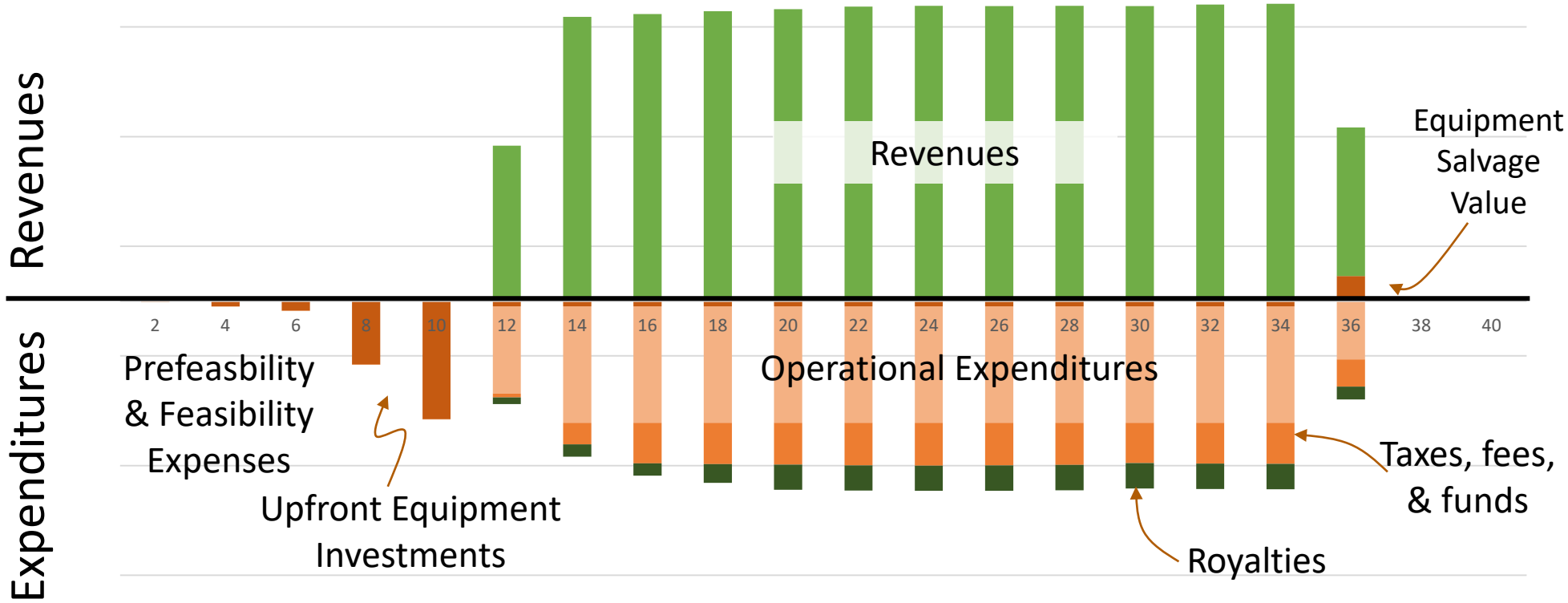
Analysis Must Consider **Size & Timing** of Cash Flows to Various Stakeholders: Collector, ISA, Sponsoring State, …



Values are representative, not intended to be exact.

To Design an Effective System, We Must Carefully Consider Scope and Framing of Analysis

Why consider the return to the contractor? *(Aren't we interested in maximizing return to the ISA)*

- What is a reasonable return to the contractor as a basis of analysis?

Why do we consider activities outside of ISA jurisdiction?

- Why model the activities of the metals processor?

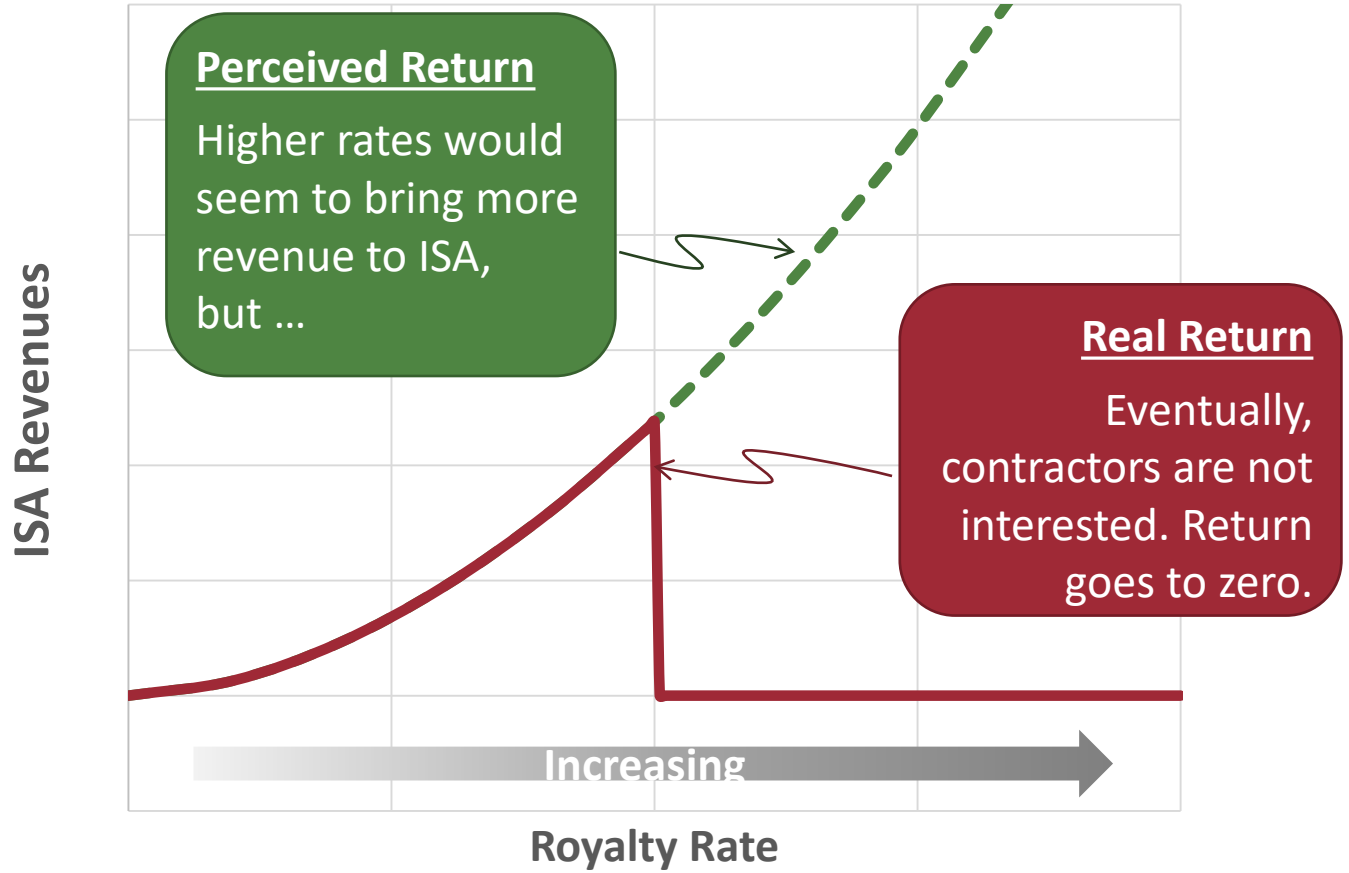
What metrics should we use to evaluate systems?

- Present value (NPV) of ISA revenues
- Contractor rate of return (IRR)
- Effective taxation rate

What is the minimum acceptable return to the ISA for the CHM?

Why Consider the Return to the Contractor?
Design problem is example of constrained optimization

- Why consider return to contractor?
  - Formally collectors will receive the money from sale of nodules
  - ISA should receive as much of these funds as possible to compensate for the transfer of ownership
- How much money should go to each?
  - Sufficient revenues need to go to collectors to incentivize risky investment

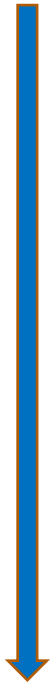


Return to Contractor

What rate of return (IRR) will be needed to attract investment?

Higher Risk

Greater Rate of Return Required



Nearly Guaranteed Investment (for example: Gov't bonds)	→	Very low returns required (0% - 3%)
Land based mining	→	Moderately high returns required due to price & geological risk (typically above 15%)
Seabed mining	→	Higher returns than land based mining Same risks, plus technological risk Never been done at scale before Banks may be unwilling to provide loans
Highly Speculative Venture Capital (Angel investments in new tech)	→	Very high returns required (sometimes well in excess of 100%)

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ISA Oversight Only Related to Collector Activities

Modelled Collector

Modelling assumes that ISA royalties are only based on activities at the collector

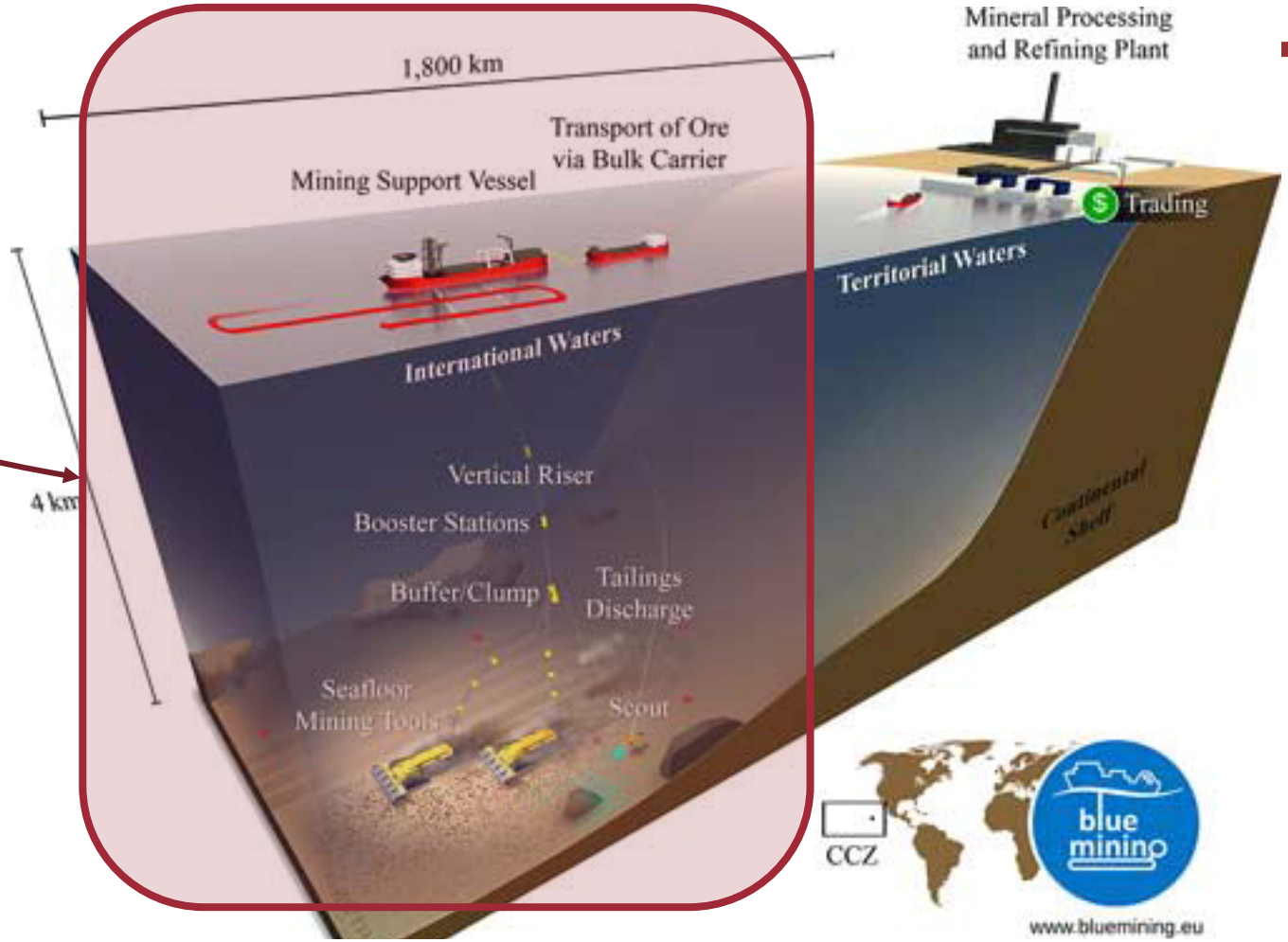
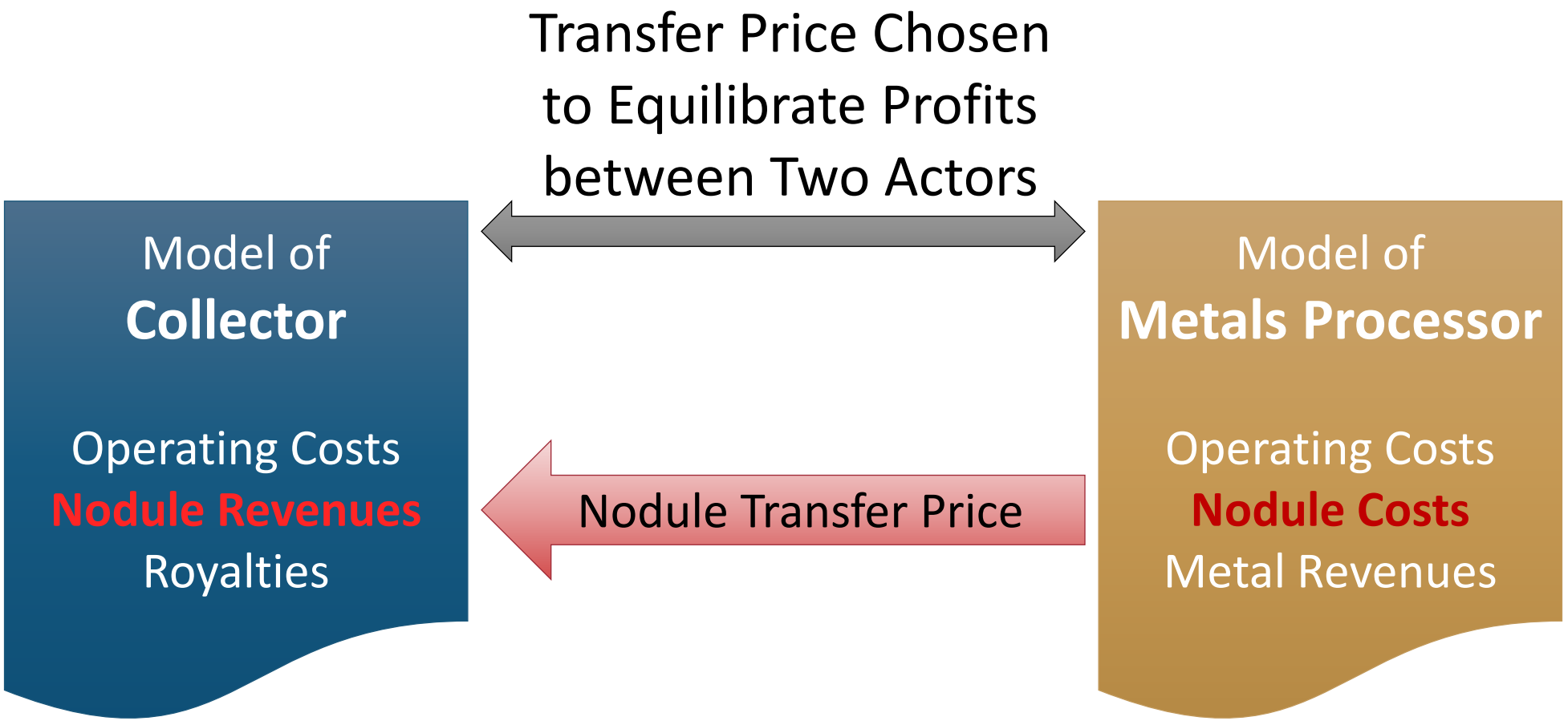


Image from: Marvasti, A. Env. and Resource Econ (2000) 17: 395. https://doi.org/10.1023/A:1026566931709

Ideally Royalties Would Be Based On Nodule Price; No Market Exists, So We Must Model It



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- Present value (NPV) of ISA revenues
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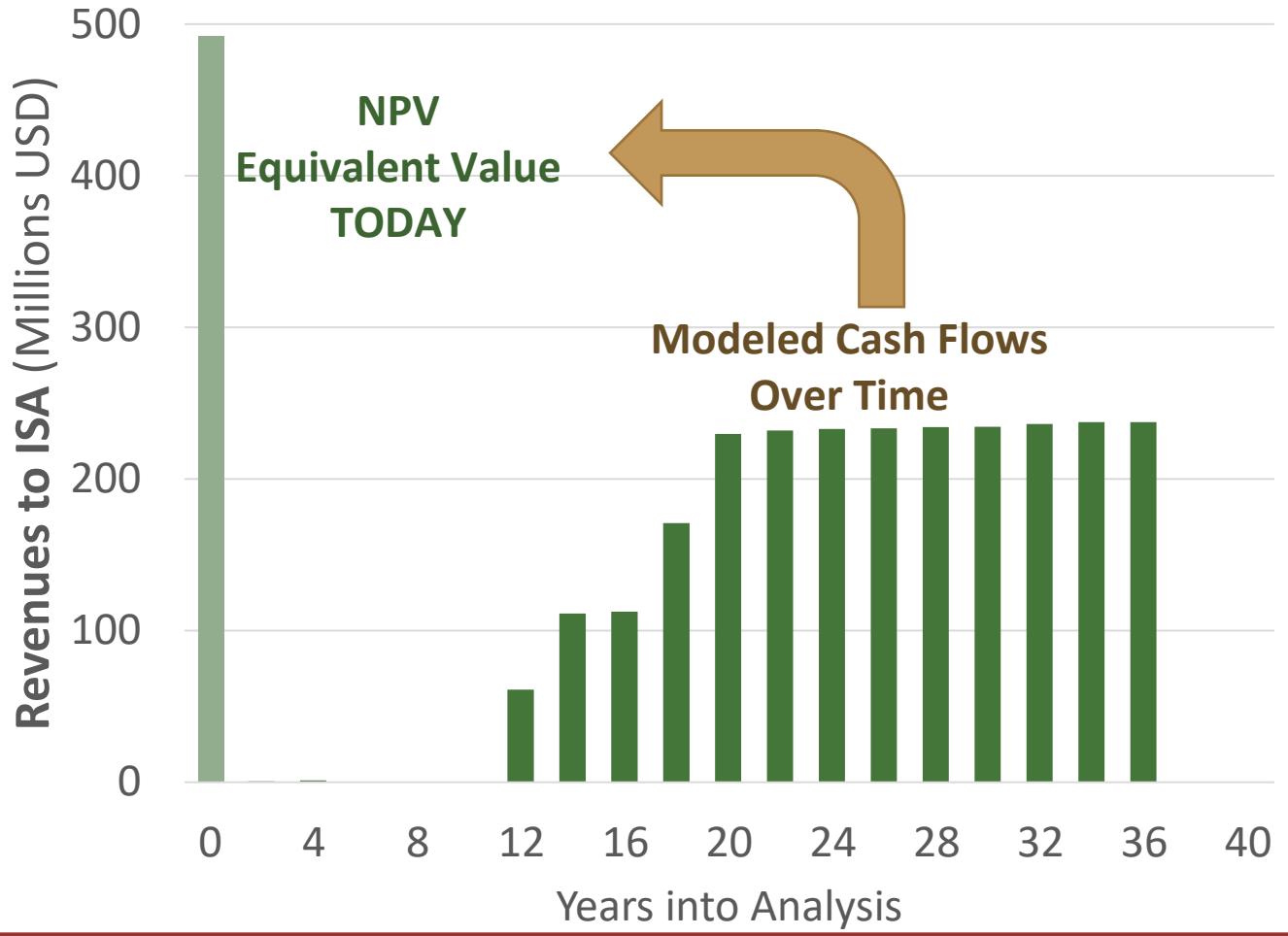
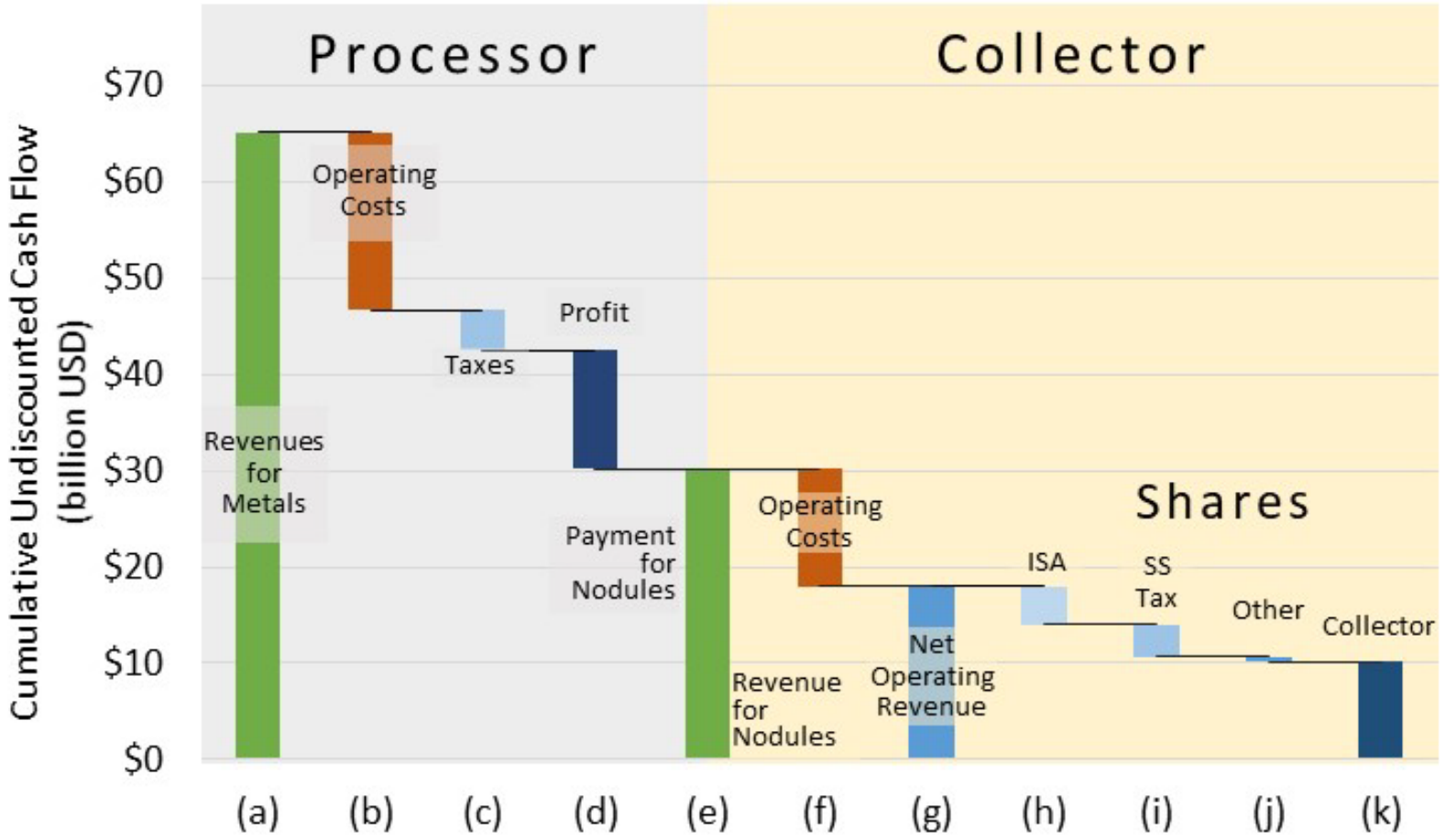
What is the minimum acceptable return to the ISA for the CHM?

Financial Payment System should be Evaluated From Several Perspectives to Explore Tradeoffs

- Cumulative gross receipts to ISA
- Present Value (NPV) to ISA
  - equivalent value TODAY of all revenues received over time
  - better captures the time value of money
  - Discounted sum of all cash flows
- Contractor Rate of Retrn (IRR)
  - Standard metric to evaluate investments
- Contractor Effective Tax Rate



NOTE: Share is Computed Based on Net Operating Revenue at the **Collector**



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Effective Tax Share

Collector Share

So, What Have We Learned?

Some Key ISA Decisions to Design the Financial Payment System

Basis of rate

- Probably value extracted (ad valorem) or ad-valorem & profits

Level of rate

- Depends on system

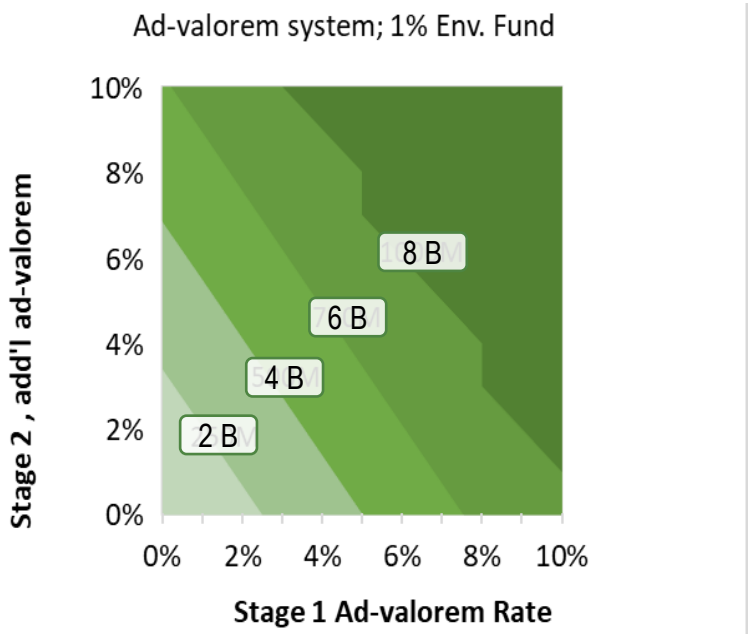
Rate staging, timing, and trigger

- Should start lower then rise – we propose after five years

There are many different systems that can generate a certain level of revenue to the ISA

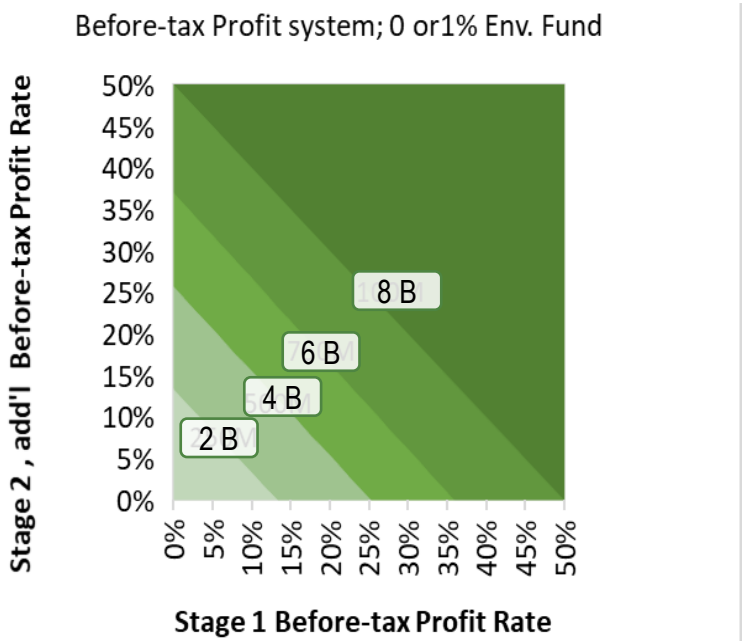
Ad-valorem Only System

Cumulative Revenue to ISA



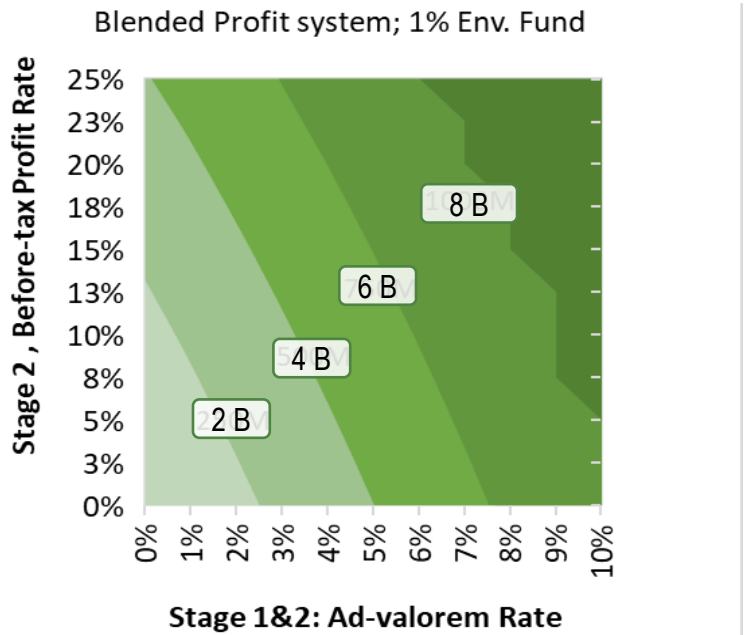
Profit-based Only System

Cumulative Revenue to ISA



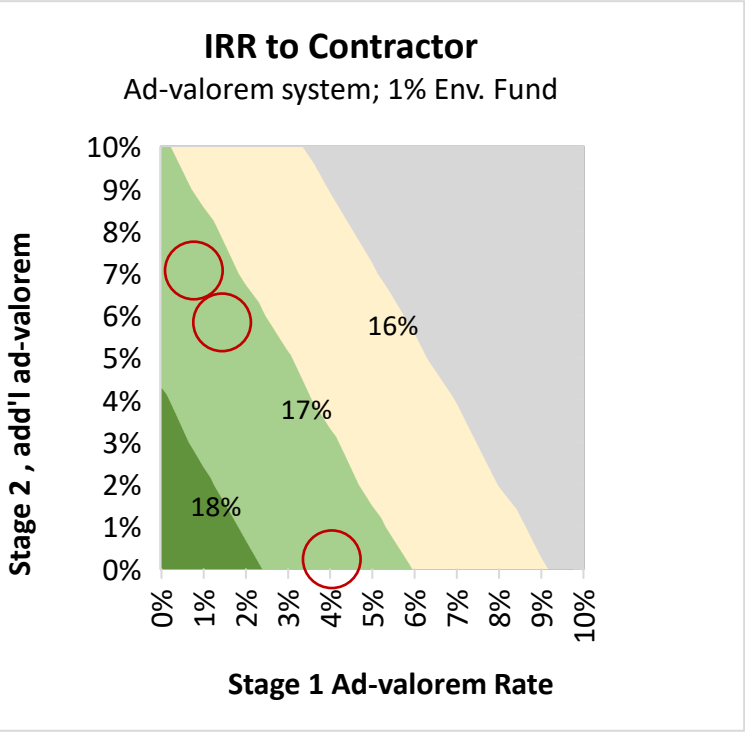
Blended System

Cumulative Revenue to ISA



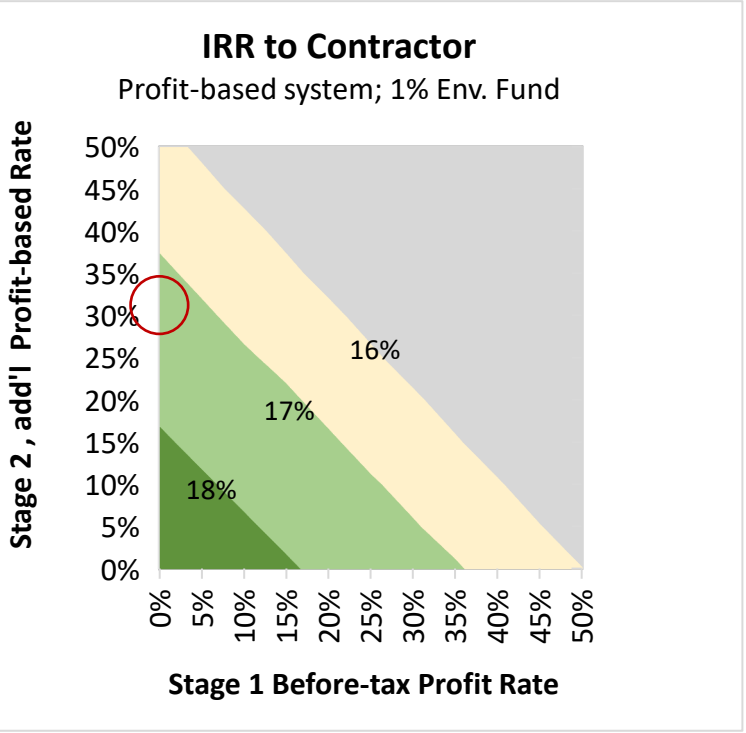
We analyzed several promising alternatives in detail: Example systems that provide 17.5% return

Ad-valorem Only System



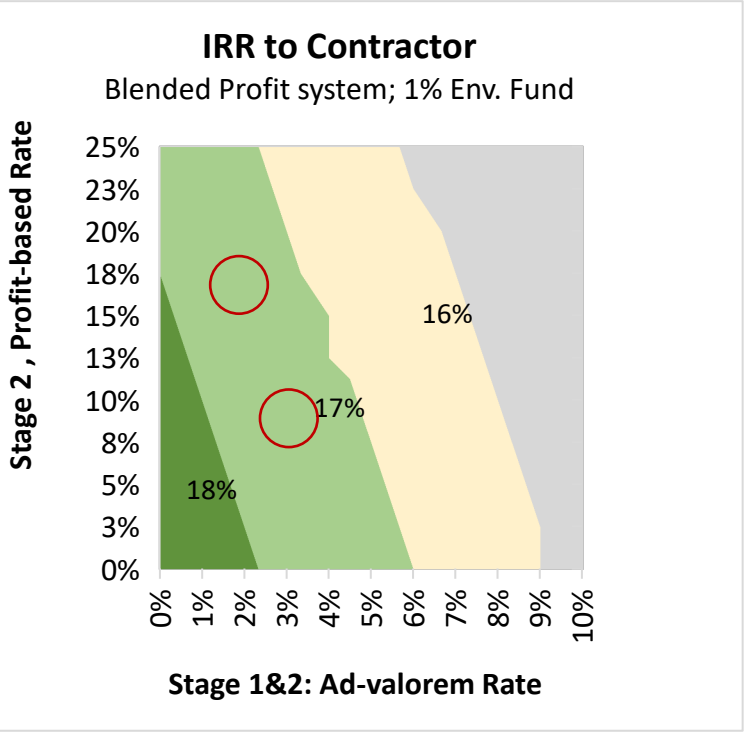
AV 4% → 4% AV 2% → 6%
AV 1% → 6.5%

Profit-based Only System



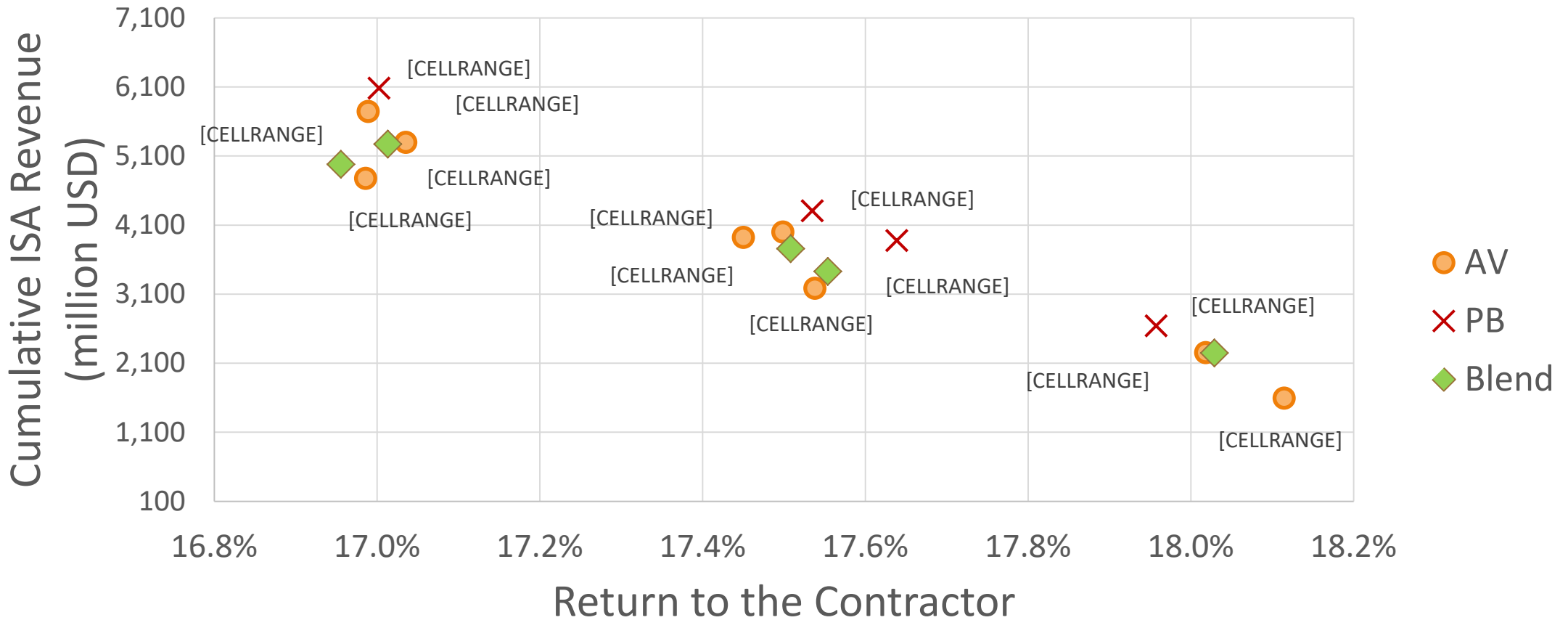
PB 0% → 27.5%

Blended System



AV 2% + PB 15% AV 3% + PB 7.5%

Even though systems provide similar return, they can yield 25% differences in ISA NPV



Balancing both total and early year ISA revenue, we recommend to consider the following options

Generally …

ad-valorem only systems generate slightly higher revenues

but they do not provide a guard against costs being lower than expected

profit-based systems increase administrative costs

Return to Contractor	System	Cumulative ISA Revenue	Contractor Effective Tax Rate
17%	AV3%→ AV8%	$5,300	49%
	AV3% + PB20%	$5,300	49%
17.5%	AV2%→ AV6%	$4,000	44%
	AV2% + PB15%	$3,850	43%
18%	AV1%→ AV3.5%	$2,300	37%
	AV1% + PB10%	$2,400	37%

* All of these values assume 1% to Environmental Fund and 25% sponsoring state tax rate

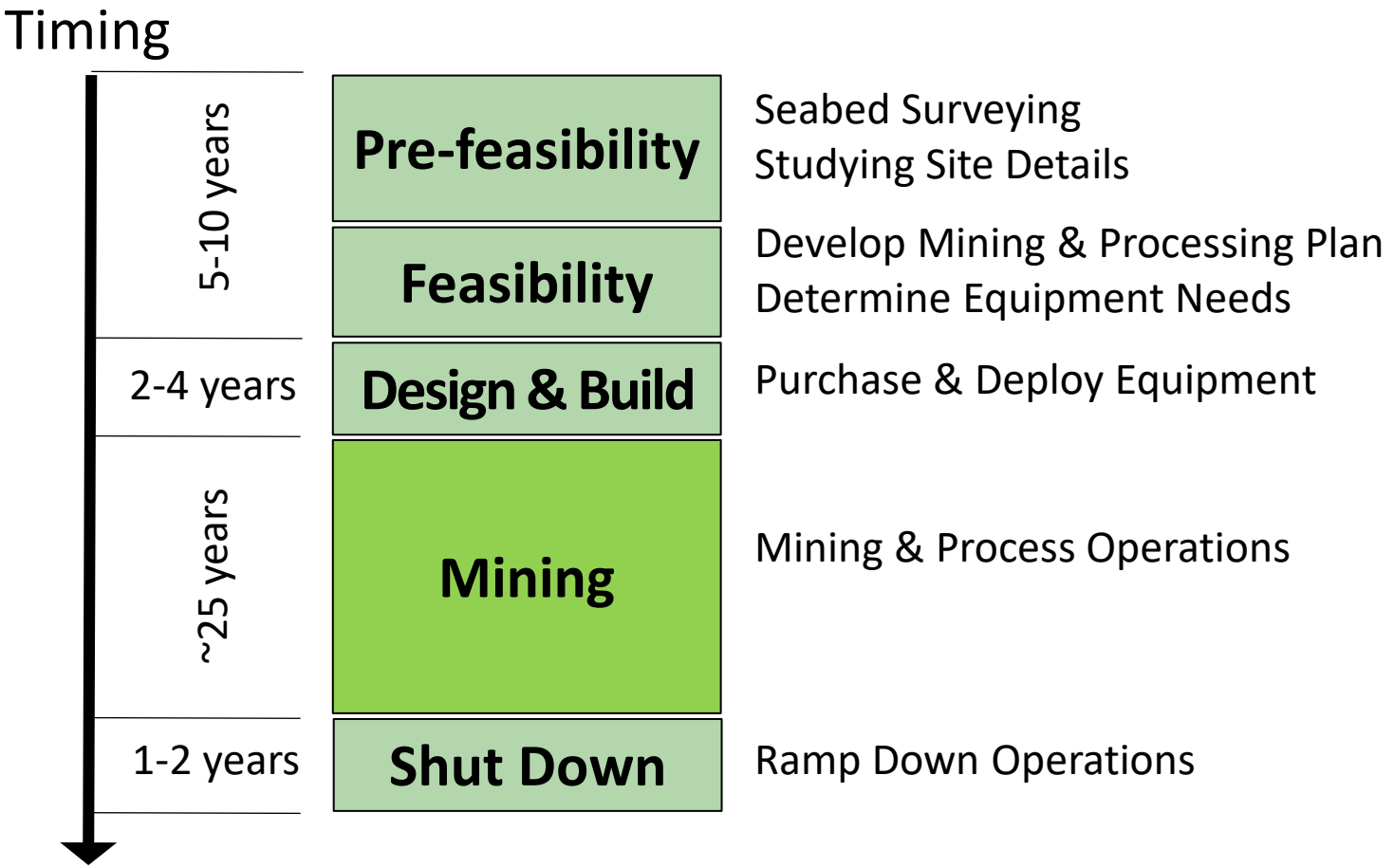
Several Questions Remain Before Settling on a Financial Payment System

- Variable-rate ad-valorem
- Scenario Analysis
- Impact of seabed mining on land-based mines particularly in developing nations
- Size of environmental impact from seabed mining vs land-based mining
- Understanding Key Aspects of Revenue uncertainty
  - Dynamic of the Mn market
    - Will processing to metal significantly change the price of Mn metal?
    - At what premium / discount would outflows not processed to metal trade at relative to current Mn ore prices
  - Dynamic of the Ni market
    - Will the Ni market support two price levels: high-purity (in which nodule-derived metal would compete) and low purity
  - Dynamic of the Co market
    - Will the Co market support a price premium for non-conflict source material

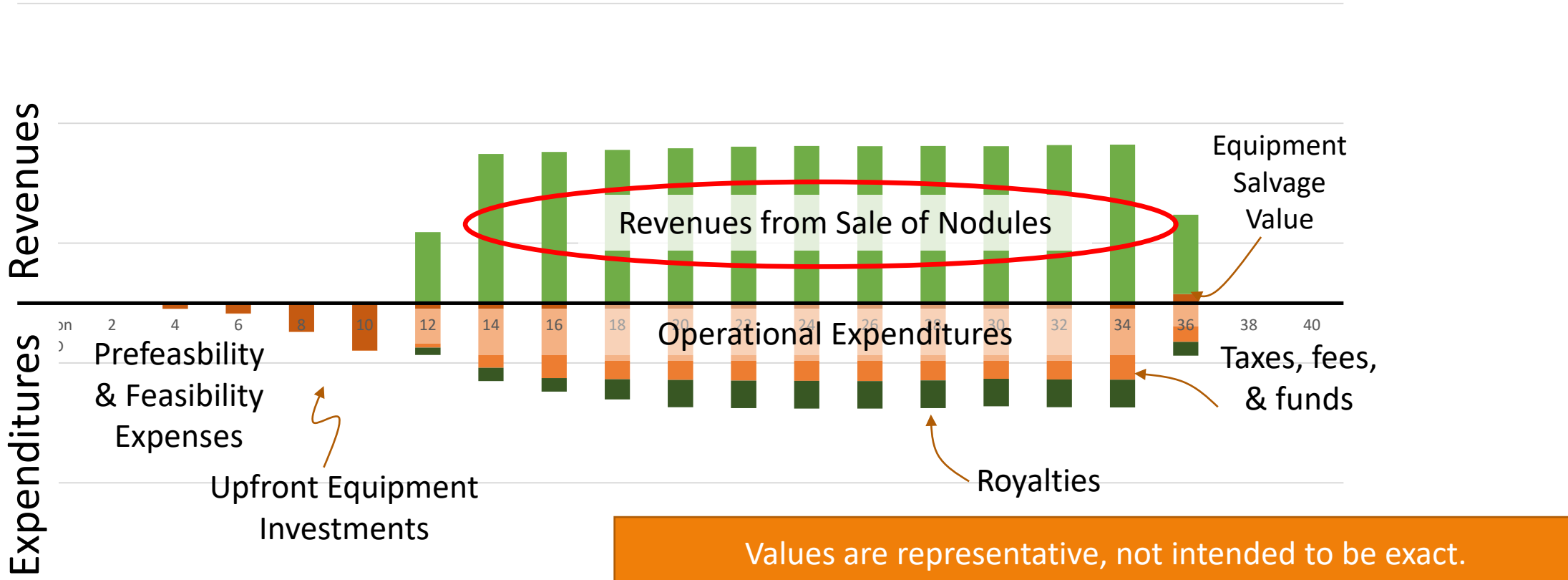
Extra Slides

How would a seabed mining project develop?

Modeling is based on progression through 5 activities



Nodule Collector Cash Flows



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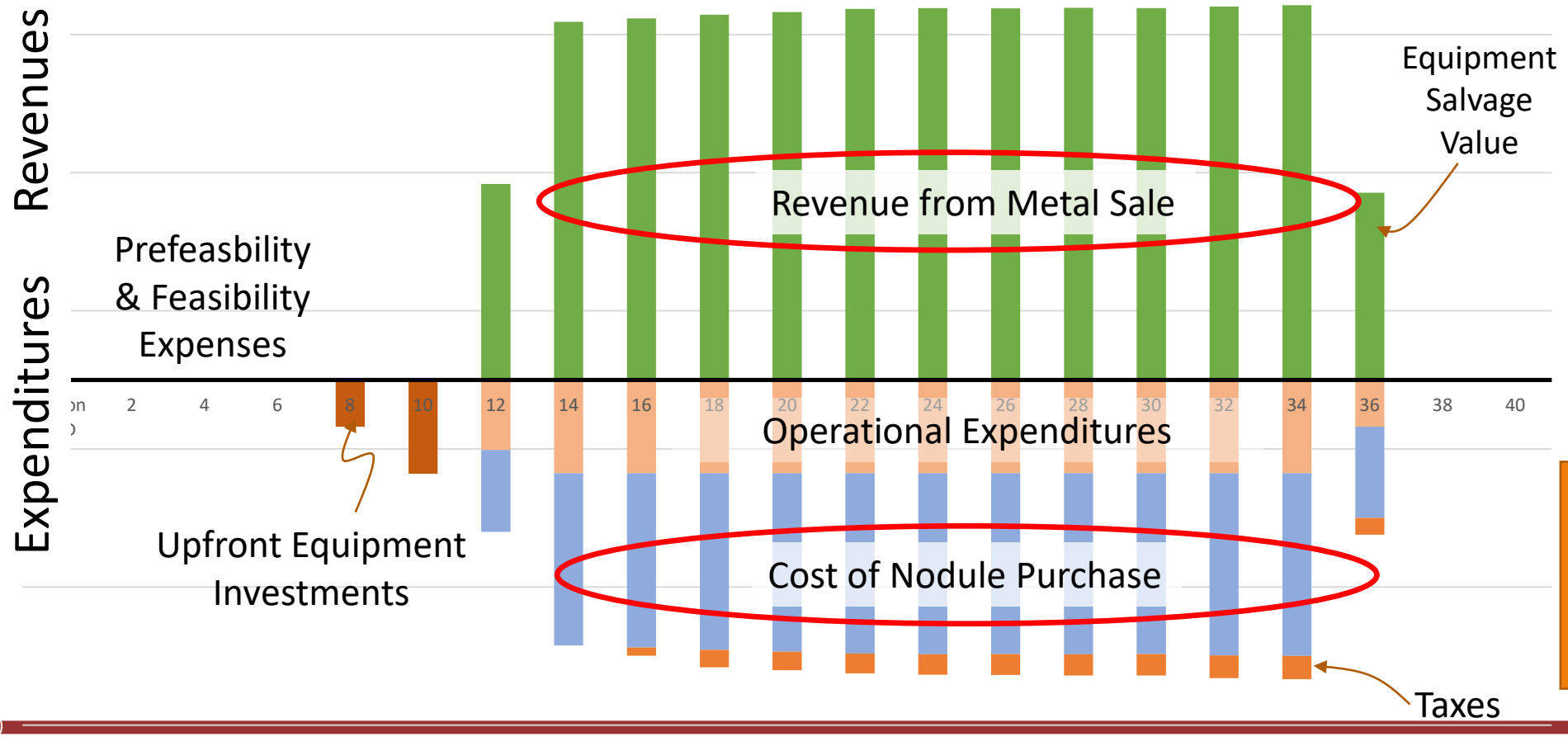
Metals Processor Cash Flows



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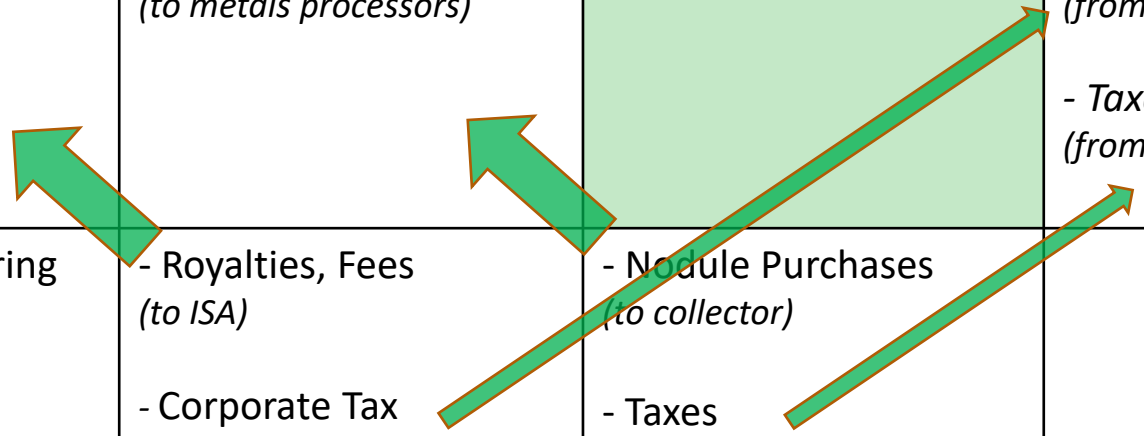
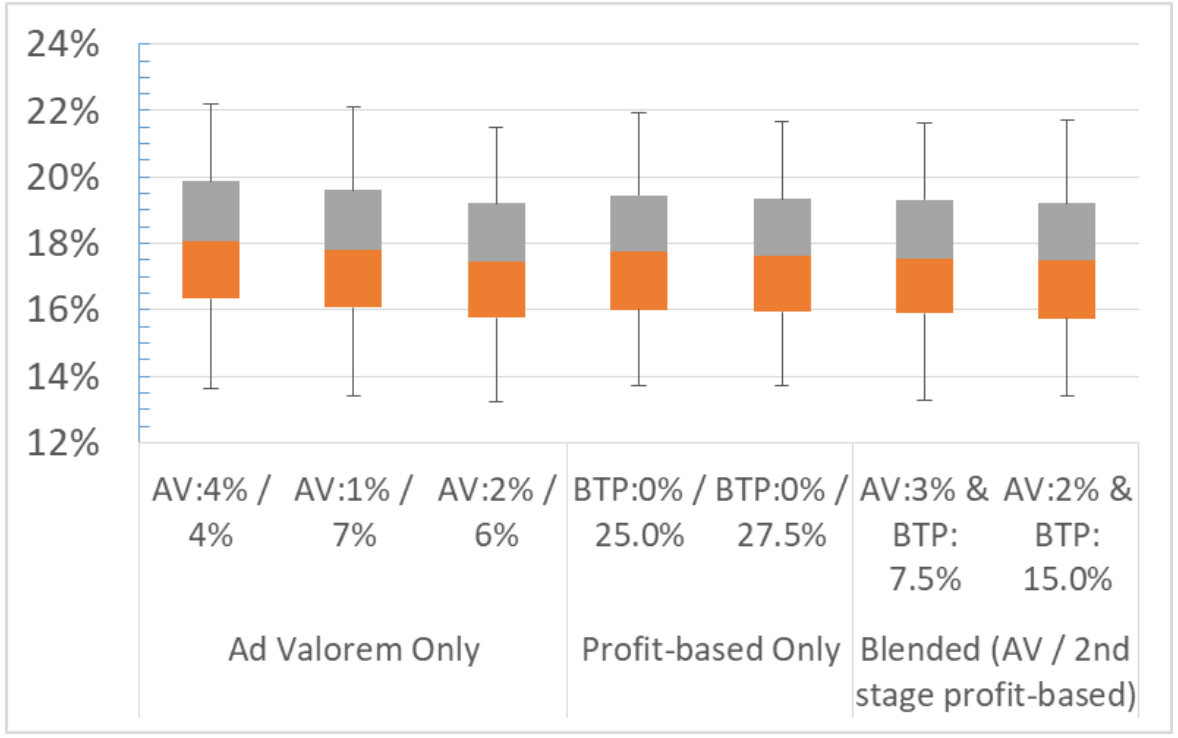
Flows of funds between major particpants

	ISA	Nodule Collector	Metals Processor	Sponsor State & Host Nation
Costs	- Administration - Oversight	- Prefeasibility Studies - Feasibility Studies - Upfront Investments - Operating Expenses	- Prefeasibility Studies - Feasibility Studies - Upfront Investments - Operating Expenses	
Revenues *(including inbound transfers)*	- Fees - Royalties *(from collector)*	- Sale of Nodules *(to metals processors)*	- Sale of Metals	- Taxes to Sponsor State *(from collector)* *- Taxes to Host Nation* *(from metals processor)*
Transfers *(outbound)*	- Revenue sharing	- Royalties, Fees *(to ISA)* - Corporate Tax *(to Sponsor State)*	- Nodule Purchases *(to collector)* - Taxes *(to host nation)*	

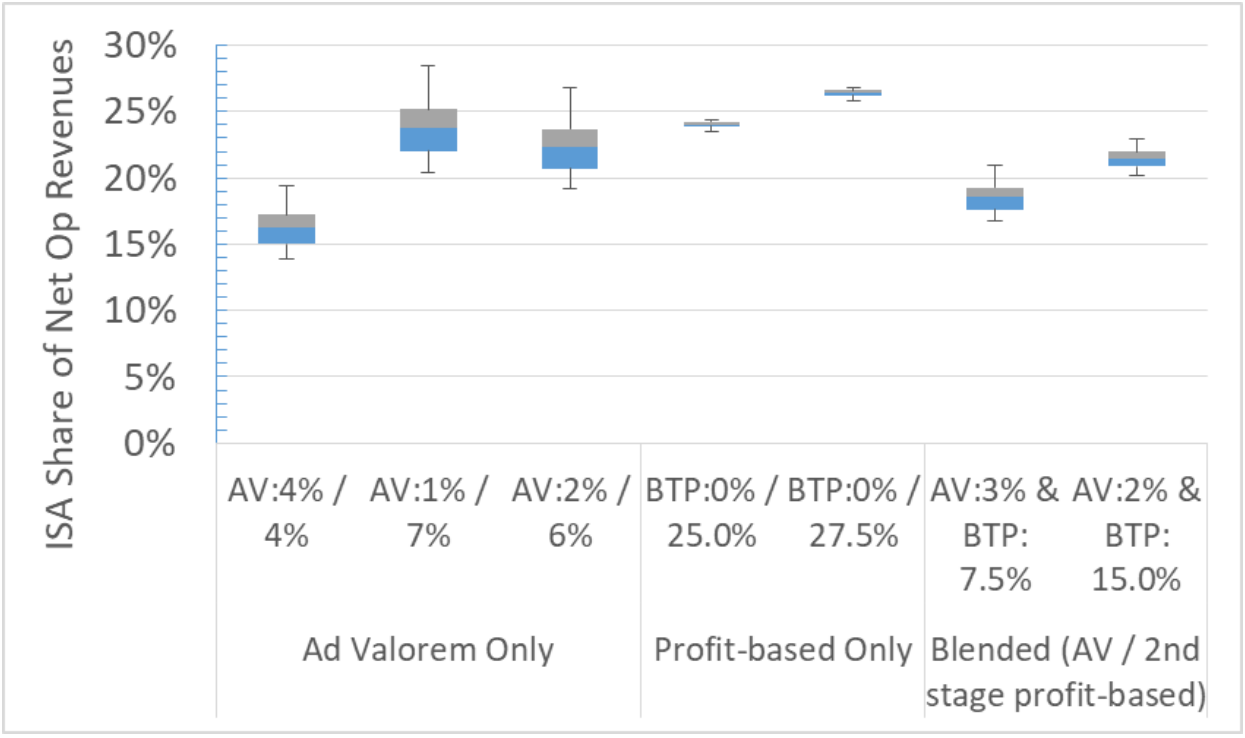


Consider these seven systems that provide a return of approximately 17.5%

- IRR Values are Similar for All Seven



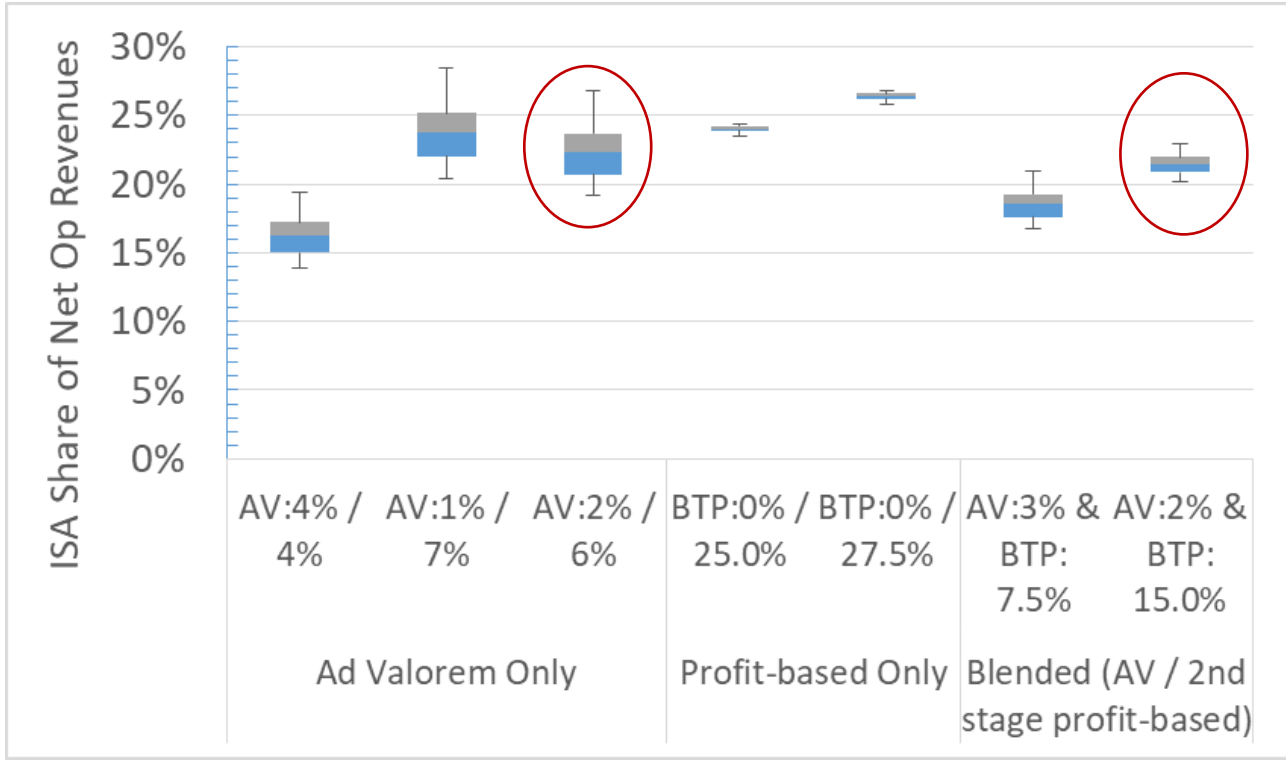
- HOWEVER …
  ISA Share of Revenues Varies



Profit-based Only Systems Can Provide Attractive ISA NPV, BUT They Generate 0 revenue for 5 years

- Profit-based only systems can generate the highest revenues for the ISA at a given return to the contractor

  but…
- They generate NO revenue for ISA for the first five years
- So, we are not going to consider them further
- Let's look more closely at two systems
  - Ad-valorem only: 2% → 6% in yr 5
  - Blended:
    - Ad-valorem 2%
    - Profit-based levy of 15% beginning in yr 5



Estimating Future Metals Revenues

$$\text{Metals Revenues} = \sum_{metal} \text{Quantity of Metals Recovered} \times \text{Metals Prices}$$

Quantity of Metals Recovered

	Composition	Recovery Rate	Amount Recovered
Cobalt	0.2%	85%	5,100 tons
Nickel	1.3%	95%	37,050 tons
Copper	1.1%	90%	29,700 tons
Manganese	28.4%	90%	766,800 tons

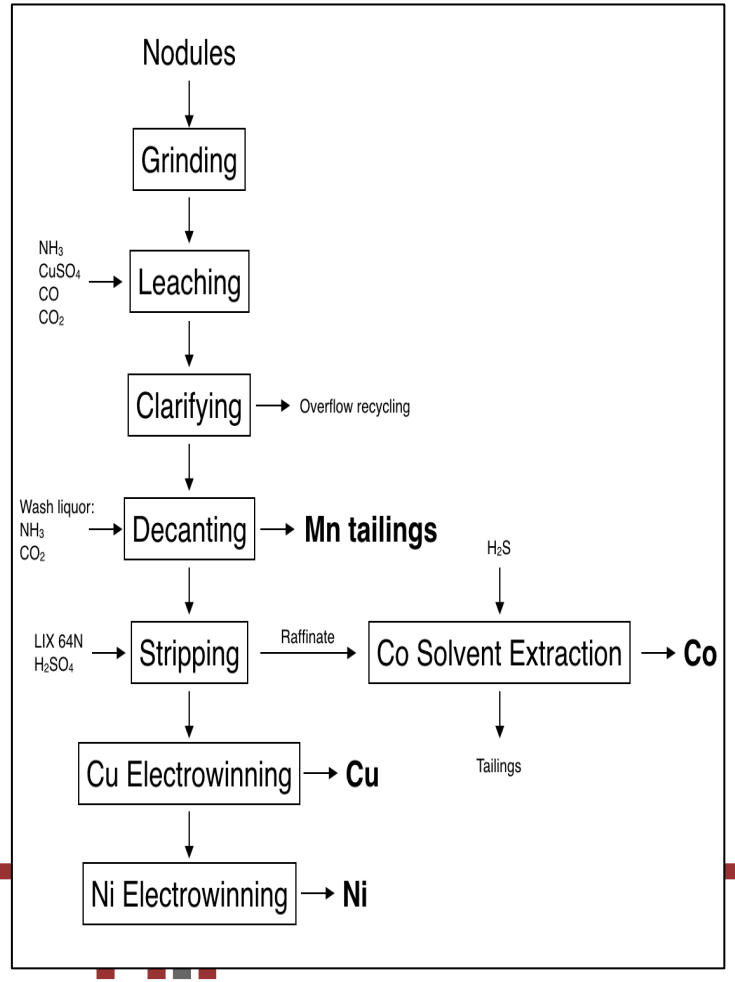
Metal Price Forecasting

	Initial Price	Long Term Price	Uncertainty Parameter
Cobalt	$38,000/ton	$55,000/ton	$3,000/ton
Nickel	$10,800/ton	$24,717/ton	$800/ton
Copper	$5,600/ton	$7,000/ton	$500/ton

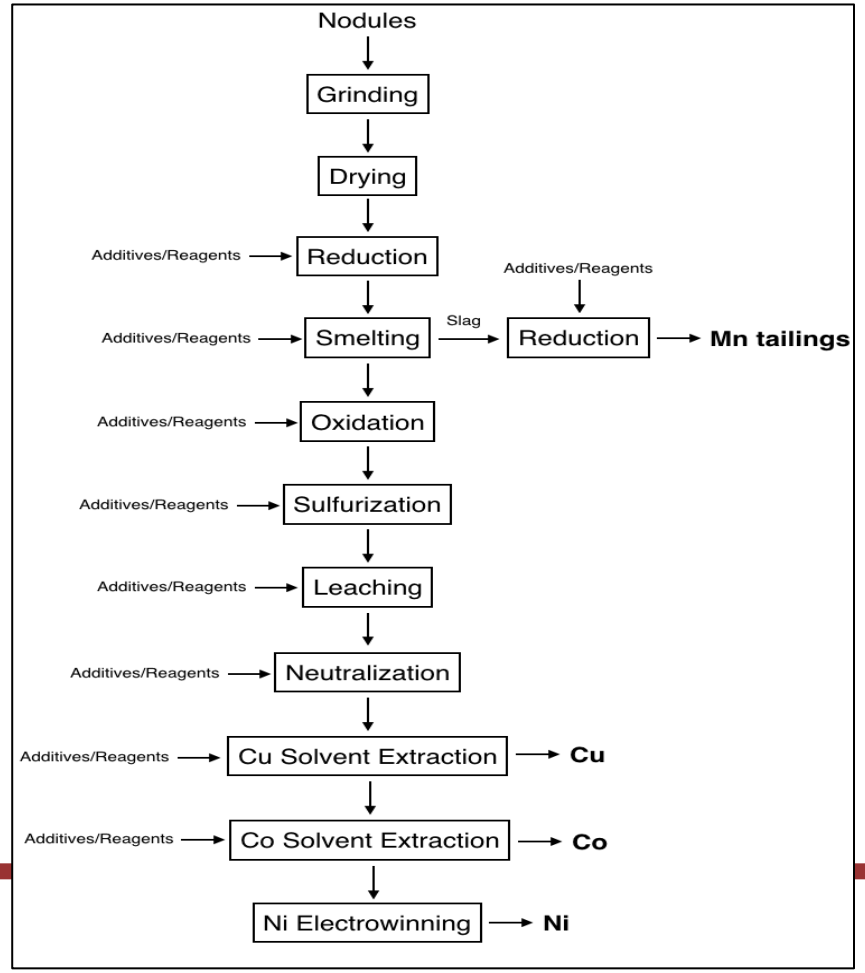
	Initial Price	Long Term Price	Uncertainty Parameter
Mn ore	$450/ton	$450/ton	$50/ton
Metal Mn	varies	Varies	varies

Estimating Metals Processor Costs

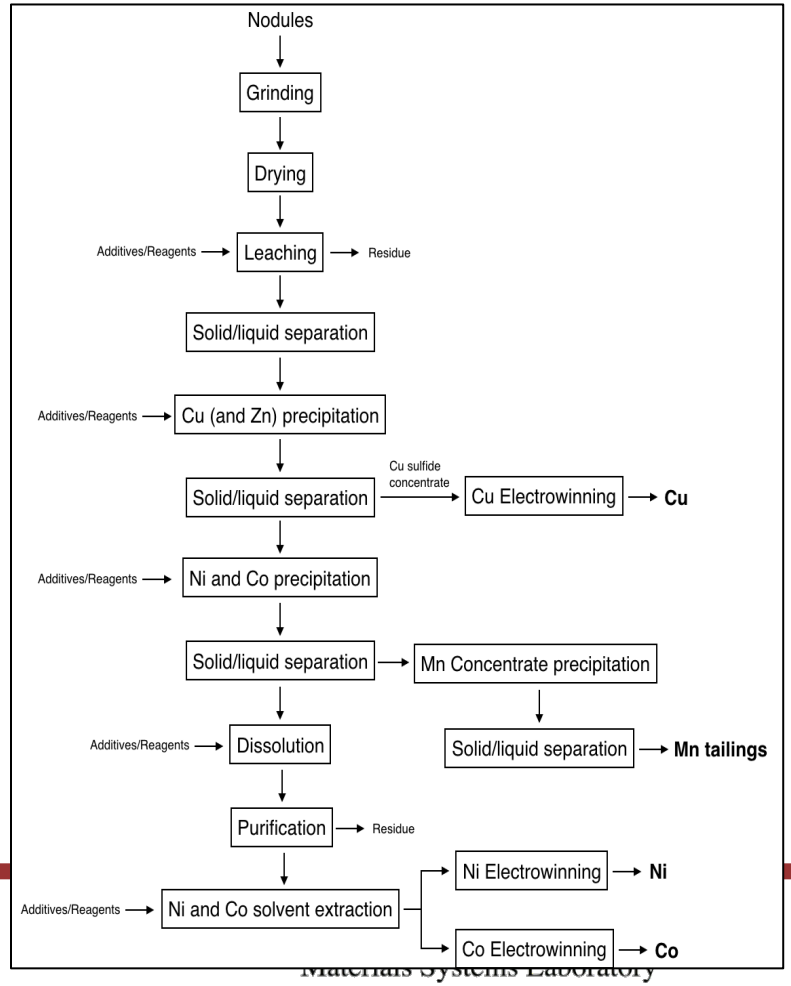
Ammonaical Leach/Cuprion



Pyrometallurgy



Hydrometallurgy



Additional Payments to ISA and Sponsoring State

- We assume that the ISA collects administrative fees
- Assume 1% of GMV to environmental liability / sustainability fund to max of $500 million per contract
- Assumed sponsoring state corporate income tax rate
  - 25%

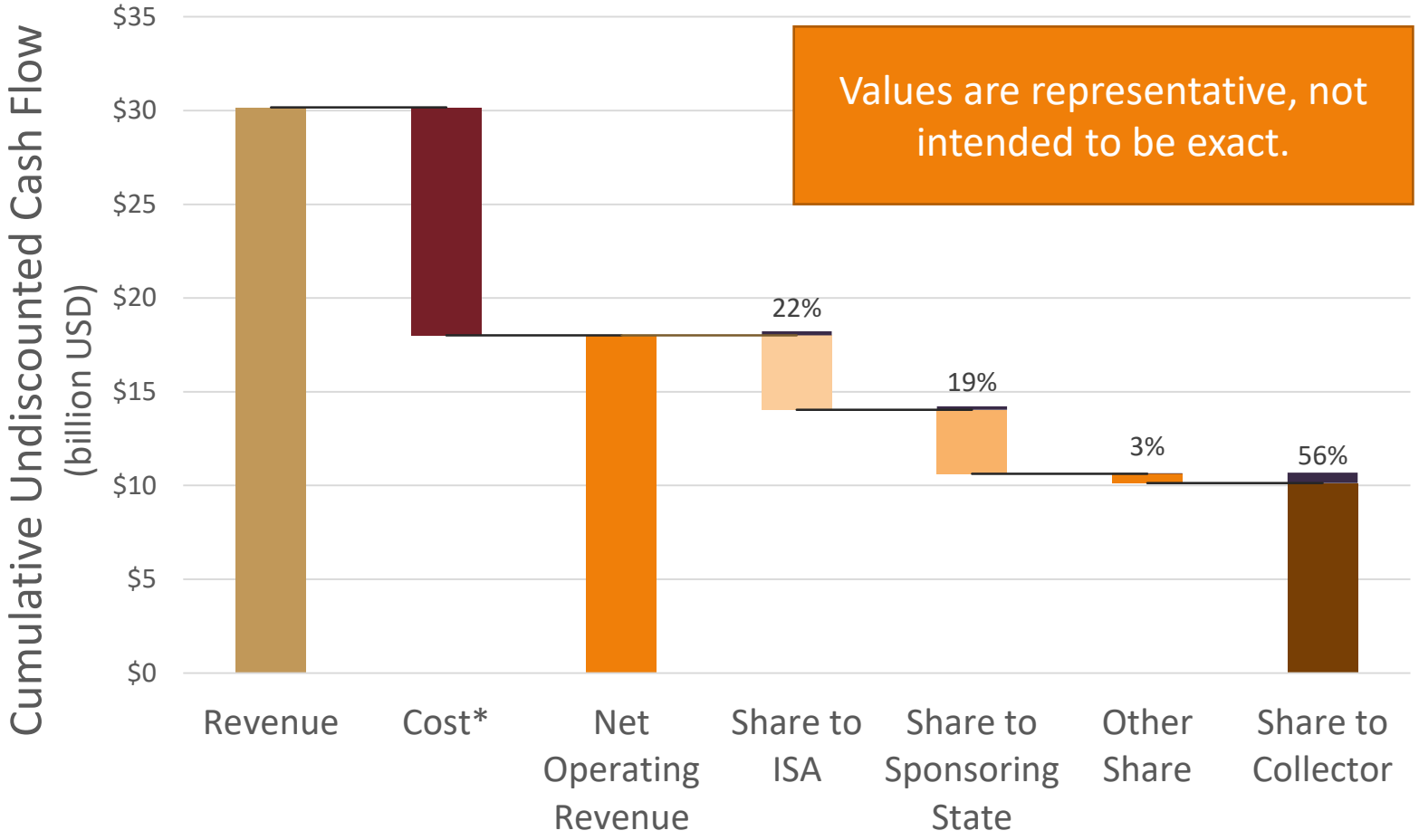
Fee	Amount	
EXPLORATION		
Exploration contract application fee	0.5	million USD
Annual administrative fee during exploration	0.047	million USD/annum
EXPLOITATION		
Exploitation contract application fee	1	million USD
Annual admin fee during exploitation contract	0.1	million USD/annum
Minimum fixed fee during exploitation contract (waived if royalty or profit-based payments exceed this amount)	1	million USD/annum

These values have recently been updated in 2019

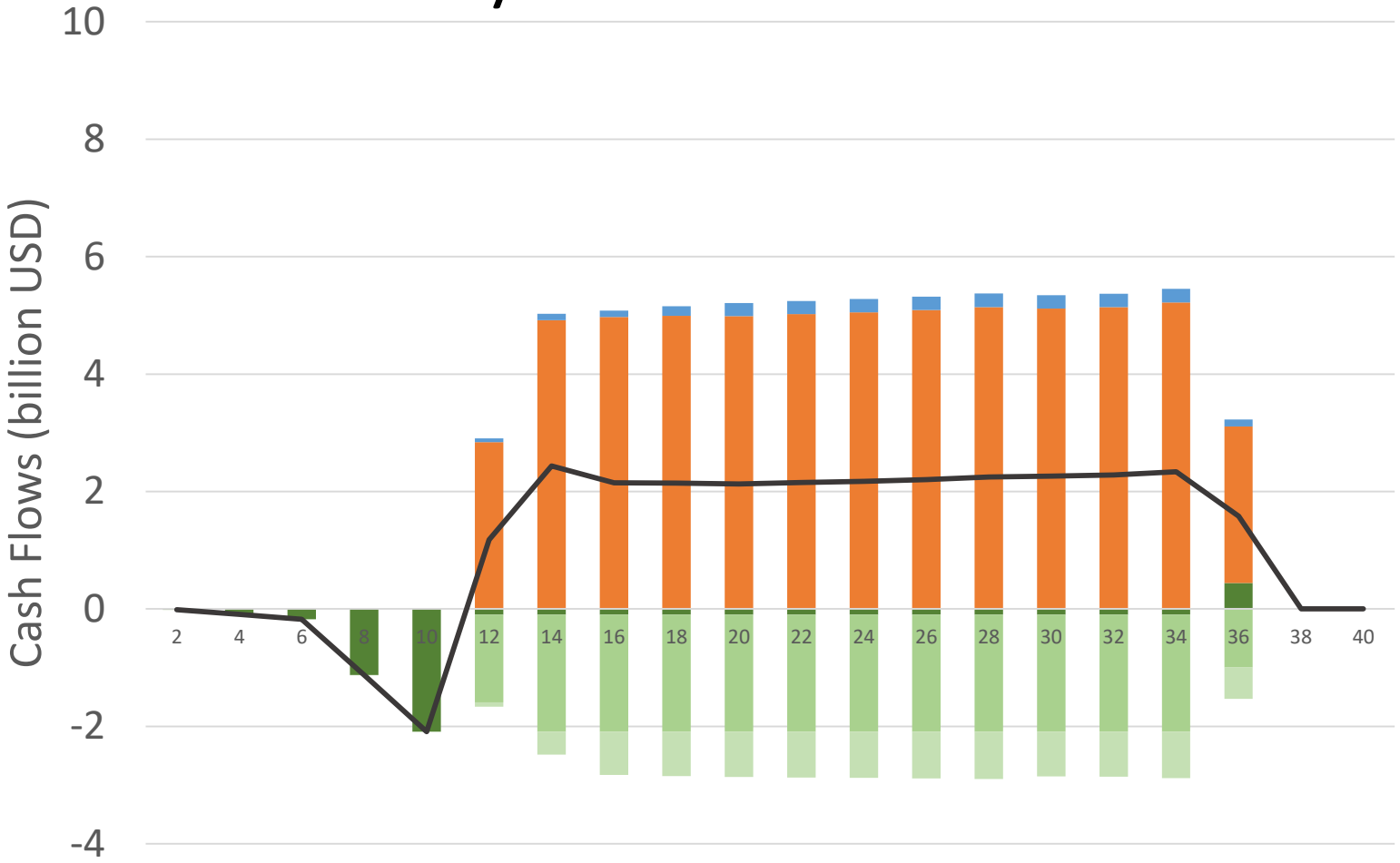
Financial Payment System Evaluation: Shifting to More Metrics to Quantify Tradeoffs Among Stakeholders (2)

New metrics suggested by the LTC

- Share of Net Operating Revenues to
  - ISA
  - Sponsoring state
  - Other
  - Contractor



We will look at each type of system individually: First estimate cash flows



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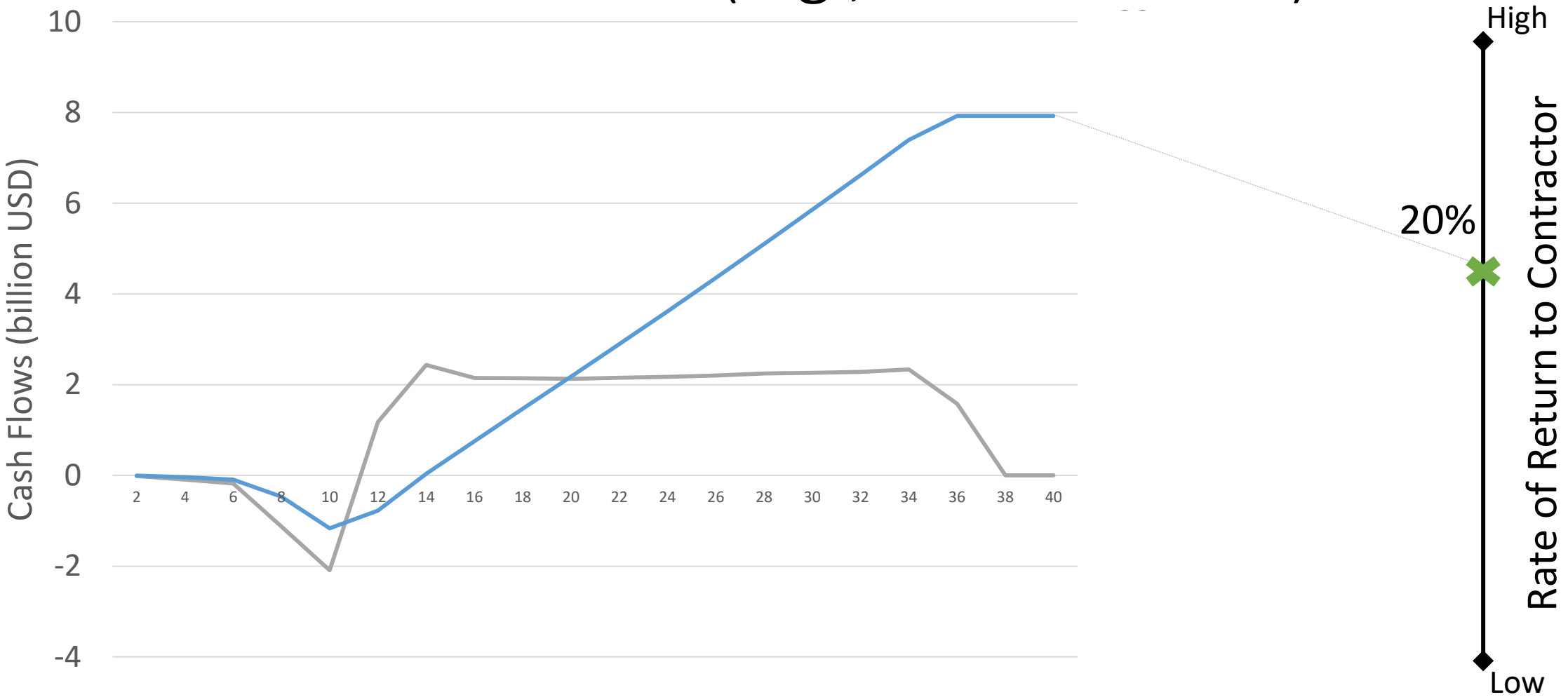
We will look at each type of system individually: Then estimate metrics (e.g., rate of return)



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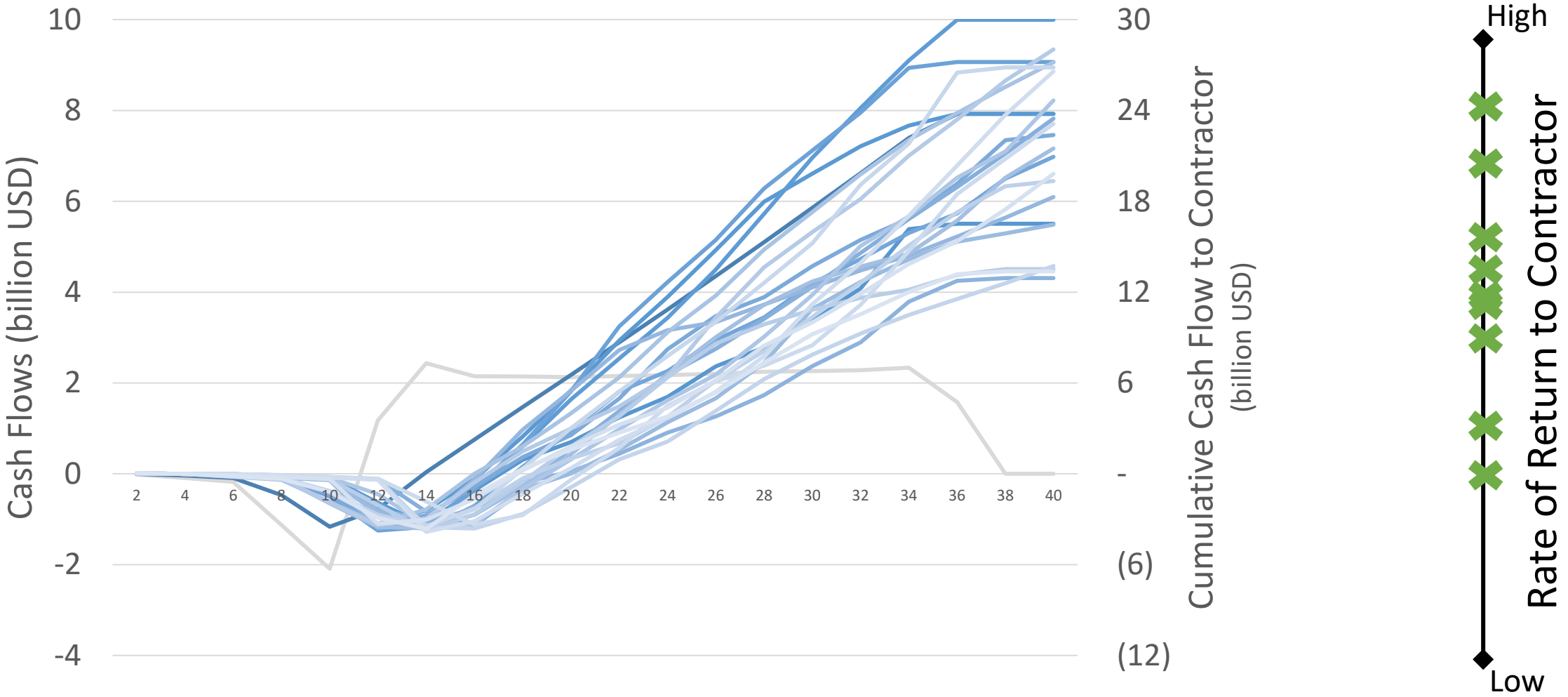
Because of Uncertainty, Simulate Many Futures to Estimate Distribution of Performance Metrics



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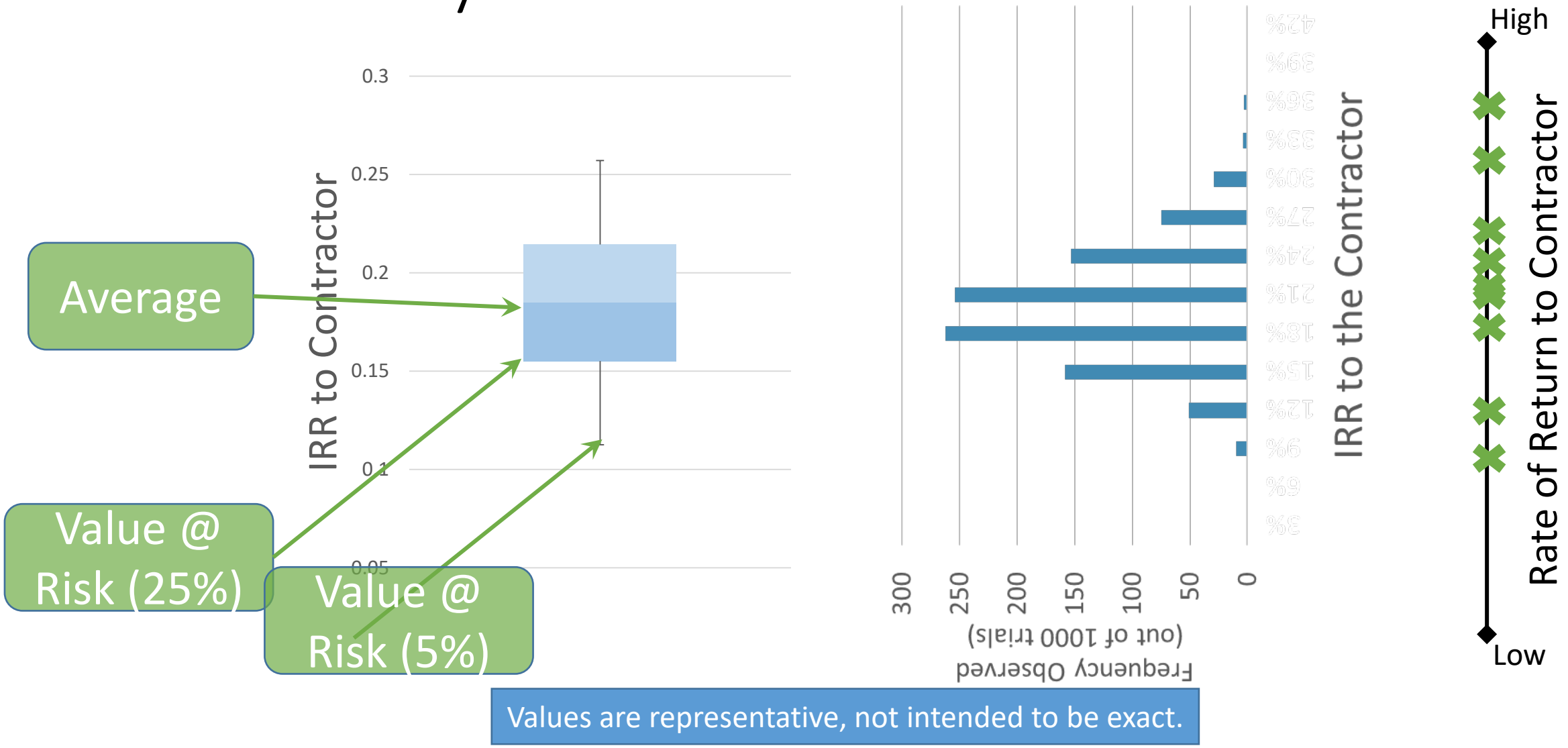
Distribution of Metrics Can Be Represented Several Ways



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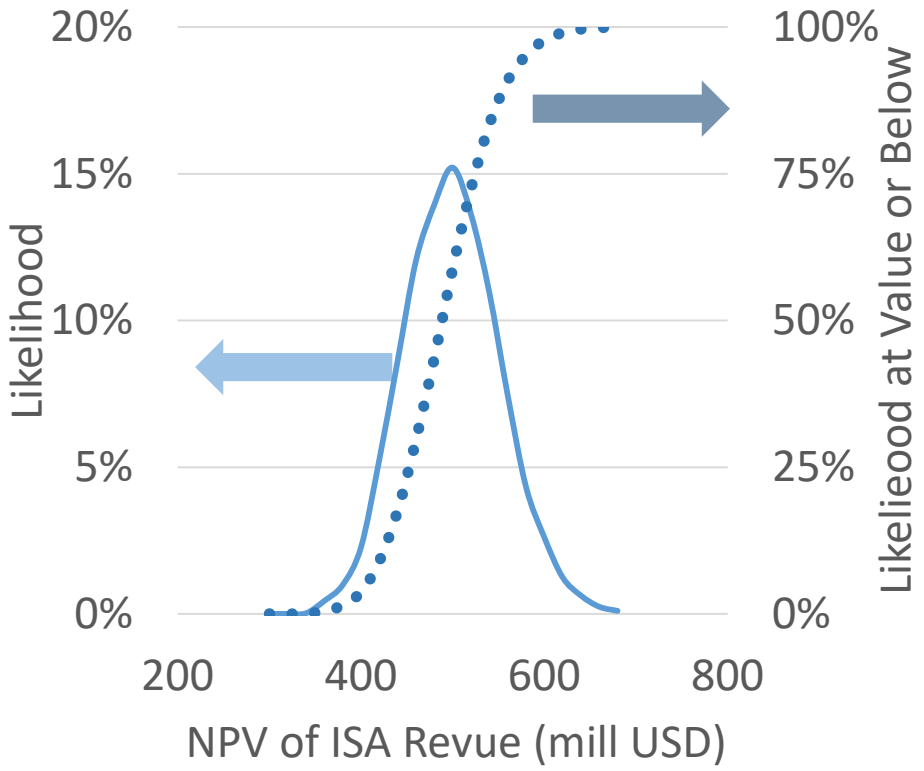
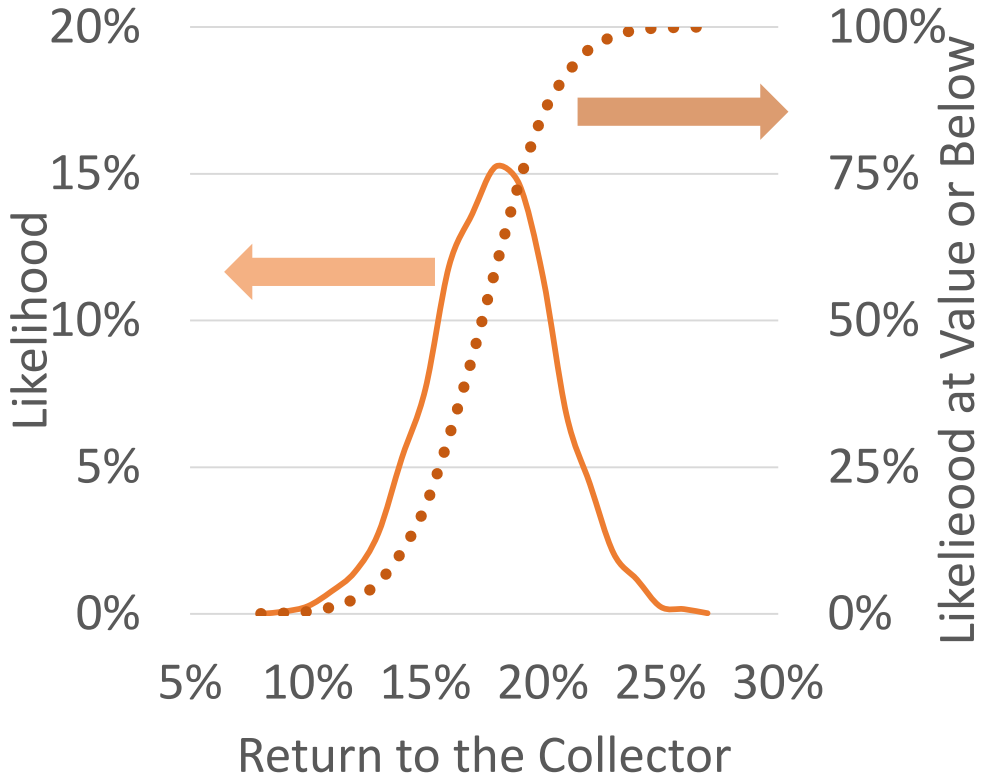
Ad-valorem Systems

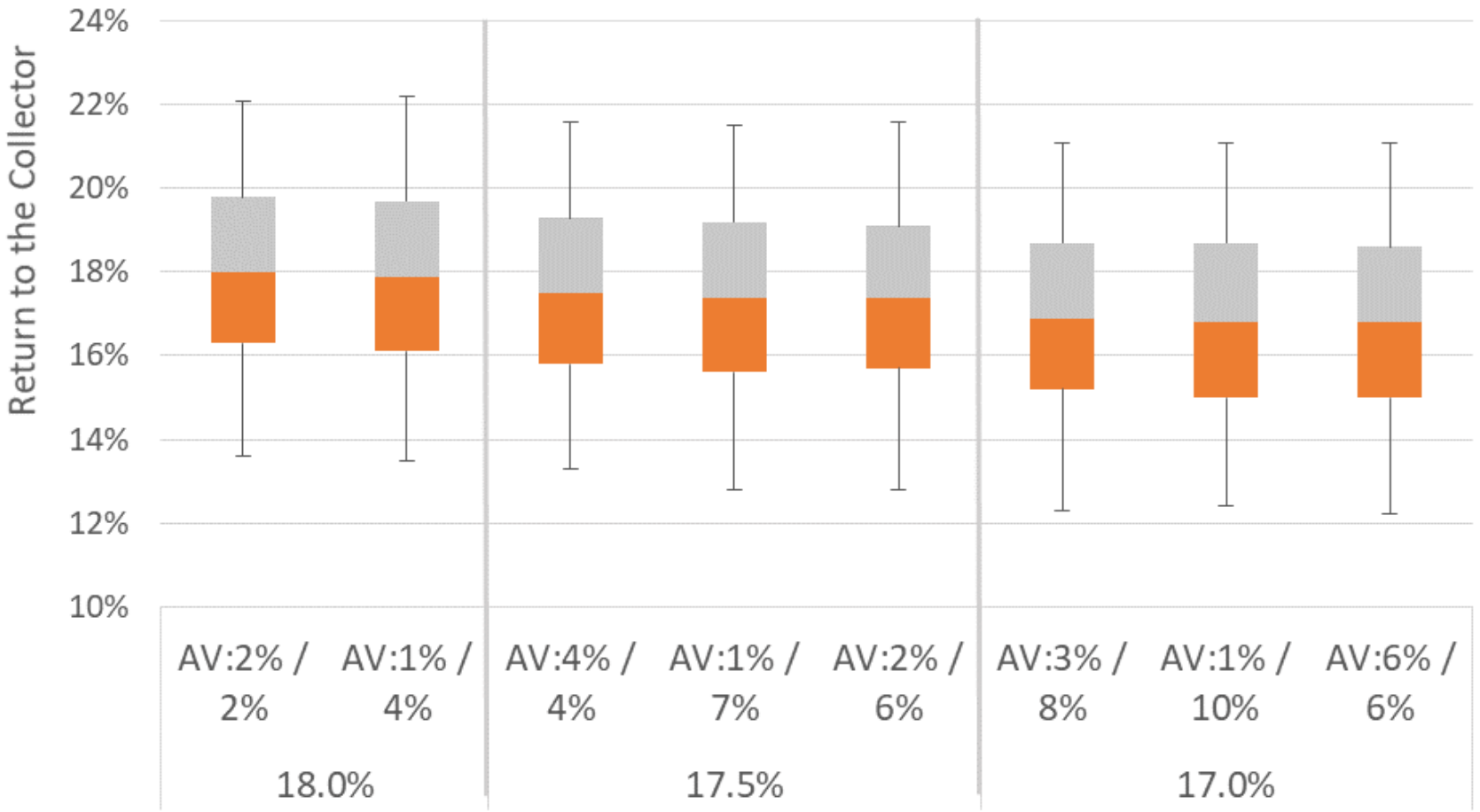
- Basis of rate:
  - Value of metal contained in the collected nodules
  - Referred to as Gross Metal Value (GMV)
- Two stages of rates
  - Allows ISA to maximize revenue while providing a target return to the contractor
    - Early revenues are more valuable to contractors than the ISA
  - Set at five (5) years, approximately when contractors begin to make a net annual profit (3-6 years)
- Scope of screening rate
  - Stage 1: 0% to 10% of GMV
  - Stage 2: Plus additional 0% to 10% of GMV
    (Stage 2 rate = Stage 1 + Stage 2 add'l)

Each **selected** alternative stem was analyzed using Monte Carlo simulation: Example Ad-valorem 2%→ 6%

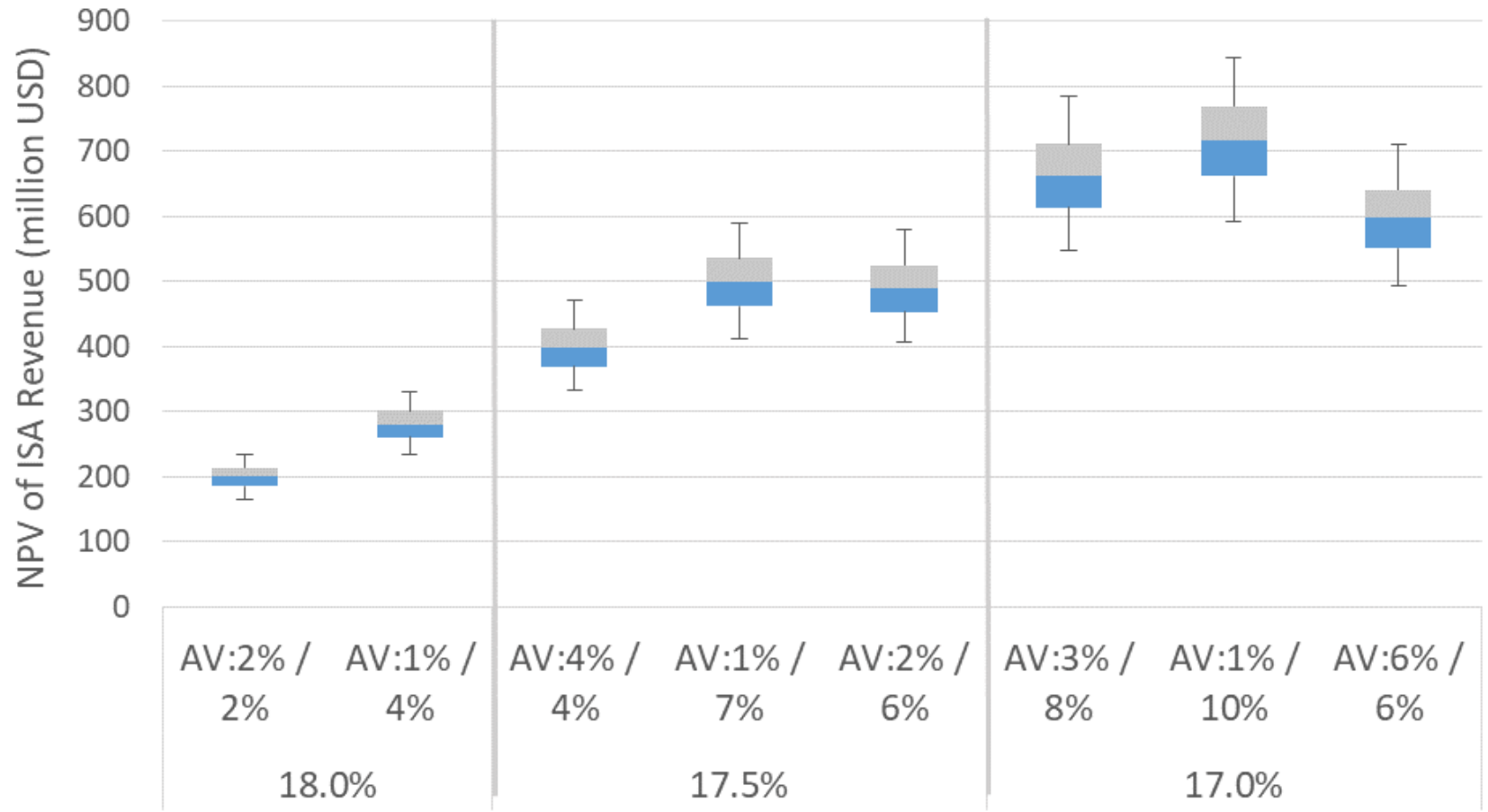




Ad-valorem: Options within a group provide similar returns, but…



Ad-valorem: Options within a group provide similar returns, but not the same revenue to the ISA

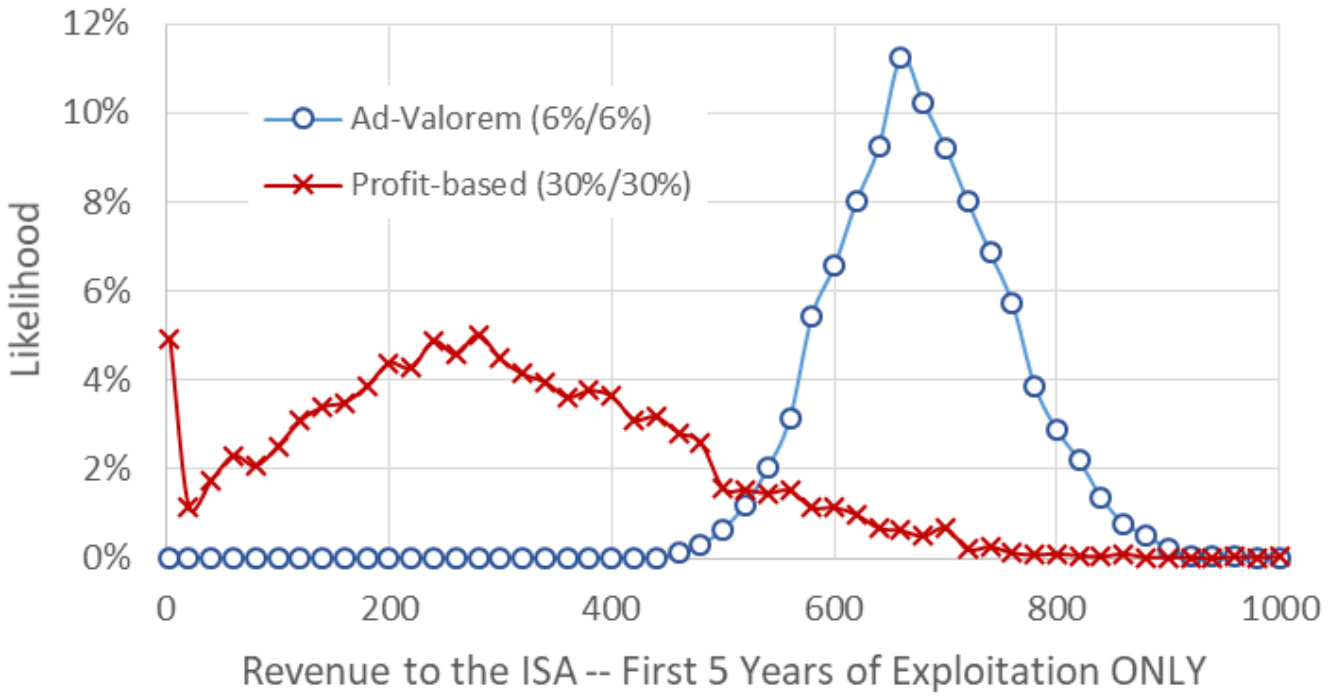


Profit-based Systems

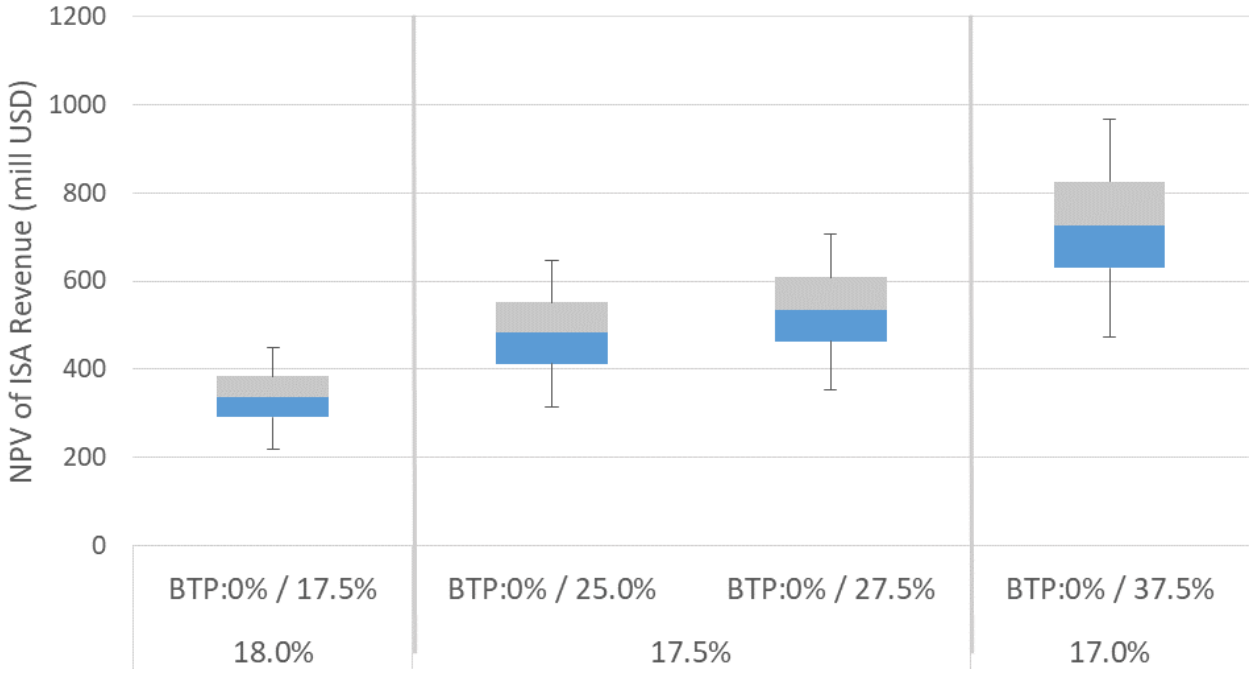
- Basis of rate:
  - Net operating revenue including any fees paid to ISA
    - Collector's revenue minus operating costs (including capital carryover charges) and fees paid to the ISA
    - Capital carryover is a deduction for investments made in years prior to revenue
  - Referred to as Net Operating Revenue (including fees) for the collector ($NORif_c$)
- Two stages of rates
  - Allows ISA to maximize revenue while providing a target return to the contractor
    - Early revenues are more valuable to contractors than to ISA
  - Set at five (5) years, approximately when contractors begin to make a net annual profit (3-6 years)
- We only explore in detail profit based systems when Stage 1 rate = 0
  - All profit-based systems provide little revenue to ISA in the first five years of mine operation
- Scope of screening rate
  - Stage 1: 0% to 10% of GMV
  - Stage 2: Plus additional 0% to 10% of GMV (Stage 2 rate = Stage 1 + Stage 2 add'l)

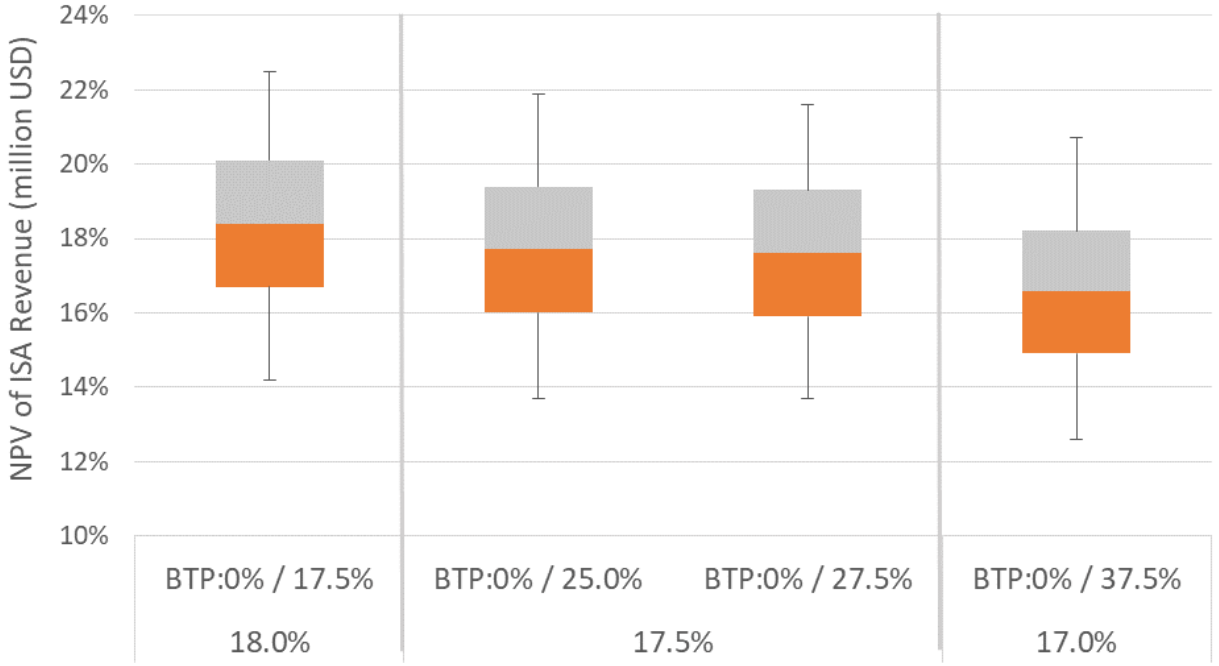
Note: Profit-based only systems provide little revenue to the ISA in early years

- Model assumes that contractors can deduct the cost of upfront investments against early year profits.
- Therefore, early year profits are small or zero



Profit-based Systems: Alternatives straightforward, higher rate, higher ISA NPV, lower contractor IRR



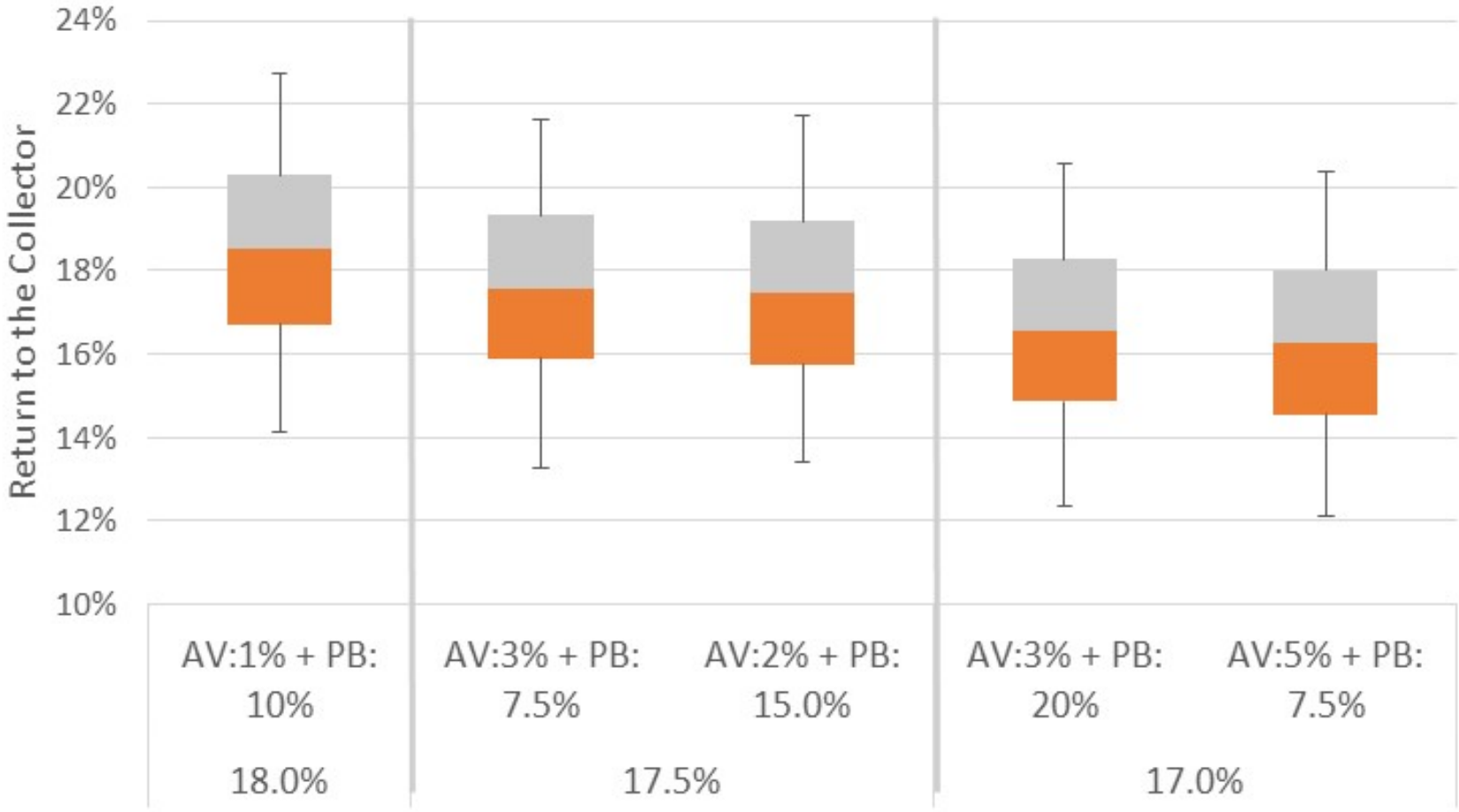


Blended systems

- Combine
  - Ad-valorem rate that begins in Stage 1 and continues in Stage 2
  - Profit-based rate that begins in Stage 2
- Stage 2 begins after 5 years of mine operation

- Scope of screening rates
  - Stage 1&2: 0% to 10% gross metal value collected
  - Stage 2 only: plus an additional 0% to 50% of NOR

Blended Systems: Options within a group provide similar returns, but…



Blended systems: Options within a group provide similar returns, but not the same revenue to the ISA