International Seabed Authority

Financial Payment System Working Group Meeting

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Decision Analysis Framework & Review of Cash Flow Approach

Underlying philosophy of the analysis

Identify payment systems that **maximize** the return to the common heritage of mankind

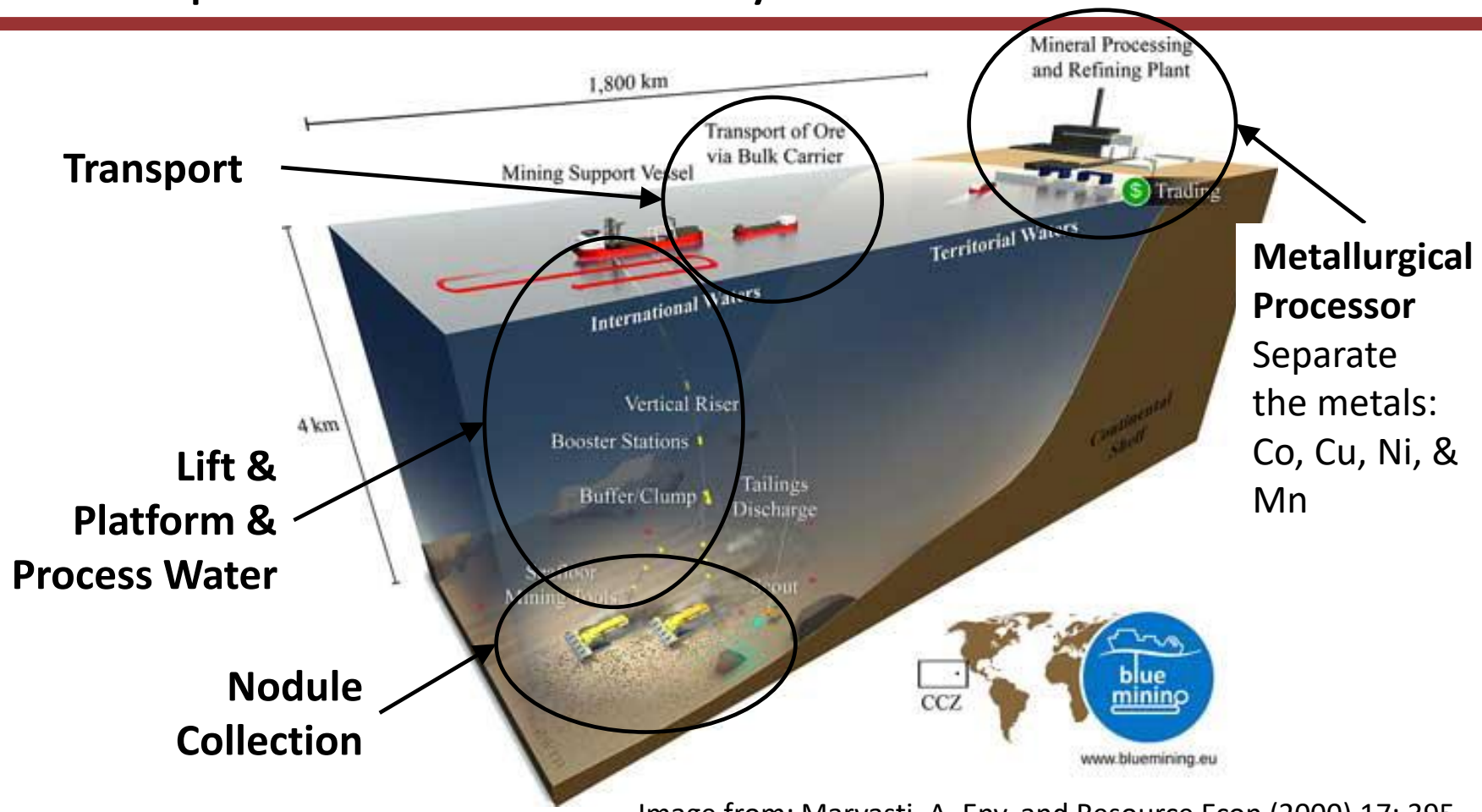
Key Question for Today: Basis of Payment

Key Elements of Payment System

- What should be the basis of payment?
  1. Ad-valorem (one stage)
  2. Ad-valorem (two stage)
  3. Variable ad-valorem
  4. Blended Profit share (contractor profit)
     Combination of profit based and ad valorem
- What should be the rate of payment?
- If ad-valorem, what metal prices should be used to determine value?
- Should we assume that other administrative fees and/or an environmental / liability fund will be assessed?

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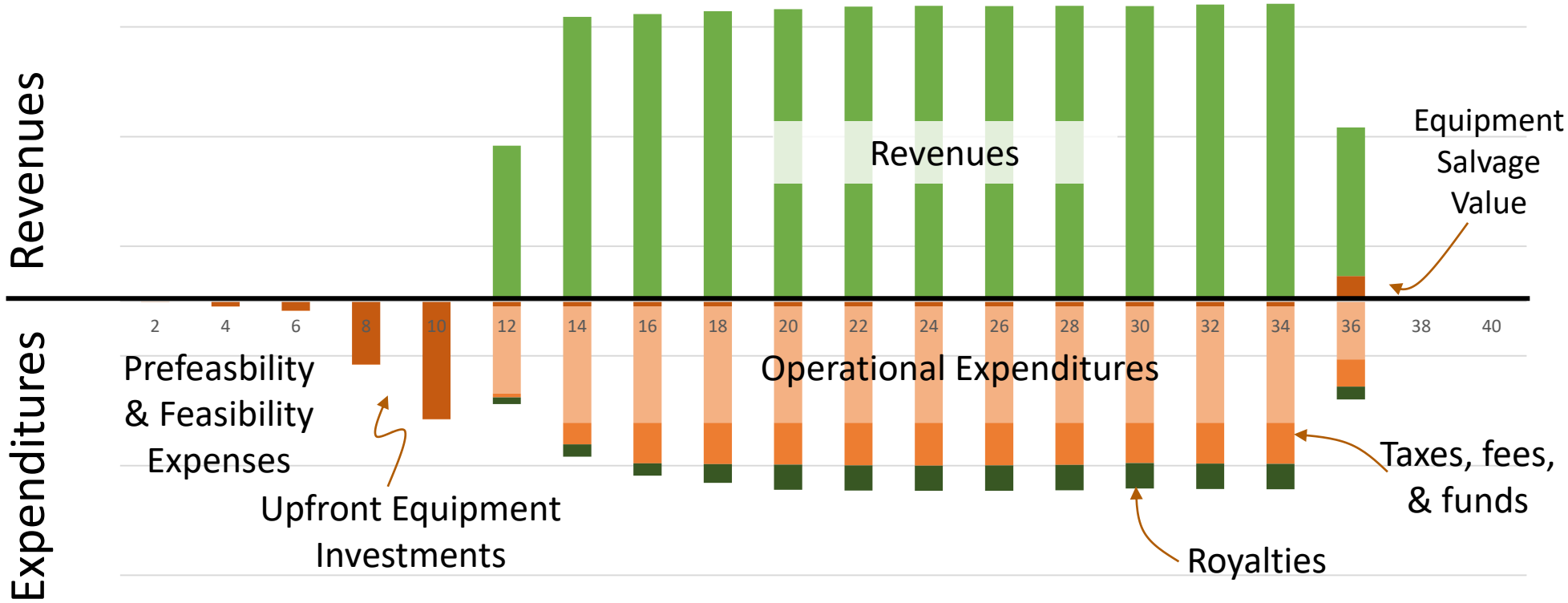
Analysis Must Consider **Size & Timing** of Cash Flows to Various Stakeholders: Collector, ISA, Sponsoring State, …



Values are representative, not intended to be exact.

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

Why do we consider activities outside of ISA jurisdiction?

- Why model the activities of the metals processor?

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

- What is a minimum return to the contractor to incentivize?

What metrics should we use to evaluate systems?

- Value of ISA revenues
- Effective taxation rate

ISA Oversight Only Related to Collector Activities

Modelled Collector

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

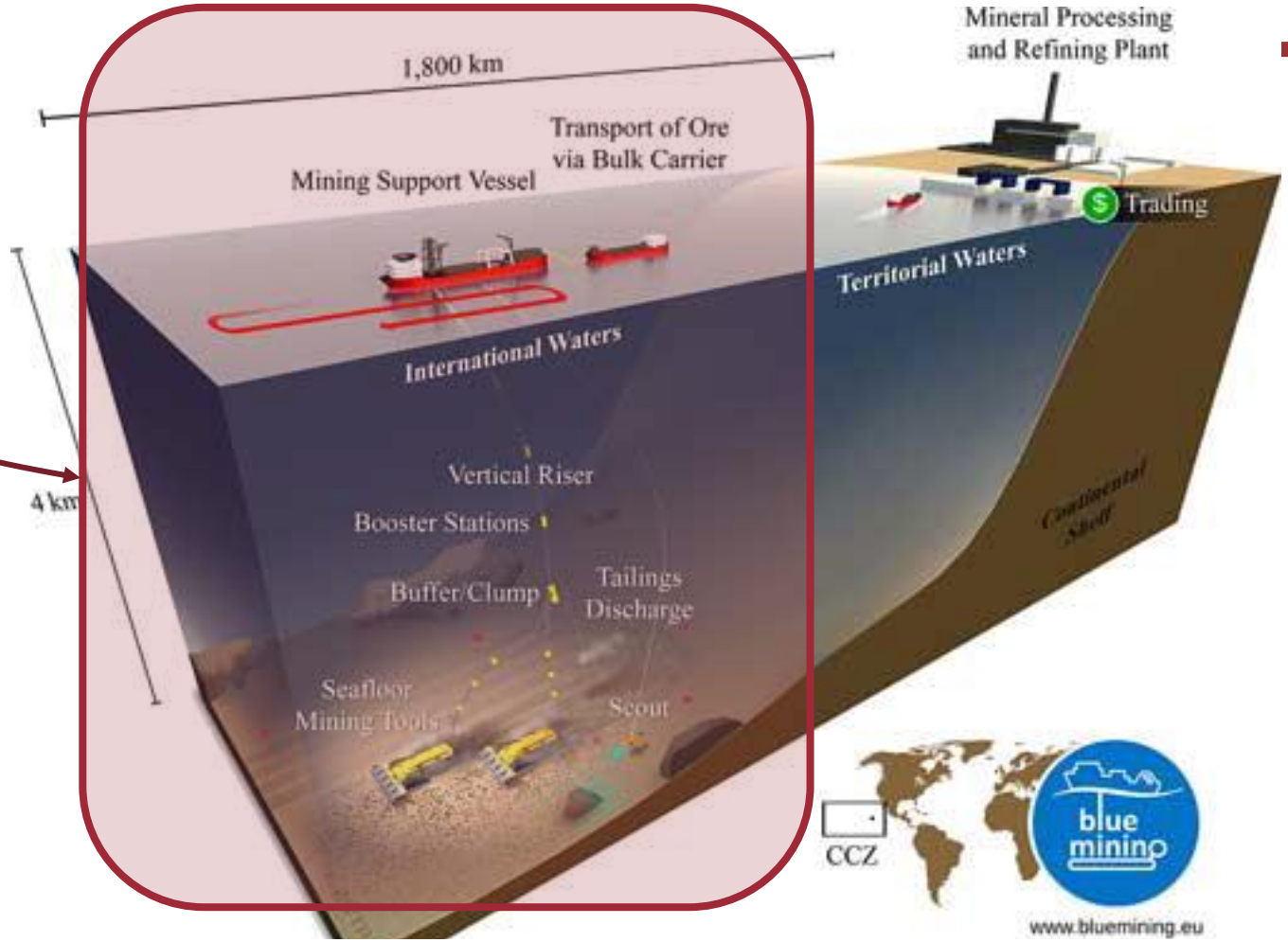
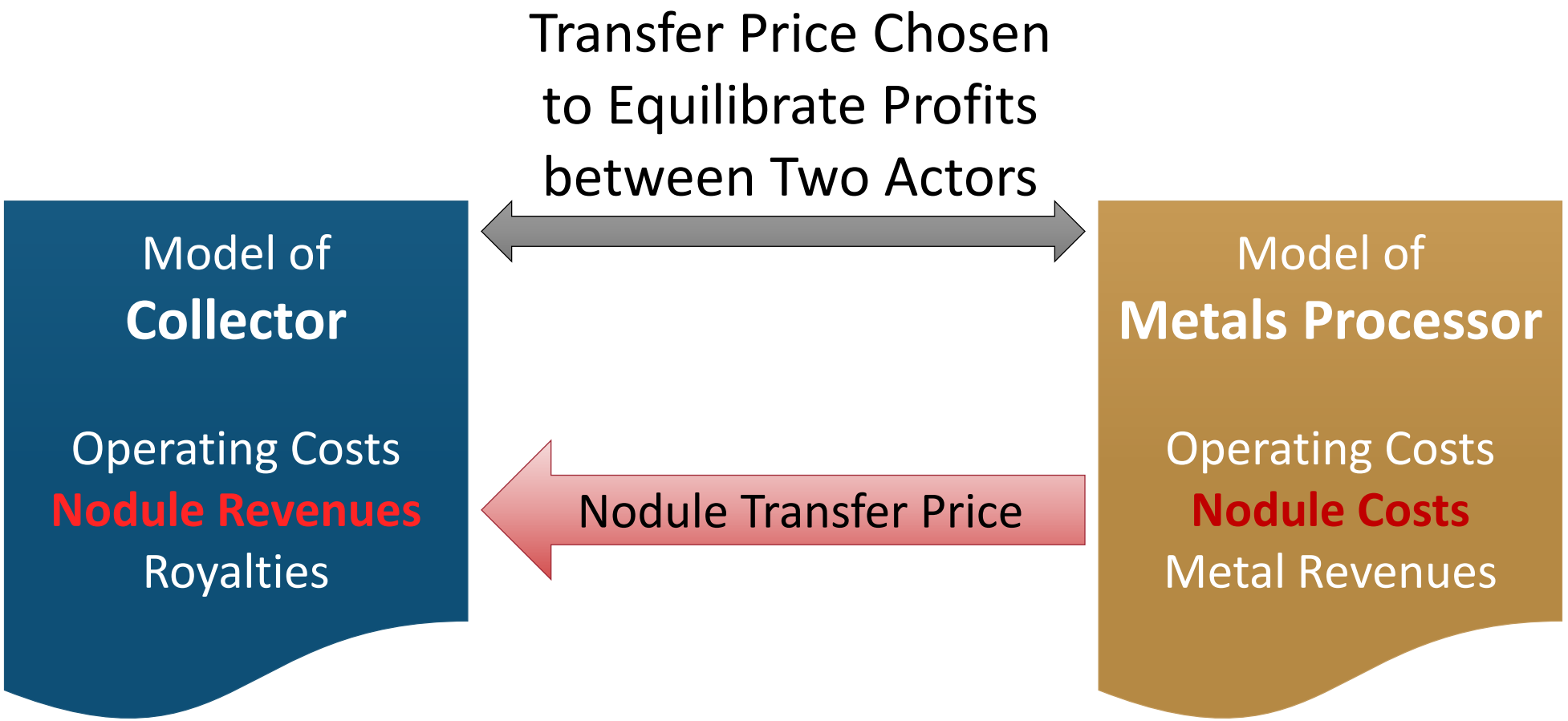


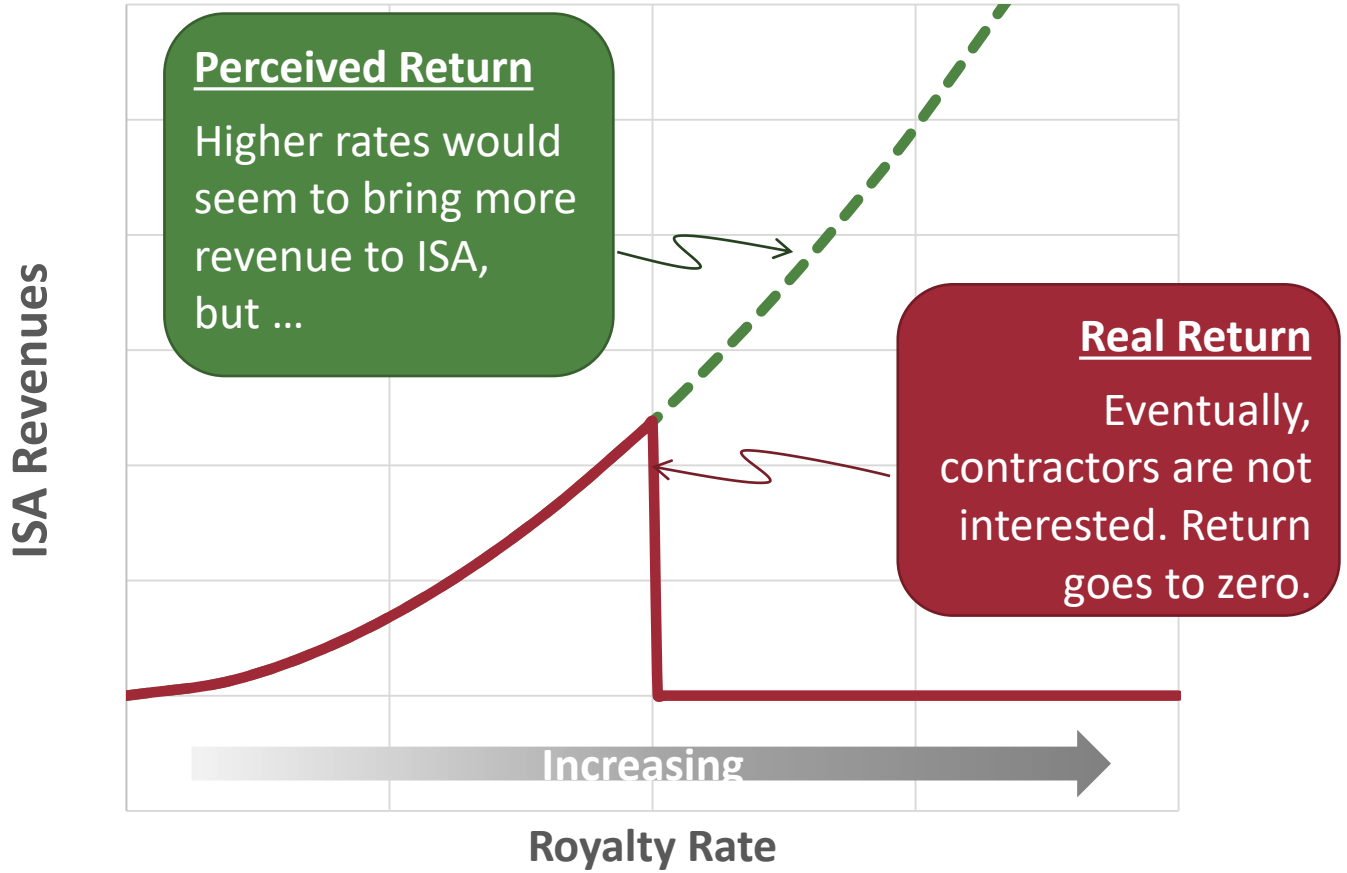
Image from: Marvasti, A. Env. and Resource Econ (2000) 17: 395. https://doi.org/10.1023/A:1026566931709

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



Why Consider the Return to the Contractor?
Need to find constraint to find ISA maximum return

- 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

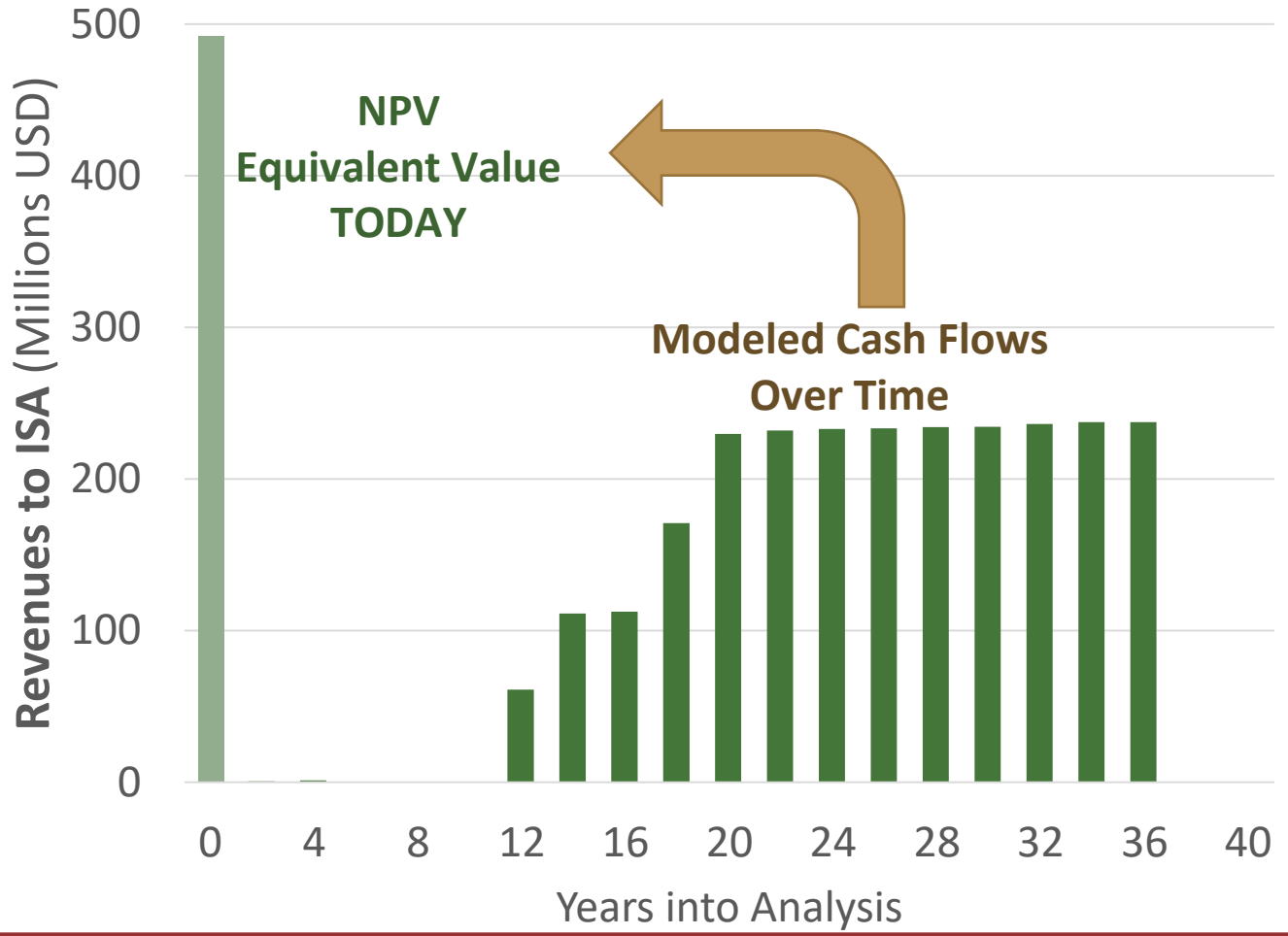


Once we have estimated all cash flows, what do we do with that?

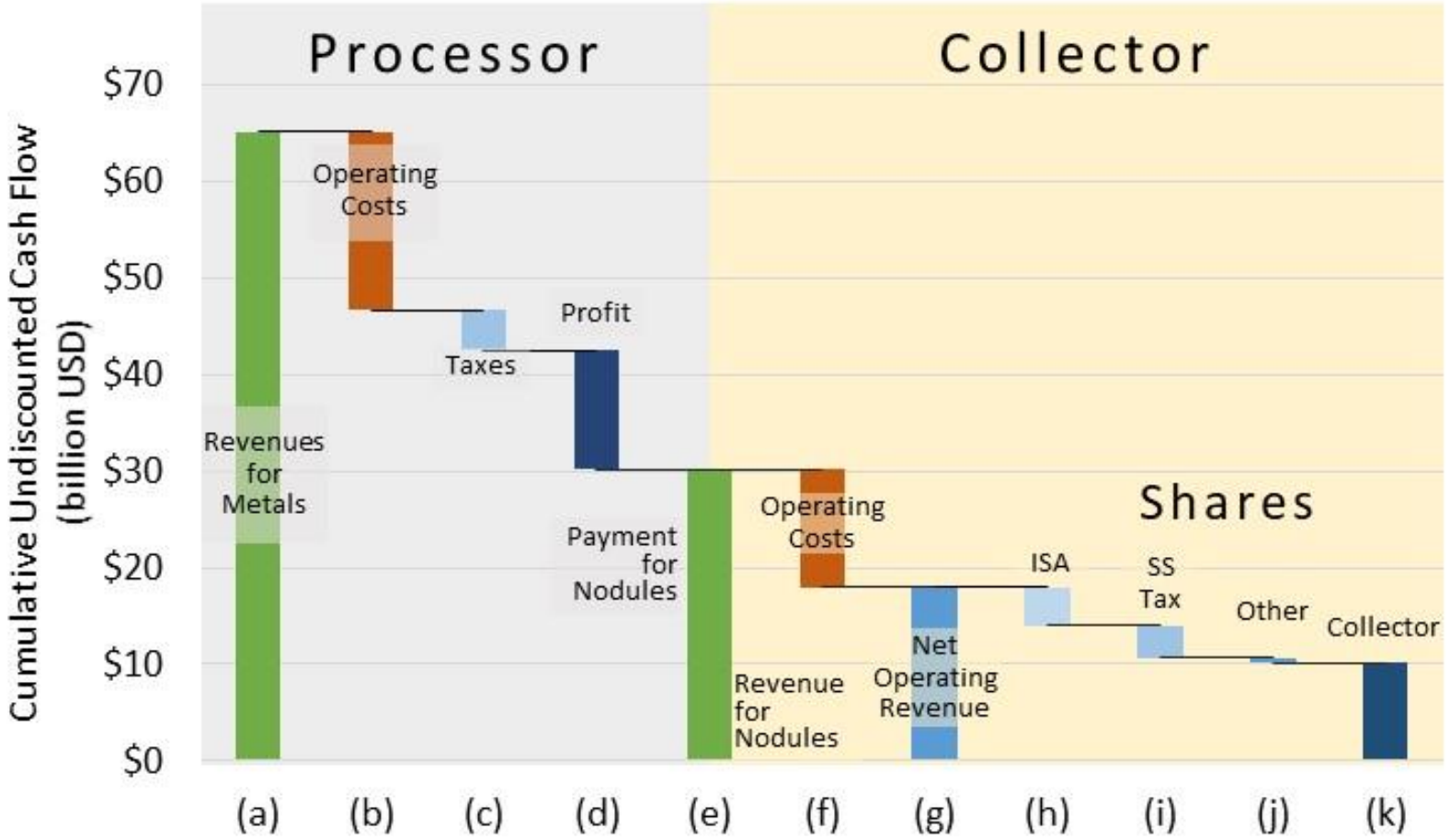
Evaluation Metrics

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 Return (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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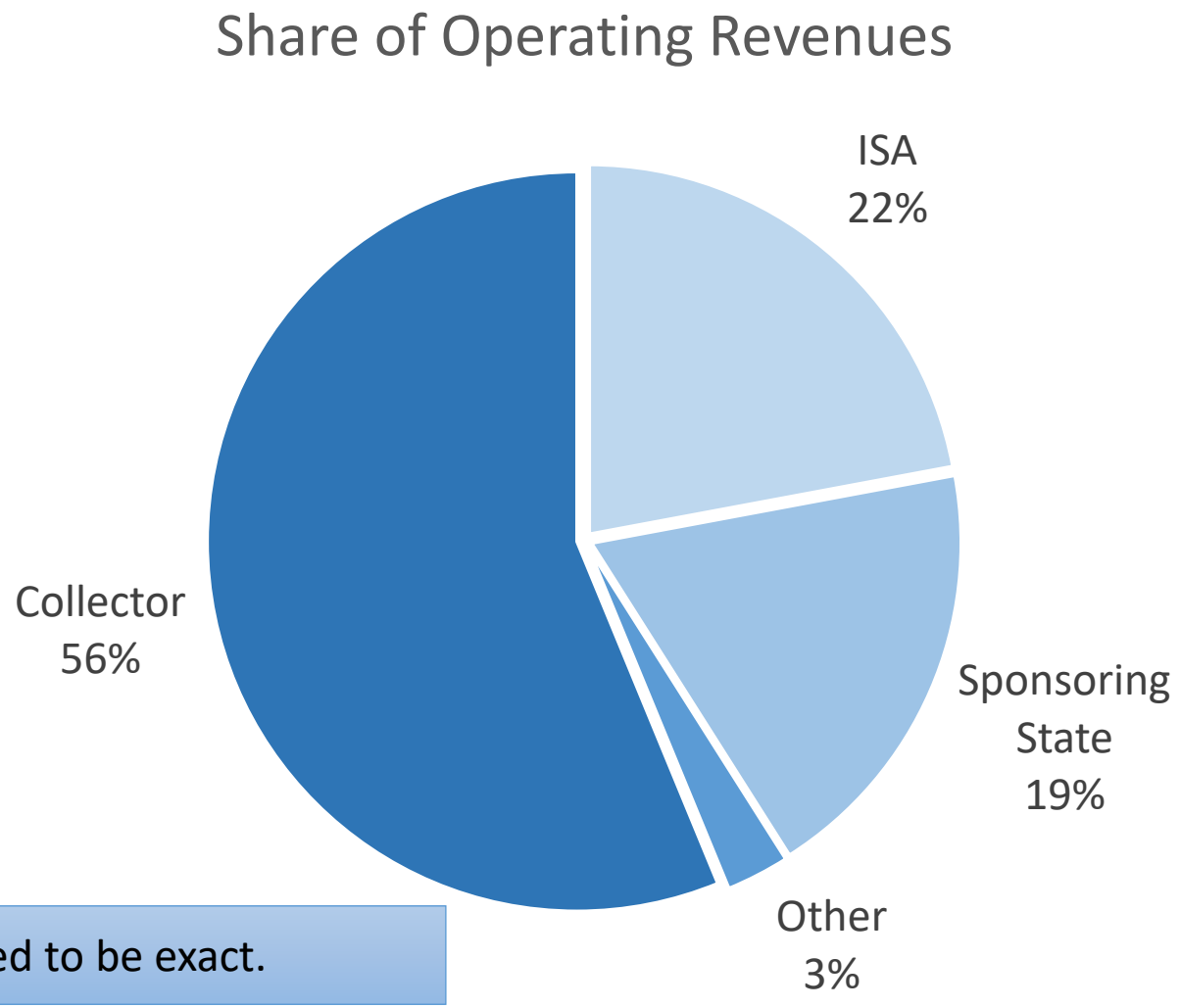
Using Net Operating Revenue at the Collector, Shares are Computed

- Share of Net Operating Revenues to
  - ISA
  - Sponsoring state
  - Other
  - Contractor
- Effective tax rate = 100% – Collector Share



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Financial Payment Systems Under Consideration

Four Options

1. Fixed ad valorem - one stage
2. Fixed ad valorem - two stage
3. Variable ad valorem - two stage
   (fixed 1st stage, variable 2nd stage)
4. Blended Profit – two stage
   (fixed ad valorem 1st stage, blended profit & fixed ad valorem 2nd stage)

One Stage vs Two Stages:

- One stage: same rate in all years
- Two stage: rate changes in 2nd stage

Financial Systems:

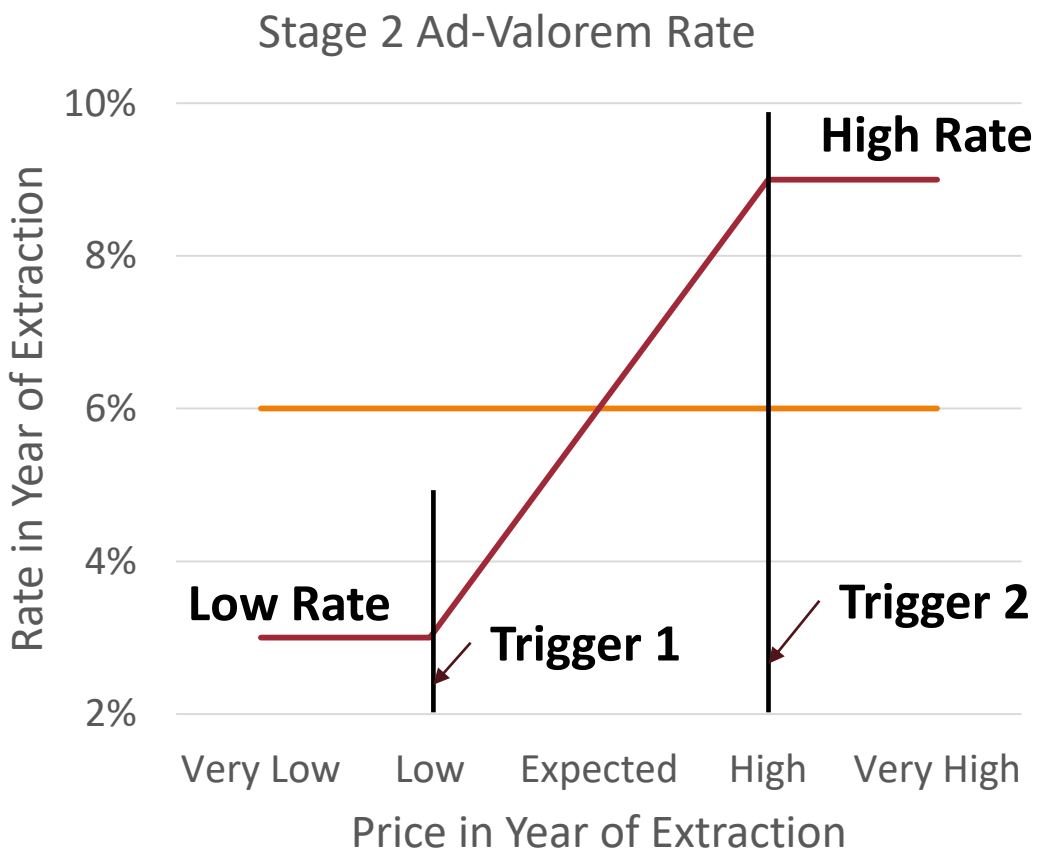
- Fixed ad valorem rate (in each stage)
- Variable ad valorem rate (rate changes with metals prices)
- Fixed rate on profits
- Blended ad valorem and profit

All systems can be designed to yield the same revenue to the ISA under baseline conditions

For Variable Rate Ad-valorem Changes With Metal Prices

- In all cases, we assume fixed 2% rate for first five years
- For second five years, …

  Variable ad-valorem requires more definition
  - Low rate
    - Price at prices below Trigger 1
  - Trigger 1
    - Price above which rates go up
  - Trigger 2
    - Price at or above which rates are at maximum
  - Max rate



How Do the Systems Differ?

- Timing of payments to ISA

- Provide different amounts to the ISA if future does not equal baseline conditions that were forecast
  - Future metals prices turn out to be different than forecast
  - Different levels of metals recovery rates are achieved
  - Contractor cost overruns or savings

Timing Opportunities

- Would the ISA be willing to accept lower payments in the first few years in return for higher total revenues across the lifetime of the project?
- If so, how much lower in early years and for how much higher in the future?

Example:

One Stage System:
$100 million/year for 25 years

vs.

Two Stage System:
$50 million/year for 1st 5 years
$150 million/year for next 20 years

Lifetime Revenue = $2.5 billion

Lifetime Revenue = $3.0 billion

Can be designed to provide contractors with same return for either system
Takes advantage of contractor need to pay off debt earlier, if ISA is willing to wait

How Do Systems Respond to Different Future Conditions?

- Goal:
  - Capture “upside potential” if future exceed expectations
  - Limiting the “downside risk” if future conditions fail to meet expectations.
- Sources of “upside potential”
  - Higher than expected future metals prices
  - Higher than expected metals recovery rates
  - Lower than expected contractor costs
- If these occur, the total net revenues are higher
- A system can be designed to let ISA capture different shares of these additional revenues.

However, it's impossible to design a system that only gives upside benefits without downside risks

- Any system that limits the upside rewards to contractors, must also limit their downside risk
  - Required to keep the "expected" or average value constant.

- This is essential because the systems and rates will be chosen to give contractors only what they need and no more on average.

- Lower net revenues to be divided between ISA and contractors

How much downside risk would you be willing to accept to achieve higher upside potential?

Simplified example:

- equal probability of different future net revenues:
  - 20% below forecast baseline values
  - Equal to forecast baseline values
  - 20% higher than forecast baseline values

- For simplicity sake, let's assume lifetime net revenues at the baseline forecast values are:
  - ISA = $3.0 billion
  - Contractors = $3.0 billion

Total System Net Revenue = $6.0 billion

Several approaches to risk & reward sharing: Simplified Example

	System Net Revenue
Low Net Revenue Future	$4.8 billion
Expected Net Revenue Future	$6.0 billion
High Net Revenue Future	$7.2 billion
AVERAGE RESULT	$6.0 billion

1 & 2: Fixed Ad Valorem

3: Variable Ad Valorem &
4: Blended Profit

Each System Responds Different to Sources of Risk

	Metal Price Risk	Metals Recovery Rate Risk	Contractor Cost Risk
3. Variable Ad Valorem	✓		
4. Blended Profit Based	✓	✓	✓

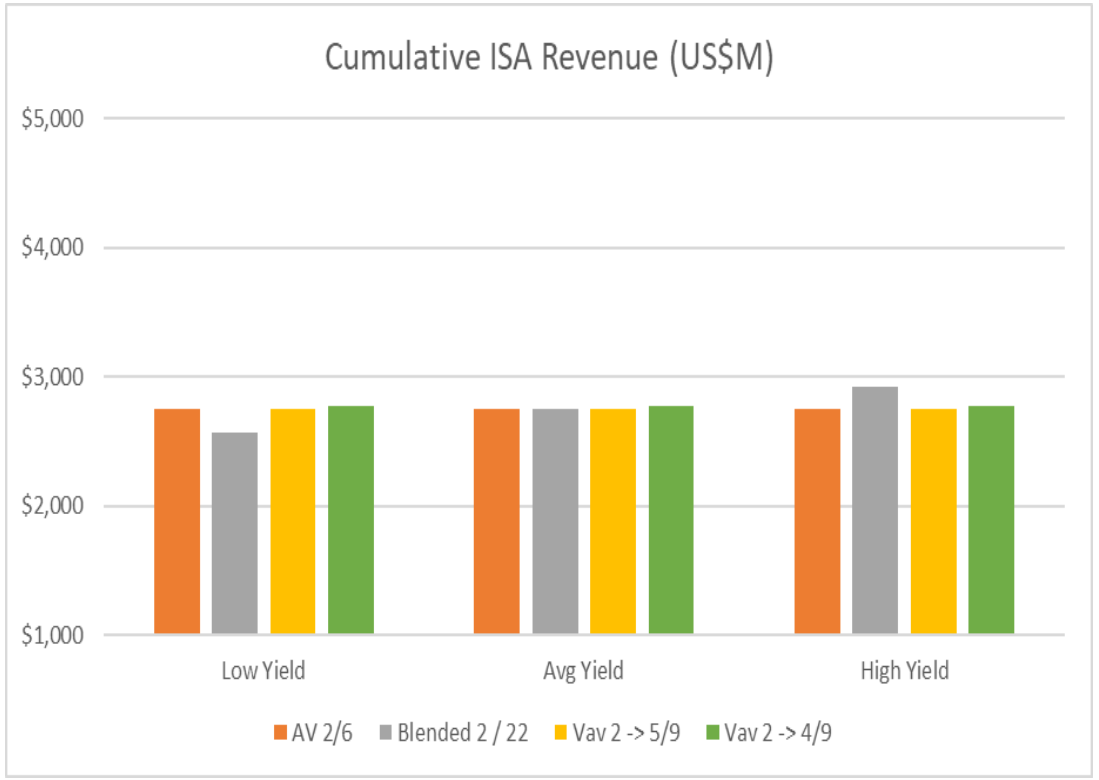
However, addressing each source of risk will also require ISA to monitor each of these variables

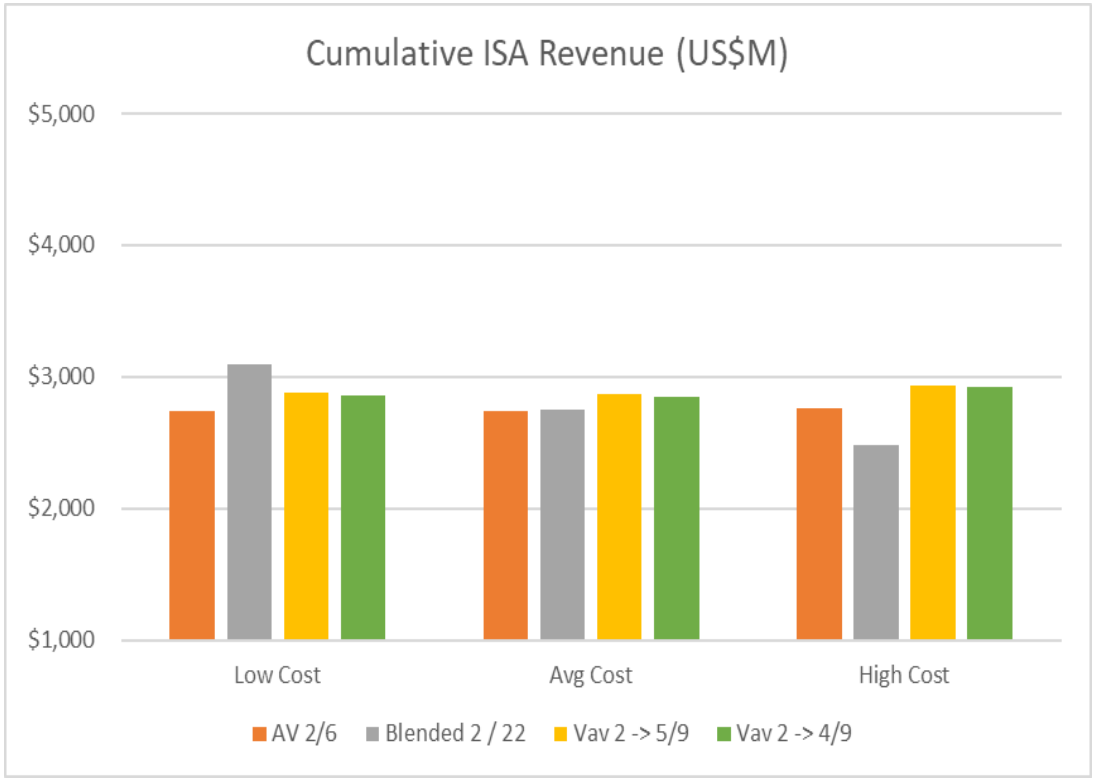
Many System Configurations Were Evaluated, Four are Recommended for Further Consideration

- Research team selected systems that
  - Maximize return to ISA
  - Provide nearly identical median return to ISA
- Systems differ in how they respond to extreme conditions

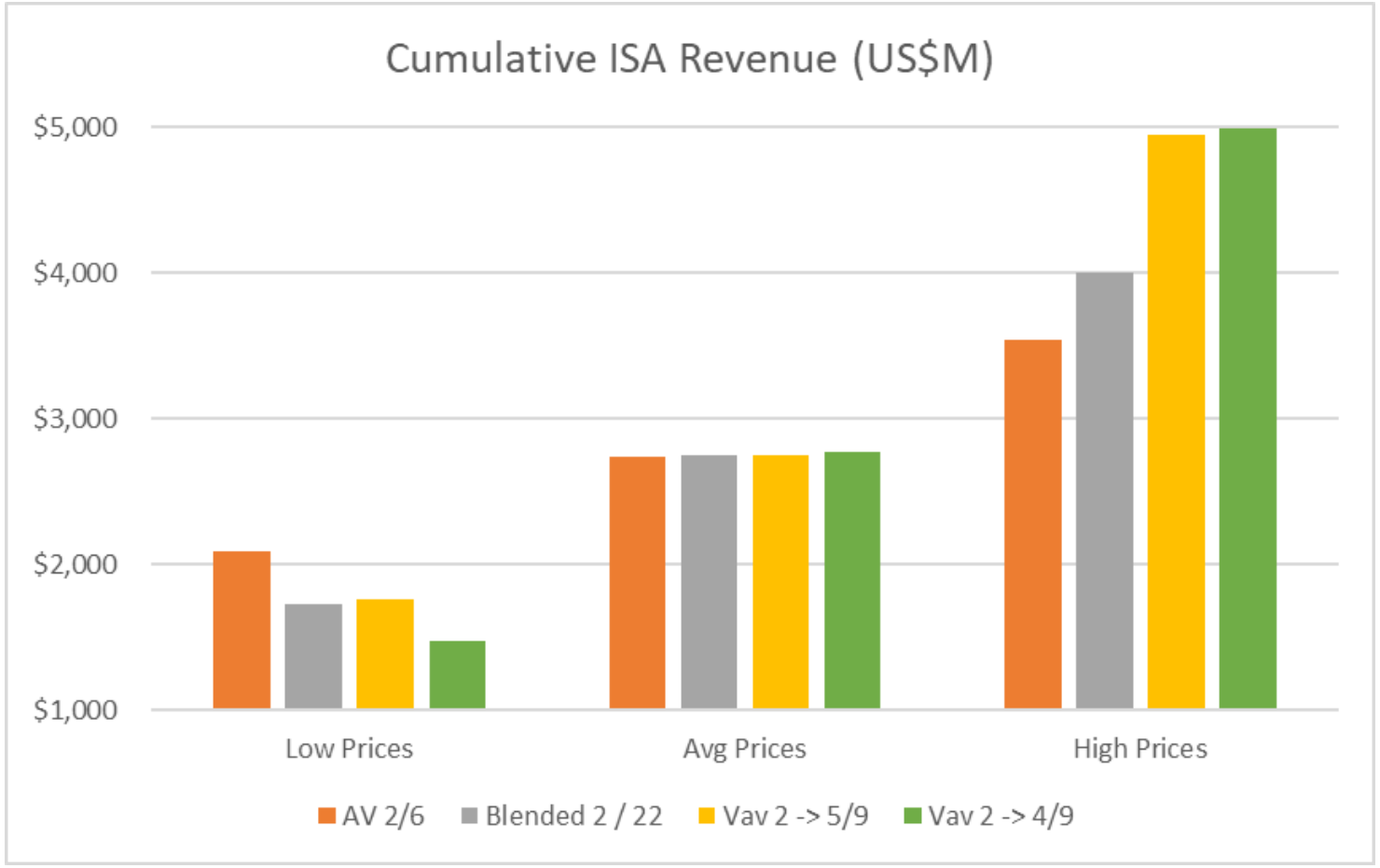
	System	ISA Revenue ($M)	ISA NPV ($M)	Effective Royalty Rate	Effective Tax Rate
1.	**Fixed Ad Valorem:** 4%	$1,962	$1,524	12%	43%
2.	**Two Stage Ad Valorem:** 2% → 6%	$2,741	$1,920	6% → 18%	49%
3a.	**Variable Ad Valorem:** 2% → between 4% & 9%	$2,734	$1,922	6% → 18%	49%
3b.	**Variable Ad Valorem:** 2% → between 5% & 9%	$2,775	$1,924	6% → 18%	49%
4.	**Blended Profit:** 2% AV & 22% on Profits	$2,744	$1,899	6% → 18%	49%

All Systems Respond Similarly to Changes in Realized Metal Yield and Collection Cost





Variable Ad-valorem Allows ISA to Capture upside, If Prices Rise



Steps for Calculating the Payment

Ad Valorem(fixed or variable)

1. Monitor mass of nodules retrieved
2. Measure the quantities of each metal in nodules
3. Look up prices of 4 metals on global markets
4. Calculate the value of the metal retrieved from the seabed
5. Calculate royalty rate associated with the metals prices
6. Apply royalty rate to the metal value retrieved to obtain payment

Profit Based System

1. Track all capital expenditures
2. Monitor all ongoing expenses
3. Monitor all revenues (this is based on the sale price of the nodules and not the directly on the metals prices)
4. Monitor all other accounting charges including capital depreciation, local taxes, R&D expenditures, etc.
5. Calculate “profit”
6. Apply rate to profit to get the payment

Establishing Rules for Different Systems

Ad Valorem

1. Establish all royalty rates and trigger prices
2. Specify global price indexes for each metal
   (for example: LME 30 day Copper)
3. Establish a system for monitoring:
   - amount of nodules retrieved
   - measuring metal content from a sample of those nodules

Profit Based System

1. Establish the rate of payment on profits
2. Develop full accounting code for treatment of all expenses & revenues
   (possibly adopt existing system?)
3. Establish a system tracking all cash flows
   - Amount of nodules sold
   - Nodule transfer price
   - All expenditures

*Note: A blended system with profit and ad valorem rates require all of the above

Multiple Jurisdictions May Allow Strategies for Reducing Payments from a Profit Based System

Mining firms often strategize on how to minimize royalty payments

- Move revenues between jurisdictions
- Move expenses
- Strategic use of R&D to offset profits

Some examples of risks specific to Deep Sea Mining

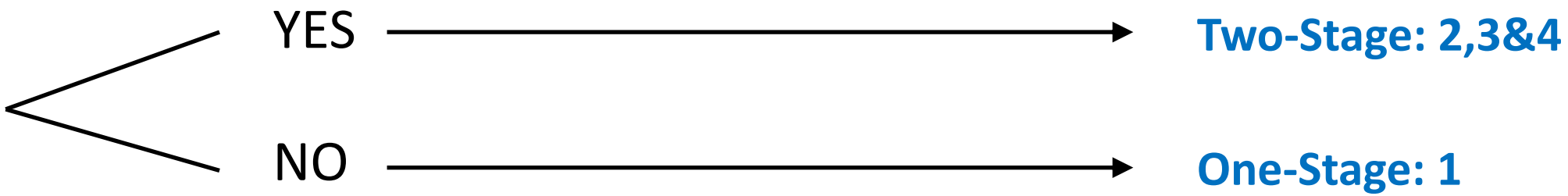
1. Nodules sold at low transfer price to an affiliated on-shore company
   Result: Collector profits are lower → ISA revenue is lower

2. Company-wide R&D done by (and charged to) seabed mining division
   Result: greater offsets against profits → ISA revenue is lower

Detailed accounting rules can help address these, but can be complex and challenging

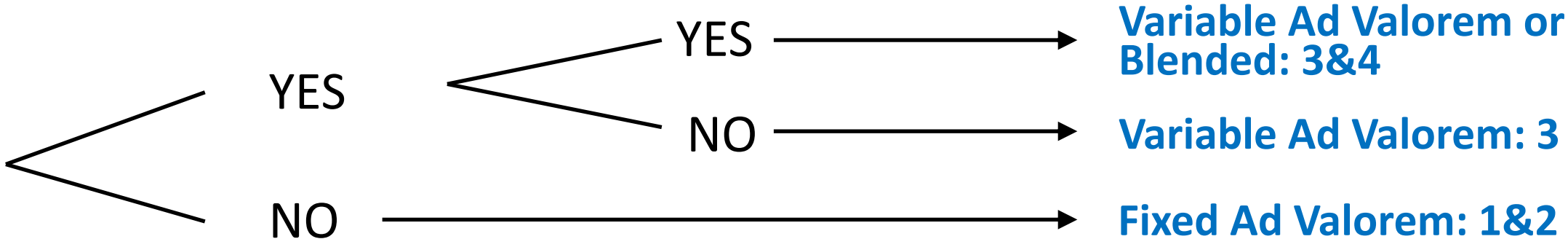
How to Select a Financial Payment System?

1. Are you willing to sacrifice some early revenue to get a greater total?



2. Willing to take on extra downside risk to get more upside rewards?

3. Willing to implement full accounting system? Willing to accept risks of "gaming" the system?



Summary & MIT Recommendations for Financial Payment System

1. One Stage with a Fixed Ad Valorem
2. Two Stage with a Fixed Ad Valorem
3. **Two Stage with a Variable Ad Valorem**
4. Blended Profit plus Fixed Ad Valorem

Two stage system with a variable ad valorem allows:

- ISA to capture a good amount of upside benefits with only limited downside risk.
- Can be designed to give higher overall revenues to ISA accepting slightly lower revenues in the 1st stage