LG/12/14

**12th Meeting of the London Group on
Environmental Accounting
Rome, 17-19 December 2007**

Depletion of renewable environmental resources

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DEPLETION OF RENEWABLE ENVIRONMENTAL RESOURCES: ISSUE PAPER FOR THE LONDON GROUP MEETING IN ROME, 17-19 DECEMBER 2007

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Summary: Measuring depletion of renewable environmental resources presents a unique problem. Renewable resources are, by definition, able to sustain or increase their abundance through natural growth in excess of natural mortality. This very ability presents a range of problems for measuring the value of renewable resources used in production: 1. how to value depletion in renewable resources used in production, and 2. how to value the stocks of such assets in the absence of market prices.

The paper proposes that that the value of natural growth for these resources should be recorded as an addition to income, and that extraction of renewable natural resources is akin to consumption of fixed capital and should be treated as a charge against income.

This paper suggests a method for decomposing resource rent from renewable resources into a measure of depletion and a measure of return to the natural resource. The paper further suggests a method for estimating the value of stocks of renewable natural resources used in production.

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Introduction

1. Chapter 10 of the Handbook of National Accounting Integrated Environmental and Economic Accounting 2003 (SEEA), ‘Making environmental adjustments to the flow accounts’ presents five sets of treatment options for recording depletion-related transactions in a set of environmentally adjusted national accounts. The treatment options cover:

A. Identifying the income element of resource rent.

B. Recording mineral exploration and mineral deposits.

C. Recording the additions to and subtractions from the stock of environmental assets.

D. Recording ownership of mineral-related assets.

E. Recording depletion – asset recorded in the legal owner's balance sheet.

The challenge is to reduce each set of options to a single, unequivocal recommendation.

2. The Australian Bureau of Statistics presented an issues paper at the London Group meeting in Johannesburg, March 2007, setting out preferred responses to the first two sets of options. The recommendation put forward for ‘Identifying the income element of resource rent’ was that part of resource rent should be considered as income and the remainder considered depletion (Option A3). While this recommendation was subsequently accepted by the London Group and UNCEEA, the issues paper specifically addressed the treatment of non-renewable environmental assets. The question then arose whether the recommended treatment of resource rent from use of non-renewables, Option A3, is equally applicable to the treatment of renewable environmental assets.

3. A broader question arises from the London Group endorsement of Option A3. If depletion of natural resources reduces income, should additions to natural resources be considered as additions to income?

4. At the same meeting, the London Group rejected Option B3 - to combine the value of mineral exploration expenditure with the value of the associated new mineral and energy discoveries to form a 'developed natural asset', which in turn would be classified as a produced tangible asset. The primary reason for rejecting this option was described in the relevant issues paper (Comisari, P. 2007 Issues paper: Depletion in the SEEA - narrowing down the options). That is, option B3 effectively assumes that mineral exploration expenditure gives rise to (and forms part of the valuation of) the new mineral and energy discovery.

5. The central question addressed by this decision is whether mineral and energy resources are the result of some type of productive activity as defined in the SNA, or whether they constitute non-produced assets. If the former, it would be necessary to both identify the productive activity giving rise to the mineral and energy resource, as well as establishing that discoveries are in fact the output of that activity. Production

is typically thought of as a process of *transforming* inputs into outputs. Using a conventional economic accounting perspective, it is difficult to conceive how newly discovered mineral and energy resources have been produced at all, let alone by a process utilising knowledge assets.

6. This current paper again addresses Option A3 to explore the question of whether the treatment of depletion for renewable environmental resources used in production is consistent with the recommended treatment for valuing depletion of non-renewable environmental resources used in production. Defining depletion of renewable resources is central to answering the question. Valuing such depletion is also important in providing an answer. A method for valuing depletion of renewable environmental resources that provides a consistent link between the System of National Accounts 1993 (SNA) and SEEA is proposed.

7. The scope of this paper is renewable economic environmental resources used in production, though the proposed treatment of depletion is also applicable to non-renewable resources. Economic environmental resources are assets in the SNA sense.

1. What is an asset?

8. Assets recorded in the balance sheet of the SNA are economic assets. An economic asset is an entity functioning as a store of value:

(a) Over which ownership rights are enforced by institutional units, individually or collectively; and
(b) From which economic benefits may be derived by its owner by holding it, or using it, over a period of time.

9. In SNA terms, economic environmental assets ('natural resources' in the draft SNA93 Revision 1) are a class of 'Non-financial non-produced assets'. By definition, non-produced assets come into existence other than through processes of production. More precisely, non-produced natural resource assets are environmental assets over which ownership may be established and transferred. Natural resources capable of being included on a national balance sheet are:

Land
Mineral and energy reserves
Non-cultivated biological resources
Water resources, and
Other natural resources

10. The natural resource asset boundary in the System is determined, in compliance with the general definition of an economic asset, by whether the assets are subject to effective ownership and are capable of bringing economic benefits to their owners, given the existing technology, knowledge, economic opportunities, available resources, and set of relative prices. Environmental assets over which ownership rights have not or cannot, be established, such as open seas or air, are excluded.

11. SEEA extends the SNA asset boundary to cover all environmental entities that are of interest and can be measured, in fact any entity that provides an environmental 'function'. There is no requirement that assets must be 'economic', that they be owned, or that they provide a stream of benefits to their owners.

12. Environmental assets covered by SEEA are grouped into the following broad categories:

Natural resources
- Mineral and energy resources
- Soil resources
- Water resources
- Biological resources

Land and associated surface water
Ecosystems

13. While the scope of SEEA's environmental asset classification is substantially broader than that of the SNA, any environmental assets that are neither owned, nor provide either an income stream or store of wealth for their owners remain beyond the

scope of this paper. Because such assets are not economic assets, no depletion associated with economic production can be charged against them.

14. A key purpose of asset accounts in both SNA and SEEA is to reconcile opening and closing asset balances through transactions and other changes that occur in the accounting period. In the SNA, this is done exclusively by valuing the opening stocks, transactions, other changes and closing stocks. SEEA allows this reconciliation to be undertaken in either monetary and physical units, or a combination of both. However, as the scope of this paper is depletion of economic environmental resources used in production, its concern is valuing depletion in economic (monetary) terms. The corollary of valuing depletion is to value the economic appearance of economic environmental resources used in production.

2. Renewable and non-renewable resources

15. Of the environmental assets covered in SEEA, mineral and energy resources (*reserves* in the SNA) are considered non-renewable. Once they are used they are gone. The term non-renewable applies even though many of these resources are so abundant that they will not be exhausted in the foreseeable future. Indeed, many mineral and energy resources are identified and measured only so far as mining and petroleum producing companies need to delineate production reserves for the next few years.

16. The other environmental assets in SEEA; soil, water, biological resources, land and ecosystems may be considered renewable resources insofar as if they are used sustainably, they will last in perpetuity. History has shown though, that renewable resources are not always used sustainably. Fish stocks, for example, may be exploited to the point of collapse of the underlying resource. Soil is often used to the point of exhaustion, forests are logged out and ecosystems collapse.

17. The SNA is of the view that if an asset used in production is infinitely abundant (or infinitely renewable) any amount of use would not affect its value (which would be zero). Consequently, there is no decline in its current value during the accounting period as a result of its use in production and the entire value of the capital service flows generated from using such an asset in production is an income to the owner of the resource. This condition cannot apply to produced assets but is implicit in SNA’s treatment of some non-produced assets. The implication of assuming no decline in the value of natural resources used in production must be that natural growth always keeps pace with harvest of the resource or that there is such an abundance of the resource that it is free and there is no cost to using up this ‘capital’.

18. This view does not always reflect reality. When natural resources are used unsustainably or their abundance is reduced, the income generated from their use includes revenue from selling off part of the stock of the resource. That stock will not be available for use in future production. When a natural resource is depleted through its use in economic production, the value of such depletion should be recorded as a cost of production both by the units using the resource and by the economy, i.e., Option A3 in SEEA. The treatment recommended by Option A3 applies to both renewable and non-renewable environmental resources used in production.

3. What is depletion?

(i) Depletion in the SNA

19. The SNA provides for a variety of ways for an asset to leave the System: through consumption of fixed capital, through withdrawals and recurrent losses of inventories, and through extinguishing financial claims. None of these are applied to natural resource assets. Instead, the *Other changes in volume of assets account* records the departures of these assets in another way–economic disappearance. One form of economic disappearance is depletion.

20. Depletion of natural deposits is the reduction in the value of deposits of subsoil assets as a result of the physical removal and using up of these assets. In principle, the reduction in the value of renewable natural economic assets (natural forests, fishstocks and other non-cultivated biological resources) as a result of harvesting, forest clearance, or other use should also be recorded as depletion.

21. Economic disappearance of natural resources can take other forms as well as depletion, including:

a) Changes in the condition of exploitable mineral and energy reserves (e.g. reductions in the level of proven reserves that reflect changes in technology and relative prices);
b) Changes in the quality of economic use from a higher to a lower value (e.g. from cultivated land to grazing land);
c) Natural mortality; and
d) Degradation due to economic activity (e.g. erosion and other damage to land from deforestation or improper agricultural practices, harmful effects on fishstocks from acid rain or excess nutrients from agricultural run-off).

22. These other forms of economic disappearance are not regarded as depletion in the SNA sense.

23. Catastrophic losses, which may be caused by major earthquakes, tsunami, exceptionally severe cyclones, drought, wild fires and other natural disasters; acts of war, riots and other political events; and technological accidents such as major toxic spills, are recorded as a separate item in the accounts. Catastrophic losses are not regarded as depletion in the SNA.

24. The range of possible additions and reductions to volumes (hence values) of an environmental asset allowed by the SNA and SEEA are set out in matrix form in Figure 1. Unlike produced assets, environmental assets in the SNA cannot be added to by capital formation or reduced by consumption of fixed capital (so no charge for their using up is recorded as a cost of production). All volume changes in natural resource assets, both additions and reductions are recorded in the *Other changes in the volume of assets account*. Volume changes are also defined to include the effects of quality and classification changes, e.g. from cultivated land to land underlying buildings, and changes in condition, e.g. from sub-economic to economic subsoil assets as a result of technological changes or relative price changes. Effects of pure price changes on asset values are recorded in the *Revaluation account* and are not

further discussed in this paper though they would need to be accounted for in any measure of depletion adjusted income.

25. The matrix presentation in Figure 1 shows how changes in volumes of natural resource assets between the beginning of an accounting period (St) and the end of the accounting period (St+1) are reconciled by the changes occurring in period 1. These changes can be measured as flows in the SNA *Other changes in volume of assets account*, such that:

$$St+1 = St + \Sigma EA + NG - \Sigma ED - CL - US + OVC + CC$$

where: EA is economic appearance, NG is natural growth, ED is economic disappearance, CL is catastrophic loss, US is uncompensated seizures, OVC is other volume changes, and CC is changes in classification.

Figure 1. Changes in volume of a natural resource

SEEA asset account	SNA equivalents:	Asset account	SNA Other changes in volume of assets account (flow account)							Asset account
			Period 1							
Changes to volume of stock other than from transactions:			Economic appearance	Natural growth	Economic disappear.	Catastrophic losses	Uncompen. Siezures	Other volume changes	Changes in classificat'n	
		St	K3	K5	K6	K7	K8	K9	K12	
Discoveries	Discovery		X							DIS
Reclassification - function change	Changed conditions		X		X					ΣCCO
	Transfers to/from economic		X		X					ΣTE
Reclassification - quality change	Quality change		X		X					ΣQC
Natural growth & mortality	Natural growth & mortality			X	X					NGM
Extractions	Depletion				X					DP
Degradation	Degradation				X					DG
Catastrophic losses	Catastrophic loss					X				CL
Uncompensated siezures	Uncompens. seizures						X			US
Other changes in classification and structure	Classificat'n changes								X	OCC
	Other volume changes							X		OVC
		St	ΣEA	NG	ΣED	CL	US	OVC	CC	St+1

26. Expanding this further, the change in volumes from t to t+1 can also be measured in SEEA asset accounts (SEEA Table 7.5), with SNA equivalents, as:

$$St+1 = St + DIS + \Sigma CCO + \Sigma TE + \Sigma QC + NGM - DP - DG - CL - US + OCC + OVC$$

where: DIS is discovery, CCO is changed conditions, TE is transfer to economic status, QC is quality change, NGM is natural growth/mortality, DP is depletion, DG is degradation, CL is catastrophic loss, US is uncompensated seizures, OCC is other classification changes and OVC is other volume changes.

27. In practice, it is difficult to measure all possible changes to a stock during a period. Some changes will, by necessity, be measured on a combined or a 'net' basis.

(ii) Depletion in the SEEA

28. SEEA offers no prescriptive definition of depletion. SEEA notes that depletion is equivalent to consumption of fixed capital on the decline in value of a produced asset, but also notes that the word ‘depletion’ is commonly used with different meanings. Depletion is sometimes used to denote the total volume of extractions of natural resources multiplied by the unit resource rent and is sometimes used to represent the effect of extractions on the value of the stock of the resource. SEEA uses the words ‘extractions’ in the first sense, i.e., equivalent to resource rent. Depletion is used here, as in the SNA, to mean the change in value of the stock of the resource from its use in production.

29. Depletion in the SNA sense is not simply the change in value of the resource; more strictly, it is the change in the value of the stock of the resource due to the physical using up of the resource. Thus, depletion is intrinsically linked to reductions in volume of the resource and the consequent reductions in expected future income streams through extractions. Depletion excludes non-extractive changes in the stock of a resource. This view of depletion is applied to extraction of non-renewable environmental assets (subsoil assets) in the SNA, represented by the ‘Depletion’ row in the ‘Economic disappearance’ column in Figure 1. With some modification, the definition of depletion can be extended to the range of renewable natural resources used in production.

(iii) Depletion of renewable natural resources

30. With the exception of water, economic renewable natural resources are biological resources, of which fish stocks and natural forests are the most economically significant. The unique feature of renewable natural biological resources is that, under favourable conditions, they are able to sustain or increase their abundance through natural growth in excess of natural mortality. Natural growth is growth without the influence of economic entities, i.e., it is an economic appearance, not economic production in the SNA. If renewable resources are used sustainably they have infinite asset lives, although of course, individual animals and plants have finite asset lives.

31. SEEA aims to account for effects of economic activity on natural resource endowments to facilitate planning for sustainable development. An informed assessment of the sustainability of economic activity needs to consider natural growth of renewable natural resources used in production as well as the extraction of these resources. Thus, a more meaningful SEEA measure of sustainability of income from using renewable natural resources in production may be to integrate values for natural growth (net of natural mortality) and extractions, which together indicate if depletion of the resource is occurring, into an ‘adjusted’ measure of resource rent. These elements are shown shaded in Figure 1.

32. This approach leads to three alternative outcomes for attributing resource rent of renewable natural resources in an accounting period:

1. Adjusted resource rent is entirely attributed to income;
2. Adjusted resource rent is split between income and depletion; and

3. Adjusted resource rent is entirely attributed to depletion.

33. Conventionally, natural growth is recorded as an economic appearance in the SNA *Other changes in volume of assets account* and an addition to stock levels from natural growth in a SEEA asset account (SEEA Table 7.5, A SEEA asset account). However, the conventional approach fails to indicate whether income derived from using renewable natural resources in production is sustainable in the long term.

34. Using SNA accounts as a template, it is now proposed that the value of net natural growth of renewable natural resources be recorded as an 'other non-market output' in the *Production account*, and the value of extractions be recorded as 'consumption of natural capital', a charge against this output. Domestic product will in turn change to reflect any excess of growth over extraction, or any excess of extraction over growth. Operating surplus and saving will similarly change to reflect the excess position. The value of the net growth is recorded as an 'addition to the value of non-produced, non-financial assets' in the *Capital account* while the value of extractions is recorded as a consumption of natural capital. 'Net lending' will be unaffected by the changed treatment. The *Changes in balance sheet* will record any excess in 'tangible non-produced assets', leading to a corresponding change in the *Closing balance sheet.* SEEA accounts would show corresponding adjustments. Together, these changes will provide a guide to the sustainable use of renewable natural resources in production

35. Other events impacting on volumes of stocks of the renewable resource, e.g. changes in volumes due to changes in classification or technology, changes due to degradation, or changes due to catastrophic events, etc., are still regarded as 'other changes in volumes of the asset', not depletion. Effects of price changes are not regarded as depletion; they are recorded in the *Revaluation account*.

36. The 'adjusted' approach outlined has the advantage of integrating both values of additions to and extractions of renewable natural resources into an income stream measure that better indicates whether natural resources are being used sustainably (i.e., where growth equals or exceeds extraction) or unsustainably (where extraction exceeds growth).

(iv) Is consumption of natural capital equivalent to consumption of fixed capital?

37. The SNA defines consumption of fixed capital (COFC) as 'the decline, during the course of the accounting period, in the current value of the stock of fixed assets owned and used by a producer as a result of physical deterioration, normal obsolescence or normal accidental damage.'

38. Consumption of natural capital (CONC) reflects the decline during the course of the accounting period, in the current value of the stock of natural assets owned and used by a producer as a result of physical removal, or extraction, from the stock of the asset. In economic terms the effect of extraction of the resource is the same as physical deterioration; it reduces the future income stream that can be derived from the asset. Thus, the application of CONC to extraction of non-renewable natural resources is clear-cut.

39. The application of the CONC concept to renewable natural resources is less clear-cut because of the inherent potential of renewable resources to increase through natural processes. At the same time, it is clear that extraction (or harvest) of renewables reduces their value through use in production, this element is equivalent to COFC.

40. Natural resources used in production, whether renewable or non-renewable, are economic assets. The value of these assets should be recorded in the balance sheets of the units that own them, as well as in the national balance sheet (though there are issues to be resolved around how to appropriately record ownership when assets are owned by one sector and used by another). That such assets are 'non-produced' is immaterial for the owner unit. Their value lies, as for produced assets, in their expected future income flows. Insofar as future income flows are reduced by the using up of the natural resource, CONC is equivalent to COFC.

(v) What about degradation?

41. Degradation may be either an anticipated or an unanticipated consequence of economic activity. Where degradation is anticipated, it should be included with extractions in CONC, again equivalent to the treatment of physical deterioration, normal obsolescence or normal accidental damage in COFC. Where degradation is unanticipated, it should remain as an 'other change' in the volume of the asset. In many cases it will not be possible to identify and partition elements of degradation as either anticipated or unanticipated consequences of production. A practical solution is to record all degradation in the *Other changes in volume of assets account*, reflecting its character as a negative consequence of production rather than a using up of an asset in production.

4. Valuation

42. The SNA's general principle for valuing an item in balance sheets is that it should be valued as if it were being acquired on the date to which the balance sheet relates, including any associated ownership transfer costs. Such valuation relies on prices for these items being available on the balance sheet date, and ideally, these prices should be observable market prices for the item in question. This valuation method is not broadly applicable to environmental resources as market price information is often not available.

43. SNA's next-best option is to approximate market prices by the discounted value of the rent (resource rent) that assets will yield over their effective life. The 'net present value' (NPV) method is used extensively to value non-renewable natural resources on national balance sheets.

(i) Resource rent

44. Natural resources, like produced assets, provide capital services to the economy as they are used and are remunerated in the gross operating surpluses generated by the units that use them. The gross operating surplus of an entity using a combination of produced and natural capital can be divided to show how much is attributable to produced assets and how much to natural assets. The part due to natural

assets is ‘resource rent’. The other part, the return to produced assets, is ‘other economic rent’. In the absence of a market value, the value of an asset used by the entity, whether produced or non-produced, is the discounted present value of the rent expected over its effective life. Resource rent can in turn be decomposed into a return to the owner of the resource and a measure of depletion of the natural resource.

(ii) Net present value

45. Economic valuation of subsoil assets has been widely discussed. While issues of measurement, appropriate discount rates, and returns to capital remain to be resolved, there is a general consensus that appropriate values can be assigned to these assets, in the absence of market transactions, by calculating the NPV of the stream of future resource rents the resource will yield until it is exhausted. That is, assets are valued on the basis of the net present value of the expected future earnings. In theory, this is equivalent to the market price of the natural resource stock. The NPV method generally used to determine the present value of net cash flows is represented in equation 1.

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

where: V = net present value, RR = resource rent, r = discount rate, n = asset life

46. This method assumes that for each year the ongoing resource rent remains constant over the life of the asset (though ideally, factors that may affect future resource rents should be taken into account). The NPV of the asset at the beginning of each year for the remaining asset life is calculated, using the expected life length and (real) discount rate.

47. Economic depletion (consumption of natural capital) in any one year is the change in the value of the resource between the beginning and end of the year arising purely from the extraction of the resource. Economic depletion in the year can also be shown to be equal to the resource rent in the year minus a return (income) on the natural resource asset (equation 2). The income component is at least equal to the interest that could be earned if the asset were sold and then invested at an interest rate equivalent to the real discount rate.

$$d_t = V_{t-1} – V_t = RR_t – rV_t \qquad \text{(equation 2)}$$

where: d = depletion

(iii) Non-renewable resources

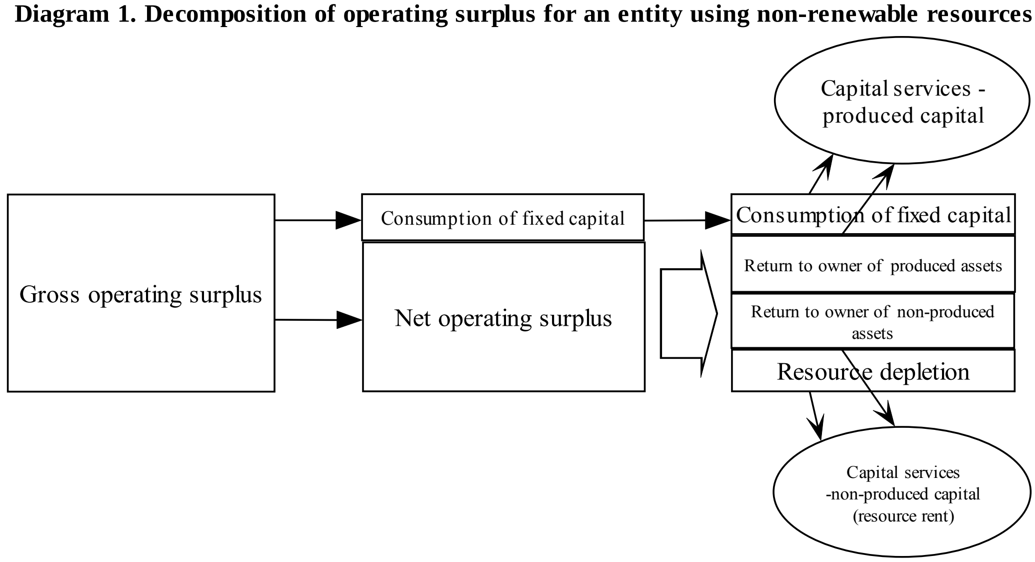
48. Resource rents are not directly observable but instead are typically derived as the difference between total revenue generated from the extraction of natural resources less costs incurred during the extraction process including the cost of produced capital (which itself includes a return to produced capital). Or, as stated more simply in SEEA, "the value of capital service flows rendered by the natural

resources, or their share in gross operating surplus, is the...resource rent" Depletion is then derived as resource rent minus the opportunity costs of capital invested in the natural resource. Depletion of non-renewable resources represents the reduction in the value of the asset as a result of the removal and using up of the asset.

49. Institutional units may use either produced capital assets or a mixture of produced and non-produced capital assets as factors in the production process. For any enterprise or industry, its gross operating surplus can be decomposed into consumption of fixed capital and net operating surplus. For institutional units or industries using only produced assets as capital inputs, the whole of its net operating surplus is a return to the produced assets employed. For institutional units or industries using a mixture of produced and non-produced assets (natural resources) as capital inputs to the production process, the net operating surplus can be further decomposed into an exogenous return to produced assets and resource rent. Resource rent can then be further decomposed into a return to the owner of the non-produced assets and a measure of depletion.

50. By convention, the measure of depletion has been charged to those industries using non-renewable natural resources, such as the mining industry. The decomposition of net operating surplus into a return to produced assets, to non-produced assets and to depletion is typical of a mining entity extracting subsoil assets. The relationship is depicted in diagram 1.

Diagram 1. Decomposition of operating surplus for an entity using non-renewable resources



(iv) Renewable resources

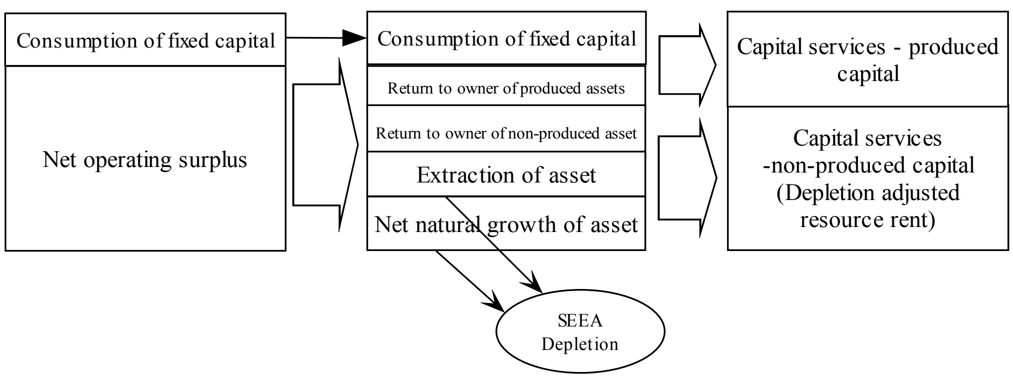
51. The value of any asset used in production can be derived from the value of its expected future income stream. When renewable resources are used unsustainably they have identifiable, finite asset lives and can be valued using the NPV approach shown in equation 1. When a renewable resource is being harvested at a sustainable rate, its asset life is infinite and the NPV formula reduces to:

$$V_t = \frac{RR_t}{r} \qquad \text{(equation 3)}$$

where: V = net present value, RR = resource rent, r = discount rate

52. The defining characteristic of renewable natural resources is their ability to reproduce, to grow new stock to replenish diminished stocks. Calculation of resource rent for units using renewable resources should reflect the ability of the resource to replenish itself. A method for calculating resource rent for renewable resources is now proposed, based on the concept of 'adjusted' resource rent discussed earlier, where what may usefully be termed 'SEEA depletion' is now defined to be extraction less natural growth (net of natural mortality) of the stock during the accounting period. The proposed relationship is depicted in diagram 2, which picks up the decomposition of operating surplus at the point where COFC and net operating surplus have been derived.

Diagram 2. Decomposition of operating surplus for an entity using renewable resources



53. As noted, where the renewable resource is being used sustainably, there is either no depletion charge or a negative depletion (repletion) value. A depletion adjusted resource rent for utilising renewable resources can be calculated in the same way as that for non-renewable resources by making two additional assumptions:

1. that depletion of renewables is represented by extractions less net growth, as discussed; and
2. where depletion of renewables is zero or negative, all resource rent represents income to the owner of the asset.

54. Recasting equation 2 to represent depletion of renewable resources yields the following equation (4).

$$\check{S}d_t = \check{E}t - \check{G}_t = \check{R}R_t - rV_t \qquad \text{(equation 4)}$$

where: $\check{S}d_t$ = SEEA depletion in t, $\check{E}t$ = extractions in t, $\check{G}_t$ = net natural growth in stock in t, $\check{R}R_t$ = depletion adjusted resource rent, rV_t = return to owner of natural capital in t

55. The net present value of a renewable resource used unsustainably is calculated as in equation 1, except that the expected asset life n is calculated as the total value of (economic) stock at end of period t divided by SEEA depletion ($\check{S}d_t$) in period t, i.e.,

$$V_t = \sum_{t=1}^{n} \frac{\check{R}R_t}{(1+r)^t} \qquad \text{(equation 5)}$$

where: n = asset life = stock/ $\check{S}d_t$

In conclusion

56. The following points represent the key conclusions arising from this Issues Paper:

i. SEEA accounts should include values for both extraction of renewable natural resources and natural growth of these resources.
ii. The concept of adjusted resource rent encompasses both income and depletion elements (consistent with Option A3 SEEA Chapter 10, Box 10.1).
iii. It is possible to identify both a charge for depletion and a NPV for renewable natural resources used in production.
iv. Natural growth is treated as an addition to output (other non-market output) and as capital formation (additions to the value of non-produced non-financial assets).
v. Extractions (economic depletion) of renewable natural resources are treated as a consumption of natural capital.

Questions for discussion

1) Does the London Group agree that both extractions and natural growth of renewable natural resources should be included in an adjusted measure of resource rent?
2) If so, should extractions be treated as ‘consumption of natural capital’ (akin to COFC), and natural growth be treated as an ‘other non-market output’?

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