
Valuing Mineral Resources

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Summary

- The Government has put forward a figure of \$194 billion as the “value of New Zealand’s onshore minerals excluding hydrocarbons”. This MED figure is the gross sale revenue that could be secured from mining the entire mineral estate. It takes no account of the costs of exploration, development, extraction, decommissioning, and land rehabilitation, nor for environmental and other external costs of mining. The result is a number which is large but economically meaningless.
- The economic value of the nation’s mineral resources is measured correctly by taking the present value of the resource rents that could flow to New Zealand after all costs of mining, including the cost of capital, have been covered. The best estimate of this value, by Statistics New Zealand, is about \$1 billion - less than 1% of the MED’s figure. This represents the price which the entire mineral estate would be expected to fetch on sale to the highest bidder.
- Areas proposed for deletion from Schedule 4 of the Crown Minerals Act, in order to open them to mining, are reported to contain 10% of the nation’s mineral resources, implying an economic value of roughly \$100 million. This is the amount over and above the full cost of extracting and selling those minerals. If adverse effects that are not currently monetised are also taken into account, the economic value would be lower still.
- \$100 million is equivalent to a one-off payment of \$36 per voter in the New Zealand electorate. There are strong indications that a single \$36 cash payment per adult person would be inadequate compensation for giving mining companies access to the proposed areas of high-value landscapes and ecosystems. According to a recent public-opinion survey, a large segment of the public would require royalties thirty times the current rate that is applied to mineral resources. Insofar as this is an accurate reflection of the existence value of Schedule 4 land in the eyes of the public, it immediately rules out any possibility that mining in Schedule 4 areas could pass a cost-benefit test.

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1. Gross Sales Revenue: The Minister's Big Number

In August 2009, the New Zealand Government signalled its intention to review the status of parts of the conservation estate listed in Schedule 4 of the Crown Minerals Act 1991.¹ A discussion document published by the Ministers of Energy and Conservation in March 2010 claimed that the nation's endowment of on-shore minerals (excluding petroleum) had a "value" of \$194 billion² and that "about 40 percent of New Zealand's known [non-petroleum] mineral potential is estimated to be in Schedule 4 areas"³ or some \$80 billion.⁴

The discussion document proposed the removal from Schedule 4 of a number of particular areas in Great Barrier Island, the Coromandel, and Paparoa National Park. The Government's estimated "value of minerals" within those targeted areas, according to the MED website⁵, comprises:

Coromandel (including Great Barrier):	\$18 billion
Inangahua (Paparoa National Park):	\$1-2 billion
Total (approximate):	\$20 billion

The areas that the Government is proposing to remove from Schedule 4 therefore include one quarter of the estimated minerals within all Schedule 4 lands (\$20/\$80 billion), and about 10% of the national total (\$20/\$196 billion).⁶

In considering this proposition that the nation's non-petroleum mineral resources have a "value" of around \$200 billion, of which \$20 billion is supposedly at stake in the Schedule 4 debate, the immediate question to ask is what valuation methodology (if any) was used to derive this figure and what it means. The discussion document is silent on this, and no official supporting analysis could be located on government websites⁷. However, both the order of magnitude of the Government's "value" figure,

¹ As amended in 1997.

² Ministry of Economic Development, *Maximising our Mineral Potential: Stocktake of Schedule 4 of the Crown Minerals Act and Beyond*, March 2010, http://www.med.govt.nz/templates/StandardSummary_42577.aspx, p.2.

³ *Maximising our Mineral Potential*, p.2.

⁴ Put the other way round, this means that 60% of the total is accessible without encroaching on those parts of the conservation estate with the highest landscape and ecosystem values - at least, as indicated by their inclusion in Schedule 4 after a bruising political debate in 1997.

⁵ http://www.med.govt.nz/templates/Page_42795.aspx. **10. What is the value of minerals in the areas proposed for removal from Schedule 4?** Answer: The Coromandel is one of the most mineral rich areas of New Zealand with production value of gold and silver alone in excess of \$17 billion to date. The potential in-ground value of remaining metallic and non-metallic resources in the Coromandel area has been estimated at \$54 billion based on current prices. About a third of that is estimated to be in the less than four percent of the area proposed for removal from Schedule 4. The Inangahua sector in the Paparoa National Park is moderately to highly prospective for coal, worth at least \$1-2 billion. The sector is the subject of considerable permit interest and has been the subject of mining activity in the past.

⁶ The most publicised current mining prospect, Newmont's Onemana investigation, would be unaffected by retaining Schedule 4 in its present form.

⁷ Nor does the New Zealand Minerals Association, a leading advocate of more mining development, offer any economic analysis other than a recital of the gross values of minerals output under various scenarios, along with some data in exploration expenditures: http://www.minerals.co.nz/html/main_topics/minerals_industry_in_nz/minerals_strategy.html

and some stylistic similarities, suggest reliance on a 2008 report by a mining industry consultant, Richard Barker, which stated that:

New Zealand's potential mineral resources were assessed by GNS Science in a study in 1999. It identified potential for 16 metals in 32 different types of mineral deposit. These potential metallic mineral resources were valued at \$86 billion using 1999 values, based on conventional resource modeling techniques. Real prices of most metals and minerals were at historical lows in 1999. Since then further investigations and price rises have increased the potential value of the assessed resources [including non-metallic minerals] to more than \$200 billion.⁸

Both in that 2008 report, and in his 2010 paper on the “value” of precious metals on Great Barrier⁹, Barker's figures are not for resource value but for gross sales revenue, which he calculates by taking an estimate of the volume of recoverable metals or other products, multiplying this by the current market price of each, and adding up the results, with no allowance for costs of exploration, development, extraction, decommissioning, and rehabilitation, nor for environmental and other external costs of mining. The result is a number which is large but economically meaningless.

Gross output or revenue without regard to cost is not an indicator of economic benefit. An economic analysis of the potential for mining development would focus on three areas: the value added (contribution to GDP) of mining; the distribution of returns between the New Zealand economy and overseas interests; and the valuation of the depletable resource itself. Confusion of potential sales revenue with the value of the underlying resource explains why Barker's number, apparently relied on by the Government in its discussion paper, is so much higher than any credible economic valuation of New Zealand's mineral resource endowment, and grossly overstates the benefits to be secured by removing protection from Schedule 4 land.

2. Economic Value: Statistics New Zealand's Method

The casual and economically uninformative treatment of mineral valuation in the 2010 MED discussion document is in striking contrast to the systematic work carried out by Statistics New Zealand in 2000-2002 to construct a “Mineral Monetary and Physical Stock Account”, based on the United Nations System of Environmental and Economic Accounting (SEEA)¹⁰. That exercise yielded a valuation of New Zealand's

⁸ Richard Barker, *The Natural Resource potential of New Zealand*, March 2008, http://www.minerals.co.nz/pdf/Natural_Resource_NZ_web.pdf, p.7. Of the \$200 billion, \$139 billion was metals; the increase from \$86 billion to \$139 billion in metals was attributable entirely to Barker's use of (high) 2008 prices in place of the (low) 1999 prices used in his main source, Christie, A.B. and Braithwaite, R.L., *The mineral potential of New Zealand*, Institute of Geological and Nuclear Sciences science report 99/4, 1999.

⁹ Richard Barker, *An assessment of the value of Crown minerals in the Te Ahumata area, Great Barrier Island*, report prepared for Ministry of Economic Development, January 2010, <http://www.med.govt.nz/upload/71519/Assessment-of-the-Te-Ahumata-area.pdf>.

¹⁰ United Nations, European Commission, International Monetary Fund, Organisation for Economic Cooperation and Development, and World Bank *Handbook of National Accounting: Integrated Environmental and Economic Accounting*, final draft 2003 <http://unstats.un.org/unsd/envaccounting/seea.asp>

non-petroleum mineral resources in the vicinity of \$1 billion¹¹ – roughly 0.5% of the figure used by the Government. Under the Statistics New Zealand valuation, the mineral resources in the areas targeted for removal from Schedule 4, estimated as 10% of the total, would be \$100 million, not \$20 billion.

The SEEA valuation methodology estimates the value of a mineral resource as the total sale price that the owner could hypothetically receive by selling it to the highest bidder. In the case of mineral resources owned by the Crown on behalf of the nation's people, this value is estimated as the discounted present value of the resource rents that the owner could collect from a developer of the resource without rendering development commercially unattractive.¹² That is, the value of the resource itself is the present value of the residual (rental) income that would be available from development of the resource after paying for all the costs of exploration, development, extraction, processing, marketing, decommissioning, and site rehabilitation. Statistics New Zealand designed its study to be consistent with the international standard methodology, and with the national accounts. It drew its physical estimates of the total mineral stock from the same source that Barker and the Government's discussion paper have used - the 1999 Christie/Braithwaite mineral resource inventory.¹³

The resulting estimate of around \$1 billion corresponds reasonably closely with the observed rate of royalties received by the New Zealand Government from the non-petroleum mining industry. Royalties are notionally set in the vicinity of 1% of gross revenue, with actual receipts often less than this, and \$1/196 billion is the same order of magnitude.

The implied estimate of \$100 million as the value of the minerals that would be opened up for exploitation by removing from Schedule 4 the areas listed in the 2010 discussion document is likely to be a considerable over-estimate of the actual recoverable value. As Barker notes, his gross-revenue figures "are not predictions of what is achievable in the near future"¹⁴, given the uncertainties and likely difficulties to be overcome in developing the resource. (A simple reality check on the geology and topography of the Coromandel suggests that the likely actual recovery of minerals in the event of mining companies being granted access would fall well below the gross total estimate, given that much of the resource would require open-pit mining and very large tailings containment structures in country that presents well-known engineering problems. Similarly, the costs of securing adequate power supplies on Great Barrier Island will be high as it would require a new dedicated plant, probably fired on barged coal.)

¹¹ Statistics New Zealand, *Environmental Accounts Series: Mineral Monetary and Physical Stock Account 1994-2000*, available at <http://www.stats.govt.nz/publications/nationalaccounts/minerals/interpretation-of-the-mineral-stock-account.aspx>, p.6 and Table 4.4 p.16. The valuation fluctuated widely from year to year because of the volatility of the commodity prices used to estimate it. The low, in 1999, was \$114 million; the high, in 1996, was \$1.06 billion.

¹² For detailed discussion of the methodological and conceptual issues surrounding valuation of minerals see UN et al 2003, *Integrated Environmental and Economic Accounting*, Chapters 7 and 8, especially pp.275-290 and 318-323.

¹³ Christie and Braithwaite (1999) *The Mineral Potential of New Zealand*, Institute of Geological and Nuclear Sciences, Wellington, 1999.

¹⁴ Barker 2008, p.8.

3. What Price to Forego Conservation Values and Allow Mining?

Only a small fraction, if any, of the mineral deposits in the Schedule 4 areas being targeted by the Government would be recoverable by underground mining with limited footprints for the portals – and even such “surgical” underground mining still requires large tailings dams in the close vicinity.¹⁵ Effectively, a large part of the ecological and landscape values associated with the affected segment of Schedule 4 would have to be sacrificed, at least for the period of mining and rehabilitation, and potentially for far longer in cases of irreversible environmental impacts. If these environmental costs were to be internalised by means of charges on developers to compensate for the loss of landscape and ecological values, it is highly unlikely that more than a small fraction of the potential, if any, would actually be profitable to mine.

To convert the economic valuation into laypersons’ terms, one could think of the Crown-owned mineral resources of New Zealand as being the property of the people. The proposal to grant mining access to parts of Schedule 4 can then be framed as a hypothetical purchase offer by a developer to pay the people of New Zealand a sum of \$100 million in exchange for the right to mine, resulting in several decades of environmental disruption in iconic landscapes. There are 2.8 million registered voters in the New Zealand electorate, which means that the gain from granting access would be \$36 or less per voter. Whether a one-off payment of \$36 each would be sufficient to persuade a majority of the electorate to support the mining proposal is then the litmus test to be passed by the Government.

One can think of this \$36 per adult person as either a “willingness to accept” payment for handing over a slice of the nation’s mineral estate; or as a “willingness to pay” to prevent mining companies from having access to Schedule 4. Either way, the suggested deal does not appear particularly attractive.

This is consistent with the results of a public-opinion survey of 2,215 people commissioned by the Business Council for Sustainable Development, which found that “while a majority of New Zealanders acknowledge mining on Schedule 4 land’s royalty revenue, jobs and economic growth and wealth benefits the majority still oppose it”.¹⁶ Generally the survey found that existing royalty rates on mining were considered too low, often by a very wide margin. “Royalties for mining Schedule 4 land would need to be above 30% for a majority of New Zealanders to feel satisfied the economic benefits and effects on the environment are balanced.”¹⁷

¹⁵ The Tui mine at Te Aroha, whose tailings continue to present a massive environmental problem, was entirely underground with portals occupying only small areas of the site.

¹⁶ Shape NZ, *New Zealanders’ views on the mining industry, royalties and tax: A ShapeNZ nationwide survey of 2,215 New Zealanders*, May 13-18, 2010, Part 2, p.5.

¹⁷ “New Zealanders want mining firms to pay higher royalties and new super tax on profits”, Business Council for Sustainable Development media release 23 May 2010, p.2, summarizing answers to the question “To achieve a balance between economic benefit and the environment, what level of royalty should the Government receive from those mining Schedule 4 conservation land?”- see ShapeNZ 2010 p.8

The interpretation of this would seem to be that to compensate for the environmental damage caused by mining activities, a large segment of the public would require royalties thirty times the current rental value that is applied to mineral resources. Insofar as this is an accurate reflection of the existence value of Schedule 4 land in the eyes of the public, it immediately rules out any possibility that mining in Schedule 4 could pass a cost-benefit test.

Three features of mining as an economic activity contribute to this outcome:

- First is the relatively short life-span of a typical New Zealand mine. Few large-scale metal mines last more than a decade or so before going into decline and closure as the resource is depleted.¹⁸
- Second is the contrast between the depletable nature of mining and the sustainable nature of other, potentially competing, activities such as tourism, which rely upon the preservation of landscapes and ecosystems for non-consumptive use by visitors, and for purposes of national branding in overseas markets.
- Third is political risk. Recent history has shown mining development to be highly contentious, in the sense of dividing popular opinion into sharply-opposed camps. This means that there is a clear risk that a partisan policy decision in favour of a heavily-contested mining project may be overturned by a future government. Without a political consensus underpinning the rules for mining development, the resulting uncertainty can be expected to have a chilling effect not only on mining projects in contentious areas such as Schedule 4, but on mining activities more generally. There is a high premium attached to access rules that have the sanction of a united Parliament.

¹⁸ The ironsands of the North island west coast are the most notable exception, because of the very large scale of the resource; but no metals deposits of comparable size appear to be located in Schedule 4 land.