

Strategy for a low carbon economy

By **Emeritus Professor Patrick Troy AO**, Fenner School of Environment and Society, ANU on clean energy in regional Australia and in particular how the economic security of regional Australia might be advanced. Drawing on existing renewable energy power plants in regional Australia and how they might link to the National Transport Arc. The paper will be published shortly in Economic Labour and Relations Review (used with permission).

Introduction

For a century we have we have tried to meet our demand for a reliable supply of energy to develop our cities and pursue a rich variety of activities in them. From some perspectives we have been successful in doing so. We are now, however, confronted by the paradox that our 'success' comes at an unacceptable cost.

We have relied on the consumption of coal, oil (petroleum) and gas to secure a reliable supply of 'clean' energy to transform the materials needed to construct our cities and to enable us to 'create' the conditions under which we wanted to live. A feature of the mode of production of energy we have employed is that the energy conversion and supply system was highly centralized. The economies of scale of the 'production' and distribution of energy led also to a concentration of political and economic power making the suppliers of high carbon based energy important actors in public decision making.

We have also relied heavily on petroleum products to develop and sustain reliable supplies of food and secure our health and well-being and to enable us to 'move about' and travel between the settlements in which we live and to engage with others.

We have now reached the point where we must review our behaviour and the way we conduct our relationships with one another. We are forced to do this because we have entered an agreement with our world* to reduce the level of CO₂ production which, at present levels of production, the sustainability of life as we know it is now threatened. While it is clear that not all communities engage in activities and modes of production that contribute equally to the emerging crisis there is now recognition that the sum of the stresses, the must be reduced.

The question then is: What could we expect of a low carbon development plan? Before essaying an answer we need to acknowledge that we cannot alone expect to 'solve' the global problem of the 'over production of CO₂' but that we are morally bound to pursue such a strategy if we want to encourage others to commit to appropriate remedial action. It is a contemporary reassertion of the old adage 'united we stand, divided we fall'. That is, if we want to encourage others to recognize and act on the dangers to ourselves and indeed to the global community of the excessive production of CO₂ from our activities we must first put our own house in order which would then give us the moral authority to engage in collective action with others to reduce our energy consumption.

This is no simple task if only because within our own 'house' there are significant differences between 'household members' in their production of CO₂ and in the way the costs or burdens of its production are borne. We nonetheless must attempt to construct an appropriate plan to reduce the production of CO₂ and produce a calculus of its burden.

An appropriate Australian Plan would:

1. significantly reduce production of CO₂ to reduce our impact on the global climate system
2. increase in our energy security
3. reduced cost of electrical power
 - a) for domestic purposes, and
 - b) for regional development of value adding of primary production
4. increased industry development of modern high efficiency building materials
5. increased efficiency in development of renewable energy production
6. increased economic security of regional centres
7. improved efficiency of the national freight and passenger transport systems
8. greater protection of areas of high primary production value
9. greater protection of environmentally sensitive areas
10. greater regionalisation of education and research which in turn would bolster regional development and security

11. better management of waste water flows to reduce their negative impact on the environment.
12. lead to a better, fairer Australia.

Before we explore the contours of an appropriate plan we must begin with a mapping of our present situation.

The net effect of our behaviour is that through the consumption of carbon based energy sources we have imposed large stresses on the eco-systems we are part of, in which we live and on which we depend but which may yet lead to their collapse unless we rapidly adopt policies and practices to ameliorate the consequences of or to change our behaviour. Australia is already in a vulnerable state in that it currently operates with low levels of fossil fuel reserves. It has approximately two weeks “buffer supply” of petrol and diesel on which to run most of the land based transport and other fossil fuel dependent activities (including not a little of its electricity generating capacity). Such short term supply leaves the nation highly vulnerable – not only to its economy but also its ability to defend itself.

There is a high level of variation between different sections of the population in their consumption of ‘natural resources’ but it is possible to reshape the nature of our demand for energy by pursuing ‘renewable’ energy sources that have a less damaging impact on the eco-system. In doing so we need to acknowledge the income and even wealth contingent nature of the variation between citizens in their consumption of energy and develop strategies to ensure that there is a fair sharing of energy resources and the associated burden on the eco-system of which we are all a part.

We are now facing a tragedy of the commons of unprecedented scale. Some hold the view that we are obliged to try to reduce our stresses on the environment to avoid what is seen as an inevitable catastrophic outcome and pursue policies and strategies to reduce consumption of carbon based energy that directly increases environmental stress.

Fortuitously, one opportunity that offers hope lies in the possibility of substituting renewable energy sources, which have significantly lower carbon signatures, on the production of materials and transport of people and goods in and between settlements as well as reducing limitations on their activities.

One of the most promising is the direct conversion of solar energy to electrical energy.

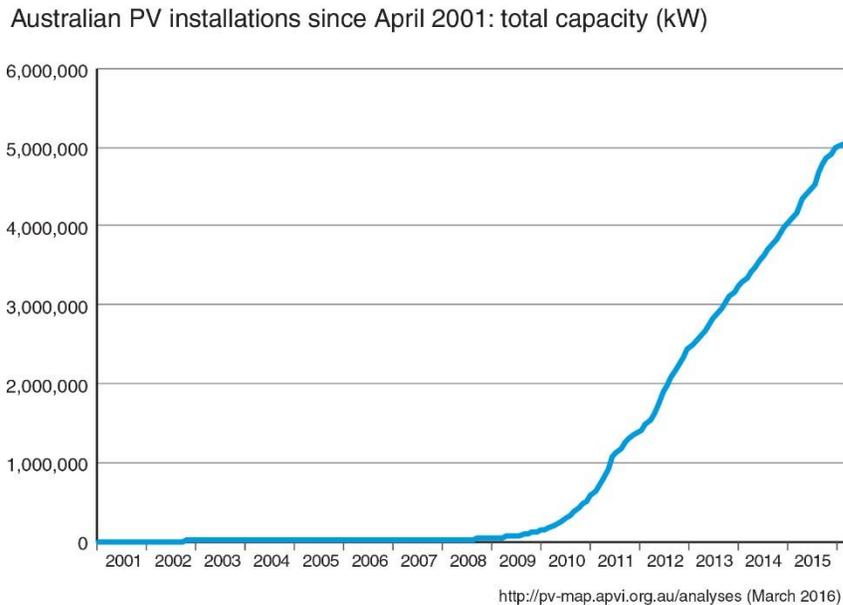


Figure 1 Australian PV Installations since 2001

Figure 1 reveals the speed with which Australian households and some commercial undertakings have ‘taken up’ investment in solar energy. Over a relatively short period we have experienced a dramatic increase in the number of households installing solar energy supply systems to meet some of their demand for domestic energy consumption. Some have done so out of concern for the sustainability of the environment. Others to reduce their household energy bills. We have also seen local authorities and an appreciable number of commercial undertakings investing in renewable energy systems for similar reasons. The production and installation of new domestic systems is also leading to innovation with significant increases in the efficiency of energy capture and conversion. The focus on renewable energy has also led to research into ways in which comfort levels for dwellings may be efficiently attained and maintained.

One limitation to wide ‘take-up’ of solar energy conversion systems was their ability to provide an assured supply of energy throughout the day. The continuing development of the reliability and favourability of battery storage now opens further opportunities for ‘domestic’, commercial and industrial exploitation of renewable energy.

The incremental ‘accidental’ decentralization of solar energy conversion to electrical energy together with improving technology in energy storage now offers opportunities for the development of a ‘mixed’ energy system that is at once more robust, more economically efficient and based on the pooling of resources.

One feature of the emerging system is that it is able to accommodate differing modes and scales of energy production and storage. That is, the adoption of solar energy conversion employing different technologies has meant that the earlier systems of renewable energy collection and storage may continue to produce and store energy in an economically efficient manner. The efficiency of wind turbines (on both vertical and horizontal axes) to generate electrical energy has increased dramatically and may be a significant source of renewable energy that may be ‘stored’. This enables a system with a significant degree of decentralization and mixed mode of production to flourish and allow households and businesses to obtain the economic benefits from their investment.

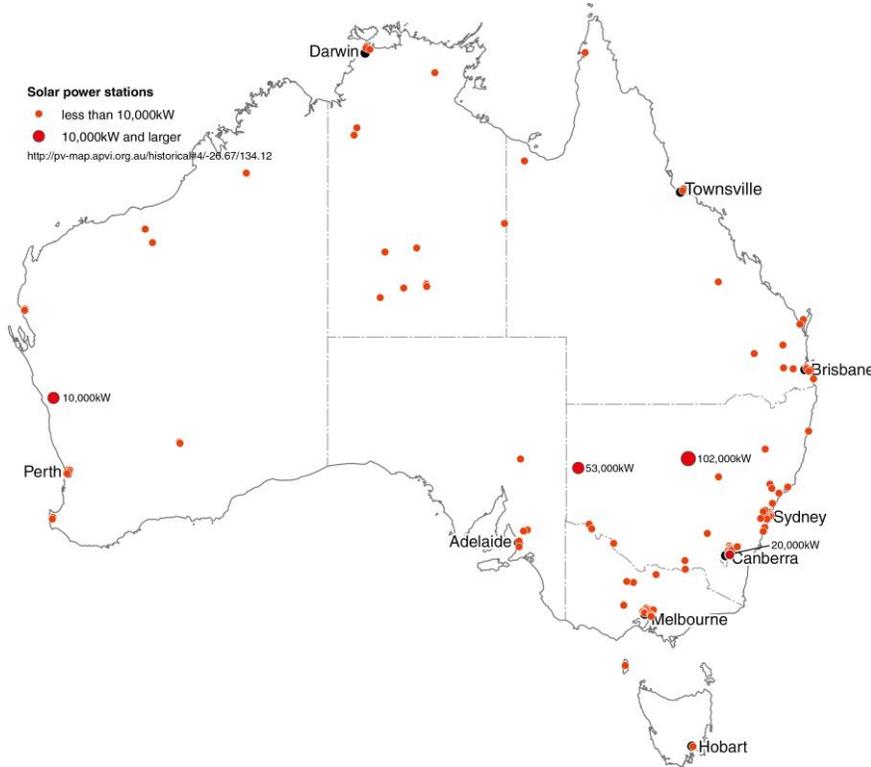


Figure 2 Existing Renewable energy power plants

The flexibility of the emerging regional power centres would enable those who participate in their creation by ‘connecting’ their individual domestic

solar and or wind conversion systems to form the power centres to participate (and benefit) in a manner that is consonant with their own demands and financial abilities and capacities. It may be seen as a ‘new’ way of developing a collaborative or communal response to the demand for a more environmentally sensitive source of energy. One important benefit would be that it would generate increased communal understanding of the imperative need to reduce the pressures on climate change.

Another feature of the present ‘social landscape’ of the development of solar power is that its benefits are available to individuals, households and businesses who can ‘afford’ the investment in the necessary u/v light panels and/or wind turbines but are not so obviously available to low income households or tenants, or even to small businesses.

One benefit of the development of community owned low carbon footprint regional power centres, especially those that would be community owned, is that associated with them would be a stronger focus on local community power enabling them to share the benefits of lower cost energy production with their customers – residential and commercial.

Another benefit of the new ‘dispersed’ form of energy production is that it provides a degree of resilience and security in supply not available in other, more traditional organizational forms of electrical energy supply which usually depend on large ‘central’ sources (it must be noted, however, that historically the connection of other ‘central’ energy suppliers to one another has afforded a high degree of security).

New developments in battery technology extend the reliability and resilience of such supplies and opens possibilities to pursue other changes to the organization and operation of the nation’s cities and towns.

It also creates new ways of developing and operating the infrastructure that is needed to support the social and economic ambitions of society.

Renewable Power Plants.

Siting renewable power generation plants (wind and solar and possibly hydro or tidal plants) in or close to regional centres on the National Transport Arc connecting the state capitals and intervening regional centres from Townsville, Brisbane, Sydney, Canberra, Melbourne, Adelaide to Perth would also provide incentives for the location in those centres of new

industries to manufacture the modern high performance materials to build the new generation of high efficiency, low cost housing needed to redress the current slide into low levels of home ownership.

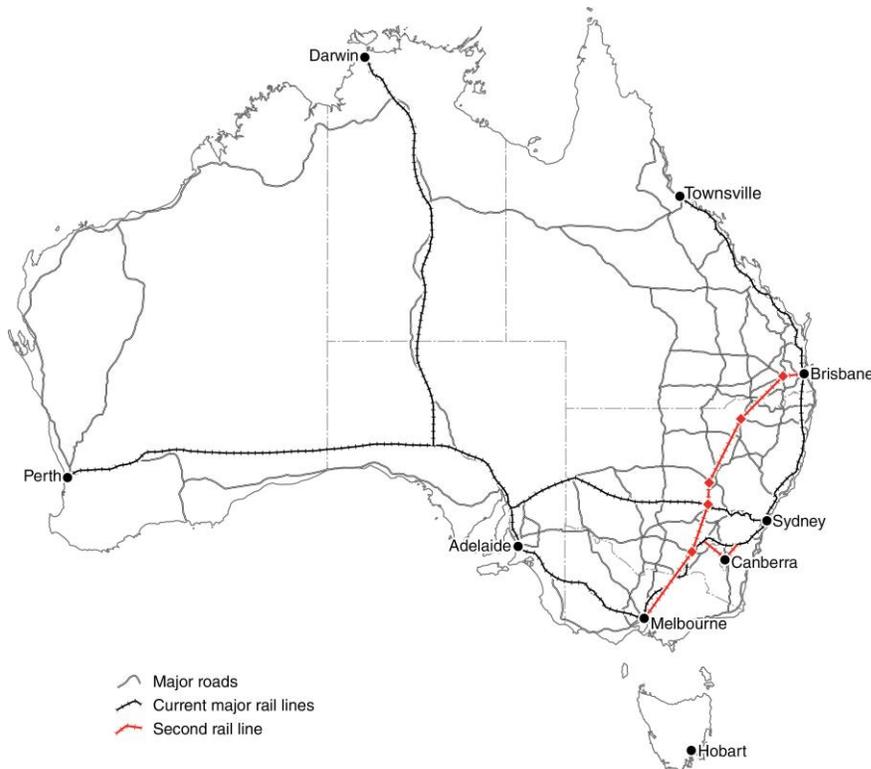


Figure 3 National Transport Arc

Developing such local power plants would require a new approach to the management of pooled energy production sources. It would also lead to greater regional economic independence and therefore of regional influence in national public life. The precise form that the ‘ownership’ of community power plants would take would reflect the level of ownership of the power source – this might involve new arrangements to ensure that the present attractions of renewable energy ownership were retained. That is, it would be important to retain the strong element of ‘self preservation’ and of communal engagement that development of the present systems offer.

National Transport System

At the time of Federation we had no plan for the development of a national transport system. We then had rail systems that reflected the jealousies and narrow visions of the various colonies with the state rail systems operating on different gauges. We also note that up to that time the great bulk of interstate transport of goods and people was by sea.

One condition set for the siting of the new national capital was that it would be directly connected to Melbourne and Sydney – a condition which has been observed in the breach and increasingly becomes a source of inefficiency and unnecessary environmental stress.

The most ambitious and important initiatives in developing some of the basic elements of a national rail system have now been taken. We now enjoy a standard gauge rail connection between the major centres on our National Transport Arc and have improved the geometry of the main line between Sydney and Melbourne enabling faster freight and passenger services between them.

It would be feasible to take the next step in the development of the national infrastructure by further upgrading the National Transport Arc connecting the state capitals and intervening regional centres from Townsville, Brisbane, Sydney, Goulburn to Canberra to Yass, Melbourne, Adelaide to Perth with the major cities and regional centres able to take faster train services for passengers and freight.

Upgrading the second high quality north-south rail service in that Arc by connecting regional centres in the more fertile regions west of the Great Divide. Connecting Wagga to Parkes, Dubbo, Narromine, Moree, Toowoomba to Brisbane would also be beneficial.

Additional improvement would be realised as a consequence of improved rail services. For example, we could expect that increasing the speed of direct rail services between the cities and regional centres would lead to fewer people driving or even flying between them thus also reducing environmental stress. Introducing new technology in freight management would also greatly reduce road and air freight – especially for high value or perishable goods. A further benefit is that passenger rail services would be provided from city centre – to city centre.

It may not be essential to adopt immediately the latest very high speed trains - although that could become a medium term ambition - because many of the benefits sought could be realized by improving the permanent way on the main lines and operated the rail system at speeds appreciably faster than those presently achieved. That is, although we are facing a period of financial stringency it would be feasible to ‘stage construct’ and operate an

improved National Transport Arc. Although it is important to make no small plans - if only because they have no capacity to capture the public imagination – it is more likely that the community would share in and support the development of a plan of larger imagination if they could see and experience progress in the development of a modern transport system.

Holding out a promise to develop a high speed rail network would likely be more strongly supported if individuals and communities could see and experience a revivification of regional economies that was made feasible by development of regional renewable energy power plants

Encouraging or facilitating the development of regional renewable energy power plants would also facilitate the staged development of an electrified rail transport system on the National Transport Arc.

“Electrification of Highways”

Electric powered buses, trucks and cars are now available and will become increasingly common – we already have buses that can run 500+K between ‘charges’ and cars that easily manage 250+K between charges. Advances in battery storage technology are rapidly changing the ‘practical’ adoption of electrical powered road vehicles and will increase their ‘range’.

The improvement in the transport systems would also be reflected in regional development plans. Improvement of the national passenger and freight rail system would also elevate the importance and development opportunities of the regional centres.

The national transport corridors would thus also become baseline electricity supplies. One opportunity this would present would be to strategically locate alternative energy power plants so that they provided energy to the settlements and regional centres on the line of National Transport Arc.

This would not only facilitate the use of such energy to power the rail lines but make it easier strategically to locate ‘battery recharge centres’ on the major highways to take advantage of and provide incentives for households to take up electric powered vehicles and would provide the facilities for buses and trucks to be also conveniently ‘recharged’.

Ecological Sustainability

Central to the development of Australia's infrastructure is the determination to proceed in a way that is sustainable - meaning nothing must be done to prejudice the ecological sustainability of the planet.

The regions in Australia that are fertile and from which we derive much of our primary production are limited in extent.

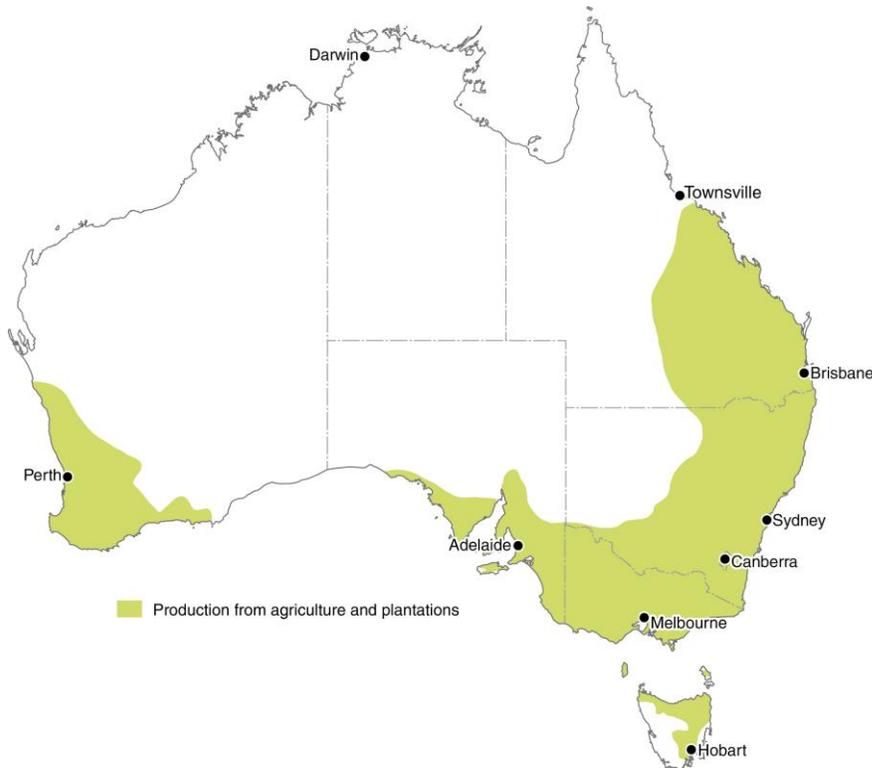


Figure 4 Fertile regions of Australia

Australia has substantial reserves of gas, coal and oil which for the most part overlap or coincide with the smaller areas of fertile land from which our food supplies and indeed a considerable portion of our export income is derived.

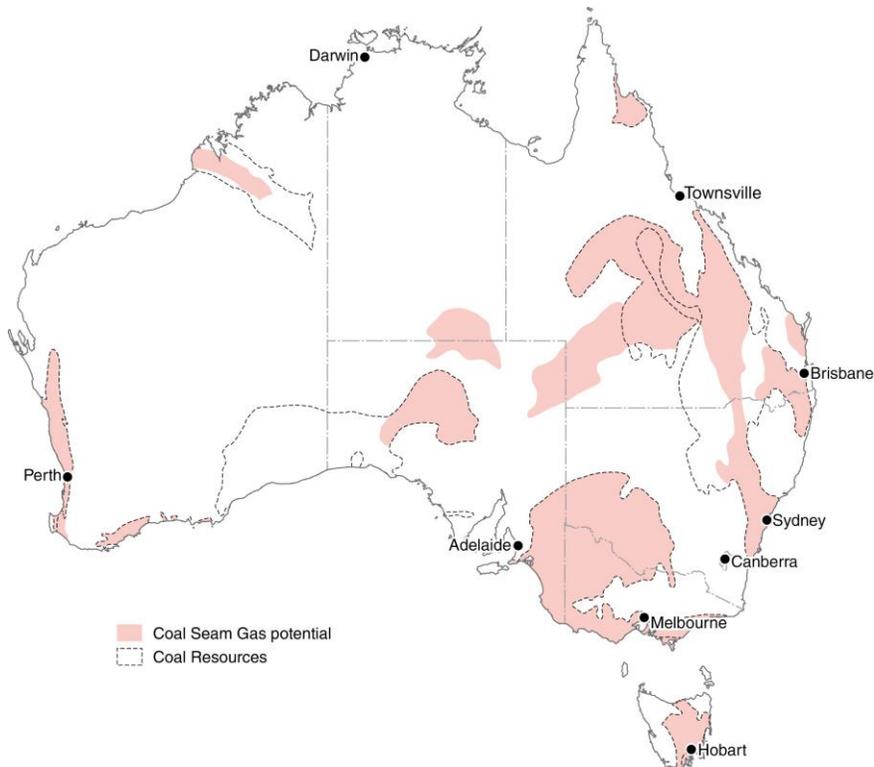


Figure 5 Mineral resources of Australia

A high premium should be placed on securing the integrity of the areas of high agricultural value. That is, every effort should be made to ensure that primary production in the fertile regions is protected from injury to their water table. The fertile areas should be protected from mining and fracking activities that are detrimental to the pursuit of primary production. Similar efforts would be needed to ensure that those areas where primary production might be compromised by noise and dust problems are similarly protected.

It would be preferable to leave the oil, gas and coal in the ground to ensure the sustainability of our society but it is also acknowledged that some exploitation of those resources may be necessary outside the areas of prime agricultural land during a 'conversion' phase of the world economy.

The sustainability of society could be achieved by making a national effort to develop a network of renewable energy 'power stations'. We could not only encourage the take up of 'distributed' or 'domestic' solar panel sources of renewable energy but also develop local or regional centres that may include a variety of energy sources (domestic solar panels +wind turbines (on vertical or horizontal axes) or, where appropriate, hydro or tidal power

capture). It will be obvious from Figure 2 that we, as individuals (households and businesses) already have made significant investment in the development of solar power plants which makes it easier for other communities to make similar investment in and development of a national solar power network. Encouraging the further development of renewable energy power plants by locating them appropriately on the National Transport Arc would significantly increase the resilience and integrity of the national energy system.

The new international awareness of the importance and urgency of the need to respond to the challenges of climate change offers an opportunity to develop a new plan for the development of our economy. It would be a plan to protect, develop and enhance the most important elements of the national patrimony.

It would build on a further development of the great natural resources of the nation including the protection and enhancement of its highly fertile regions.

Regional Economy

Infrastructure development is central to the development of an environmentally sensible, efficient, thriving economy.

The development of a national renewable energy system designed around the National Transport Arc would encourage local value adding processes to local agricultural production. This would in turn strengthen the nation's regional economic base. One feature of this is that it would enable a stronger engagement by regional communities in their development and operation.

Developing the National Transport Arc in the manner outlined would significantly reduce national vulnerability. It would also mean that the development strategy would stimulate the investment networks needed to develop the national infrastructure.

During and following WW11 a shared understanding between the Commonwealth and States and was developed to articulate a set of programs to address major challenge to our infrastructure - road, rail, health services and housing. The crucial thing then was that we built a cooperation between the Commonwealth and States in pursuit of that national compact.

Our task today is no less challenging but we now have a more urgent need to build our nation in a way that meets our ambition to build a more sustainable, fairer nation.

To give focus to this development strategy would include, where appropriate, identification of local projects which may be seen as taking communities across the nation together on that journey.

Where the States have relevant competence or operational responsibilities, it will be necessary for them to work on the articulation of the development strategy and in the delivery of the appropriate infrastructure.

Proceeding sequentially in the manner suggested will provide opportunities for private investment. Private and community investment in regionally located electricity power generation is only one of the more obvious areas in which the private sector might become engaged. Private sector engagement in the actual construction envisaged in development of the National Transport Arc would be essential.

Australia already has world class research capacities in this field that wants only a public determination to secure the development of battery technology for domestic energy storage and for the manufacture of motor vehicles that depend on their ability to rapidly re-charge and also to increase their range.

The twin objectives of developing electrification of rail passenger and freight transport and ‘electrification’ of road transport would be sustained by the development of regional power generation and the appropriate degree of engagement by regional tertiary education and research institutions in the development of power generation and energy storage.

This would facilitate the regionalisation of value adding to the processing of primary products closer to their point of production to become a source of strength for regional Australia.

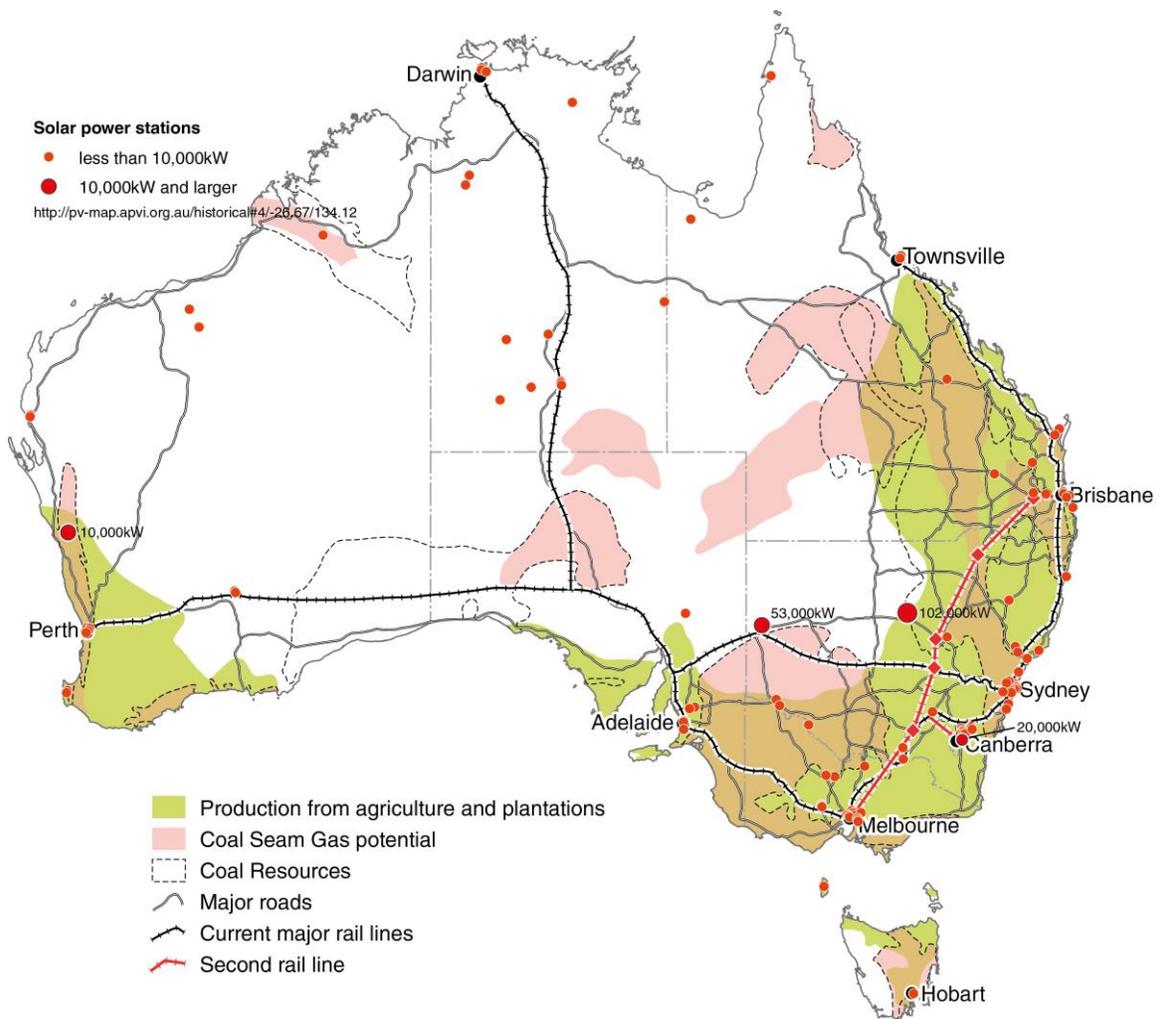


Figure 6: National low carbon economy

Rather than conclude that Australia cannot compete in the production of basic materials of construction and fabrication we would reshape our production of steel, aluminium and cement to take advantage of the variable availability of low cost energy from the renewable energy power stations. The profile of demand for energy for domestic purposes and the daily rhythms of the cities and regional centres means that we expect regularly to generate more renewable energy which could be available at low cost for the production of materials for construction or manufacture of products. We would also be able to use battery storage to enable us to change the profile of that manufacturing. One early candidate for consideration in the use of low cost energy in manufacturing would be the adoption and improvement of electric arc smelting techniques in the manufacture of steel.

Management of water resources

Another area which has been neglected to our cost is water. We have not been prudent in our stewardship of our water resources. In our cities we have exploited all easily available water resources but now are approaching some limits to their growth. Rainfall has become less predictable which consequently means we must exercise more caution. Unfortunately, we have not made a major attempt to minimize or treat urban or regional waste water flows, as a consequence, we discharge increasing volumes of waste water that has led to increasing levels of acidification of 'in shore' ocean waters – including those inshore of the Great Barrier reef which is now experiencing low coral growth.

The growth of our cities and their increasing per capita domestic consumption of water now poses problems. Domestically, the greater part of our water consumption is not for sustenance of life nor is it for godliness but is a debt to pleasure. That is, our consumption of water in the shower, clothes washer and dish washer is more than our basic needs but is a measure of the pleasures we take in showering, in having an easy way of 'cleaning' our clothes and in our preparation and cooking of food. We have become more conscious of the water consumption in our gardens and have changed many gardening practices but we need to do more to develop ways of maintaining our level of cleanliness and comfort. This requires us to develop ways of reducing and managing our 'waste water' flows. It will also require us to pay more attention to the dangers to public health of the use of nano-particles that may not be removed from present waste streams but may become a serious threat to public health and to the environment. This may require the development of Commonwealth wide regulations to prevent the use of such particles.

We may use some of the renewable energy production to 'process' waste water flows from inland centres to bring them to a standard where the recovered water may be used in other industrial projects (including primary production) or to create greater security in the supply and to the preservation of bio-diversity in our regions. Some renewable energy may also be employed to reduce the pollution load of water discharged to near shore coast regions.

In all this we must ensure that the security of water supplies to our major cities and towns is not compromised by mining of resources such as coal or attempts to recover oil or gas by fracking in our near city water catchment areas. The threat to the security of Sydney's water supply by mining in its

near catchment reserves is eloquent confirmation of the need for urgent action.

Developing a sensible response to the challenges of growth is not confined to exploring ways of capturing solar energy. We continue to face the challenges posed by population growth especially in our large cities all of which have grown beyond their capacity to provide their own food. Taking advantage of the opportunities that low cost energy production offers to facilitate regional industrial development does, however, offer an avenue to reduce the pressures under which they now operate.

A high level of private investment in solar energy conversion should be encouraged. We could however, magnify the effect of this environment related and economically sensible energy initiative by encouraging regional centres to support and facilitate the development of renewable energy power plants as pooled resources that should be managed. By, for and on behalf of the community.

The Commonwealth already has *Infrastructure Australia* now shaped to be a major development bank, that could be charged with the responsibility to encourage the construction of community owned regional renewable energy power stations to deliver power to the developing transport networks and also to support the development of enterprises to add value to primary production in the regions. In performing such a task Infrastructure Australia would be seen as a 'change agent' especially in providing or facilitating access to technical and financial advice needed to establish the appropriate model of renewable energy power plant for each region.

The Commonwealth could enhance such an initiative by increasing research funding in the conversion of solar energy and in the development of new battery technology. It could also encourage and support regional centres in the development of new production processes not only for value adding of primary production but also for new modes of production of basic materials like steel, cement and aluminium to take advantage of supplies of low cost energy.

Developing such local power plants would require a new approach to the management of pooled energy production sources. It would also lead to greater regional economic independence and therefore of regional influence in national public life. The precise form that the 'ownership' of community

power plants would take would reflect the level of ownership of the power source – this might involve new arrangements to ensure that the present attractions of renewable energy ownership were retained. That is, it would be important to retain the strong element of ‘self preservation’ and of communal engagement that development of the present systems offer.

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