AUSTRALIAN ENERGY POLICY AND CONSERVATION

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1. Introduction

Thepublication in April 1988 of the Australian Government document, *Energy 2000: A National Energy Policy Paper* (DPIE, 1988*b*), was the first time the Federal Government had clearly stated its energy policy. It followed the publication and circulation of a series of ten discussion papers on aspects of energy production and use in Australia[1] and the convening of a conference in Canberra for industry representatives, State and Commonwealth Government officials, officials from energy utilities both private and semi-government, and academics and other interested parties. Thus, the document had received inputs from all interested parties except perhaps for two: domestic household energy consumers and foreign purchasers of Australia's energy exports. As we shall discuss below, the outcome was not a radical change of policy from the previous incrementalism, but if this was a plus for steady government, it left unaddressed some aspects of energy conservation policy that may well be weaknesses in Australia's response to the issues of energy production and use—and especially its use of liquid fuels—when energy markets tighten in the future.

The energy sector plays an important rôle in the Australian economy, most particularly in generating exports. After delineating this, we examine Australia's energy policies, as outlined in *Energy 2000*. In our analysis of its strengths and weaknesses we shall focus on an aspect of energy management in which Australia—perhaps because of its unusual position as a First-World net energy exporter—has not performed well, compared to other International Energy Agency (IEA) member countries: energy conservation. Constitutionally, energy is the province of the States, each of which has its own policy towards energy conservation. This precludes easy summary of energy conservation policy and practice nationwide, but a final section suggests further actions for the Federal Government to encourage energy conservation in Australia.

2. The Importance of Energy to Australia

Energy2000 (DPIE, 1988*b*, Chapter 2) provides a rough summary of the key indicators of energy and the Australian economy. In 1986[2] the Australian energy sector provided or represented around:

- 7% of GDP;
- 25% of export income (coal—both metallurgical and steaming—was the largest single export item, oil was the fifth largest);
- 2.3% of all jobs; and

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1. *An Overview*; *Petroleum*; *Electricity*; *Coal*; *Natural Gas*; *Renewable Energy*; *Synfuels*; *Energy Research, Development, and Demonstration*; *Energy Conservation*; and *Energy Demand Scenarios: 1985–2000*.
2. Because Australian data cover the fiscal year through June 30, all references to years in this report should be taken to mean the year ending on June 30.

- 7% of the consumer price index.

Over the four years through 1985, energy supply projects represented an average of 16% of total non-residential investment (DPIE, 1988*b*).

A brief history of energy use in Australia in the 200 years of European settlement is presented in Marks (1986). The main emphasis of any concern with energy policy has been over the security of supply of liquid fuel: it was only in 1965 that domestic crude oil was first produced in any significant quantities, but over the next twenty years production—mainly from the Bass Strait off-shore wells—grew to virtually 100% of Australian demand, although it is now less. (Some heavier crude was imported, and some lighter crude exported, along with refined petroleum products.) Price regulation meant that the effects of the world oil price rise of 1973–74 were felt at first only indirectly in Australia. Only after the partial deregulation of 1978 did Australian refineries start paying the world parity price for their domestic crude.

The growth in domestic crude oil production was accompanied by a growth in production of natural gas, producted from off-shore wells in Bass Strait and the North West Shelf, but also from on-shore wells in the Cooper Basin in central Australia. From zero in 1967, natural gas' share of Total Energy (TE) consumption[3] had risen to 17% by 1986 (DPIE, 1988*a*). From almost 51% in the early 1970s, oil's share of TE consumption had fallen to 37.3% in 1987 (ABARE, 1989*b*).

From historical highs in 1978, and after the post-tax price of crude oil to domestic refineries had reached world parity in 1979, until 1987, per-capita Total Final Energy (TFE) consumption[4] remained stable to slightly rising, while TFE intensity[5] declined by 11.0% (ABARE, 1989*b*). Total oil intensity in Australia fell by 29.8% over this period, and TE intensity by 10.5%. The fall in TFE intensity in Australia was about half of the fall in average energy intensity of all IEA countries of 20%. This can perhaps be explained partly by technical factors and partly by economic factors.

The breakdown of Australia's Total Final Energy consumption by consuming end-use sector for 1987 is shown in Table 1, with IEA average shares for comparison. From Table 1 it is clearly seen that transport's share of TFE consumption (38.4%) is larger than any other sector's. That the transport sector is predominantly (79.9%) petroleum-fuelled road transport is reflected in the TFE consumption of petroleum products in road transport of 728.5 PJ,[6] which is 30.5% of the total TFE consumption in Australia (ABARE, 1989*b*). Indeed, inclusion of air, rail, and water transport brings the reliance on petroleum fuels in the transport sector up to 99.0%, and petroleum fuel's share in total TFE consumption to 38.0%; counting non-transport fuel use brings the share of petroleum products in TFE consumption up to 50.1%, which highlights the reliance on liquid fuel in Australia's TFE consumption. Indeed, petroleum products used for transport account for almost 76% of total final oil consumption, compared to 57% for the IEA average (IEA, 1988).

Given this reliance, the possibility for further reducing Australia's energy intensity will depend to a large extent upon further reductions in its oil intensity, which in turn will

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3. Total Energy (TE) consumption is the quantity of primary and derived fuels consumed less the quantity of derived field produced. It is identical with the IEA's measure of Total Primary Energy Requirement (TPER). Hydroelectricity is valued as the energy equivalent of the fossil fuels necessary to produce an equal amount of thermal electricity.
4. Total Final Energy (TFE) consumption is the total amount of energy consumed in non-conversion sector end-use devices. It is identical with the IEA's measure of Total Final Consumption (TFC).
5. TFE intensity is measured as TFE consumption divided by Gross Domestic Product in constant dollar terms.

TABLE 1 Total Final Energy Consumption, 1987

End-Use	TFE Consumption (Petajoules)	Share (%)		IEA 1986 (%)
Transport	917.2	38.4		31
Manufacturing	833.8	34.9		36
Agriculture, mining	169.0	7.1		
Commercial	126.3	5.3	24.9	33
Residential	298.0	12.5		
Lubricants etc.	47.0	2.0		na
Total	2,391.0	100.0		100

Source: ABARE (1989*b*); IEA (1988).

depend on changes in liquid-fuels consumption—either more efficient use or changes in the activities which consume liquid fuels.

There have been considerable changes in the mix of fuels used in Australia since 1973 (Marks, 1986), but the importance of transport—given the "tyranny of distance"—not only from Europe and North America but also within the sparsely settled island continent—has meant that for technical reasons the possibilities for reductions in energy intensity have been limited, compared with societies in less temperate climates, where heating of both residential and commercial sectors plays a larger part. In 1982, Australian residential/commercial energy consumption was 18% of TFE consumption, against 29% in the United States overall, and 22% in California (Marks, 1986).

A below-IEA-average reduction in Australian energy intensity might also be partly explained by the five-year lag in the first rise in the price of domestic crude oil paid by Australian oil refineries. As Marks (1986) details, it wasn't until 1978 that the Import Parity Pricing policy for Australian crude was introduced whereby the Federal government imposed a "crude oil levy" on the regulated selling price of domestic crude, to bring the buying price up to "world parity" and incidentally to greatly enrich the Revenue.[7] This lag in economic stimulus must also be followed by a lag in response—although importing energy-saving technological know-how or energy-saving capital equipment developed in countries that had earlier experienced the onset of higher energy prices, and particularly oil prices, would reduce the response lag compared to the history of the response of the rest of the world.

A further point to note is that, as a net energy exporter (ABARE, 1989*a*), Australia has a higher proportion of energy-intensive industries than countries that are net energy importers. For example, the Australian aluminium-smelting industry experienced a large growth after the second oil price rise of 1979–80, in apparent response to Australia's perceived comparative advantage of low-cost electricity with its coal-fired power stations, and aluminium exports continue to grow, by a rate of 22% p.a. over 1975–1987, and by

6. One million tonnes of oil equivalent (Mtoe) = 41.87 petajoules (PJ).
7. The Crude Oil Levy contributed up 9.3% of total Federal taxation (in 1981); total energy levies, taxes, duties and excises reached 13.0% of total Federal taxation (in 1984). (DPIE, 1988*b*)

80% from 1986 to 1988 (ABARE, 1989*a*).

In 1985, Australia experienced the beginning of a decline in its terms of trade which resulted over a two-year period in a 15.5% collapse, as a result of the fall in world commodity prices, including energy commodities such as coal and oil. Australia exports coal (both coking or metallurgical coal and steaming coal), petroleum (crude oil, liquid petroleum gas or LPG, and refined petroleum products), and uranium; the country imports petroleum (crude oil and refined products). From late 1989 Australia will become a major exporter of liquid natural gas or LNG from the North West Shelf wells off the Western Australian coast. Australia's net energy trade balance was $A5,499 million in 1985, $A6,324 million in 1986, and $A5,921 million in 1987 (DPIE, 1988*b*). Australia is one of the five net-energy-exporting OECD countries and is the largest exporter of coal, accounting for about a quarter of the world's coal trade. Australia produces about 10% of the western world's uranium, accounting for more than 10% of its uranium trade—there is no domestic consumption of uranium in Australia.

3. Australia's Energy Policies

Marks(1986) surveyed the evolution of Australia's national energy policy. Until the *Energy 2000* policy paper was published—as mentioned above—there had been no comparable *official* statement of Australian national energy policy. The Federal government had in 1977 characterised the most important issues in energy policy as the need for general energy conservation, for the substitution of more plentiful fuels for scare ones, and for a reasonable level of self-sufficiency in liquid fuels (Anthony, 1977). In practice, the government had allowed Australian crude oil prices to rise somewhat to encourage conservation, substitution, and behavioural changes, and had increased the incentives for private exploration for energy resources. It also established an advisory committee with members drawn from government, industry, and academia, which produced reports on energy sources, liquid-fuel use, and conservation during its six-year life. Other panels established included a State–Federal ministerial committee, a council to advise on energy research, development, and demonstration (RD&D), and a committee to advise on emergency petroleum allocation. In 1979, Australia joined the International Energy Agency, one year after imposing the crude oil levy on domestic crude oil, to bring the price to refineries up to world parity.

In 1988, the policy stated in *Energy 2000* espoused the objectives of (DPIE, 1988*b*, p.15.1):

- maintaining Australia's energy security,
- maximising the export performance of Australia's energy industries, and
- achieving an efficient domestic energy sector.

The document emphasises the importance of flexibility and responsiveness to changing circumstances. In response to falling domestic oil production as the Bass Strait fields are exhausted, the policy is to encourage:

- domestic oil exploration,
- greater efficiency in oil use, and

- a "pragmatic program" for the development of alternative fuels.

The government's alternative to a "master plan" is another energy consultative group, this time including representatives from the trade union movement as well as from the Federal and State governments and energy industries.

The driving engine for this process is to be competition in the "market place" among energy sources and energy technologies, with Government "initiatives" where necessary to "reinforce" market competition when market imperfections loom. As an example, the document suggests that government initiatives may be necessary to ensure that "Australia's dependence on oil as an energy source does not grow in such a way as to weaken the nation's energy security" (DPIE, 1988*b*, p.15.3).

In the short run, the immediate priorities are to encourage greater efficiency in the energy-exporting industries and in the domestic energy sector. The government judges that Australia currently has a high level of energy security, where *energy security* is not synonymous with self-sufficiency or with some "absolute guarantee of customary supplies of energy in all circumstances" (DPIE, 1988*b* p.1.16)—rather, it is more a concept of "relative assurance and dependability of overall energy supplies in foreseeable circumstances, within an economic, regulatory and consumption framework which is acceptable to the Australian community" (DPIE, 1988*b*, p.1.6). The document acknowledges that there is a trade-off between the risks of supply inadequacies and the costs of attempting to attain target levels of energy security, however measured. Given the long lead times seen in large-scale investments in the energy industry, the document calls for *diversity of supply* as the best policy to preserve flexibility and responsiveness on the supply side, not least with the prospect of the run-down of Bass Strait crude oil production into the 1990s.

The document clearly reflects the wider economic concerns of the Australian government: the collapse in Australia's terms of trade and the need to increase exports and reduce imports. Energy exports are a valuable proportion of total exports, as discussed above, and the Government intends to increase exports of coal, LNG, and uranium (although this last is politically sensitive). Furthermore, as a consequence of the restructuring of Australia's economy to produce "a more open, internationally competitive industrial and service structure" (DPIE 1988*b*, p.15.6), energy inputs will play a part in import substitution and greater exports of manufactured goods. Restructuring occurred first in the financial sector, followed in December 1983 by the floating of the Australian dollar. There was some reluctance *to deregulate the domestic oil industry*—since 1952 wholly privately owned—but on January 1, 1988, this was accomplished (DRE, 1987; DPIE, 1988*c*).

The Government dismisses specious claims that import replacement (say, of LPG for imported petroleum in cars) is to be encouraged because of Australia's negative balance-of-payments—in a deregulated environment this replacement activity must satisfy the market criterion: only where there are market imperfections or distortions might the shadow price of foreign exchange differ from the market value. Similar fallacious claims have been made for the establishment and growth of such energy-intensive industries as aluminium smelting—the price of thermally generated electricity should reflect the long-run opportunity costs of the coal inputs (Gibbons, 1985).

Since restructuring the Australian economy in general and promoting energy exports in particular depend on an efficient domestic energy sector, the Policy Paper emphasises this, both for supply-side activities (oil exploration, development, and refining; gas production and distribution; electricity production and supply) and for

demand-side activities (energy conservation); in addition, the Paper lists labour relations and energy-related RD&D as playing a part in improving domestic energy efficiency. Incidentally, the Paper reaffirms the Government's decision not to introduce nuclear power into Australia for the foreseeable future.

But the main focus of *Energy 2000* is on liquid-fuel policy: to promote a "more efficient" oil industry through the deregulation mentioned above, through changes to the taxation regimes affecting the industry, and through the lowering of administrative barriers. Since there can be no guarantee that sufficient discoveries will be made to retain Australia's level of petroleum self-sufficiency, the Government will also consider such policy options as increased fuel switching, alternatives to petroleum products, and greater conservation of oil.

Given the low levels of spot oil prices, the Government concludes that, owing to the large capital investments necessary, alternative fuels ("synfuels" from oil shale or lignite) are not economical substitutes. Although some have argued that subsidised construction of demonstration plants for producing alternative fuels might be thought of as insurance against tighter oil markets and higher future prices, the Government rules this out, based on its forecasts of future oil prices, on its budgetary constraints, and on the Government's attitude towards market involvement—for a Labor government, it has proved to be a reluctant interventionist.

Offering low levels of financial support, the Government nonetheless:

- encourages substitution away from petroleum-based liquid fuels to LPG and LNG,
- encourages work on methanol as an emergency liquid fuel,
- encourages RD&D to reduce adverse environmental impacts arising from the production and use of alternative fuels,
- encourages synfuel development, and
- facilitates Commonwealth/State coordination of regulations and standards relating to alternative fuels.

At the end of the *Energy 2000* report, the Government affirms the importance of energy conservation as "a central element" of its energy strategy, but closer reading reveals that this focus is almost entirely on conservation of oil, either by substitution to other sources or by more efficient use. The Government acknowledges the need for a comprehensive RD&D program to improve the efficiency of production and utilisation of conventional fuels and to help to diffuse knowledge of the new technologies across the end-user groups.

4. Energy Conservation—The Demand Side

Sincethe first oil price rise of 1973–74, followed five years later by the Government's Import Parity Pricing policy for Australian crude oil, there has been a reluctance on the part of the Government to use "non-pecuniary external" inducements to change consumers' behaviour. In fact, there has been a strong emphasis on satisfying the demand for energy without trying to curtail demand or to shift demand from one fuel to another, except as nominal price changes result in reductions or substitutions. For instance, Swan (1988) shows that in the case of electricity, the state-owned utilities in New South Wales, Victoria, and Tasmania have on several occasions in the last fifteen years priced at below

break-even (0% real rates of return), which has been reflected, not surprisingly, in high demands for electric power, although there is a significant over-investment in electricity generation plants at the moment,[8] mainly because of over-optimistic forecasts of demand for electricity, rather than any great increase in the efficiency of electricity end-use. Perhaps this emphasis on increasing the supply of energy to satisfy demand is a holdover from the days of the dominance of the engineers in the energy utilities. Victoria has adopted an electricity pricing structure based on a targetted rate of return of 4% p.a.

It is the purpose of this section to analyse the approach taken by the authors of *Energy 2000* and its supporting documents to conservation as an arm of energy policy. In fact, the discussion paper *Energy Conservation* (DRE, 1986) is a good summary of the state of knowledge of research into the means and ends of energy conservation. The paper summarises the evolution of policies for energy conservation in Australia:

- the National Industrial Energy Management Scheme (NIEMS), which aims to improve the commitment energy management in both public and private enterprise;
- the National Average Fuel Consumption Program (NAFC), which aims to improve the weighted average fuel efficiency of new passenger vehicles, over time, to specified levels; and
- the Commonwealth's program for improving the management of its own (mainly commercial) energy needs.

It reports that there exists significant potential for cost-effective improvements in the efficiency of energy end-use. In the industrial sector, it reports that a combination of better "housekeeping" measures and modifications to or replacement of existing plant could achieve fuel savings of up to 30%. In road transport there are, it reports, significant savings to be made to fuel efficiency—we shall see below that this may be especially true in Australia's case. In the residential sector, it reports that measures such as replacement or installation of insulation and use of more energy-efficient appliances may yield energy savings of between 10% and 30%. In commercial buildings, it reports that energy audits linked with energy-management programs can achieve energy savings of about 25%.

In those areas where international comparisons can be made, Australia cannot be considered at the forefront of effective energy conservation. A recent IEA publication (IEA, 1987) provides data on the effectiveness of conservation efforts in IEA countries. Whereas the average for all IEA countries was a fall of 20% in TFE intensity over the period 1979–86, Australia managed only 10%. Each country is a unique bundle of attributes with a unique response to outside stimuli, but when we consider a specific response—indeed, one targetted by the Government with its NAFC program—that of the fuel efficiency of new cars, we find that since 1978 new cars sold in Australia have been on average some of the least fuel-efficient in the world (IEA, 1987, p54):

- in (calendar year) 1978 Australia and the U.S. tied at 11.8 litres per 100 kilometres;
- by 1984 Australia had improved to 9.5 but the U.S. had improved to 8.9;
- the average for selected IEA countries had improved from 9.93 to 8.33 l/100 km.

Subsequently, Australian performance has worsened to 9.7 in 1987 (DPIE, 1989), despite a target of 8.5 l/100 km. (DPIE, 1988*b*).

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8. The installed generating capacity in mid-1987 was 34,610 MW, significantly above the peak demand of 24,378 MW (DPIE, 1988*b*).

And yet, as DRE (1986) points out, the NAFC program, with its target of 9 l/100 km. for 1983 cars, was unusual for Australian Government conservation programs in having a clearly defined performance objective (Hartman and Doane, 1987)—which with 9.5 l/100 km. in 1983 was not achieved. Not only is Australia lagging most other countries in improving the fuel-efficiency of its new car fleet, but it is not attaining its own targets. This is despite a clear shift towards four-cylinder cars both absolutely and relatively from 1972 to 1983 (DRE, 1986, p.60). The car manufactures argued that the introduction of unleaded petrol—over their objections—had diverted their engineers away from the task of improving fuel efficiency. Whether true or not—since Australia was alone neither in requiring more fuel-efficient new cars nor in introducing unleaded petrol, it is difficult to understand this excuse—their statement reminds us that increased energy efficiency can go hand-in-hand with pollution reduction: if engines are more efficient, or if more effective use is made of the national car fleet, then the amount of emissions may well fall, as Gibbons (1985) points out. Indeed, Fisher and Smith (1982) found that in the U.S. most air pollution is energy-related, with 70% of carbon monoxides, 43% of hydrocarbons, and 51% of nitrogen oxides generated by transportation alone.

Other indicators of energy efficiency are:

- Australia's energy intensity in industry is reported (IEA, 1987, p.191) to have ended up in 1985 where it started in 1973, whereas across the IEA on average the industrial energy intensity had fallen by 28.5%.
- For the IEA on average the per-capita TFE consumption in the residential sector fell by 15.8% over 1973–85; for Australia it *rose* by 21%—although the Australian per-capita consumption (0.40 toe per capita in 1985) was still below the IEA average (0.61 toe per capita).
- Over the ten years from 1973 to 1983, total oil consumption for road transport in all IEA countries rose 4.4% for cars and 33.9% for commercial vehicles, but in Australia the figures were 21.8% and 88.9%, respectively, the latter figure representing the highest percentage change of any country in the IEA (IEA, 1987, p.203).

These figures are absolute totals and not normalised in any way; nonetheless, the Australian figures should give pause to any policy maker who wants to reduce Australia's future dependency on petroleum fuels. Australia has, however, been quite successful in displacing those petroleum fuels used in stationary applications—such as fuel oil and industrial diesel fuel—from 32.9% of consumption of all petroleum products in 1965–66 to 13.5% in 1982–83 (DRE, 1986, p.4).

The IEA study (IEA, 1987, p.7) provided several reasons for the continuing effort to improve energy conservation:

- it will extend the availability of exhaustible resources;
- it will delay and lessen the impact of any tightening in energy markets, especial that of oil;
- it reduces the environmental consequences of energy production and use, including the greenhouse effect (Marks and others, 1989);
- it provides a better return than investment in energy supply, at the margin; and

- it is flexible, since it can be undertaken in small increments.

Rationales for these are provided by Fisher and Rothkopf (1989) in a study which analyses causes and consequences of market failures in the energy sector, and proposes remedies which the authors characterise as "selectively" conservationist.

- If private market discount rates exceed the social rate of discount, then exhaustible resources—such as crude oil—will be depleted too rapidly; a severance tax on domestic crude oil production would have the effect of reducing its production and use.
- Because of the lack of markets for environmental amenity, lack of incentives to protect the environment results in too much pollution, which would be reduced directly by emission charges or a market for emission rights and indirectly by reduction in energy use, given the contribution of energy production and use in the generation of air pollution at least.
- In the residential sector, the "landlord/tenant" relationship may result in inadequate incentives for either party to conserve energy (through energy-saving insulation or energy use).
- Inadequate or hard-to-use information on energy efficiency results in excessively energy-intensive consumer durables, including motor vehicles.

In both cases of market failure, minimum standards may be the simplest way to overcome the excessive energy use otherwise likely to occur; in addition, effective labelling of the fuel efficiency of consumer durables—including home insulation materials—will provide purchasers with important information and will reduce the incentives for manufacturers to skimp on the fuel efficiency of their products.

The authors of the Australian Government document *Energy Conservation* agree explicitly or implicitly with most of these points: in particular, they write (DRE, 1986, p.31) that, "The results of research into energy conservation leave little doubt that, in general, present Australian consumers of energy are spending too much on the purchase of fuel and too little on measures to increase the thermal efficiency with which the fuel is used". That is, the implicit real discount rates (Gates, 1983) of Australian consumers—as implied by their decisions vis-à-vis present capital cost versus future operating costs—are much higher than the opportunity cost of capital.

Schipper (1987) examines the implicit discount rates of OECD energy consumers and concludes that their decisions imply a time rate of discount of up to 40% p.a. in some U.S. states for the installation of thermal insulation in new homes. Schipper concludes that, although the OECD would have been using 36% more energy in 1985 had the sectoral energy intensities been frozen at their 1972 levels, the savings achieved were only marginally affected by energy conservation policies: most of these savings were caused by reduced energy use per unit of activity (driving, heating and comfort, or production). He categorises conservation policies into two groups: "those that do things to things, like building standards, and those that do things to people", such as speed limits or indoor temperature restrictions (Schipper, 1987, p.542). He concludes that energy use has been reduced by the former, but that the latter have had little impact. Of course, the two are related: given alternative things, people have to choose among them.

The authors of *Energy Conservation* (DRE, 1986) speak of the derived demand for energy as being affected by:

- pricing policies (which the Australian Government has been using);
- the imperfect operation of the market in our second-best world (lack of information and misunderstanding about energy efficiency on the part of small users; unyielding behaviour by utility managers and engineers; lack of technical expertise; and institutional/organisational arrangements which may separate decision-makers from energy users); and
- such additional factors as financial incentives (loans, taxes, and subsidies); regulations, standards, and qualitative controls; and provision of additional information and expertise.

Energy-conservation policy comprises a mix of these factors.

In order to facilitate further improvements in energy efficiency, government policies should be directed at lowering the barriers to market forces pushing for greater energy efficiency. The Australian government has been content to deregulate energy markets and let the (then) rising prices of the fuel provide the only incentive for changing the behaviour of the users: substituting to a cheaper fuel or reducing the energy-consuming behaviour. There are some barriers in this case (when an initial capital investment would reduce future energy consumption but the future costs will be borne by another party—landlords and tenants is a case in point—or when energy consumers are ignorant of the possibilities for substitution, for more energy-efficient technology, or for altering the end-user behaviour), but so long as the spot price reflects the long-run costs and opportunities, by and large the market should work, eventually.

But when, as many analysts believe to be the case at present, low spot prices do not reflect the long-run costs of producing energy, then there may be opportunities for governments to intervene in energy markets to encourage the continuing process of conservation. Such policies may take the form (not necessarily exclusively) of:

- *information programs* to inform energy users of possible technologies and techniques for reducing their energy bills, and perhaps motivating them to invest in further knowledge and equipment and training of employees;
- *financial incentives* to overcome capital market imperfections where energy-saving investment for small businesses and households are concerned;
- *regulations and standards* to mandate certain levels of energy efficiency, such as the NAFC scheme for new cars, or to mandate the testing, publishing, and labelling of the energy-efficiency of new appliances or of building insulation; and
- the Government practicing what it preaches, by endeavouring to reduce the energy used in its own operations of lighting, heating, cooling, and transporting, for instance. (IEA, 1987)

An exhaustive study of the effectiveness of incentives for consumers to improve their residential energy efficiency (Stern and others, 1986) found that appropriate prices and clear information of individuals' benefits may not be sufficient. They found that larger incentives increase participation, but that "marketing and implementation may be more important than incentive size: participation varied tenfold between programs offering identical financial incentives, with more participation in programs operated by trusted organisations and aggressively marketed by word of mouth and other attention-getting methods." This study perhaps reveals the limits of the economic model as a description of consumers' behaviour, and provides some empirical justification for mandatory minimum

energy-efficiency standards for household appliances and automobiles.

The Australian Government has had some success with information programs and reducing its own energy usage (from extremely high levels), but, as we have seen, the target of the NAFC scheme has not been attained and Australian new cars are on average some of the least fuel-efficient of the IEA member countries. Indeed, there is no longer a fuel-efficiency target, but a "projection," currently of 9.7 l/100 km. for 1988, 1989, and 1990 (DPIE, 1989). The Government's policy of funding energy RD&D has encouraged research into many supply-side projects, including several on alternative fuels such as solar cells, but has left relatively underfunded research into determinants of the (derived) demand for fuels on the part of businesses and households, or the social consequences of particular energy policies. (The Government's fund-granting body, the National Energy Research, Development and Demonstration Council, began to redress this lacuna with a workshop on the social dimensions of energy use held for energy researchers in Sydney in February 1988.) Two states—Victoria and New South Wales—have introduced mandatory appliance energy labelling, and have moved to help poorer households reduce their energy use. Only since 1987 has co-generation (in Victoria) been allowed or encouraged (Anon., 1988).

Given the imbalance in investment in energy conservation—which, for instance, from Canadian data (IEA, 1987, p. 84) would yield a return between twice and eight times the return on investing in existing sources of energy supply—there exists the possibility of a net social gain from greater investment in energy conservation, such as reducing the energy consumption of new and existing housing and commercial buildings through better insulation and more efficient heating, cooling, and lighting systems. Of course, there can be inefficient investment in particular energy-conservation projects, just as there can be in all other sorts of investment, and the best judge of the worth of an investment is the risk-taker, but given the data quoted in the IEA study and in *Energy Conservation* (DRE, 1986) there is room for greater encouragement, and perhaps more incentives, on the part of the Australian Government.

As with many government programs, there will be a trade-off between achieving what Weisbrod (1977) terms vertical target efficiency—the degree to which *only* the target group are assisted, with no "free riders"—and horizontal target efficiency—the degree to which *all* the target group are assisted, with none overlooked. Reducing the incidence of free riders may well have the effect of increasing the number of households or businesses no longer eligible for assistance, despite their worthiness.

5. Conclusion

Theimportance of energy conservation is becoming ever more apparent.[9] We have discussed in the previous section several reasons why societies should value energy conservation, and perhaps view it as a new source of energy, in the hands of the energy users rather than the energy producers. But therein lie some of the problems to be faced by any government attempting to stimulate energy-saving behaviour: whereas the energy producers are primarily in the business of energy and so have every incentive to avail themselves of any means to reduce costs and increase efficiency and so their profits (so

9. A recent study (Marks and others, 1989) emphasises its importance in reducing the emissions of greenhouse gases associated with fossil-fuel use.

long as they operate in competitive markets), for the many energy users, their energy bills may be only a small part of their overall costs, and the cost of informing themselves of the opportunities—through investment in energy-saving machinery or through better housekeeping measures or through switching fuels—may not at first be balanced or more by the distant and uncertain prospect of reduced energy bills in the future.

There are other barriers to greater energy efficiency, as discussed above, but in the light of Australia's unenviable record of energy savings in some areas, such as new cars, there is a strong argument for the Australian Government, and perhaps too the State governments, to consider a greater degree of intervention in the market for energy and energy-using activities, perhaps through better education and information, or, to follow Schipper's conclusions, through a greater use of regulated energy-efficiency standards, especially for liquid-fuel use, given the Government's evident concern over energy security in this area.

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