DAY 02: SESSION 04

Asset Account for Mineral and Energy Resources: Monetary Terms

Regional Training Workshop on the System of Environmental-Economic Accounting

Ross Alexander
Australian Bureau of Statistics

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Unit Outline

- how does SEEA define and record mineral assets?
- what are asset accounts?
- what are the differences between balance sheets and assets accounts?
- what are the differences between economic and environmental assets?

Acronyms

AFR	=	Australian Financial Review
EDR	=	Economically Demonstrated Resources
GMI	=	Gross Mixed Income
GOS	=	Gross Operating Surplus
GOSMI	=	GOS plus GMI
LME	=	London Metals Exchange
NPV	=	Net Present Value
OCE	=	Office of the Chief Economist
USGS	=	United States Geological Survey

Acronyms

SEEA	=	System of Environmental-Economic Accounting
SEEA-CF	=	SEEA Central Framework
SNA	=	System of National Accounts
2008 SNA	=	SNA Manual (2008 Edition)
UNFC-2009	=	UN Framework Classification for Fossil Energy and Mineral Reserves 2009

Asset Account for Mineral and Energy Resources

This session is based on Section 5.5.4 *Monetary asset accounts for mineral and energy resources* in Chapter 05 of the System of Environmental-Economic Accounting 2012 - Central Framework (pp.153-159).

Valuation of Mineral and Energy Resources

Both the SNA and SEEA recommend asset valuation based on market prices, but these prices are often unavailable, especially for environmental assets. In particular, the following conditions may apply to environmental assets:

- **never sold or rarely sold**
- **leased instead of sold**
- **have long production 'lead' times**
- **sale price is unrepresentative of value of similar assets**

Valuation of Mineral and Energy Resources

The measurement boundary extends to all known deposits in physical terms BUT:

- **it may not be possible to value all of these deposits in monetary terms owing to degrees of uncertainty regarding expected extraction profiles and incomes**

SEEA-CF recommends that valuation be undertaken only for deposits in:

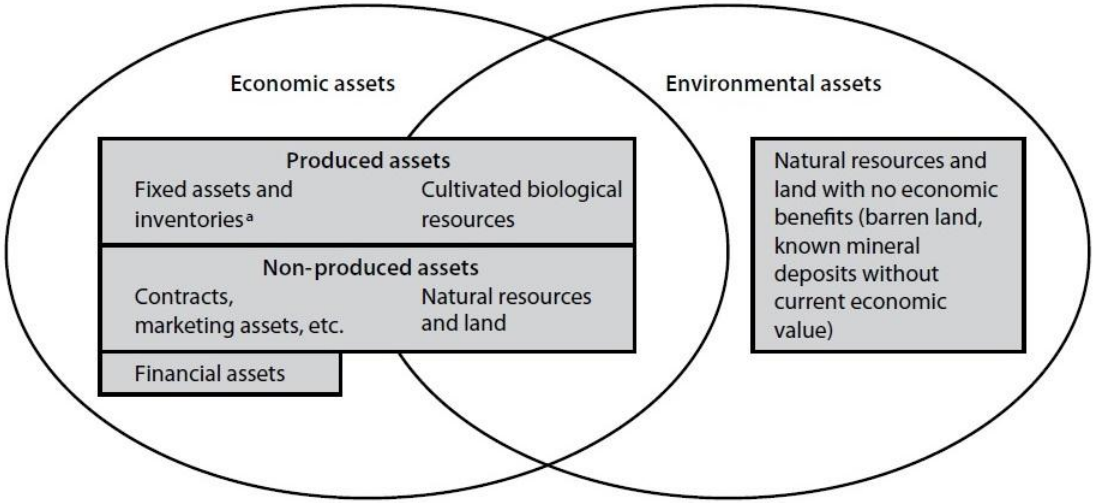
- **Class A Commercially recoverable resources (UNFC for Fossil Energy and Mineral Reserves 2009)**

  corresponding to

- **economic demonstrated resources in McKelvey Box**

Valuation of Environmental Assets

In the Central Framework, consistent with the SNA, the scope of valuation is limited to the benefits that accrue to economic owners of economic assets (including many environmental assets):



SOURCE: Figure 5.1 Relationship between environmental and economic assets, in UN (2014) *System of Environmental-Economic Accounting 2012 - Central Framework*, p.139.

Valuation of Mineral and Energy Resources

As discussed in Session 01, SNA and SEEA-CF suggest methods to approximate market values for environmental assets where market prices are unavailable or unsuitable:

- **net present value method**
- **rights-based valuation**
- **appropriation method**

Valuation of Mineral and Energy Resources

Net Present Value (NPV) method

- resource rent (or RR) derived using residual value method
- discounted value of expected future economic benefits from the asset

Rights-Based Valuation method

- on the basis of tradeable rights to own or use asset

  e.g. fishing rights

Appropriation method

- sum of taxes, levies, royalties collected by government

Net Present Value Method

1. measurement of returns on environmental assets – *resource rent derived through residual value method*
2. rate of return on produced assets
3. expected pattern of future benefits
4. asset life of the resource
5. choice of discount rate

Net Present Value Method

The value of subsoil mineral and energy resources is usually determined by the present value of the expected net returns resulting from the commercial exploitation of those resources:

- **such valuations are subject to uncertainty and revision**
- **it may be difficult to obtain appropriate prices for valuation purposes as ownership changes infrequently**
- **it may be necessary to use valuations determined by owners of the assets in their own accounts.**

Net Present Value Method

Asset value derives from expected benefits rather past or current returns:

- difficult to know future prices, extraction rates and costs
- assume past and current extraction rates and resource rents will continue unless better information available
- using a moving average of resource rent will reduce volatility of estimates
- 'abnormal' results require re-estimation of NPV model

Net Present Value Method

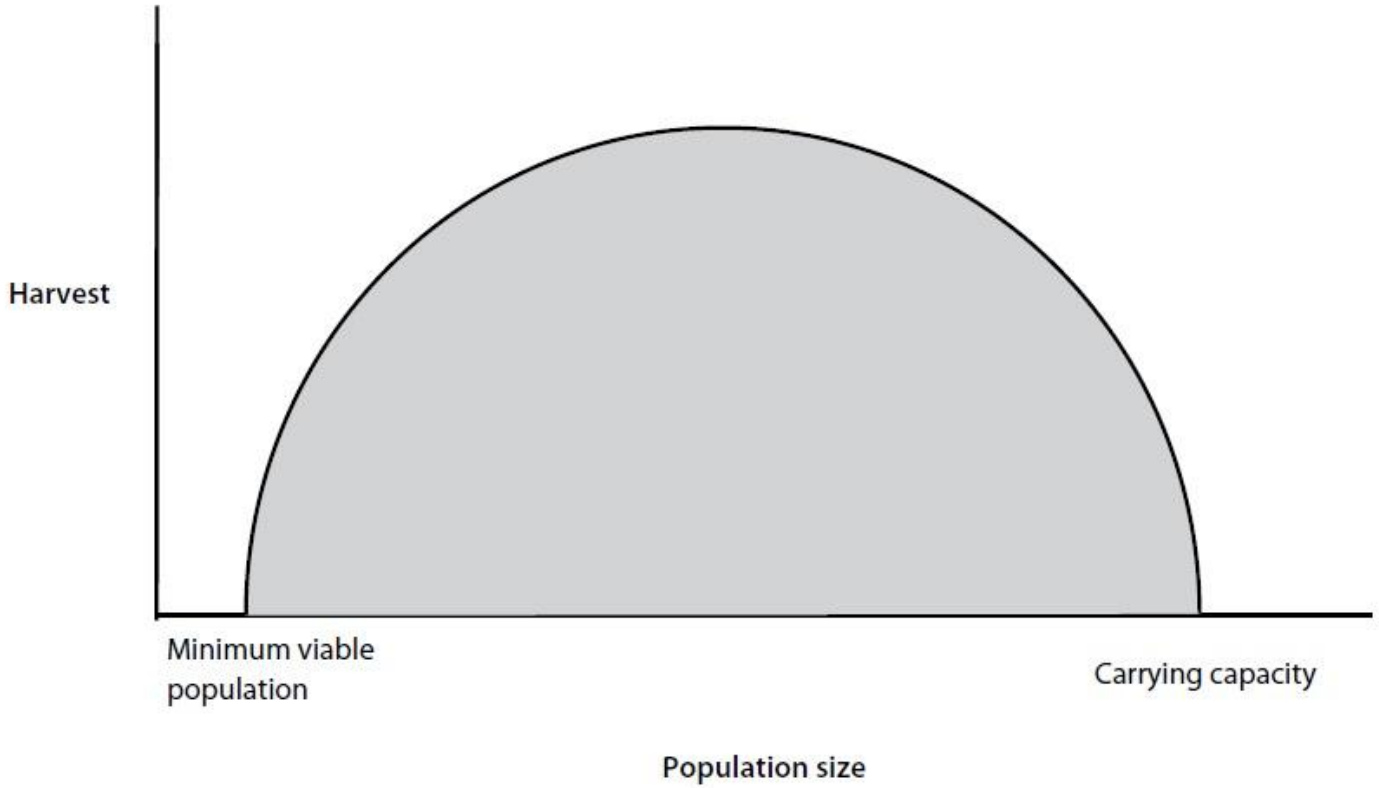
Estimates of the asset life must be based on the available physical stock and on assumed rates of extraction:

- need to consider expected growth for renewable resources
- use of models is necessary to determine asset life for biological resources (e.g. fish)
- no depletion is recorded where extraction is less than the sustainable yield

NPV estimates are stable for this factor where asset lives are over twenty years.

Asset Account for Mineral and Energy Resources: Monetary Terms

Figure 5.2 Stylized sustainable yield curve



SOURCE: Figure 5.2 in UN (2014) *System of Environmental-Economic Accounting 2012 - Central Framework*, p.148.

Net Present Value Method

Which mineral and energy resources should be valued in monetary terms?

- variability in price, extraction costs and technology mean that, over time, considerable scope for resources to move between classifications

  e.g. Classes A, B and C (UNFC-2009)

  EDRs, sub-economic and inferred resources

Net Present Value Method

Which mineral and energy resources should be valued in monetary terms?

- justifies the use of a moving average in calculating NPV asset values
- physical estimates of mineral and energy resources should indicate which resources have a corresponding monetary estimate

Net Present Value Method

Most countries (including Australia) use the NPV method to value mineral and energy resources:

$$V_t = \sum_{t=1}^{n} \frac{RR_t}{(1+r)^t}$$

where V = net present value
n = asset life
r = nominal discount rate
RR = resource rent
t = time period

Net Present Value Method

Asset life

- EDRs (or commercially recoverable resources) at year end divided by five-year moving average of production

Discount rate

- ABS uses large business borrowing rate published by Australia's central bank
- BPS assumes discount rate to be 0.04 or 4% for NPV
- this rate represents the opportunity cost of the funds which mining and oil companies invest in extraction.

Net Present Value Method

A discount rate is needed to convert stream of resource rents into an estimate of asset value:

- **rate expresses asset owner's time preference, and their attitude to risk**
- **a market-based discount rate is assumed to equal the rate of return on produced assets**

This rate can be seen as the expected (or approximate) rate of return on non-produced assets.

Net Present Value Method

Resource rent **(or net income per year) is the share of GOSMI earned from the extraction of resources:**

$$RR = (p - c) * q$$

where	p	=	average price received per unit (or unit prices) at 30 June
	q	=	average quantity extracted
	c	=	average production cost per unit at 30 June (including a normal return to produced capital)

Note that 'average' in Australia refers to five-year lagged or moving average.

Net Present Value Method

Note the following data sources by variable for ABS data:

- ***average***: **refers to five-year lagged or moving average**
- ***quantity***: **production volumes are published annually by Geoscience Australia (AIMR | OGRA)**
- ***unit prices***: **Australian Financial Review (AFR)**
  London Metal Exchange (LME)
  Resources and Energy Statistics (OCE)
  United States Geological Survey (USGS)
- ***production costs***: **are provided by a private consulting firm using a sample set of mines and industry trends**

Net Present Value Method

Example valuing crude oil:

mine life	= 5 years
price	= $1,000 per kilolitre
cost of production	= $500 per kilolitre
production	= 10 megalitres per year
discount rate	= 7.5%
resource rent	= $(p - c) * q$
	= (1 - 0.5) * 10,000,000
	= $5 million per year
	= $25 million over 5 years

1 megalitre = 1000 kilolitres

Net Present Value Method

Example valuing crude oil:

$$NPV = \sum_{t=0} \frac{\$25 \text{ million}}{(1+0.075)^n}$$

$$= \frac{5}{1.075^1} + \frac{5}{1.075^2} + \frac{5}{1.075^3} + \frac{5}{1.075^4} + \frac{5}{1.075^5}$$

$$= 4.65 + 4.32 + 4.02 + 3.75 + 3.48$$

$$= \$20.2 \text{ million}$$

GROUP ACTIVITY 03

Key Concepts

SNA and SEEA measure the same assets. SNA uses balance sheets and SEEA uses asset accounts:

- balance sheets measure the value of stocks of assets and liabilities at the beginning and end of the accounting period
- all changes between the opening and closing balance sheet are recorded in the various accumulation accounts