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Encouraging Environmentally Sustainable Growth in Australia

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ENCOURAGING ENVIRONMENTALLY SUSTAINABLE GROWTH IN AUSTRALIA

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by
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ABSTRACT/RÉSUMÉ

This document analyses aspects of natural resource and environmental policies in Australia, focusing on water resource management, salinity and climate change mitigation. The state and central governments have not made use of their taxation powers in these domains. The cap-and-trade system for water rights in the Murray Darling basin aims at better integration of economic and environmental reform. Still higher benefits could be reaped from trading if the various restrictions on trade were lifted, and if water pricing reform were accelerated in rural areas, so as to reflect economic and environmental costs. The rules for allocating flows for the environment also need to be clarified. To address dryland salinity, more co-ordination between the States and the Commonwealth is needed, for example to avoid the contradiction inherent in subsidising revegetation programmes while at the same time authorising further land clearing. Economic instruments could be used for intermediate objectives, *e.g*. targeted subsidies for revegetation and a tax on land-clearing. This would at the same time encourage low-cost reductions in greenhouse gas emissions. The modification of fuel prices resulting from the recent tax reform runs counter to Australia's mitigation objective. Introducing an economy-wide tax or a permit-trading scheme is likely to be the only way to achieve significant reductions in greenhouse gas emission from energy use in a cost-effective manner.

JEL Classification: H23, Q00, Q20, Q28, Q40, Q48
Keywords: Australia, sustainable development, environmental policy.

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Ce document analyse certains aspects de la politique des ressources naturelles et de l'environnement en Australie, en se concentrant sur la gestion de la ressource en eau, le problème de la salinité et la politique de lutte contre le changement climatique. Les gouvernements des états et du *Commonwealth* n'ont pas fait usage de leurs pouvoirs fiscaux dans ces domaines. Le système de plafonnement et d'échange des droits d'usage de l'eau tente de mieux intégrer la réforme économique et environnementale. Des bénéfices accrus seraient toutefois tirés de cette réforme si les restrictions pesant sur les échanges étaient levées, et si la réforme de la tarification de l'eau était accélérée dans les zones rurales – afin que les prix reflètent mieux les coûts économiques et environnementaux. Les règles d'allocation de débits pour l'environnement devraient être clarifiées. Dans la lutte contre la salinité des terres arides, une meilleure coordination entre le *Commonwealth* et les états est requise, notamment pour éviter la contradiction inhérenteau fait que l'on subventionne des programmes de reboisement dans le même temps que l'on autorise le déboisement; des instruments économiques pourraient être utilisés pour atteindre les objectifs indirects, comme des subventions mieux ciblées pour le reboisement et une taxe sur le déboisement. Cela contribuerait également à réduire à faible coût les émissions de gaz à effet de serre. La modification du prix des carburants résultant de la récente réforme fiscale va en revanche à l'encontre de cet objectif. Une taxe sur l'ensemble des consommation ou un système de crédits d'émissions plafonnés et échangeables est probablement le seul moyen de réduire de façon significative et efficace les émissions de gaz à effet de serre provenant des consommations énergétiques.

Classification JEL : H23, Q00, Q20, Q28, Q40, Q48.
Mots clés : Australie, développement durable, politique environnementale.

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1. Introduction

1. Most of Australia's domestic environmental concerns have developed out of a clash between its biogeography and its settlement and land-development patterns. Australia is rich in biodiversity, with many unique species of plants and animals. Many are threatened with extinction due to habitat alteration and loss, or competition and predation from introduced species. Similarly, imported systems of land and agricultural exploitation, and the pattern of settlement to which they are related, have had substantial negative impacts both on the country's biological diversity and on its ecosystems, including rivers, estuaries and tidal marshes. The long-term effects have emerged as Australia's two most pressing domestic sustainable-development concerns, dryland salinity and inefficient agricultural use of scarce water resources. At the same time, the Australian perspective on global sustainable-development issues is shaped by its size and remoteness and by its rich natural resource endowments. Australians are as subject to ozone depletion and global warming concerns as other OECD citizens, but there is no problem of transnational boundary pollution and the size of the country makes fuel costs a highly sensitive issue. Moreover, because of its physical resource endowments Australia originally built its economy, and its export capacity, on large non-renewable resource availability. These activities have received relatively little support from governments through direct or indirect subsidies, which means that Australian attitudes to global energy conservation are highly influenced by issues of natural comparative advantage as well as international competitiveness.

2. Apart from the above, unique, combination of interests and concerns, the most important formative influence on Australian attitudes to environmental and natural resource issues, and the related policy instruments, has been the country's federal structure. Interests may differ across states on some energy conservation issues, linked both to energy production patterns, biodiversity concerns and water-use, and the fact that Australia is a federation has meant overcoming problems of internal cohesion and co-ordination. Constitutional powers, including the respective right to raise taxes, have been important in determining the choice of instruments of environmental policy. The chapter thus begins by discussing the impact of Australia's institutional arrangements on natural resource and environmental policies. This is followed by a review of water management issues, where the role of economic instruments is quite developed, and then by a discussion of the salinity problem, which is particularly acute in Australia, and where the problems of using market instruments are exacerbated by the fact that polluters can be generations and jurisdictions apart from those suffering the pollution. The subsequent section discusses the

1. This paper was originally produced for the OECD Economic Survey of Australia, which was published in August 2001 under the authority of the Economic Development Review Committee. Working papers on the same subject have been published for Norway, Finland, Germany, the United States, Denmark, Sweden, New Zealand, Canada and Belgium and are forthcoming for a number of other countries.

2. Ann Vourc'h and Robert Price are economists in the Economics Department of the OECD. The authors would like to thank colleagues in the Economics Department of the OECD, for their comments and advices especially Paul O'Brien, Jørgen Elmeskov, Mike Feiner and Val Koromzay, as well as Christian Averous and Jan Corfee-Morlot from the OECD Environment Department and Jean-Marie Strub, Janice Gabela, Sheila McNally and Veronica Humi for their technical support. The paper has also benefited from valuable materials provided by and discussions with Australian officials and researchers, in particular Kevin Goss from the Murray-Darling Basin Commission, Michael Krockenberger from the Australian Conservation Foundation, Colin Mues from ABARE.

challenges facing Australia with respect to global warming, where the use of economic instruments, taxes or tradeable permits, has run up against distributional objections. The final section presents an assessment and recommendations for further policy action. The environment issues that have been selected for discussion have qualified both from their importance and the fact that they illustrate a number of problematiques applying to other issues.

2. The institutional setting

2.1 Increased co-ordination and Commonwealth involvement

3. The fact that Australia is a federation of states, where the respective roles and powers of the Commonwealth and the States have been the cause of much controversy and dispute, has had an important influence on environmental policy and its effectiveness. The Constitution does not give the Commonwealth direct power over the environment, because at the time it was drafted the States were clearly in control of land- and natural resource management. In practice, a nation-wide environmental consciousness only began to develop in the late 1970s and 1980s, after much environmental damage had become irreparable.

4. A more centralised, or co-ordinated, structure may be called for where there is a need to address national issues, implement commitments under inter-national agreements, or where there are cross-state spillovers. Momentum for change in this direction has come both from emergent environmental concerns at state level and from the Commonwealth seeking to take a leadership role in addressing national environmental and natural resource issues. The Commonwealth Government is allowed a potentially important role because it is responsible for protecting features of national environmental significance and implements international environmental treaties, such as those dealing with climate change, destruction of the ozone layer and protection of biodiversity; and because of its Constitutional responsibility for matters related to external affairs, trade, corporations and certain taxation powers, it could effectively override state legislation affecting the environment. But it has preferred not to be confrontational. Rather, it has sought to delineate a leadership role on national environmental issues while reducing duplication of the activities of the States, Territories and Local Government at the Commonwealth level. It has become increasingly involved as the initiator and co-ordinator of national strategies drawn up and implemented in co-operation with the states. Examples of such national strategies include Australia's Oceans Policy, the National Forests Policy, the National Greenhouse Strategy, the National Strategy for Ecologically Sustainable Development, the National Strategy for the Conservation of Australia's Biological Diversity (1996), and the National Action Plan for Salinity and Water Quality (2000).

5. Institutionally, the implementation of these national strategies has involved the establishment of a wide range of co-ordination bodies. With respect to global warming, the Australian Greenhouse Office was established for greenhouse gas policy. As governments started to address the problem of water depletion in the 1980s, the Council of Australian Governments (COAG) agreed a comprehensive framework for water reform and the *COAG Water Reform Framework* was agreed amongst jurisdictions in February 1994. While much of the responsibility for implementing the COAG framework rests with individual jurisdictions, collaborative activity has also been undertaken to deal with issues that are of concern to all jurisdictions and that would benefit from national co-ordination. Where environmental problems span state boundaries, co-ordinating institutions have been created to fit the right "geographical level", such as the Murray-Darling Basin Commission established in 1986 as the executive arm of the Murray-Darling Basin Ministerial Council. The Commission is an autonomous organisation equally responsible to the governments represented on the Ministerial Council as well as to the Council itself; it is neither a government department nor a statutory body of any individual government.

2.2 The Environment Protection and Biodiversity Conservation Act

6. In spite of this increased co-ordination, the Commonwealth has been concerned that it did not have adequate legislative capacity to discharge its key commitments in international agreements and conventions. Conversely, Commonwealth environmental legislation has sometimes been triggered by matters which were more appropriately the responsibility of Local or State governments. There was thus a growing mismatch between the issues in which the Commonwealth wanted to be involved and those in which it could legitimately be involved. There was a parallel recognition by all stakeholders, including the states, that the shortcomings of the system combined to limit the level of protection offered to the environment and to create unnecessary delay, duplication and uncertainty for industry and the community. The response has been to legislate a new Act, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC), which has been in force since July 2000 (see Annex I).

7. Under the EPBC Act, actions that are likely to have a significant impact on matters of national environmental significance (NES) are subject to a rigorous assessment and approval process. This process also applies to actions that are likely to have a significant impact on the environment of Commonwealth land and actions taken by the Commonwealth anywhere in the world. The Commonwealth may, through bilateral agreements, delegate to the States the responsibility for conducting assessments and, in limited circumstances, the responsibility for deciding whether to grant approval. A key function of the bilateral agreements is thus to provide for the accreditation by the Commonwealth of State environmental assessment processes and approval decisions. It is important to note that the Act sets out various constraints on the scope of any accreditation that can be effected through bilateral agreements, and imposes certain minimum standards that must be observed. To be accredited, a State process will need to meet "best practice" criteria.

8. The Act focuses the responsibilities of the Commonwealth on matters of national environmental significance. It significantly extends the reach of the Commonwealth, giving the Environment Minister the veto power over large numbers of social and economically significant projects throughout Australia where they might have a significant impact on a matter of national environmental significance. It would seem to be the precursor of a more activist national approach to environmental problems. The National Action Plan for Salinity and Water Quality was subsequently endorsed at the Council of Australian Governments in November 2000. This represents the first concerted and targeted national strategy to address salinity and water quality problems.[3]

9. From a Commonwealth perspective, the Act has many positive benefits, including removing indirect triggers and replacing them with triggers now related directly to potential impacts on environmental matters under Commonwealth control. It also provides more certainty and transparency for proponents by specifying timeframes and processes for Commonwealth decisions.[4] From the states' perspective, the Act does not rely sufficiently on the States' long-established systems for assessment and approval, while it applies too rigid requirements for bilateral agreements which make it difficult to achieve

3. A range of Working Groups are considering issues relating to the capacity-building of regional community-based bodies; the composition, structure and content of regional. National Resource Management Plans; the necessary land and water policy reforms and changes; the elements of a communication programme; biodiversity; standards and targets on salinity, water quality and associated water flows; and options for market-based incentives in Natural Resource Management.

4. It also provides a more direct relationship between the proponent and the Commonwealth, allowing, for example, the proponent to trigger the referral and assessment process, which was not possible under the previous legislation.

such agreements and dilute the incentives for the State to pursue agreements.[5] While the aim of the new Act has been to provide "clear guidelines on what projects will attract Commonwealth involvement", the administrative guidelines defining "significant impact" are extremely broad, qualitative and open to interpretation. As a result, actions that have relatively low impacts could be potentially caught by the Act in a way that was not envisaged by the States when negotiating the agreement on the Act. While the Act represents a significant redistribution of responsibilities between the States and the Commonwealth in the management of environmental issues, it is too early to say how well the system of bilateral agreements will work.

2.3 Co-ordination in conserving biodiversity

10. As is reflected in the title of the new *Ac*t, the conservation of biodiversity is one of the essential motivations in the new approach. The ongoing loss of biodiversity is severe. European settlement has significantly altered Australia's natural landscape – and with it, Australia's biodiversity. Australia ratified the Convention on Biological Diversity in 1993 and at a national level, a major initiative has been the National Strategy for the Conservation of Australia's Biological Diversity (1996). Because of the public-good nature of much biodiversity preservation, and the fact that the relative economic costs and benefits are difficult to quantify, the emphasis will continue to be on regulatory co-ordination rather than on market-based solutions. Since the states have their own legislation, which are not always consistent across borders, an appropriate and standardised regulatory framework could promote conservation goals in a co-ordinated and integrated way. The ideal to which the Strategy and the new Act aspire, is an integrated approach which requires co-operation and co-ordination from all levels of government, industry, community groups and individual land managers.

11. The preservation of biodiversity is an area where the role of economic instruments is limited because property rights cannot be clearly defined, completely and exclusively allocated or legally enforceable.[6] However, the loss of biodiversity has recognisable costs in many instances which can be reduced by private sector investment, thus reducing budgetary costs. In particular, the preservation of biodiversity has obvious pecuniary implications for tourism and fishery development, where conservation policies can exploit private-sector involvement. Moreover, besides the importance attaching to biodiversity in its own right, it is also critical for soil formation, recycling of nutrients, atmospheric quality and climate, as well as the maintenance and regulation of water resources, which are to a greater or lesser degree susceptible to cost-benefit analysis, especially as they are essential underpinnings for much of Australia's commercial – particularly agricultural – production. Indeed, stemming the biodiversity loss from factors such as the clearing of native vegetation, damming of rivers, drainage of wetlands, and water release from water storages, is an important ingredient in the sustainable development of Australian agriculture, all of which are to some degree susceptible to a more market-based approach.

5. In particular, all accredited approval decisions need to be based on management plans which must not only be in force under a State law but have been tabled for potential disallowance (for the purpose of accreditation only) in both houses of Federal Parliament.

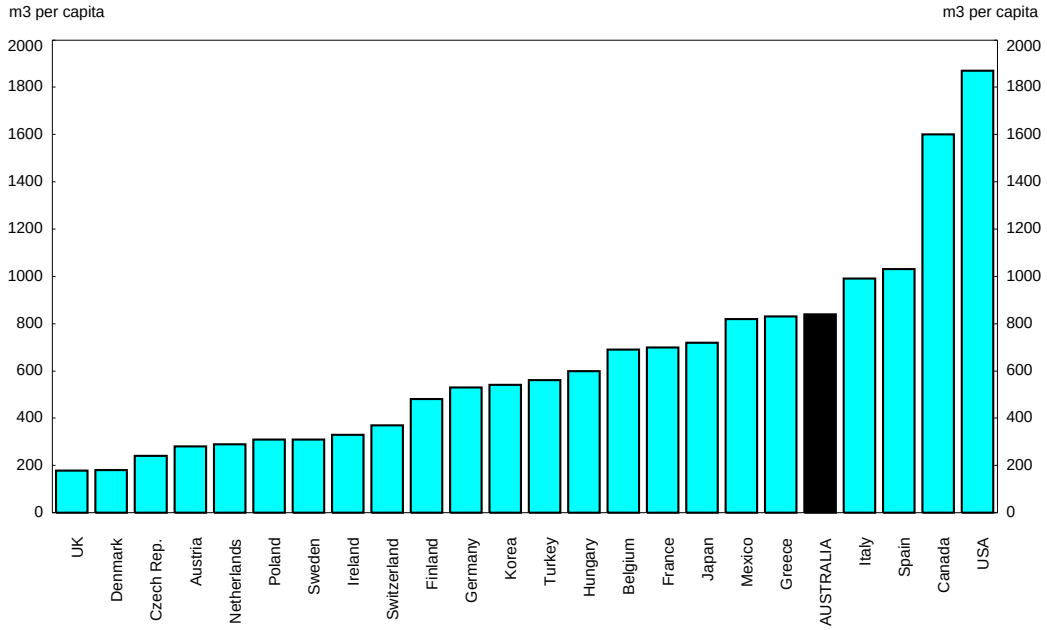
6. The private sector is involved in biodiversity conservation via a number of local, regional and national activities, both for philanthropic or commercial purposes. Private funds have been used to acquire wildlife and habitat, support education in the value of wildlife and biodiversity, and community involvement in government funded activities.

3. Water management: seeking efficiency and environmental sustainability

12. Water management is a prime example of evolution from state-based policy towards a more co-ordinated, market-based approach. Australia is a relatively dry continent, in which water scarcity is exacerbated by climate variability, including periodic drought. Water is a state property in Australia, and entitlements to use water, granted as a statutory right under state legislation, were traditionally tied to land. Compared with other OECD countries, a relatively large share of water goes to agriculture (between 70 and 80 per cent), in particular for irrigation in the Murray-Darling Basin, which has been very fast-growing over the last two decades.[7] Rapid growth of population and activity in urban areas is also increasing the level of water use, and intensifying competition for water resources is putting pressures on the environment, as flow levels in rivers are reduced and irrigation-induced salinity increases. Water use levels are high by international standards (Figure 1). Indeed, water was formerly heavily subsidised, favouring overuse and inefficient allocation. However, increasing scarcity has spurred significant changes in water policy since the 1980s, which culminated in 1994-95 with the adoption by COAG of a *National Agenda for Water Reform,* whereby all jurisdictions committed themselves to implementing a range of market-based measures.

Figure 1. **Water use per capita**

1997



1. In 1997.
Source: OECD Environmental Data Compendium, 1999.

13. Under the *National Agenda for Water Reform*, pricing practices were to be reformed so that prices reflected the full economic cost of resources and were consumption-based. First, cross-subsidies were to be removed and other subsidies made transparent. Second, allocative efficiency was to be dealt by trading in water entitlements. The agenda also included the specific provision of water for the environment, making water services providers operate on a commercial basis and separating regulatory functions from provision, as well as limiting new investment in rural water supply to economically viable and ecologically

7. The Murray-Darling Basin accounted in the mid-1990s for some 60 per cent of total water use. Irrigated area increased at a rate of 3.7 per cent per year between 1983-84 and 1993-94.

sustainable projects. The reform aims at increasing efficiency in water allocation and use, while at the same time striking a better balance between consumption and environmental needs in stressed rivers. It is thus an attempt to integrate micro-economic policy reforms with environmental ones. Reform implementation is also backed by an interesting enforcement mechanism, as it is incorporated into the national Competition Policy. The National Competition Council is responsible for assessing water reform progress in the various states and can recommend suspension of competition payments by the Commonwealth government if commitments are not met.

3.1 Water pricing

14. Progress in implementing water reform has been uneven across water-use categories and between states. Pricing reform in urban areas is generally well-advanced, but has been proceeding much more slowly in rural areas, in particular for irrigation pricing. For urban water supply, a two-part tariff has generally been introduced, with a fixed charge for access to service and a variable user charge, the latter providing an increasing share of water utilities revenues. Free allowances, which used to be large and widespread, are being gradually phased out in favour of charges starting from zero consumption. Assistance for low-income households is provided through clearly-defined and separately funded Community Services Obligations. Increasingly also, water charges for industrial and commercial users, which were often based on the property value instead of consumption, are being brought in line with residential charges, and the cross-subsidies from industrial and commercial users to households are being reduced or removed. Full cost recovery for urban water was found by the National Competition Council to be achieved in all jurisdictions except Queensland, where there is still a substantial way to go.[8] Consumption-based tariffs have resulted in decreasing individual water consumption. Water use in Brisbane, for example, was reduced by 20 per cent between 1995-96 and 1997-98, after the adoption of metering and use-based charges. This is happening despite a decrease in metropolitan water prices, which fell on average across Australia by more than 16 per cent between 1992-93 and 1997-98.

15. Pricing reform for water in rural areas, by contrast, has still a considerable way to go in all jurisdictions, despite some performance variation from state to state. In the past, subsidies for irrigation water were used to promote regional development, and as in many other OECD countries, the price of water supplied to agriculture is substantially less than that supplied to households (Figure 2) although differences in the quality and quantity of water supplied explain part of the gap. Low water prices were the main support provided to agriculture in Australia, which has received very little direct support compared with most other OECD countries.[9] Compared with other OECD countries with similar water conditions, Australia is also going quite far in reforming agricultural water pricing arrangements. However, due to various factors, including falling world commodity prices, rural/regional Australia has been undergoing important structural change, with some regions experiencing high growth but others being hit hard as their core activities decline. This makes the water reform politically difficult to implement.

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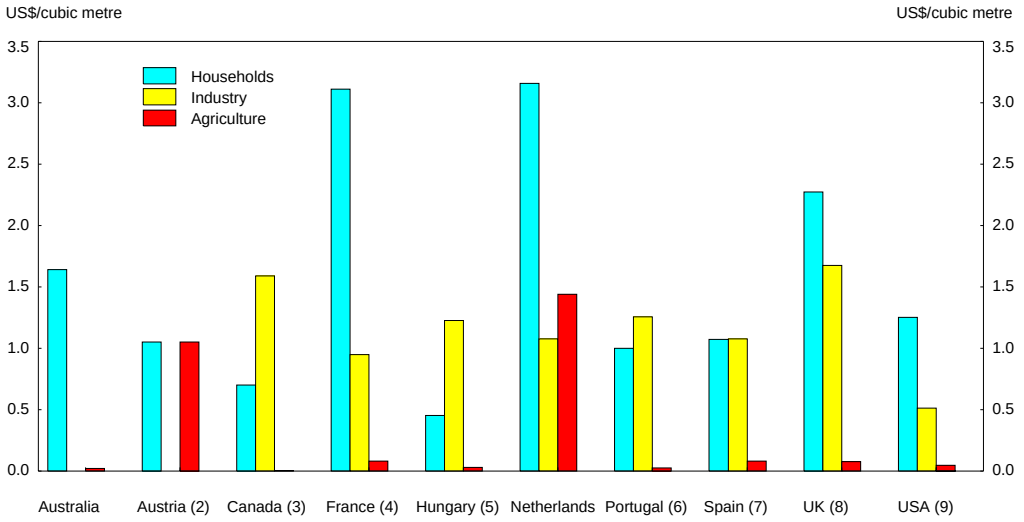
8. In the Second Tranche Assessment of June 1999, the NCP found that too little information had been provided for it being able to judge if reform commitments had been met in Queensland. The December 1999 supplementary second tranche assessment concluded that, despite progress, full cost recovery has not been implemented, in particular where reform is being encouraged by state authorities instead of being required.

9. In 1999, the Producer Support Estimate (PSE) was estimated at 6.4 per cent, which is less than one sixth of the OECD average. The PSE is 1 per cent of total farm receipts in New Zealand, 23 per cent in the United States, 40 per cent in the EU, and over 60 per cent in Iceland, Japan, Korea, Norway and Switzerland.

Figure 2. **Water prices in selected OECD countries**[1]

Mid-1990s



Notes:
1. For agriculture, industry and households, prices are the median values for the range of prices for each category.
2. Water used for livestock activities is obtained from municipal systems and priced at households rates.
3. Industry: these rates apply to commercial establishments only. While this may include small industries, the rates do not apply for major industrial operations.
4. Agriculture: data refer to the regions of Adour-Garonne and Côteaux de Gascogne; industry - the value refers to 1990-93 and excludes taxes, pollution and abstraction fees.
5. Agriculture: the value refers to 1998 water abstraction charges; households and industry : the values refer to 1998 maximum and minimum user charges for public water supply.
6. Agriculture: data refer to the regions of Sorria and Vigia. When it is a two-part tariff, the values were based on the estimated water volumes and the value per cubic metre.
7. Agriculture: data refer to the regions of Andalucia, Castille and Valencia. Industry: the values refer to 1992:94.
8. Agriculture: data refer to Northumbria and Wales.
9. Agriculture: data refer to the regions of Sacramento River and Tehama.
Source: Environmental Indicators for Agriculture - Volume 3: Methods and Results, OECD, 2001 and "The Price of Water" , OECD, 2001.

16. Full cost recovery is also a stated objective for rural water, but interpreted in a narrow sense, as it excludes the costs of existing infrastructure.[10] On this restricted interpretation, charges should thus cover operational costs as well as the costs of infrastructure maintenance; governments may decide not to implement cost recovery fully, but they are supposed to make subsidies transparent. There is no comprehensive information on progress in that area, as it was not included in the last assessment of the National Competition Council, but it has been slower than anticipated. Some states do not endorse the full cost recovery principle; Queensland, for example, plans to subsidise 10 to 15 per cent of the rural water supply in 2004. On average, charges covered about 124 per cent of operational costs, and probably only about 65 per cent of operational and maintenance costs in 1998-99, but with a large variation across irrigation schemes. Irrigators using water from the Snowy river electricity dam, for example, do not pay for

10. By and large, the groups of irrigators did not have the capacity to pay for historic debt. Attempts to recover capital costs would therefore probably have prevented the current use of water for irrigation. The 1998/99 *Benchmarking Report of the Australian Irrigation Provider*, issued in February 2000, indicates that the provision made for asset replacement represented on average 50 per cent of the loss in asset value each year. By contrast, urban water utilities were required to fully account for their accrued debt and realise a positive rate of return on their assets. For a discussion of the differentiated treatment, see Fisher (2000).

any of the operational, maintenance or refurbishment costs of the dam,[11] while others are probably reaching cost recovery in the narrow sense.

17. Average cost recovery does not ensure efficiency especially when there is a wide variation in the cost of providing water to individual irrigators. The prices paid by each irrigator should reflect the costs of providing water to individual irrigators. Most irrigation schemes charge a volume-based component, but 17 per cent still charge a land area component, and volume charges are still generally based on average costs for the irrigation group. While it was part of the COAG water reform agreement, the coverage of environmental costs is not implemented yet, and is seen as a long-term objective only.

18. The water pricing reform also included a commitment that new water development projects in rural areas would be both economically viable and ecologically sustainable, and that a robust evaluation process should be used for that purpose. While these principles seem to have been respected in most states, concerns have been expressed regarding projects conducted in Queensland, involving large public subsidies and in some cases unclear environmental effects.[12] Some of these projects, in particular, have contributed to rapid growth in irrigated development in the Northern part of the Murray-Darling Basin, while water management plans and the evaluation of downstream impact of the projects had not yet been completed. The penalty imposed on Queensland by the National Competition Council for non-compliance with commitments (amounting to 25 per cent of competition payments, or A$ 15 million, withheld for six months until reform commitments were made) has halted progress in those projects, until a clearer cost benefit analysis is available. The problem remains, however, that "economic viability" is not clearly defined, and departs from "commercial viability", since the Commonwealth and States governments can factor possible "community economic benefits" into the evaluation.

3.2 Water trading

19. The structure of water rights is such that the link between pricing and trading in water management reform is not straightforward. Pricing reform -- which affects what water users pay suppliers for the use of their rights -- is needed to ensure appropriate economy in water use by individual holders. An expansion of trading should improve the reallocation of water, between holders of rights as well as to users with no initial allocation, allowing water to go from low to high value uses. Water rights differ across states, but they tend to share a number of characteristics, which make them unsecured and imperfect. Entitlements generally specify a volumetric allocation, but the actual allocation may not be by volume, due to the high variability of supply. In some states, such as South Australia, the required adjustments to entitlements in period of low water supply are made according to considerations of the potential injury to the various water users, and would often represent a proportional re-allocation of entitlements, while in period of high flows, licensees may also be assigned "surplus" rights.[13] In other states, like New South Wales, rules for adjusting allocation have been incorporated in the entitlements through a priority system, with "high security" rights, in general for permanent crops, and "low security" rights for mostly annual crops. Water rights are usually issued for a given number of years, although they are commonly renewed in practice.

11. Fisher (2000).

12. See Productivity Commission (1999) and National Competition Council (1999).

13. Low security rights are specified as a proportion of the available resource, and not in nominal terms.

3.2.1 Trading developments

20. Transferability of water rights was first introduced in 1979 in South Australia. Initially limited to annual transfers, it has been progressively extended to other states, to various types of users and to permanent transfers. By the early 1990s, permanent trading had been allowed in the three south-eastern states of the Murray-Darling Basin. The COAG water reform, however, has made the development of water markets part of the general policy framework, at the same time as the Murray-Darling Basin Ministerial Council introduced an overall cap on water diversion in the basin at its 1993-94 level[14], to avoid increasing environmental pressure on rivers and ensure the security of supply for existing users. Trading volumes, mostly concentrated in the Murray-Darling Basin, have been increasing over the years, but apply mainly to temporary transfers, as shown in Figure 3 for New South Wales, the state with the largest irrigation industry. By contrast, the permanent water market has not experienced much growth, failing to exceed more than 0.5 per cent of the total water entitlements available for trade in New South Wales. On average, in 1997-98, 7.3 per cent of total water entitlements were traded in Australian irrigation areas where trade is taking place, of which only 1.8 percentage points applied to permanent trading.[15] While in theory, there should be no distinction between annual and permanent transfers, since it should be possible for a series of temporary transfers to be equivalent to a permanent one, this may not be so straightforward in practice.[16]

21. The expected benefit from developing water markets is the equalisation of the marginal "productivity" of water use. The wide variation in average value added among agricultural activities illustrated in Figure 4 suggests that marginal productivity varies a lot and hence that the potential to increase the efficiency of water use exists in Australia, even when restricted to agricultural uses. In fact, although comprehensive information on the nature of transfers is lacking, most trading seems to be taking place among agricultural users. Permanent transfers seem to be moving water in the expected direction, that is from low-value-pasture and broad-acre farming to higher value horticulture, viticulture and vegetable production.[17]

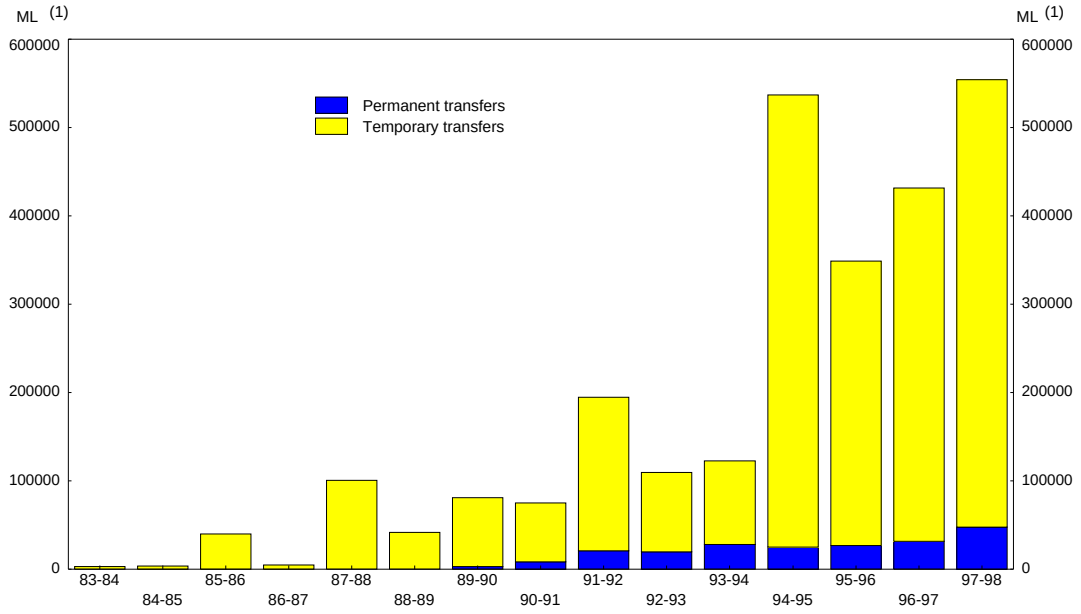
14 More precisely, the cap set each year is not the volume of water that was used in 1993-94, but rather the volume of water that would have been used with the infra-structure (pumps, dams, channels, etc.) that existed in 1993-94, assuming similar climatic and hydrologic conditions to those experienced in the year in question.

15. Source: 1998/99 Australian Irrigation Water Provider, Benchmarking Report, February 2000.

16. Administrative restrictions or differentiated tax treatment, about which information is lacking, may be obstacles.

17. Bjornlund and McKay (1998) obtained this result having surveyed about 50 per cent of the permanent transactions that took place in South Australia between 1987 and 1993. The Productivity Commission (1999) also notes that water trading has allowed significant new investment in wine and horticultural activities in some parts of Victoria.

Figure 3. **Water entitlement in New South Wales**



1. Million of litres.
Source: Australian Agricultural and Resource Economics Society, 2000.

22. Overall, this points to a relative thinness of the market when it comes to permanent transfers, at least. Most studies on Australian water markets see this as problematic; for example, investment in high-value horticultural enterprises may be incompatible with a movement of temporary water alone.[18]. The reason is that water conditions are extremely variable from year to year, which makes water supply inherently unreliable relative to many other parts of the world.[19] However, provided that the temporary market is working well, it is not obvious that the thinness of the permanent market is problematic *per se*.[20] There are nevertheless some market imperfections which may explain the thinness of the market.

3.2.2 Reasons for a thin market

23. To some extent, the thinness of the market can be explained by the inherent properties of water and water use, in particular its spatial dimension, which make it a non-homogenous good. Transfers of water entitlements, in particular permanent ones, are subject to approval by the appropriate water authority, to ensure that there is no negative externality caused by the trade. A major cause of concern is that changing the spatial location of water may damage the environment, in particular by increasing salinity

18. Crase *et al.*, 2000.

19. Brennan and Scoccimarro (1999) indicate that the ratio for annual variations in maximum to minimum flows ranges from 300 to 1 000 in Australia, against 3 to 15 in North America.

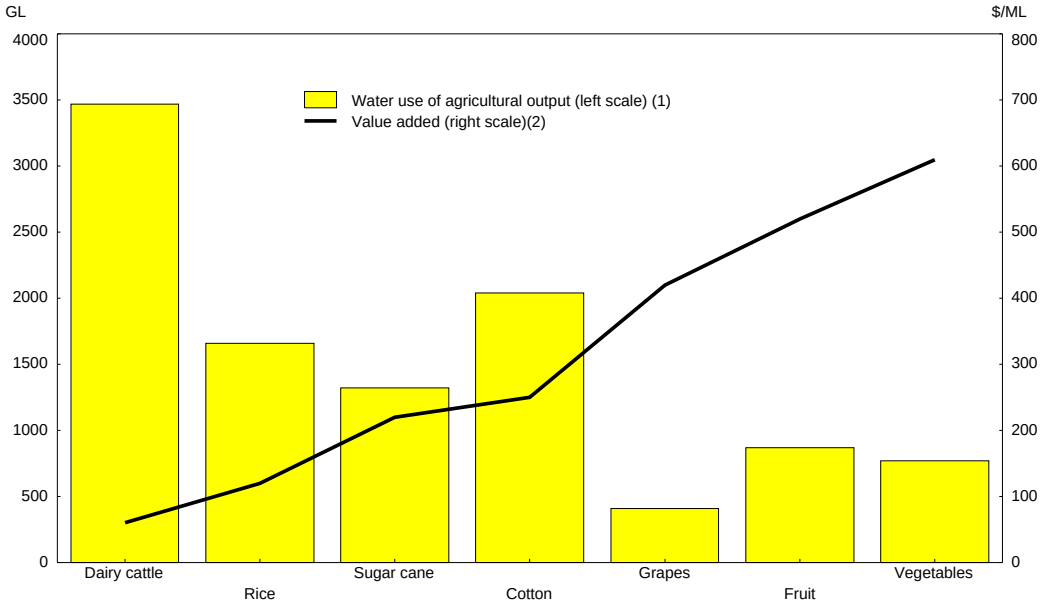
20. What should matter for the holder of both sellers and buyers is the shadow price (or opportunity cost) of water rights. In a dry year, the shadow price of water should go up, and even holders of permanent rights should consider selling it if it is more profitable for them to sell it rather than to use it for their usual activity.

(see following section), so that states require environmental assessments and water management plans. In Victoria, land has been designated as high or low salinity impact zones, and transfers to high salinity zones are forbidden. Water authorities also review the effects of trade on the security of supply of third parties, which may be affected, as water may have to come from a different source (reservoir or river). For example, the further upstream a water entitlement is moved, the more reduced the security of supply becomes, as less storage options are available.[21]

24. Differences in water entitlement specification across states also introduce heterogeneity. Water transfers between farmers in different states were not permitted in the past, but since 1998, an interstate pilot trading scheme has begun on part of the river Murray. Initially restricted to private diverters, the scheme now includes irrigators belonging to irrigator groups. Administrative and legal procedures have been amended to facilitate interstate transactions in high-security entitlements only. In order to limit the impact of trading on supply security, an exchange rate of 0.9 has been established for transfers from South Australia to Victoria or New South Wales (that is upstream transfers).[22] As for environmental clearance, the same processes apply as for intrastate trading.

Figure 4. **Water use and value added intensity of selected agricultural industries**

1995-1996



1. Water use in GL (Billion of litres).
2. Value added per ML (Million of litres) of water supplied.
Source: Australian Academy of Technological Sciences and Engineering and the Institution of Engineers (1999).

21. The transfer can also result in transmission gains or losses in the rivers and channels through which the water moves.

22. Hence, a sale of 10 megalitres from South Australia would mean a receipt by an irrigator in New South Wales or Victoria of 9 megalitres, the difference remaining in the river.

25. A number of direct or outright restrictions also weigh against permanent trading, although it is difficult to estimate the extent to which they are binding. In some jurisdictions or regions, trade out from irrigation use is not permitted, and land-ownership and irrigation development approval are needed to purchase water. In other cases, trade out of a given irrigation district is limited to a very small percentage of total water entitlements, sometimes also for temporary trading.[23] In part, these restrictions are meant to prevent water entitlements moving to "absentee landlords". They are also intended to protect remaining irrigators from substantial rises in price that may be necessary to cover water delivery system costs in the event of a rapid reduction in water supplied in an area. However, alternative pricing mechanisms for joint cost recovery are possible to design, that would remedy this problem and remove the need for such administrative regulations. Finally, limits also apply to the share of individual rights that can be transferred on a permanent basis even within a given district – 40 per cent in the largest irrigation district of New South Wales, 25 per cent in South Australia.

26. These various restrictions have *de facto* prevented intermediaries from intervening in the market.[24] Allowing the development of intermediaries would have a number of advantages. Their presence would enhance transparency. But probably the main advantage to be expected from their development would be to allow the spreading of the risks associated with the inherent unreliability of water supply, which would boost the development of long-term trading. High search costs incurred in establishing the price of permanent water rights may also partly explain the paucity of permanent trading; price information seems to be more readily available for temporary trading.[25] In fact, while parties to a permanent transaction have to report the quantity of water rights transferred, they are not required to report prices. The dispersion observed in prices may also to some extent result from these relatively high transaction costs. Introducing a price-reporting requirement would enhance the efficiency of the market. This could be done by the regulatory agencies, as in the land or housing markets, or even possibly by private intermediaries, if those were allowed to intervene on the market. Difficulties in clearly specifying water rights may also slow the transition to market-based allocation mechanisms. In particular, the uncertainty remaining about the minimum flows allocated to the environment may hamper trading. These flows, referred to as "environmental flows", constitute one of the instruments retained in the water reform to improve the sustainability of water use. The establishment of an overall cap on diversions has increased the security of water. rights for current users, but reductions in overall water allocations to irrigators in order to provide for environmental water allocation (as for example in 1998 in New South Wales) have attenuated such rights. In principle, environmental flows based on clearly established rules should not impair market efficiency, as buyers and sellers should factor them in the transfer price. In practice, nevertheless, there is still significant uncertainty as to what environmental flows should be (see Box 1), and the uncertainty regarding the future regulatory framework for environmental flows may impede water trading, as farmers may expect water value to rise in the future, if overall diversions are further restricted. A further policy-related uncertainty which may reduce permanent trading relates to the future subsidisation of irrigation infrastructure, as this obviously matters for the return on investment of potential traders.

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23. For example, in Victoria, Goulburn-Murray Water can prevent trading if more than 2 per cent of the total water right is traded out of an area in any irrigation season. According to Challen (2000), in South Australia, the net reduction to total entitlement of the Central Irrigation Trust, composed of the ex-government irrigation areas that were privatised in 1997 irrigators, has not been allowed to exceed one per cent of the total entitlements. In the largest irrigation district of New South Wales, temporary transfers outside the district have been restricted by local rules (Crase *et al.*, 2000).

24. It is not clear whether there are also outright legal restrictions on intermediaries participation to water markets.

25. This is apparently less of a problem for temporary trading, as irrigation districts tend to centralise and diffuse the relevant price information (Crase *et al.*, 2000).

Box 1. **Minimum environmental flows**

One element of the COAG water reform framework is for jurisdictions to give priority to determining allocations or entitlements to water, including formal allocations to the environment as a recognised use of water. Historically, the environmental rights to water use have been residual to commercial developments, which has resulted in the severe degradation of river ecosystems. Most states have now reformed or are in the process of reforming their water legislation to assign a prior right to the environment. Yet, progress in the determination of formal allocation rules for the environment has been uneven, and, when developed, the rules remain approximate and *ad hoc*, mainly due to limited ecological data and incomplete understanding of the environmental consequences of current levels and patterns of water and land-use.[1] Further research is needed to develop appropriate rules for minimum flows,[2] as well as to determine the appropriate level of the overall cap on diversions in the Murray-Darling Basin. As concluded by the 2000 Review of the Operation of the Cap, there is no certainty that it currently represents a sustainable level.

Environmental flows are a contentious issue in the Australian debate, as they involve a trade-off between current and future uses and the environment. There has indeed been a rescheduling of commitments from 2001 to 2005 to implement the provisions for environmental flows included in the COAG water reform. Environmentalists argue that the environment should have a strict prior right prior to water allocation decisions, which comes down to bringing environmental allocations into the cap. Irrigators, on the other hand, call for a trade-off among economic, social and environmental objectives, and require an enhancement of the security of their water rights. Efficiency and distributional issues are difficult to separate. One proposal is that environmental flows should be purchased directly from water markets. In theory, this could achieve a more efficient environmental out-come, as water would be bought from lower value uses. In practice, at the current stage of market development, there are still doubts about the efficiency of that solution (water for sale may be unavailable, while the buying or selling of environmental water may have an inflationary or deflationary effect if the market is swamped, and the transaction costs may be high). There are also distributional issues involved: if environmental flows were to be bought from current users, this would amount to making the general taxpayer pay instead of irrigators. In fact, any measure increasing the security of water rights at their current level would require the taxpayer to compensate irrigators in the future if their rights have to be reduced. Market mechanisms may allow desired environmental outcomes to be met in a more cost-effective way, but they cannot set the target. A combination of the "market" and "regulatory" approaches could also be used.[3] Increasing the efficiency of irrigation networks by financing engineering works out of public funds – transmission losses are currently substantial – and keeping the savings for the environment, is another option considered. It would be important, however, that proper incentives for water savings be provided in the first place through full economic pricing of water.

Another issue in the management of environmental flows is the level at which the decision has to be taken. While it is important, as enshrined in the principles of the water reform, to have community involvement in the decisions regarding flow rules, devolving responsibilities at the regional/local level is not efficient, as the environmental consequences of decisions are not only felt locally, but also by downstream users. Water planning in Queensland, for example, does not take into account the impacts on downstream water in New South Wales and South Australia. A regional perspective is needed, calling for more interstate co-operation in this field.

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1. For a review of progress regarding the environmental part of the COAG water reform, see Cullen *et al.* (2000).
2. Determining environmental requirements is complex, as many factors have to be taken into account, such as timing, quantity and duration of flows, rainfall, land-use, diversions, transmission losses, daily flows and seasonal variation (Siebert *et a*l., 2000).
3. Siebert *et a*l., 2000.

4. The challenge of salinity

4.1 Nature of the problem

27. Agriculture is an important source of environmental degradation in Australia, as in many other OECD countries, as intensive crop production and regional concentration of livestock farming have brought rising levels of nutrient surpluses, ammonia and greenhouse gas emissions, among others, with consequent increases in water and air pollution. In Australia, a particular feature of this degradation is the problem of soil and water salinisation. Massive land clearing for agricultural purpose, combined with irrigation in some places, has initiated changes to groundwater balances, mobilising salts which have had significant adverse effects on soil and water quality, albeit some distance away and removed in time from where and when actions were taken (see Box 2). At least 2.5 million hectares (5 per cent of the country's cultivated land) is currently affected by dryland salinity, and a recent audit[26] estimates that approximately 5.7 million hectares are within regions mapped to be at risk or affected by dryland salinity. The area affected or at high risk could rise to 17 million hectares around 2050,[27] concentrated in the populated parts of the country (Table 1). One-third of the rivers are in extremely poor conditions, concentrated mainly in the southern part of the country. The costs of salinity include the loss of productive land for agriculture and reduced yields from irrigated crops and pastures, but also damage to infrastructure, such as roads and buildings,[28]92 and costs to urban and industrial water users. At risk from increased salinity is also the quality and variety of a range of environmental assets, both on land and riverine eco-systems. In 1998, the costs of dryland salinity, excluding biodiversity costs, were estimated at A$ 270 million annually (about 1.7 per cent of agricultural value added), but they may well rise substantially in the long run.[29]

28. A number of key aspects of the salinity problem make it a difficult issue for policy to tackle. First, the causes and effects of the problem are not always felt in the same place. In some cases, the farmer causing the problem is the one suffering from it, but in most cases, the most acute impact is a long distance (even hundreds of kilometres away) from the source. This externality problem is made more complex by the fact that it extends over state boundaries, which makes the usual institutional/administrative division ineffective to deal with it. Second, given the long time lags involved (see Box 2), landholders implementing land-use changes are not those who will experience the consequences. Third, there is significant uncertainty as to the precise linkages between actions and salinity effects as well as to the length of time for action to take effect. Fourth, given the diffuse nature of causes and effects, it is quite difficult (or costly) to monitor both actions and consequences. All this makes it difficult to convey a proper "signal" for landholders' response.

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26. The Commonwealth and States have contributed collaboratively to the National Land And Water Resources Audit for it to prepare an assessment of resource condition needed for decision making.

27. See "A National Action Plan for Salinity and Water Quality", Council of Australian Governments, November 2000.

28. In affected areas, roads last only about a quarter of their normal life. Salinity damages public infrastructure, but also the foundation of private dwellings.

29. Report to the Prime Minister's Science, Engineering and Innovation Council, "Dryland Salinity and its Impact on Rural industries and the Landscape", December 1998. The amount includes A$ 130 million in lost agricultural production, A$ 100 million in infra-structure damage and A$ 40 million in loss of environmental assets.

Table 1. **Areas at high risk of developing or affected by dryland salinity**

By State

	Area affected -- PMSEIC report		Area affected or at high risk -- National Land and Water Resources Audit			
	Thousands of hectares and percentage of total State surface					
	1997		1998/2000		2050	
State/Territory						
New South Wales	120	0.1	181	0.2	1300	1.6
Victoria	120	0.5	670	2.9	3110	13.7
Queensland	10	0.0	..	..	3100	1.8
Western Australia	1804	0.7	4363	1.7	8800	3.5
South Australia	402	0.4	690	0.7	600	0.6
Tasmania	..	..	54	0.8	90	1.3
Total	2476	0.4	5658	1.2	17000	2.7

Source: Report to the Prime Minister's Science, Engineering and Innovation Council, "Dryland Salinity and its Impact on Rural industries and the Landscape", December 1998; and National Land and Water Resources Audit.

Box 2. **Nature of the salinity problem in Australia**

Australia is geologically and climatically prone to concentrating salt in the landscape, as it combines a generally flat terrain with low rainfall, high evaporation, and very limited sub-surface drainage to the sea. Groundwater and rivers are thus naturally very salty, and salt often occurs at the land surface in the form of salt lakes or salinised land. However, human-induced land use changes have exacerbated these conditions, making rising salinity a critical problem.

Two types of salinity are normally distinguished, dryland salinity and irrigation salinity. *Dryland* salinity results from changes in the water balance of landscapes following the removal of native vegetation and the introduction of European-type agriculture. The deep-rooted and perennial native vegetation uses most of the rainfall, so that there is limited leakage to groundwaters. By contrast, shallow-rooted crops such as wheat and pastures for livestock production use less water and increase groundwater recharge. The result is a general elevation of water tables, which most often increase down-basin flow, and lead to higher groundwater pressures at some point lower in the catchment. This pushes the salt contained in groundwater and in the soil to the surface, where it concentrates by evaporation, and also increases discharges of saline groundwater to streams.

Given the time scale of hydrogeological processes, it may take from tens to thousands years before the increase in groundwater recharge translates into increased discharges and salinity, so that much of the effect of past actions is yet to come. The potential for increased groundwater recharge varies across regions, with the soils and climate. Where the soils are shallow, they are less capable of storing seasonal rainfall, and groundwater recharge can be greater. This is also the case where the growing season does not coincide with the dominant rainfall season, such as for example in the south of the country, which experience cold, wet winters and hot, dry summers. The time it then takes for a change in the rate of recharge to be fully reflected in the rate of discharge depends on the slope of land and soil characteristics.

In *irrigation* areas, the problems that can result from the removal of native vegetation have been compounded by the application of large additional quantities of water, very often without drainage facilities to remove excess water, which has substantially added to the leakage into groundwater. In practice, the two types of phenomena (dryland and irrigation) have combined to increase salinity both in land and water.

4.2 Policy response

29. Three main types of technical options exist for salinity mitigation: changes in land and water use and management practices; engineering salt-interception schemes (which pump saline groundwater and collect the salt through evaporation), and river flow management. To date, the main policy initiative to mitigate salinity has been taken in the Murray-Darling Basin – which concentrates most of Australian irrigated agriculture and where most of the salinity effects were initially felt – relying mainly on salt-interception schemes which provide immediate reductions in river salinity.

4.2.1 The Murray-Darling Basin Salinity and Drainage Strategy

30. Launched in 1988, the strategy provided a framework for joint action by the New South Wales, Victorian, South Australian and Commonwealth governments to manage waterlogging and land salinisation in irrigation areas and river salinity in the lower Murray. Engineering schemes to intercept salt had already been constructed in the lower part of the river, but the cost of further schemes was increasing and downstream users were reluctant to build new schemes while salt discharges from upstream were continuing.[30] The strategy is a schedule to the Murray-Darling Basin Agreement Act (1989) – one of the few instances that binds government to common action within the Australian federation; it imposed rights and responsibilities on the government members, holding them accountable for actions taking place after 1988 that affect salinity. The four governments jointly engaged to finance a programme of works for groundwater pumping,[31] to reduce salinity at Morgan (just upstream of Adelaide, South Australia's capital town) by 80 EC, to come close for most of the time to the 800 EC threshold for desirable drinking water quality.[32] There was no a precise time commitment. The states may take actions which exacerbate salinity, such as further drainage works and irrigation developments, to the extent that they earn "salinity credits" through additional engineering works.

31. Ten years after the commencement of the strategy, the contribution of engineering works to the reduction in salinity at Morgan has been of the order of 76 EC, while irrigation developments and water management changes have resulted in a 19 EC salinity increase, giving a net reduction of 57 EC. This has deferred the expected date of average salinity at Morgan breaching the threshold for desirable drinking water quality from 2020 to 2040-50 (Figure 5). This one-off reduction in salinity, however, does not improve the trend, which is due to actions taken in the past.[33] Although the 80 EC reduction target was set with reference to the threshold for desirable drinking water quality, cost considerations have also been taken into account in designing and implementing the strategy. In fact, a rapid cost-benefit analysis shows

30. The downstream impact of increased irrigation salinity had become the basis of court action between South Australia and New South Wales. According to Gutteridge *et al.* (1999), over 90 per cent of the salinity impacts in the Murray Valley for water supply are experienced in South Australia.

31. The capital costs of construction of these jointly-funded salt-interception schemes is shared equally among the Commonwealth, New South Wales, Victorian and South Australian governments, and the operating costs among the three State governments.

32. Salinity is generally measured in Electrical Conductivity (EC) units. According to the World Health Organisation, the threshold for desirable drinking water quality is 800 EC. At 1500 EC, options for consumptive use become much more limited, as susceptible irrigation crops cannot be grown, more tolerant ones can but at high risk, and adverse ecological effects are likely to occur. In the previous decade, 1975-85, salinity exceeded 800 EC 42 per cent of the time at Morgan. The notional aim of the Salinity and Drainage Strategy was to bring it to 800 EC 95 per cent of the time.

33. Salinity at Morgan is now below 800 EC for more than 90 per cent of the time compared with 60 per cent for the pre-strategy period.

that the benefits of the works have exceeded their costs.[34] The marginal costs of engineering salt-interception schemes are increasing, however, though the Murray-darling Basin Commission estimates that there are still another 50 EC of works which would provide positive net benefits.[35] That engineering works have provided net benefits does not imply that the over-all salinity and drainage strategy has been cost-effective, however. Victoria and New South Wales have used some of their "salinity credits" for irrigation development and water management changes,[36] and an evaluation of the economic and environmental costs and benefits associated with these developments, which would be required to assess the cost-effectiveness of the strategy, is not available.

4.2.2 Land management

32. To address the underlying causes of dryland salinity, which has been found to contribute much more than expected to river salinity,[37] land management measures have to be used. Groundwater recharge can be reduced in some regions by improving the water-use efficiency of pastures and cropping rotations or by replacing agriculture with plantation or agro-forestry systems. Until recently, there was no clearly specified objective or strategic approach for dryland salinity mitigation. To date, most of the land management measures with impacts on dryland salinity have been implemented as part of wider land management programmes, such as Landcare and Bushcare, which are parts of the Natural Heritage Trust (NHT), a Commonwealth government initiative for land and water management and the conservation of biodiversity.[38] The Landcare programme aims at addressing the causes of land degradation, relying on relatively small projects identified and implemented at the landholder or community level. Since 1997, the Bushcare programme finances projects to conserve native vegetation or replant, also mainly at the community level, the goal being to reverse the decline in Australia's native vegetation cover with no net loss by June 2001. These programmes may have increased community awareness of environmental issues at stake in land and resource management, but there is increasing recognition that incremental changes at the local level can deliver only marginal changes, not commensurate with the scale of the dryland salinity problem.[39] In addition, the local approach has meant that programmes are not necessarily prioritised towards areas where they would provide most benefits in terms of controlling dryland salinity.

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34. The annual costs for water users of increasing salinity by one EC, or alternatively the benefits of decreasing salinity at Morgan, have been estimated to range between A$ 65 000 and A$ 152 000, while the annual costs of reducing the salinity level at Morgan by one EC unit (through new or enhanced engineering schemes) have amounted to A$ 52 700 on average between 1988 and 1998. The further upstream the salinity increase takes place, the higher the costs. The lower bound corresponds to a place located downstream of the major irrigation areas. "The Salinity Audit -- A 100 year perspective, 1999", MDBC. *Source*: OECD calculations based on Goss *et al.* (2000).

35. According to the Murray-Darling Basin Commission, each EC unit reduction measured at Morgan currently costs about A$ 1million in capital *(i.e.* A$ 50 000 yearly) and A$ 40 000 in yearly operating costs. Assuming that benefits have not changed, with a A$ 90 000 annual cost, not all salt-interception work are cost-effective.

36. Integrated land and water management plans that address salinity and other environmental concerns have also been implemented. These plans, covering about two million hectares, have directed public and private investment towards improving water use practices on farm and minimising losses in supply infrastructure.

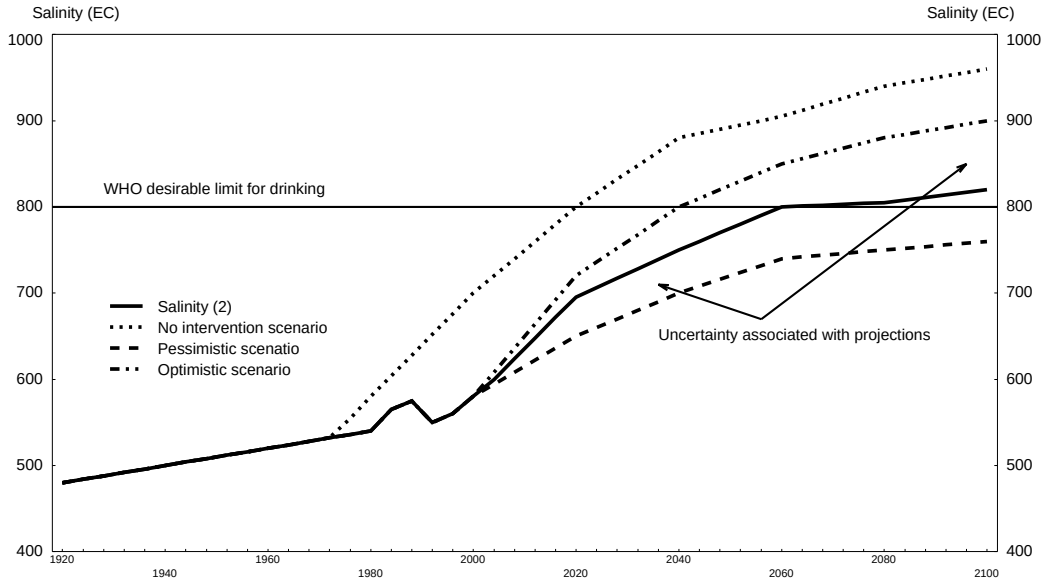
37. Sixty to 70 per cent of salinity increase at Morgan in 2050 is attributable to dryland sources.

38. The Commonwealth government is committed to spend A$ 1.5 billion over five years under the programme that was launched in 1997. An extension of the NHT over a further five years has been recently announced in the 2001-02 Budget.

39. See March 2000 report of the Standing Committee on Agriculture and Resource Management entitled "Management of Dryland Salinity – Future Strategic Directions" and "Mid-Term Review of the Natural

Figure 5. **Forecast of salinity at Morgan (South Australia)**

Electrical conductivity (EC) units[1]



1. Electrical conductivity (EC) units are used as measures of water salinity. The threshold for desirable drinking water quality according to WHO is 800 EC.
2. Recorded salinity until November 1988, projections thereafter.
Source: Murray-Darling Basin Commission.

33. Land clearing has been going on at relatively high rates over the last years in some states, especially Queensland, but also New South Wales and Tasmania.[40] Clearing of native vegetation is estimated to average about 300 to 340 thousands hectares per year, in net terms (with over 340 000 hectares in Queensland), while 10 000 hectares had been revegetated and 120 000 hectares of native vegetation had been protected in one year and a half under Bushcare.[41] Subsidising revegetation and allowing land clearance at the same time is obviously not cost-effective.[42] In large part, this inconsistency reflects an institutional problem, as states have primary constitutional responsibility for land-clearing regimes, while the Commonwealth has been financing the Bushcare Programme, thus illustrating the difficulties of policy co-ordination in a federal country mentioned earlier.

Heritage Trust – Dryland Salinity and Associated Vegetation Management Study, Final Report", The Virtual Consulting Group, November, 1999.

40. The number of hectares cleared in 1997 as reported in the National Greenhouse Gas Inventory were 16 400 for New South Wales, 350 000 for Queensland and 10 000 for Tasmania. Estimates for 1999 by the Australian Conservation Foundation are 32 800 for New South Wales, 400 000 for Queensland and 10 000 in Tasmania (see "Greenhouse Implications of Increased Rates of Land Clearing, *www.acfonline.org.au/campains/landclearing/official/glc.htm*).

41. See the Mid Term Review of the Natural Heritage Trust – Bushcare program, CSIRO, November 1999.

42. Of course, in principle, it could be the case that land clearing has been authorised in areas where salinity impacts would be evaluated to zero, while revegetation is financed in areas where it is thought to reduce salinity. This does not seem to be the case however.

34. The recently-released National Action Plan for Salinity and Water Quality is the first concerted and targeted national strategy to address the salinity problem, in particular dryland salinity, supported by a A$ 1.4 billion public financing (half of which from the Commonwealth government) over seven years. Targets and standards for salinity are to be developed in collaboration between the Commonwealth and the States, and integrated catchment/regional management plans addressing salinity will be established. Given the nature of the salinity process, in particular the regional variability of the benefits derived from salinity mitigation and the potentially large distance between where land use actions are taken place and where the salinity effect is felt, it is appropriate to design and implement policies at the regional/catchment level. The plan also recognises the necessity to prohibit land clearing in areas at high risk of land or water degradation, and envisages the creation of a number of market-based mechanisms to achieve more desirable salinity outcomes as well as greenhouse gas abatement.

4.2.3 The choice of instruments and targets

35. The extent to which economic instruments -- *i.e.* instruments using price incentives -- could be used for salinity mitigation is currently a matter for debate.[43] Directly addressing salinity through economic instrument would require a "tax base" to be identified, with direct links to salinity. But although much progress has been made in assessing salt levels and future salinity hazard, significant uncertainty remains as to the links between land-use and management actions and salinity. While the effects of land-management practices or land-use changes on water recharge can usually be measured, there is no direct link between recharge rates and salinity effects, which depends on discharges (see Box 2). Besides, the effects of revegetation on salinity vary across region with the climate and soil conditions. The effects on salinity of improvement in water use efficiency are also not straightforward to assess, as they affect not only ground-water recharge but also the run-off, with a net effect on river salinity for down-stream users varying across location and time. Introducing, for example, a tradeable scheme that would cover diffuse sources of salinity is not possible. A trading scheme exists in the Hunter River (Box 3) to deal with industrial point sources, which although important at the margin, are not the main source of salinity problems. It was initially planned to integrate diffuse sources in that scheme, but uncertainties over the link between vegetation and salinity make both monitoring and control extremely difficult. Extending the scheme to include diffuse sources thus seems impossible at the moment, and plans to do so have been shelved.

36. Intermediate targets have therefore to be set, such as end-of-valley salinity levels, revegetation or irrigation improvement. To the extent that actions can be identified as intermediate targets, as for example revegetation of specific areas where it is assessed to have effect on recharge rates, economic instruments can be applied to achieve these indirect targets. Indeed, subsidies provided for revegetation can be improved as an economic instrument by structuring them to improve the link between the subsidy and the environmental outcome. In fact, the National Action Plan for Salinity and Water Quality includes measures heading in that direction. In two pilot areas, a competitive bidding for subsidies for revegetation projects would be organised. The various environmental benefits associated with revegetation (in terms of salinity, biodiversity and other possible environmental impacts), which vary according to the land location, would be taken into account, along the lines already used in the Conservation Reserve Programme in the United States.[44] This system would also help to minimise the costs of meeting a given revegetation target.[45]

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43. For a discussion of the potential role of economic instruments in salinity management, see Bell *et al.,*(2000).

44. See O'Brien (2001) pp. 16-17.

45. Other pilots under the National Action Plan are expected to involve the use of a "trust" or market intermediary to bring together and facilitate private trading between private landowners who provide eco-system services such as for salinity, carbon and biodiversity and both private and public investors in

In the longer run, however, to provide a consistent system of price signals, in the same way as subsidies are provided for revegetation, governments could also consider taxing land-clearing according to the environmental damage that it is evaluated to cause.

Box 3. **Managing salinity discharges from point sources: the Hunter River salinity trading scheme**

The policy aimed at managing salinity discharges from coal mines and electricity companies in the Hunter River in New South Wales was reformed in 1995, from a pure licensing approach to an approach combining command and control regulation and the use of market-based instruments in the following way:

- Saline discharges are prohibited during low flow periods, when they cause most damage, and are authorised without any limit during periods of flood flows.

- In periods of high flows, saline discharges are managed by a pilot cap-and-trade system. The total amount of salt that can be discharged by mining and electricity companies is calculated daily so as to respect thresholds for salinity levels in three distinct locations ranging from 600 EC to 900 EC. Discharge entitlements, which give the right to a share of the total allow-able discharges for periods of one or two years, are allocated for free, based on a number of criteria including the environmental performance of the firm as assessed at the inception of the scheme, output, employment and site-specific conditions.

This new scheme can be considered as successful, as salinity targets were not exceeded due to discharges by the scheme participants. However, to date, this seems to result more from the regulatory provisions of the scheme than from the effectiveness of the cap-and-trade system. In fact, the utilisation rate of the total amount of salt that can be discharged has been low (only 13 per cent) as most participants have been able to meet the bulk of their discharge needs by discharging into flood flows. Trading has also been relatively scarce (one transaction in 1995, two in 1996, none in 1997, 20 in 1998, 18 in 1999 and 22 in the first eight months of 2000) and although participants are not required to disclose whether or how much they are paying when they trade, it appears that much of the temporary trading has been on a bilateral *quid pro quo* basis without money exchange, although longer-term trades have had a price.

The importance of the trading mechanism is likely to grow over time as economic activity in the region increases, as can be expected from current developments. The interest in trading may also increase once the pilot scheme is formalised, especially if, as currently envisaged, the Environment Protection Agency of new South Wales introduces a gradual auctioning of discharge entitlements, which would also facilitate new entry.

37. To determine which actions are most beneficial, and how resources should be allocated, cost-benefit analysis has to be used. The Murray Darling Basin Commission is currently undertaking such an assessment, considering the options of reforestation and improvement in irrigation water use. The analysis takes into account the costs of salinity for agriculture and urban and industrial water users -- but not other infrastructure costs neither environmental costs -- and tries to identify the most cost-effective options. Preliminary results indicate that overall costs are relatively low and that although revegetation would be highly effective in some areas, improvement in water use for irrigation or changes in the location of irrigation would greatly contribute to mitigating salinity in some places. Accelerating the implementation of the water reform in rural areas would thus also contribute significantly to improving the cost-effectiveness of policy for salinity mitigation. Indeed, a full "economic" pricing of water would increase the incentives for using it efficiently, and including the environmental costs associated with water use in its price would further increase the consistency of governments policies in this domain.

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those services. Details of how eco-system services would be measured and how such markets could function and currently being developed.

5. Climate change mitigation

38. Climate change is a challenging issue for Australia. The statement by the United States that it opposed the Kyoto Protocol has caused uncertainty as to the outlook for the Protocol and its targets. However, Australia has stated that it remains committed to the pursuit of emissions reductions, as well as to the unrestricted international trading of greenhouse gas (GHG) emission allowances within any global agreement. As in other OECD countries, curbing greenhouse gas emission growth to a significant extent would entail significant structural change and adjustment costs, especially as 84 per cent of electricity is generated from coal, the fuel with the highest global-warming potential. Moreover, if the Kyoto Protocol or another international agreement to limit greenhouse gas emissions were implemented, as the world's largest coal exporter, Australia would also have to face a reduction in demand for coal exports and the associated terms of trade implications. The policy setting is also complicated by the fact that given the country's energy structure, policy effects may be unequally distributed across states, with those relying more on natural resources and coal, such as Queensland, New South Wales and Western Australia, bearing a higher cost than the others. On the other hand, a relatively high share of Australian greenhouse gas emissions in 1990 was related to changes in land-use, providing more scope for reduction here compared with other OECD countries. Treatment of these emissions is still under negotiation among the Parties to the Protocol, however, and uncertainty thus remains on the role that land-use management options may play in reaching the target.

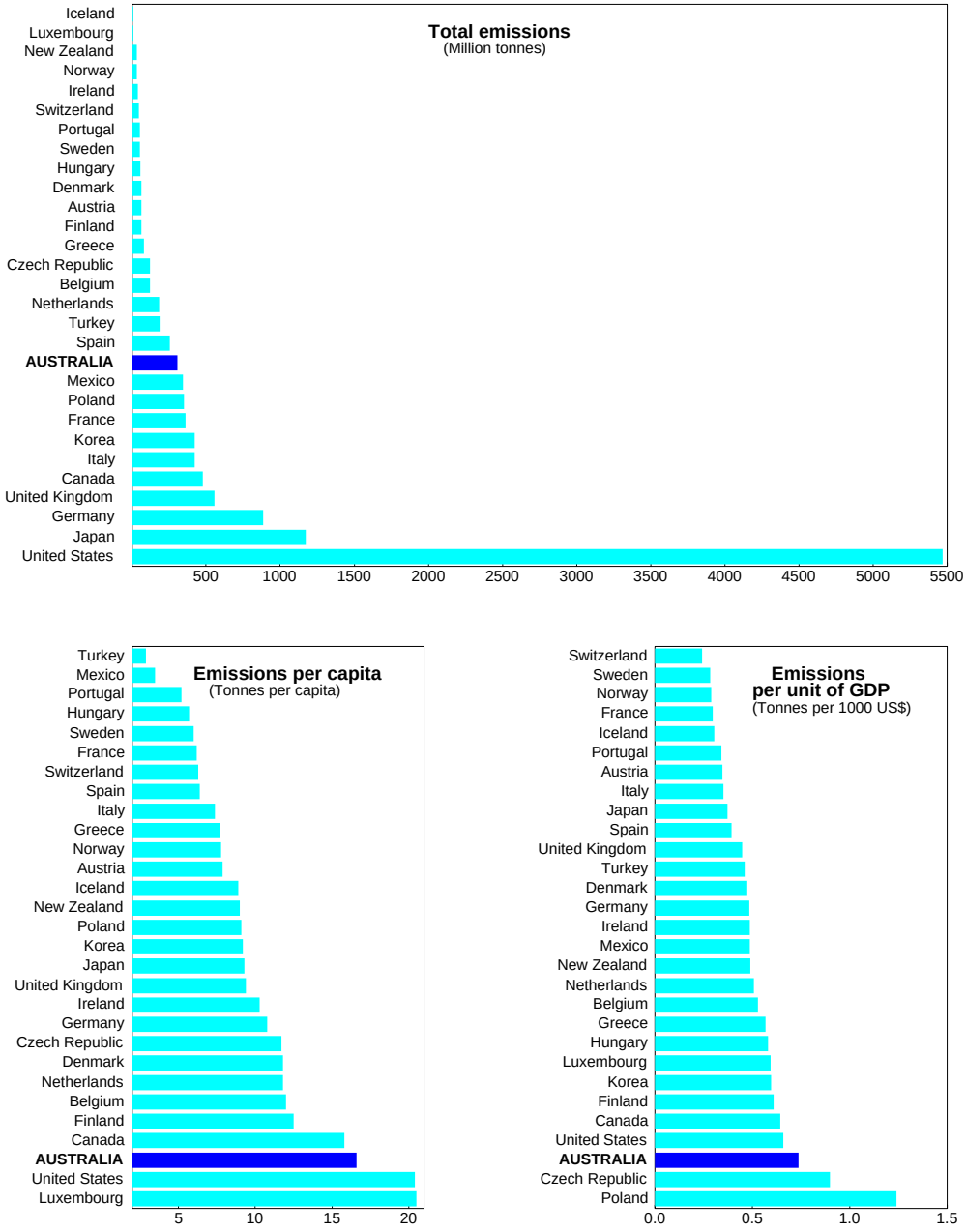
5.1 The costs of meeting the Kyoto target

39. Australian emission intensities of carbon dioxide are the third highest in the OECD both per capita and per unit of GDP (Figure 6). Australia, along with most other countries, will not meet the general commitment made in 1992 (when the United Nations Framework Convention for Climate Change was established at Rio de Janeiro) that greenhouse-gas emissions be no higher in the year 2000 than in 1990. Under the terms of the as-yet unratified Kyoto Protocol, Australia has been permitted an 8 per cent average increase in greenhouse gas emissions in the period 2008 to 2012 compared with their 1990 level. In 1999, greenhouse gas emissions, excluding those due to changes in land use, were about 17 per cent above their 1990 level and official projections are that, on unchanged policies, these emissions by the year 2010 would be 23 per cent above their 1990 level. Preliminary estimates of emissions from land and forests, although highly uncertain, show a decrease of around 30 per cent between 1990 and 1999 based on the United Nations Framework Convention for Climate Change (UNFCCC) accounting rules. Under these rules, the increase in greenhouse gas emissions over that period is 7.3 per cent.[46] The Kyoto Protocol provides for some of these rules to be revised, but no agreement on all of the revisions has yet been reached. Despite the uncertainties, the importance of emissions from land clearing in the base year (they represented about 30 per cent of total emissions in 1990) means that they will play an important role in meeting the Kyoto target. It remains difficult to judge how close Australia is to meeting its Kyoto target but it is likely that use of international carbon trading will be an important element in Australian policy. In the absence of such flexibility mechanisms, it is clear that further policy action will be required to meet the target (as is the case in many other OECD countries).

46. The estimates of emissions from land clearing may change significantly in the future, as changes in methodology and a quantum improvement in data should allow robust trends to be established in the near future.

Figure 6. **Carbon dioxide emission intensities**

1997



Source: OECD

40. One of the options under the Kyoto Protocol is indeed to purchase emission permits from other countries. Australia is an active supporter of the use of such mechanisms.[47] Model simulations covering the

47. Apart from straightforward permit trading among Annex B countries, the Kyoto Protocol includes two other "flexibility mechanisms": Joint Implementation, where an emitter in one country invests in emissions reduction in facilities in another Annex B country with an emission target, earning credits for use at home, and the Clean Development Mechanism, which is similar except that the reduction takes places in a developing country without an overall ceiling on its own emissions.

three main greenhouse gases provide a cost estimate, in terms of GNP foregone for Australia in 2010, of 0.6 per cent with no emissions trading and 0.5 per cent with unrestricted trading among the so-called Annex B countries.[48] T he same simulations show that the Australian target could be met with an implicit carbon tax (or a price of an emission permit) of US$206 per tonne (at 1992 prices) without trade or US$87 with full Annex B trading.[49] Comparable OECD simulations (but in which Australia is grouped with other countries) provide a significantly lower estimate for the price of permit with trading of US$58 per tonne.[50] In any case, these simulations do not take into account possible emission reductions from changes in land use. A quantitative evaluation of the marginal abatement costs associated with reducing land clearing is not available, but it is very likely to be lower than those of reducing emissions from energy use, especially since reducing land clearing (or even revegetating) may have ancillary benefits, in particular on salinity. Including this option would probably lower the implicit carbon tax required to meet the target, and thus the overall costs of meeting it.

41. However, in the longer run, even with a substantial amount of trading, an international agreement to mitigate climate change would certainly require a significant decline in Australian greenhouse gas emissions, including reduced fossil fuel use. This would require a shift in carbon dioxide intensity trends, whose decline has slowed in terms of unit of output in the late 1980s, and are still on arising path in per capita terms (Figure 7). Electricity generation accounts for about 37.5 per cent of total national GHG emissions and the scope for fuel substitution in that sector is large.[51]In the current framework in which the carbon externality is not internalised, coal has a strong price advantage over alternative fuels such as natural gas or renewables and substitution is not economical. There are some expectations that, in the long-run, as the liberalisation of the gas market will further proceed, gas price will be reduced, opening some possibility for substitution of coal by gas.[52] Curbing emissions from transport, the component projected to grow most rapidly, would require considerable improvements in fuel economy, or reduction in transport activity, or technological advances to increase the scope for fuel switching *(e.g.* to fuel cells).

48. Brown *et al.* (1999). Annex B to the Protocol lists the countries accepting emission targets, that is the OECD countries with the exception of Korea, Mexico and Turkey, plus Russia, Belarus and Ukraine.

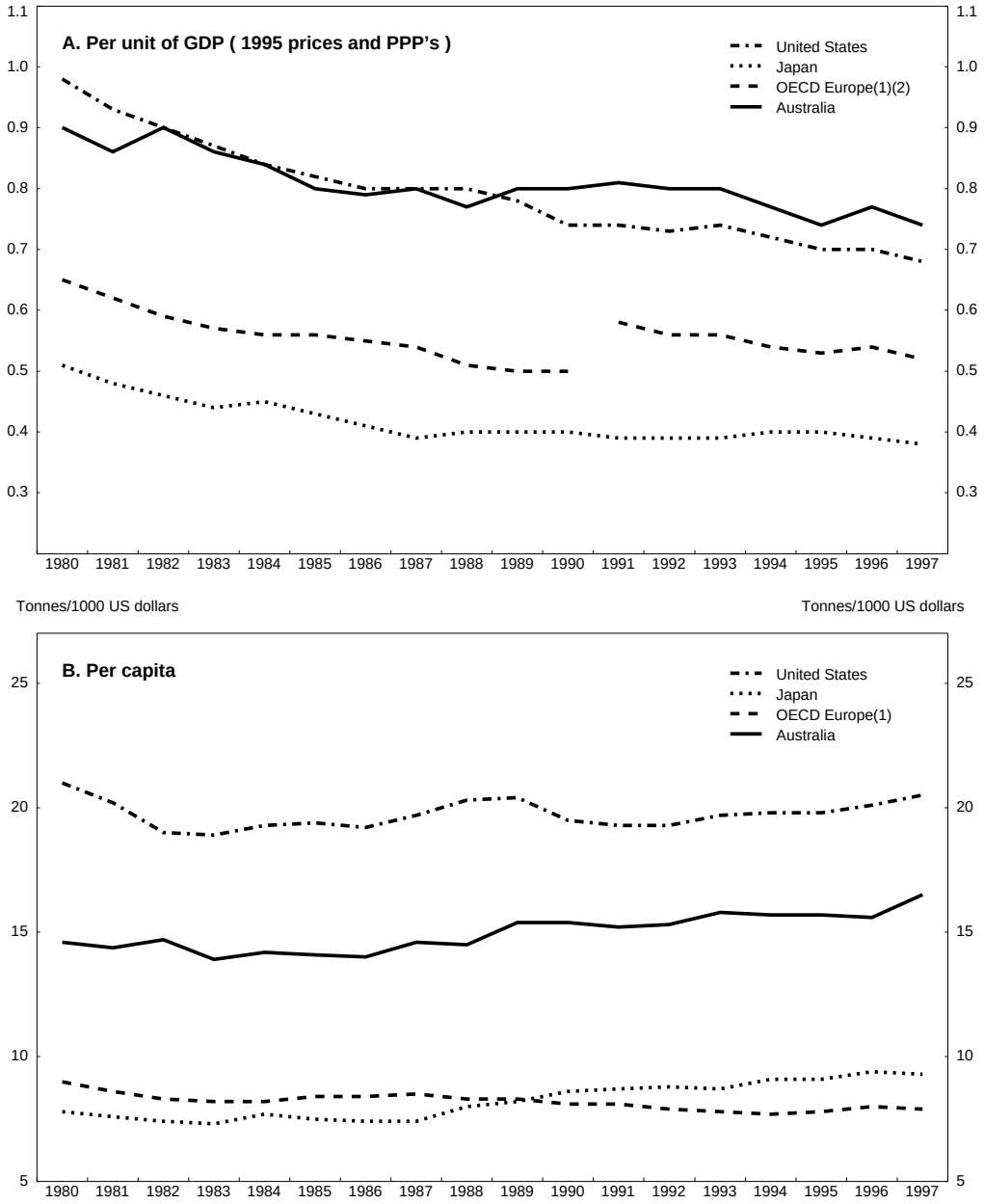
49. *Ibid.*

50 . Burniaux (2000).

51. 1999 National Greenhouse Gas Inventory.

52. IEA (2001).

Figure 7. **Evolution of carbon dioxide emission intensities**



1. Excluding Czech Republic, Hungary and Poland.
2. Including West Germany until 1990 and total Germany afterwards.
Source: IEA.

5.2 Mitigation measures

42. The framework for Australia's greenhouse response is provided by its National Greenhouse Strategy (NGS), which was launched in 1998. The NGS consists of 86 measures, comprising a mix of regulatory, voluntary and market-based approaches.[53] The Greenhouse Challenge, initiated in 1995, which registers voluntary commitments from firms from all sectors (with the exception of house-holds and private transport), has been one of the main initiatives taken to mitigate greenhouse gas emissions up to now. The coverage of the programme is extensive, embracing for example 98 per cent of emissions from the electricity sector. However, as in other OECD countries (Box 4), the effectiveness of such voluntary initiatives can be questioned, due in particular to doubts about accountability and verifiability. It is indeed always difficult with such agreements to determine whether a particular action would have taken place in their absence, as evidenced in the evaluation report of the Greenhouse Challenge.[54] Independent verification of baseline, inventories and action plans, introduced since 1999 for a random sample of participants, may partly remedy that problem. Their effectiveness could be further improved if complemented by specification of clear targets and actions to be taken in case of non-compliance. In any case, these types of agreements provide few incentives for firms to take measures that go beyond the "no regret" opportunities, and administrative and monitoring arrangements which ensure that they do effectively reduce emissions are very costly.

43. Measures have also been implemented to favour the production and use of renewable energy. The main one up to now is probably the initiative announced in 1997 to increase the share of renewable electricity in Australia by 2 per cent by the year 2010.[55] While the target was fixed rather arbitrarily, a cost-effective trading approach has been proposed for its implementation, similar to that already used in Denmark and announced in Belgium.[56] Electricity generated from renewable sources would give the right to renewable credits or certificates, and electricity retailers and wholesale purchasers will be able to meet their 2 per cent target by obtaining certificates through contracts with renewable generators or by purchasing them from other parties. A A$ 40 per MWh penalty will apply to those who fail to meet their obligations. Interim targets have been adopted and have been operative since 1 April 2001. The trading mechanism will provide for useful flexibility in meeting the target.

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53. The Commonwealth and all States and Territories have developed plans for implementing the NGS measure for which they are responsible, with those requiring national co-ordination being handled through a number of joint Commonwealth-State Ministerial Councils.

54. Until 1999, the task of describing the baseline path was the responsibility of the participating companies. The 1999 Greenhouse Challenge evaluation report indicated that over the period 1995 to 2000 the actions taken by firms participating to the programme were expected to result in a reduction of GHG emissions of 16 per cent compared with the baseline for industrial firms, and 3 per cent for firms in the electricity sector. That same report, however, noted that: "In practice (in the Challenge, in other international programs and for this evaluation), it has not been possible to quantify consistently and reliably for individual organisations which actions would have occurred in the absence of a programme (business as usual) and which actions are a direct result of the program."

55. This amounts to 9 500 GWh.

56. O'Brien and Høj (2001) and O'Brien *et al* (2001).

Box 4. **Voluntary agreements: the international evidence**

The OECD has conducted an evaluation of voluntary approaches for environmental policy (OECD, 1999). In general, the environmental effectiveness of voluntary approaches, and in particular negotiated agreements (involving commitments elaborated through bargaining between an industry and a public authority), is found to be modest.

First, the evidence points to the central role of the industry in the target-setting process, the scope for deficient participation of firms (free riding) and the uncertainty over regulatory threats, leading to generally rather unambitious goals. Second, at the implementation stage, negotiated agreements perform poorly due to non-enforceable commitments, poor monitoring and lack of transparency. In addition, as far as economic efficiency is concerned, it seems that the burden-sharing between firms is more driven by equity considerations than by cost-efficiency concerns, and that voluntary agreements do not rely on price mechanisms to induce pollution abatement. Finally, the usual claim that negotiated agreements tend to reduce administrative burdens is not confirmed either by empirical evidence or analytical arguments.

An evaluation conducted by Krarup (1999) on voluntary agreements in energy policy in some European countries (Denmark, Germany, France, the Netherlands and Sweden) also provides similar conclusions. While the agreements reviewed had clear targets, no business-as-usual estimation had been carried out before the schemes were implemented. In the end, targets were achieved, but they were found to correspond to outcomes that required no behavioural changes. Some of the agreements had achieved significant abatement but at a high cost, while others had low effects at low cost.

Voluntary approaches can play some beneficial role when used as complement to traditional command-and-control systems, as they allow for some flexibility in meeting targets. Although it has been rarely implemented up to now, voluntary agreements may also be mixed with economic instruments. However, the target itself should be set outside the negotiated agreement, as in some of the Dutch agreements, for example. Possible safeguards against the main draw-backs of voluntary approaches include: clearly established targets, characterisation of a business-as-usual scenario, credible regulatory threats, reliable monitoring, penalties for non-compliance and third-party participation in the process of setting objectives and performance monitoring.

44. To go beyond "no-regret" opportunities, broad-based economic instruments that internalise carbon externalities will be needed. Australia is considering the possibility of setting up a market for GHG emission quotas,[57] but has recently announced (August 2000) that it will not implement a mandatory scheme ahead of an international market or its ratification of the Kyoto Protocol. While not ruling out the eventual introduction of such a scheme, the government position reflects, at least in part, the view that introducing a domestic trading scheme before an international one is in place would reduce the competitiveness of Australian energy-intensive industries, and result in "leakage" of energy-intensive activities from Australia to its competitors, many of which are developing countries not committed to reducing their GHG emissions. OECD analysis, on the other hand, suggests that it could be possible to devise compensation mechanisms that alleviate the loss of competitiveness of energy-intensive firms associated with the introduction of a domestic emission trading scheme prior to an international one; in the longer run, some loss of competitiveness of energy-intensive firms is in any case inevitable if domestic emissions are to be significantly reduced.[58]

57. The Australian Greenhouse Office is undertaking a feasibility study on the implementation of such a scheme. It has already published four discussion papers, discussing the comprehensiveness of such a scheme, permit issuance, the possibility to include carbon sinks, and measurement, monitoring and compliance issues.

58. For a discussion of the leakage and loss of competitiveness arguments, see O'Brien and Vourc'h (2001) and OECD (2001*a*).

45. Setting up a trading scheme or a carbon tax of broad sectoral coverage is the most cost-effective way to achieve emissions reductions, as it would ensure the equalisation of marginal domestic abatement costs. Given the diverse range sources of GHG emissions and the need to include sinks, there are many design questions of a technical nature that would need to be resolved prior to the implementation of a trading system. It is important that these technical issues be pursued rapidly. The fact that firms are showing reluctance to enter the second round of agreements under the Greenhouse Challenge, because they fear they will be penalised for actions already taken if a trading scheme is set up, may be an example of the costs of waiting. After the deep structural microeconomic reforms that have been implemented under the framework of the National Competition Policy, in particular in the energy/electricity sector, the conditions are now met in Australia for economic instruments to deliver their full potential benefit. Energy market players themselves see the absence of any pricing mechanisms for GHG emissions as one of the major impediments to reducing those emissions.[59]

46. As part of the Measures for a Better Environment, announced at the end of 1999 at the same time as the tax reform measures (see OECD, 2001*b*, Chapter II), A$ 400 million of public money is to be provided over the next four years for large-scale greenhouse gas emission reductions. The Greenhouse Gas Abatement Programme (GGAP) consists of a form of competitive tender for subsidies for greenhouse gas abatement projects of all sorts, based for example on renewables, energy efficiency, afforestation or non-CO_2 gas abatement. To ensure the cost-effectiveness of the subsidy, the Australian Greenhouse Office will try to maximise the quantity of CO_2 equivalent emissions saved per dollar of public funding as well as per dollar of overall cost (private and public). A main disadvantage of this measure, compared with an economic instrument such as a tax or tradable permit scheme, is that the administrative costs, in particular those required to ensure that projects will result in abatement which is truly additional, will be very high, as in the case of voluntary agreements. A raw calculation based on the estimated marginal price per ton of carbon indicates that the abatement that could be expected from that programme would be 7 to 15 million tonnes of carbon dioxide equivalent or 1.6 to 3.2 per cent of 1999 estimated GHG emissions. (Estimated emission savings from the first year of operations of the GGAP are consistent with these OECD calculations.) Further reductions, which would be increasingly costly, would require additional funding, showing the limits of this type of programme, which aims to reduce GHG emissions without affecting energy-intensive sectors.

47. Another measure included in that same package is the allocation of up to A$ 264 million over the next four years to the conversion of diesel-fuelled electricity generators to renewable energy technology in remote, off-grid areas.[60] The cost-effectiveness of emission reductions resulting from that measure is question-able, as this sum, which represents more than a quarter of the envelope available for greenhouse gas abatement over the period 2000-04, could certainly have been used so as to deliver more reductions in GHG emissions per dollar of public funding. In fact, the measure aims at achieving multiple objectives, including regional ones.

5.3 Transport tax policy provides a negative signal

48. Transport is an important and rapidly-growing contributor to GHG emissions, accounting for 16 per cent of emissions (excluding land clearing) in 1999. Provisions included in the recent tax reform, however, have reduced fuel tax rates and fuel prices for specific sectors, in particular for businesses and non-urban transport, which runs counter to mitigation effort.

59. Allen Consulting Group (1999).

60. This is funded from excise paid on diesel used to generate electricity by publicly-owned generators.

49. To avoid an increase in the rate of tax on fuel and of fuel prices at the time of the introduction of the goods and services tax (GST), the Commonwealth government reduced the excise rate.[61] In addition, existing rebates were increased or extended and new ones introduced (Table 2), which decreased transport fuel taxes for business users in general by around 15 per cent, and by around 55 per cent for heavy vehicles, particularly those operating outside large metropolitan areas. Because of pollution and congestion concerns, heavy vehicles in large urban areas have less access to lower fuel taxes, but enforcement problems may be expected which are likely to lead to some tax avoidance. To avoid a deterioration in the relative prices of other modes of transport *vis-à-vis* road, the rebates and special provisions have also been granted to rail and marine transport, as well as to alternative fuels. The total expected tax revenue loss is of the order of A$ 4.4 billion.[62] An assessment of the net tax revenue loss would require an estimate of the GST revenue from fuel, which is presently not available. More recently, following the increase in fuel price on world markets, the Common-wealth government further reduced fuel excise tax by 1.5 cents a litre, but also permanently removed the half-yearly indexation of fuel excise. While the effects of these changes in terms of traffic growth may be limited in the short run, transport prices will have an effect on transport volumes and therefore on emissions in the long run.[63]

Table 2. **Changes in diesel fuel taxation as of 1 July 2000**

Cents per litre

	Previous	Current
Normal excise rate	44.1	37.5
Heavy vehicles (between 4.5 and 20 tonnes outside large metropolitan areas; above 20 tonnes	..	19.7
Off road		
Agriculture, forestry and fishing	0	0
Mining	0.9	0
Hospitals, nursing and aged persons homes, some private residences	10.6	0
Rail transport and marine industry	..	0
Non-metropolitan areas	..	36.5
Remote areas	..	35.5

Source: Commonwealth Treasury of Australia.

50. The reform moves road transport taxation, at least for business transport, even further from a structure needed to internalise road transport externalities. Fuel taxes and annual vehicle registration charges (for heavy vehicles only)[64] are the two existing instruments that could be used to recover the costs.[65]However, these were not designed to fully recover external costs, in particular environmental

61. This reinforced the *real* decrease in real fuel prices, as the prices of other goods increased with the GST.

62. The cost of reduction in excise rates is estimated by the Treasury at around A$ 2.2 billion; the off-road rebate is estimated to cost A$ 1.5 billion in 2000-01, the on-road rebate for heavy vehicles A$ 620 million, and the fuel grant scheme for remote areas A$ 110 million.

63 The Department of Transport and Regional Services estimates the price elasticity for petrol demand in Australia to be around -0.1 for the short run and up to -0.7 in the long run.

64. Heavy vehicles are defined here as those with a gross vehicle mass greater than 4.5 tonnes.

65. Toll charges, which are almost non-existent in Australia (the only existing toll has been recently introduced on one highway section in Melbourne) would probably be a cost-effective instrument on the major

ones.[66]The annual vehicle registration charge allows the environmental characteristics of vehicles to be taken into account, but it is an imperfect instrument as it is not related to use, and it was anyway not used to try offset the previous effect. In sum, the new tax regime reduces the real price of all types of business transport, especially for regional road transport and rail and marine transport. The recent removal of indexation of fuel excise tax will also result in a reduction of the real price of fuel for both private and business transport. In March 2001, the Prime Minister announced an inquiry into the whole structure of fuel taxation and it is important that it takes account of the environmental aspects of fuel taxation.

51. Urban transport accounts for over half of greenhouse gas emissions attributed to transport. Urban density is rather low, much closer to that of North American cities than to European ones, and 93 per cent of passenger transport is via private road vehicles.[67] Transport distances of urban commuters are relatively long, and congestion is becoming increasingly frequent. In fact, urban transport causes about 9.5 per cent of total GHG emissions (out of 16.1 per cent for the total transport sector), of which 3 percentage points are due to congestion only.[68] The outlook for transport in urban areas generally is for increasing levels of car ownership, usage and congestion and relatively stable or possibly falling levels of public transport usage. Appropriate urban development and transport policies would comprise a mix of measures, including urban planning. But road-pricing mechanisms would also be needed to internalise environmental costs, which have been estimated to represent 4.5 cents per vehicle-kilometre in 1996 (of which 2 cents from greenhouse gas emissions) or 38 per cent of total infrastructure and external costs.[69]

5.4 The need to integrate sink enhancement policy

52. As already noted, compared with other OECD countries, a large share of 1990 Australian GHG emissions comes from land use change and forestry activity and agriculture. There is still uncertainty as to how some of the sources of these emissions will be accounted for in the Protocol. The inclusions of emissions from land use and land use changes has been agreed, but the accounting methodology remains to be defined and there is still no agreement on the inclusion of additional sinks (such as soils, forests planted before 1990).[70] Australia has been active in international negotiations on implementation of the sinks provision as it could be an important and relatively low cost abatement option. This is especially so when

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corridors, although fuel taxes are also an accurately-targeted instrument when it comes to internalising the costs of greenhouse gas emissions alone.

66. Even when considering road costs only, the Bureau of Transport Economics (BTE, 1999) found that the existing road user charging system undercharged heavy vehicles by about one third of the costs they cause on road wear, thereby providing a competitive advantage on long distances to road transport over rail. It also implies that other externality costs, in particular environmental ones, are not covered. Since rail transport is now benefiting from the same rebate as heavy road transport, the recent tax reform levels the playing field between the two transport modes, but it reduces heavy road transport cost recovery ratios further.

67. Figure for 1995 taken from BTE Information sheet 14, *Urban Transport – Looking ahea*d, 1999.

68. BTE (2000).

69. Bray and Tisato (1997). This figure corresponds to the average cost, but arguing that divergence between marginal and average cost for non-time components is expected to be considerably lower than for time costs, the authors assume that, on balance, non-time marginal costs equals non-time average costs. Road and accident costs are estimated to be 3.1 and 5 cents per vehicle-km respectively. Bray and Tisato also provide an upper estimate of environmental costs of 7.3 cents per vehicle kilometre, including 2.9 for greenhouse gas emissions.

70. LULUCF emissions are treated under article 3.3 of the Kyoto Protocol, while emissions from additional sinks pertain to article 3.4.

the associated benefits of land management policy in terms of soil salinity are taken into account. It is also establishing a national carbon accounting system to measure and monitor greenhouse sinks.[71]

53. Australian governments have put in place a number of programmes aiming at preserving or increasing vegetation cover. Some of them, like the *Bushcare* and *National Landcare Programmes,* are part of land management policies (see above). More recently, other projects have directly aimed at reducing greenhouse gas net emissions. These include the *Bush for Greenhouse Programme* which is funding a "carbon broker" service, providing assistance to businesses investing in environmental planting so as to be able to claim carbon offsets if a trading scheme is implemented.[72] The GGAP mentioned above is also meant to include revegetation projects. The fact that there are a number of programmes aiming at the same intermediate goal but providing different type of support raises some concerns regarding the cost-effectiveness of the policy approach, as it is difficult to ensure that marginal environmental benefits (in terms of carbon sequestration and salinity reduction mainly) are equalised across programmes. It would in fact be important to try to integrate the various existing programmes in that domain and establish as close a link as possible between the subsidy and the various environmental out-comes. A relatively large-scale (national or regional) auction-type system for revegetation subsidies would be more cost-effective. It will also be important to link sequestration actions to the possible future cap-and-trade scheme in some way.

6. Assessment and agenda for action

54. As far as environmental protection and resource management are concerned, Australia's size and federal structure have affected the way problems have been dealt with. In one case where cross-border co-operation was important, it took a specific Commonwealth Act, setting up the Murray-Darling Basin Commission, to create the necessary institutional framework. The new Environment Protection and Biodiversity Conservation Act, which came into force in July 2000, is intended to focus the responsibilities of the Commonwealth on matters of national environmental significance and reduce duplication between the different levels of government. The Commonwealth government has been slow to use taxes and charges to influence environmental outcomes (as have state level governments). Australian governments are much more favourable in principle and in practice to trading schemes. However, the main trading schemes concern resource management -- notably water and fisheries -- and with very limited exceptions neither taxes nor trading schemes are currently used for pollution control. Hence, substantial scope exists for expanding the role of economic instruments in many fields. At a minimum, existing energy taxes should be better aligned with environmental externalities, and preferential regimes for fuel taxes be progressively eliminated.

55. Agriculture is an important sector where environmental externalities have not been well reflected in decision making, as is the case in most OECD countries. Water has historically been significantly underpriced (again as in most OECD countries) and the effects of land and water management practices on salinity have only recently been understood. Current policy in water management and salinity has to deal with this legacy.

56. Although experience with water trading is still limited, it is nevertheless the widest in the OECD. The Australian Water Reform Framework, as part of the overall competition policy, aims to improve the efficiency of water management through pricing and trading while trying to take account of the effect of flow regulation on the environment. It provides a good example of integration of micro-economic reform and environmental policies. The Murray-Darling Basin Agreement Act has also provided for the required

71. A$ 9 million have been invested so far for that purpose.

72. The Bush for Greenhouse Programme provides A$ 5.5 million over five years.

interstate co-operation on water (and salinity) issues, fitting the geographical scale of the problem to be dealt with. To increase the efficiency gains as well as the volumes traded, however, restrictions on trading should be removed and water entitlements be separated from land property rights, as proposed in the National Action Plan for Salinity and Water Quality. Restrictions on trading out of a given irrigation district should also be removed, as well as limitations on the share of individual rights that can be transferred, provided the possible environmental effects of transfers are taken into account. Allowing the development of intermediaries on water markets would also increase liquidity and efficiency, and allow risks associated with the inherent unreliability of water supply to be spread; the inability to do this appears to inhibit longer term trading. To further enhance market efficiency, it would also be important to encourage price reporting, whether through public regulatory agencies or private intermediaries.

57. While the reform of urban water pricing is already well advanced, rural water pricing is lagging. The main obstacle seems to be concerns not to hurt the "rural constituency" and the unwillingness to further reduce farmers revenue and increase the rural/urban gap. Gains from trading will be limited unless user contracts are structured to incorporate prices that better reflect both infrastructure and identifiable environmental costs and scarcity rents, as well as clear rules on defining environmental flows, where progress has so far been very uneven. Indeed, the long term objective of the COAG water reform agreement to cover environmental costs in water charges should support this goal. Such pricing will bring to the fore some of the distributional issues, between holders of water rights and water users, and between agricultural and non-agricultural users, which currently hinder development of more efficient water management. The rules for allocating the environmental flows should be clarified. Progress in this domain as been uneven so far, due in part to incomplete scientific under-standing of the environmental consequences of current level and patterns of water and land use, but also in part to distributional issues, that would be made clear when deciding about rules. This would also remove part of the disincentives to sell permanent water rights that the uncertainty about environmental flows creates.

58. Salinity involves complex interregional and intergenerational effects, and there remains much uncertainty on the links between land management actions and its effects on salinity. The policy response has up to now focused on irrigation salinity. River salinity in South Australia has been reduced mainly through engineering salt-interception schemes funded jointly by the states concerned and the Commonwealth under the Murray-Darling Basin institutional framework. Cost-benefit analysis, which has been regularly used by the Murray-Darling Basin Commission in the design and implementation process of the strategy, shows that these works have provided net benefits. However, the cost-effectiveness of policy in this domain would also be enhanced by accelerating the implementation of water pricing reform in rural areas, in particular to incorporate environmental costs, as it would increase the efficiency in water use and redirect water use towards less damaging activities. Enhancing environmentally sustainable growth.

59. To address dryland salinity, which will be the main source of future salinity increases, more long-term land management measures, including revegetation and prevention of land clearing, will have to be taken. There is now increased recognition that Landcare and Bushcare types of programmes can make only a marginal contribution to dealing with dryland salinity. Moreover, relatively large scale land clearing has taken place in some states at the same time as publicly financed revegetation programmes were under way, revealing a co-ordination problem in the federal set-up, as states govern land clearing regulation while revegetation is financed by the Commonwealth. Revegetation and cessation of land clearing seem to be essential parts of the recently agreed National Action Plan for Salinity and Water Quality, which will bind both states and the Commonwealth to specified salinity targets. If subsidies are to be used for revegetation, it would be important to improve the link between subsidy and salinity and other environmental outcomes, which vary according to the location. The opportunities to integrate the various programmes existing for revegetation should be exploited, for example, with those currently directed at greenhouse gas mitigation, to ensure a cost-effective allocation of resources.

60. Although some progress towards more cost-effective and better co-ordinated policy measures seems likely, an unanswered question so far concerns what the overall aims for salinity should be. This involves many trade-offs including across current and future generations. An important trade-off exists between agricultural output and salinity: although cost-benefit analysis has shown that the engineering works in the Murray-Darling Basin were justified in them-selves, in the longer run the benefits of maintaining agriculture in its current form in large parts of Australia need to be compared with the costs of dealing with resulting salinity and other environmental costs, which affects both agriculture and other sectors. The physical complexity of the salinity problem and the long time lags involved are often thought to limit the use of economic instruments such as salinity trading schemes to address salinity problems directly. However, economic instruments can be applied to indirect targets; indeed the subsidies for revegetation are an economic instrument, which could perhaps be complemented by a tax on land clearing. The planned pilot schemes to refine the allocation of subsidies, through better targeting their location and to introduce competitive bidding for them, seems promising to improve cost-effectiveness. The relative prices that emerge will provide information useful for other purposes, including cost-benefit analysis (whose wider use is necessary in setting targets and allocating resources) and possible taxes.

61. The connection between salinity and climate change policy in Australia is an example of linkages unusual among OECD countries. Reductions in land clearing, and revegetation programmes have the effect of considerably reducing net emissions of CO_2. The statement by the United States that it opposed the Protocol has caused uncertainty as to the outlook for the Protocol and its targets but Australia remains committed to the pursuit of emissions reductions, as well as unrestricted international trading of greenhouse gas (GHG) emission allowances within any global agreement. To date, policies have relied on a mix of regulatory, market-based and voluntary measures. The latter are high-profile but are administratively burdensome and of uncertain effectiveness. The recent programme of competitive tender for greenhouse gas abatement, although aiming to maximise abatement associated with any given public funding, is likely to suffer from similar weaknesses.

62. Although liberalised energy markets are working more efficiently, a consequence has been an increased use of coal fired generating capacity. In addition, the modification of fuel prices resulting from the recent tax reform is also likely to encourage GHG emissions, which seems to run counter to the government's mitigation objective. The plan to use a market for credits in renewable electricity, as in some other OECD countries, to increase by 2 percentage points to 12.5 per cent the share of electricity produced with renewable energy will reduce greenhouse gas emissions by 2010. This may be a relatively cost-effective way to achieve some emission reductions, but does not itself provide a significant incentive to reduce emissions from other energy use. To achieve significant GHG emission reductions, structural adjustment towards a less GHG-intensive economy would be required. In the OECD's view, this would be most efficiently achieved by putting a price on emissions, either through an economy-wide tax or a permit trading scheme which could be linked to land clearance and revegetation programmes as well as the renewable energy market. Sink enhancement is also an option in Australia, and it would be important to integrate this into such a scheme.

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Annex I

Environmental policy legislation

Constitutional responsibilities

The Constitution gives the states and territories most powers and responsibilities for natural resource management and environmental protection, including management of Crown land, Crown forests, national parks and reserves, native wildlife, fisheries and pollution control. The Commonwealth manages its own lands, including some national parks and the marine environment outside state coastal waters (three nautical miles), and is also responsible for protecting features of national environmental significance, such as World Heritage areas and threatened species. In addition it implements obligations entered into under international environmental treaties, such as those dealing with climate change, destruction of the ozone layer and protection of biodiversity.

National legislation

In the early 1970s, a series of watershed national Acts on environmental matters was passed, including the Environment Protection (Impact of Proposals) Act (1974), the Australian Heritage Commission Act (1975) and the National Parks and Wildlife Conservation Act (1975). Also, a number of significant High Court cases led to a gradual increase in Commonwealth interest in the protection and management of national assets. In 1992, all jurisdictions signed the *InterGovernmental Agreement on the Environment*, which laid down the basic parameters of operations and roles. The States were given responsibility for the management of living and non-living resources and land-use decisions; and the Commonwealth's triggers and processes for involvement, though indirect, were more clearly set out.

The 1974 Commonwealth legislation was enacted at a time when some of the States did not have comprehensive environmental legislation. However from the 1970s through to the 1990s most States enacted comprehensive and integrated environmental legislation. There was thus a growing disparity between more progressive State legislation and an outdated Commonwealth framework. As a result, in 1997, the Council of Australian Governments negotiated *The Heads of Agreement on Commonwealth/State Roles and Responsibilities for the Environment,* in which the parties agreed that the Commonwealth had a role to play in all of the matters of national environmental significance. These principles were to be subsequently enshrined in the legislation, based on its Constitutional Head of Power on the making of international treaties. The Heads of Agreement also specified that any new legislation should maximise the Commonwealth's reliance on State assessment and decision-making processes that meet relevant criteria.

Environment Protection and Biodiversity Conservation Act

The aim of the *Environment Protection and Biodiversity Conservation Act*, in force since July 2000, is to provide protection for matters of national environmental significance. It replaced five existing Acts and establishes a streamlined process for environmental assessment and approvals by clarifying when the Commonwealth will be involved in environmental assessment and approvals. It does so by:

- Reducing Commonwealth/State duplication in assessing and approving development projects through the use of bilateral agreements, which will accredit State assessment processes and, where appropriate, decisions.

- Allowing a person or organisation responsible for a project to trigger the assessment and decision process early in the planning phase and confirm if the Act applies to their project.

- Setting clear time frames for decision-making.

- Requiring the Environment Minister, when making an approval decision, to take into account the need to integrate environmental, economic and social considerations.

The legislation, for the first time, defines the Commonwealth's role in protecting the environment. It introduces a streamlined assessment and approvals process, which applies to actions likely to have a significant impact on any of the matters of national environmental significance. The EPBC Act aims to promote ecologically-sustainable development (ESD), through formally requiring environmental impacts to be taken into account when considering project approvals. It also requires Commonwealth agencies to report annually on how their activities are working towards the objective of ESD.

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