The role of EIA in greenhouse gas mitigation

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Abstract

The role of EIA in Western Australia and New Zealand in addressing greenhouse gas emissions is compared. Since the mid-1990s, Western Australia has had provisions requiring greenhouse gas emissions to be considered in EIA. With major mining and energy projects, limiting greenhouse gas emissions has been a priority. EIA has played a significant role in managing greenhouse gas emissions through improved design, carbon sequestration and forestry offsets. New Zealand's resource management legislation was amended in 2004 to introduce climate change considerations but greenhouse gas emissions were specifically excluded from the EIA process managed by regional government: they were to be addressed by a National Environmental Standard which has not been promulgated. Agricultural emissions are the dominant source in New Zealand with the greatest increases coming from dairy farm conversions often from forested land. With no EIA provisions this has led to increased emissions and loss of sinks.

Western Australian Situation

Australian Government Greenhouse Gas Policy

The Australian Government has set its 2030 target of reducing emissions to 26-28% below 2005 levels. In 2017, the Australian Government is commencing another review of its climate change policies including the opportunities and challenges of reducing greenhouse gas emissions (Australian Government, 2017). In 2011 legislation was passed to create a carbon pricing mechanism (a cap-and-trade emissions trading scheme). This commenced in July 2012 but was repealed in July 2014 and the "Direct Action Plan" implemented with the centre piece of the Emissions Reduction Fund which is to purchase emissions reduction through a reverse auction.[1]

Initial Commonwealth policies were primarily voluntary, such as the National Greenhouse Challenge Program for industry aimed at capturing the potential for reductions in emissions through voluntary and cost-neutral steps. Australia gained concessions from the international community at the 1997 Kyoto Conference by arguing that unlike most other developed countries, Australia's economy was heavily reliant on energy-intensive industries. Australia was allowed an 8% increase in 1990 emissions by 2010.

In 2013, Australia's greenhouse gas emissions were calculated under the UNFCCC accounting framework to be 538 $MtCO_2$-e (million tonnes of carbon dioxide equivalent). This is a 1.2% increase compared with 1990 levels of 532 $MtCO_2$-e. Energy is the main contributor (76%) which increased

[1] The Emission Reduction Fund operates in three parts: (1) *crediting*, where businesses identify emission reductions that go beyond business-as-usual activities; (2) *purchasing*, where the Clean Energy Regulator runs auctions to select lowest cost abatement among registered projects, and (3) *safeguard mechanism*, to ensure emission reductions paid for by the Emissions Reduction Fund are not displaced by business-as-usual levels elsewhere in the economy. Through the first two reverse auctions the government has contracted to purchase 92.9 $MtCO_2$-e of abatement (Commonwealth of Australia, 2015). Its cost effectiveness is a matter of debate (Ward, 2015)

40% in greenhouse gas emissions since 1990. This was primarily offset by the land use, land use change and forestry sector which shifted from contributing 19% of emissions in 1990 to providing a sink for 4% of emissions in 2013: principally due to land clearance controls. Australia has the highest per capita emissions of any OECD country. It was 23.3 tCO_2-e per person in 2013 which is a 25% decline from 31.2 tCO_2-e per person in 1990. While GDP grew 103% between 1990 and 2013, the emissions intensity of the economy was halved from 0.71 $kgCO_2$-e per dollar in 1990 to 0.35 $kgCO_2$-e per dollar in 2013 (Commonwealth of Australia, 2015).

Environmental Impact Assessment in Western Australia

With a heavy emphasis on resources and energy development, primarily for export, Western Australia is a major contributor of greenhouse gas emissions. The top ten emitters from mining and hydrocarbon projects emit an estimated 34.7 $MtCO_2$-e (6.5% of Australia's total emissions) (Chapple, 2012).

Environmental impact assessment (EIA) for new developments is primarily the responsibility of state governments. The Western Australian Environmental Protection Authority has recommended conditions aimed at reducing greenhouse gas emissions on development proposals using EIA since the late 1990s. Proponents of projects with significant greenhouse gas emissions are to (1) identify all greenhouse gas emission sources and calculate emissions in accordance with the National Greenhouse and Energy Reporting Act; (2) demonstrate that the proposal is designed and will be operated in a manner which maximises energy efficiency and minimises greenhouse gas emissions as far as practicable; and, (3) provide an analysis of greenhouse gas intensity (i.e. quantity of CO_2-e generated per tonne of product produced) and consider published benchmarked best practice for equivalent plants and equipment (Environmental Protection Authority, 2015).

In the initial form of the EPA policy (Environmental Protection Authority, 1998) the benchmarking was also against Australia's target from the 1997 Kyoto Climate Change Conference. The 108% target represents a 25% reduction from "business-as-usual" predictions of greenhouse gas emissions for the year 2010 (which was 143% of 1990 levels). The expectation was that companies producing greenhouse gas emissions would go beyond a "no regrets" approach.[2] Examples of the outcomes from the EIA processes for major mining and hydrocarbon projects are presented below:

- The Murrin Murrin Nickel-Cobalt project expansion was to increase to 250% of its original capacity. It involved the mining of a new ore body and transporting the ore to an expanded plant. The commitment in relation to reducing greenhouse gas emissions from the EIA process were: (1) the adoption of a recent development of nickel laterite processing – a no regrets measure achieving an estimated 10-25% reduction in greenhouse gas intensity; (2) indirect heating (rather than direct steam injection into the process); (3) rail transport of ore (rather than truck); and, (4) tree farming to offset emissions. This was estimated to achieve a 16-30% greenhouse gas emission reduction compared to 1990 business-as-usual (Environmental Protection Authority, 1999).

[2] "No regrets" approaches are greenhouse gas emission reduction measures that have positive net benefits because they generate direct or indirect benefits that are large enough to offset the costs of implementing the measures (IPCC, 2001) "Beyond no regrets" measures have net costs.

- The Gas to Synthetic Hydrocarbons Plant on Burrup Peninsula was to process natural gas to produce 1,240 tonnes per day of synthetic crude oil which can then be processed into specialty products such as lubricants and diesel fuel. The commitments in relation to reducing greenhouse gases from the EIA process were: (1) a 50% improvement in thermal efficiency compared to the pilot plant, (2) improved life cycle analysis of products, e.g. sulphur-free diesel fuel, and, (3) use of process steam for the state government's water desalination plant eliminating the need for an alternative fuel source (Environmental Protection Authority, 2000).
- The Gorgon Gas Development Expansion on Barrow Island Nature Reserve was to expand liquefied natural gas production from 10 million tonnes per annum (MTPA) to 15 MTPA by the addition of a third gas processing train. The commitments to reduce greenhouse gas emissions from the EIA process were: (1) sequestering carbon dioxide emissions into a saline aquifer 2,000m beneath the ground, (2) LNG technology improvement, (3) use of sub-sea production system, and, (4) improved waste heat recovery. This reduced the greenhouse gas emission intensity from 0.89 tCO_2-e per tonne of LNG from the 1998 concept design to 0.35 tCO_2-e per tonne of LNG (Environmental Protection Authority, 2009).

New Zealand Situation

New Zealand Government Greenhouse Gas Policy

The New Zealand Government's provisional gross emission target for 2030 is 30% below 2005 emissions (a target which is only 10% below 1990 levels). The Emissions Trading Scheme is the principal means that is currently in place to generate greenhouse gas reductions. The Climate Change Response Act 2002 put in place the legal framework to enable New Zealand to meet its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

An amendment in 2008 established a greenhouse gas emissions trading scheme (ETS). The ETS was to cover all gases and all industries but with different entry times. Compliance for industries would require the surrender of a New Zealand emission unit or an international unit for each tonne of greenhouse gas emissions. New Zealand emission units were to be capped in number and were to be allocated by grandparenting (gifting) or auctioning. Trade-exposed industries were to receive a 90% free allocation of units to 2018 with phasing out by 2030. Forest owners with pre-1990 forests were to receive a fixed one-off free allocation of units. Post-1989 afforestation would earn credits while units would have to be purchased for deforestation.

With a change of government there were amendments to the ETS in2009 (the Climate Change Response (Moderated Emissions Trading) Amendment Act 2009) and 2012 (the Climate Change Response (Emissions Trading and Other Matters) Amendment Act 2012). The current scheme has removed the cap on New Zealand emissions and has permitted unlimited importation of international units. Compliance now only requires one unit for every 2 tonnes of emissions. Trade-exposed, emission-intensive industries get free allocations based on production. The phase out of free allocations is now over a longer time period. There are no free allocations to industry that can pass on costs to consumers. There is an indefinite deferral of including agricultural emissions in the ETS.

The outcome of the ETS has led to significant deforestation before the commencement of the commitment period in 2008 (Ministry for the Environment, 2016b). The purchase of international units of dubious efficacy has removed the carbon price signal to motivate reduction in greenhouse gas emissions (Sustainability Council of New Zealand, 2015). The free allocations to industry transfer the costs of compliance to the taxpayer (Sustainability Council of New Zealand, 2015). The uncapped system with low carbon cost has led to growth in current and projected emissions. In 2014, gross emissions were calculated as 81.1 Mt CO_2-e which is an increase of 23% above 1990 levels (Ministry for the Environment, 2016a).

Agriculture is the main contributor to gross emissions (49%), the highest for an OECD nation. Energy is also a significant contributor (40%); with a high percentage of hydro generation this is low for an OECD country. In 1990, forestry was a significant sink for New Zealand (28.9 MtCO_2-e) reducing net emissions to 36.9 MtCO_2-e. With deforestation and harvesting, there has been a reduction in forestry as a sink (to 24.4 MtCO_2-e in 2014) so that net emissions are 56.7 MtCO_2-e in 2014, a 54% increase since 1990. Per capita emissions are lower than Australia at 17.2 tCO_2-e per person in 2014 and have decreased by 7% since 1990. The emission intensity of the economy has decreased from 0.82 kgCO_2-e/$GDP in 1990 to 0.55 kg$CO_2$-e/$GDP in 2013. Between 1990 and 2014 agricultural emissions increased 15% mainly due to a 95% increase in the dairy herd (increasing methane emissions) and a more than five-fold increase in the application of nitrogen-containing fertiliser (increasing nitrous oxide emissions). In the energy sector the major change was the increase in road transportation greenhouse gas emissions (72%) (Ministry for the Environment, 2016a).

Assessment of Environmental Effects in New Zealand

New Zealand's principal legislation relating to natural resources management is the Resource Management Act 1991 (RMA). The legislation includes the provisions for the assessment of environmental effects of new projects which are primarily the role of regional councils. The RMA was amended in 2004 to incorporate renewable energy and climate change provisions. However, the 2004 amendments **preclude** regional councils from having regard to the effects of greenhouse gas emissions on climate change (RMA Sections 70A and 104E). The intention was that climate change would be addressed as a national issue through a National Environmental Standard (NES): no NES has been promulgated.

There is no policy instrument to address agricultural emissions as they are not part of the ETS and greenhouse gas emissions from land use intensification, such as dairy conversions and forest clearance, is not subject to EIA evaluation under the RMA. The agricultural sector is projected to provide 77% of the growth in emissions (Sustainability Council of New Zealand, 2015).

Dairying is a significant component of the New Zealand economy. In 2013, dairy exports were $13.7 billion which was 29% of New Zealand exports and 40% of the world export market. Milk solids production increased from 599 million kg in 1990/1 to 1,890 million kg in 2014/5. The greatest growth has been in the Canterbury region increasing from 6 million kg of milk solids in 1984/5 to 376 million kg of milk solids in 2014/5 (Livestock Improvement Corporation and Dairy NZ, 2015). Conversion to dairy farms from dryland sheep and beef farms and deforestation leads to land use intensification with irrigation and increased fertiliser application. This increases methane emissions from ruminant animals and nitrous oxide emissions from nitrogen fertiliser.

Furthermore, net removals from forestry have decreased due to increased harvesting of plantation forests as a larger proportion of the estate reaches harvest age, and forest being converted to pasture. Between 2003 and 2012, New Zealand's planted forest has declined from 1,827,333 ha to 1,719,501 ha (6% decline), while in Canterbury the planted forest has declined from 122,773 ha to 110,055 ha (10% decline) (Ministry of Agriculture and Forestry, 2004) (Ministry for Primary Industries, 2013). Deforestation intention surveys indicate 86% conversion from forestry to dairying (Manly, 2013).

The greenhouse gas emissions from dairy farms are variable: Ledgard examined 26 dairy farms in Rotorua and estimated an average of 9,067 $kgCO_2$-e per ha with a range from 4,504 to 12,198 $kgCO_2$-e per ha (Ledgard, Judge, Smeaton, & Boyes, 2010). Smeaton modelled a base dairy farm model of 9,300 $kgCO_2$-e per ha compared to a sheep and beef farm of 3,400 $kgCO_2$-e per ha (Smeaton, Cox, Kerr, & Dynes, 2011). Thus for a conversion from a sheep and beef farm to a dairy farm would increase greenhouse gas emissions by about 5,900 $kgCO_2$-e per ha.

Mason and Ledgard are developing a calculator for greenhouse sinks from radiata pine plantation on the basis that one hectare of pine plantation can absorb 11,800 $kgCO_2$-e, allowing for harvesting (Mason & Ledgard, 2013). Thus for a dairy conversion from a plantation forest the net increase in greenhouse gases is about 20,100 $kgCO_2$-e per ha.

In terms of greenhouse gas mitigation the most promising options for nitrous oxide have been identified as: nitrogen inhibitors that keep nitrogen in the less mobile ammonium form for longer, the use of herd shelters that can minimize the deposition of urine patches at high-risk times of the year, and, replacing nitrogen fertilizer inputs to boost pasture production with inputs of maize or cereal silage to reduce the amount of nitrogen ingested and excreted (De Klein, Monaghan, Ledgard, & Shepherd, 2010). Potential methane reduction strategies are only in the research stages. These are selective breeding of low emission sheep and cattle, changing animal feed, and biotechnologies that target microbes in the rumen that produce methane (Parliamentary Commissioner for the Environment, 2016). There are avenues for offsets through farm forestry and hydro generation as a component of irrigation storage (Jenkins, 2015).

For management of greenhouse gas emissions in New Zealand there would be value in incorporating consideration of such emissions in the assessment of environmental effects for proposals like dairy conversions.

Concluding Comments

Management of greenhouse gases requires effective government policy. In the absence of mitigation measures greenhouse gas emissions can be expected to continue to grow. The use of EIA in Western Australia has been shown to provide a mechanism for evaluating new mining and hydrocarbon development proposals leading the adoption of "beyond no regrets" measures. However the preclusion of the consideration of greenhouse gas emissions in EIA in New Zealand has allowed land use intensification and deforestation to occur significantly increasing greenhouse gas emissions. EIA can be an effective component in the policy mix to address greenhouse gas mitigation.

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