
PART 3 THE MANAGEMENT ENVIRONMENT

3.1. Introduction

- 3.1.1. Resource management issues arise out of the interaction of people with natural and physical resources. In some cases the effects of this interaction will be minor, therefore requiring minimum control or intervention. However there are instances when resource use may have significant effects on the environment, and therefore on the sustainability of that resource, and should be permitted only if subject to strict conditions or possibly refused altogether. Effects can also be cumulative in their nature. Over time the combination of small scale effects can result in major impacts on the resource not initially envisaged.
- 3.1.2. An understanding is required of the natural and physical resource base and people and communities in Buller District in order to determine appropriate management responses. Part 3 (The Management Environment) briefly outlines and describes the resources of the District and the cultural, social and economic attributes which characterise the Buller District. In examining this interaction between people and resources, issues arise which form the basis for setting management objectives and policies contained in Part 4 of the Plan.

3.2. The Physical Environment

3.2.1. Geography

- 3.2.1.1. Mountainous terrain and terraced valleys characterise much of the District. The Karamea region is dominated by granite and sedimentary rocks. A band of limestone contains many natural features including caves and arches. Further south are coastal ranges and alpine landscapes including the Paparoa Ranges and the coal plateaux. A number of complex river systems flow through deeply incised gorges and result in alluvial plains with features such as marine and alluvial terraces and deltas. Pakihi areas are common. The Inangahua area contains the Alpine Fault and Main Divide, while alpine lakes and tarns exist in the Paparoa and Mt Victoria ranges. There are also two large valley floors in the District.

3.2.2. Climate, Soils, Geology and Minerals

- 3.2.2.1. Climate has a major influence on both the human and biophysical environment. Buller has moderate rainfall, lack of persistent wind, and mild temperatures.

- 3.2.2.2. Alluvial deposits on the valley floors have high productive potential for agricultural use. In the past, poor drainage has impeded the development of larger areas of good quality fertile soils. Large areas of upland and high country have soils which are generally of low fertility. Areas of soil at risk from erosion are identified as part of the West Coast Regional Council Soil Conservation and Erosion Control Plan. Modern methods and machinery make it possible not only to mitigate the adverse effects of soil degradation but to improve the productive values of land. Some soil types may be subject to erosion as a consequence of permanent forest removal or inappropriate earthworks.
- 3.2.2.3. The characteristics of the soil resource in the Buller have been a major determinant of the pattern of land use and have placed significant constraints on the development of intensive agriculture throughout the District. Some historic activities, in particular mining, have further degraded the soil resource.
- 3.2.2.4. The geological origins of the District gave rise to a wide range of mineral deposits, including coal, gold, limestone and mineral sand deposits containing magnetite, ilmenite, zircon and monazite. Gold is found in quartz reefs and alluvial deposits and blacksands along the coast. There are also substantial reserves of limestone currently being quarried at Cape Foulwind.

3.2.3. Water

- 3.2.3.1. Numerous rivers and streams drain the mountainlands across the District. Freshwater systems are characterised by short steep runs in the headwaters and alpine sections, then less steep runs to the sea. Annual rainfall is measured in metres and water is a dominant part of the West Coast's natural character. Climate and terrain combine to create a large and diverse range of freshwater ecosystems affecting, and being affected by the landscape they flow through. These include lakes, tarns, bogs, pakihis, swamps and lagoons as well as the District's distinctive rivers.
- 3.2.3.2. The Buller River is by far the largest river system in the District, and is widely recognised for its wild and scenic values, and recreational opportunities. Most of the river (and tributaries) is now protected by a Water Conservation Order. Other significant rivers in the District include the Heaphy, Karamea, Ngakawau, Mokihinui, Maruia, Inangahua and upper reaches of the Grey River. Instream water quality is generally high, largely due to high dilution of contaminants entering the river systems and the high levels of flushing which occur during periods of flood. Localised contamination has been associated with sewage discharges in particular at Reefton and Westport and agricultural run-off in the north of the District.

- 3.2.3.3. The catchments of rivers in the very northern areas of the District, such as the Heaphy and Kohaihai, are virtually unmodified. The Karamea River Gorge is significant for its recreational values as a location of whitewater rafting.
- 3.2.3.4. The topography of the central part of the District is dominated by the Buller and Mokihinui Rivers. Both Buller and Mokihinui Rivers have steep and narrow gorges which have recreational value especially in their provision for rafting opportunities in the gorge areas. Of all the rivers in this area, the Ngakawau River gorge is especially confined and dramatic. The headwaters of these rivers are almost all largely unmodified forest. The Ngakawau, Orikaka and Mokihinui River systems have a series of wide inland forested basins. However, even in remote areas few rivers are completely unmodified after their use as travel routes, grazing, mining, forestry, logging and seasonal habitation of river beds and riparian areas. The lowland parts of rivers in farmed areas are subjected to a high degree of modification through land clearance and channelling.
- 3.2.3.5. The coastal environment has a significant influence on the character of the Buller District. The coastline comprises a distinct combination of sandy beaches, cliffs and estuarine lagoons. The coastal marine area contains culturally significant resources which are regarded as taonga by Poutini Ngai Tahu. These include highly valued weaving plants such as pingao and harakeke, and food resources e.g: whitebait, fish, shellfish and other mahinga kai. Numerous settlements occur along the coastline, including Westport, which have a significant impact on the general character of the coastal environment.
- 3.2.3.6. The coastal environment in Karamea between Kohaihai and Kahurangi has outstanding scenic and biodiversity values. However, further south of Karamea, virtually all the coastal alluvial land between the Little Wanganui and Kohaihai Rivers has been cleared of native vegetation.
- 3.2.3.7. The coastal environment in the central part of the District is dominated by the extensive delta of the Buller River. The area is formed from a complex of marine and fluvial terraces. Westport is located on this river delta. There are various coastal swamps and lowlands in this area. Despite the extensive modification of this general area of coastal environment, some parts still provide important natural habitats including the Birchfield Swamp, Orowaiti Lagoon, tidal areas at the mouth of the Buller River (especially on the western side) and the large Okari Lagoon south of Tauranga Bay.
- 3.2.3.8. Further south is the Paparoa area whose coastal environment has largely been determined by the nature of the coastal limestone belt. This area is elaborated on in 3.2.4.3. Both Four Mile River and Bullock Creek have special aquatic values associated with them.

This is due to there being natural barriers which have developed between the freshwater in the river system and the coastal environment.

3.2.4. Caves and Karst

- 3.2.4.1. Most of the major karst areas in the Buller District are located within public conservation land and are managed primarily by the Department of Conservation. Karst is a special type of landscape characterised by distinctive hydrological processes and landforms. Features include sinking streams, gorges, caves, springs, dolines and speleotherms (cave decorations). Two significant karst features are the Oparara limestone arch, the largest such arch in Australasia, and the Honeycomb Hill Caves. Several of the cave areas in Buller contain significant fossil remains. Karst areas of importance in Buller District include the Heaphy River, Oparara River, Karamea River, Mokihinui Catchment, Buller River, Inangahua, Springs Junction, Punakaiki and Charleston.
- 3.2.4.2. The Heaphy Valley contains such features as bold limestone bluffs, vanishing streams and several large caves. Limestone bluffs provide impressive coastal ramparts south of Little Wanganui while in the north the prominent Kohaihai and Heaphy Bluffs and Kahurangi Point are all remnants of formerly more extensive limestone outcrops.
- 3.2.4.3. In the central parts of the district the karst resource has been quarried for cement at Cape Foulwind and for agriculture at Charleston. Further south in the Paparoa area are many karst features, especially on the coast. Most well known are the Pancake Rocks at Punakaiki and their attendant blowholes. These provide the single most important tourist attraction on the West Coast with around 300,000 visitors every year. The coastal limestone area of Paparoa contain examples of such features as a sequence of sculpted headlands, towering coastal bluffs, vertical walled river canyons, large natural arches and overhangs, sinkholes and slots, blind valleys, self draining basins, complex patterns of underground drainage, and numerous caves. Further inland are also significant areas of limestone features which include variations on that which are found on the coast.
- 3.2.4.4. Indigenous vegetation clearance, recreational/tourist use, roading, access tracks, foot tracks, buildings, carparks, rubbish dumps and effluent disposal can all have a detrimental impact on karst features. While the major karst areas are located on land managed by the Department of Conservation, some cave and karst features may be influenced by activities on land outside the public conservation land.

3.2.5. Natural Hazards

- 3.2.5.1. The climate and the physical characteristics of the land give rise to a number of potentially significant natural hazards. There is potential for significant flood damage to occur in the Buller, Karamea and Grey catchments. The whole West Coast region is located along the active Alpine Fault, and is therefore at risk from earthquakes. The Alpine Fault is one of the few places in the world where a major plate boundary appears on land and has been responsible for the creation of the Southern Alps and ultimately all the geographic and climatic factors that give the West Coast its highly distinctive character.
- 3.2.5.2. Earthquakes can also trigger other hazards such as slips and tsunamis. Little Wanganui Subdivision has been identified as an area at particular risk from landslides triggered by earthquakes. A rockfall hazard also exists at Punakaiki settlement.
- 3.2.5.3. Coastal erosion is a potential hazard in several locations along the coastline of Buller District. Particular problems have been noted at Punakaiki, and Waimangaroa through to Mokihinui.

3.3. Natural Habitats And Ecosystems

3.3.1. Forests

- 3.3.1.1. In the northern part of the District, forest cover is almost entirely indigenous consisting of podocarp-beech forest. The coastal forests of the northern Buller District are very different in composition from those found in the southern areas of the West Coast region. They are dominated by species like nikau palm, karaka and northern rata. Other northern species present include rangiora and titoki (which reaches its southern limit at Kohaihai) and these along with dense tangles of kiekei and supplejack vines gives the Karamea coastal forests a lush sub-tropical character. Besides their composition the fact that they are continuous for over 40 kilometres from Kohaihai to Kahurangi Point is also significant.
- 3.3.1.2. There are also extensive tracts of non-coastal lowland forests in the northern part of the District. Many are contiguous with both montane and coastal forests and hence provide linkages in unbroken altitudinal sequences. Rimu and red beech are common emergent species throughout much of these forests but composition can vary considerably.
- 3.3.1.3. The central area of Buller was originally podocarp-beech and beech forest but much of the Inangahua Valley has been cleared or modified by logging and burning. In southern Buller most of the area remains as indigenous forest except for extensive pakihis and

logged areas of the Tiropahi Valley. There may be important forest areas and remnants not on public conservation land.

- 3.3.1.4. Beech forest dominates both lowland and montane forests throughout the central part of the District. Beech forest is widespread in the Mokihinui catchment, the northern tributaries of the Buller inland from Inangahua, and the central parts of the Paparoa Range. Elsewhere beech is usually a component of more complex forest communities being joined by a wide variety of podocarp and broad-leaved trees with rimu often prominent at lower altitudes. Much of the dense coastal forest has been cleared. Lowland forest on fertile alluvial sites has also largely vanished from the coastal strip and along the Buller River but stands of tall kahikatea/rimu forest still remain in some inland lowland basins.
- 3.3.1.5. In the south of the District is a complex arrangement of ecological communities. Coastal forest in the Punakaiki area is dominated by species like northern rata along with dense tangles of kiekei and supplejack vines and native pines. Forest is lacking on the infertile coal measures and pakihi soils of the coastal lowlands near Charleston.
- 3.3.1.6. The forests provide habitat critical to a wide range of bird species, and forests hold significant soil conservation value. On private land, farmers view forests as an important potential timber asset.
- 3.3.1.7. Pests including weeds and introduced animals are a significant problem in parts of the Buller District. In the Buller sub-region weeds are a significant problem in certain areas including old man's beard, wild ginger (Karamaea), willow clematis vitalba (Traveller's Joy). Possums have also been responsible for the modification of whole forest ecosystems in certain parts of the District. They are known to have a highly destructive impact on forest structures, palatable plants and native land snail populations.
- 3.3.1.8. There are a number of threatened plants in the district, including the New Zealand sea spurge and a rare species of cress (*Lepidium flexicaule*) only two of which are found in the coastal zone. The forest areas also support threatened bird species including the great spotted kiwi, kaka, kereru, blue duck, kea, petrel and rock wren. Other indigenous threatened invertebrate species are also present including the giant land snail.

3.3.2. Alpine

- 3.3.2.1. Above the bush line (at approximately 1,200 metres) a belt of subalpine stunted trees and shrubs merge into alpine grassland and herbfield, bare rock and scree through to snow levels. Despite the harsh environment, alpine habitats support a surprisingly large number and diversity of both plant and invertebrate species. Alpine areas are also highly valued and utilised as a recreation and scenic

resource. Alpine lakes and tarns exist in the Paparoa and Mt Victoria ranges and there are two large valley floor lakes in the District.

3.3.3. Wetlands and Pakihi

- 3.3.3.1. As in other parts of New Zealand, considerable modification of wetland ecosystems has occurred, mainly through drainage and reclamation. These include the estuarine areas of the Buller, Totara, Mokihinui, Orowaiti, Little Wanganui, Oparara, Karamea and Okari Rivers; Kongahu Swamp at Karamea, German Terrace at Fairdown and Birchfield Lagoons.
- 3.3.3.2. Lowland wetland ecosystems (both freshwater and coastal) are of ecological value, despite the fact that they generally occur in areas that have undergone widespread modification since human settlement. The number of wetlands continues to diminish.
- 3.3.3.3. Much of the coastal plains north and south of Westport have been drained for farmland. Coastal swamps and lowlands still provide important natural habitats.
- 3.3.3.4. The wetlands also include natural and induced pakihi, which are areas of wetland supporting a low stunted vegetation community on wet, generally infertile soils. Central parts of the District contain sizeable areas of lowland pakihi and boggy upland which have distinctive ecological communities. Further inland in the general Reefton area most large wetland areas have been cleared and drained except for areas of pakihi swamp that are still extensive on the eastern side of the Paparoa Range. Other pakihi can be found in the coastal lowlands near Charleston. These are characterised by their infertile soils and have scrubby stunted vegetation.
- 3.3.3.5. Coastal and lowland wetlands provide important wildlife habitat and have a role in supporting the District's whitebait fishery.

3.3.4. Coastal

- 3.3.4.1. Large tracts of land in the coastal environment are being farmed. However considerable areas of largely unmodified coastal vegetation do occur, for example, along the Paparoa coastline to the south and between Gentle Annie Point and Little Wanganui Head, and around Kohaihai Bluff in the north of the District.
- 3.3.4.2. Numerous estuaries and coastal stretches are important breeding habitats, especially for birds, and also act as nursery habitats for a variety of fish species. Hector dolphins, little blue penguins and fur seals are also to be found in the coastal environment of the District. The most popular wildlife viewing facility along the West Coast is the seal colony located at Tauranga Bay near Westport.

3.4. Tangata Whenua

3.4.1. Early Maori Settlement and History

- 3.4.1.1. Maori occupation of the Buller (Kawatiri) extends back several centuries. Traditionally settlements have been coastal and associated with nearby rivers, tidal lagoons and estuaries. Favoured locations included land bordering the tidal lagoon at the mouths of the Okari and Totara Rivers along Nine Mile Beach, and other lagoons such as Orowaiti, Bradshaws and the Waimangaroa rivermouths. There is a long history of Maori use of the District's resources including flint from Pahautane for tools, karaka tree berries for medicinal purposes, and other herbs and plants for food, medicines and weaving fibres.
- 3.4.1.2. Upon European arrival in the District, sub-tribes of the main South Island Ngai Tahu tribe were well established, having for example, planted cultivations on the south bank of the Kawatiri (Buller) River.
- 3.4.1.3. Tangata whenua refers to the tribe or sub-tribe of a given place who have manawhenua or authority and responsibility for a particular area. Manawhenua is expressed through Poutini Ngai Tahu representation on Te Runanga O Ngai Tahu which is the decision making body for the whole tribe, and at the district and regional level by decision-making bodies known as runanga. In the Buller District the runanga is known as Te Runaka O Katiwaewae. The Council has a responsibility to consult with the two runanga and Ngai Tahu at the tribal level about resource management matters. This does not preclude the Council from liaising with other Maori groups who have interests in the Buller area but are not affiliated to the two papatipu runanga.

3.5. Resource Use And Trends

3.5.1. Agriculture

- 3.5.1.1. Agriculture is an essential component of the Buller economy with rural communities heavily dependent on farming activities for their social and economic wellbeing. The social structure and lifestyle in rural areas of the District is greatly influenced and shaped by changes in this sector of the economy. Agricultural activities have altered the landscape in Buller District and make a significant contribution to the District's overall character and the economy.
- 3.5.1.2. Agriculture is largely confined to small, discontinuous coastal strips, river valleys and alluvial terraces covering an area of over 131,000 hectares. Dairying is the most common farming activity, accounting for over a quarter of all farms in the District, followed by mixed livestock and beef farming. Some of this land lies idle and has potential for farm and forestry development.

- 3.5.1.3. Some areas of farmed land have the potential for more productive use, through integrated management practices and capital improvement, particularly in the north of the District and around Westport and Reefton. The best land (Class I to III as classified by the New Zealand Land Resource Inventory worksheets) often requires flood protection works.
- 3.5.1.4. Further growth in the farming industry will depend upon the extension of the farmed area and commercial viability and management initiatives. Intensification of agricultural land use has environmental implications both for water quality and habitat protection. The conversion of marginal lands, such as scrublands and wetlands, to production may result in the loss of conservation and wildlife values.
- 3.5.1.5. Other activities such as mining and forestry also exert pressure on the soil resource and can compete with farming where they involve productive soils. Demand by farmers to subdivide existing family properties is steady as is demand for rural-residential “lifestyle” blocks. These blocks are typically between three and four hectares in size.

3.5.2. Forestry

- 3.5.2.1. An estimated 95% of native (or indigenous) forest in the Buller District is under the direct control of the Department of Conservation, who operate primarily under a conservation mandate. One consequence of this is that the resource will not be available for production forestry under present legislation.
- 3.5.2.2. The majority of exotic production forest areas in Buller District, 4,504 hectares, are managed by Timberlands West Coast Limited. The main Timberlands exotic plantation blocks are in the Mokihinui, Charleston and Reefton areas of the District, as well as a smaller block in the Oparara area. There are significant tracts of indigenous forest (20,000 hectares) on private land, and also an increasing number of exotic forest blocks on private land.
- 3.5.2.3. Use of indigenous forest on private land is controlled by Part 3A of the Forests Act 1949.
- 3.5.2.4. The use of the forest resource has long been a source of development finance for farmers, as well as allowing for further areas to be opened up for pastoral activities. Approximately 14,000 hectares of regenerating indigenous forest and wetland exists on private land and may have development or conservation potential.

3.5.3. Mining

- 3.5.3.1. Buller District is relatively well endowed with a variety of mineral resources. They include substantial reserves of bituminous, sub-bituminous and lignite coal, relatively widespread alluvial gold and mineral sand deposits, the latter containing magnetite, ilmenite, zircon and monazite. Smaller quantities of uranium, copper, molybdenum and lead have also been located within the District. Industrial minerals, in particular limestone, are currently extracted in economic quantities.
- 3.5.3.2. Over 1,000,000 tonnes of coal was extracted from the Buller District in 1994, the vast majority being taken from the Stockton mine (860,000 tonnes). The coal mining industry has proposals to increase output to over 2 million tonnes per annum by the year 2000. Significant quantities of limestone, and lesser quantities of sandrock and gravel are also extracted. Ilmenite sands have been identified in the Cape Foulwind area and the viability of extraction is currently being investigated.
- 3.5.3.3. Gold bearing quartz lodes are known to exist in several locations within the District, including the Reefton and Lyell Goldfields. A major gold mine is proposed on the Globe Progress resource, and additional prospects north and south of Reefton are under evaluation. The main alluvial deposits are found in the gravels and river terraces of the major river valleys and their tributaries from the Buller River south.
- 3.5.3.4. The gold industry has historically been of great social and economic importance in the District. Many of the District's towns and communities were founded on the gold mining industry and in particular the gold bearing quartz lode of the Reefton and Lyell Goldfields. A major hard rock gold mining industry existed on those fields during the second half of the last century and the first half of this century. The Ministry of Commerce has calculated that between 1872 and 1973 the Reefton Goldfield has produced 64,678kg of gold. In today's terms of a spot price of \$700/oz, the gold produced would have a value of \$1,455,587,705.
- 3.5.3.5. There remain within the Reefton and Lyell Goldfields enormous gold resources. Almost all of these goldfields are located within land administered by the Department of Conservation. With continual advances in exploration and mining technology and the ability for mineral exploration and extraction to be undertaken in an environmentally responsible way, the District stands to reap social and economic benefits from the industry in the future.
- 3.5.3.6. The cement industry is of important economic and social significance in the Buller District. There is a large limestone quarry and cement works at Cape Foulwind. Operations on the Cape Foulwind site associated with the cement works started in 1957.

Production was at a record level in 1996 as it had been in 1995. The existing Cape Foulwind quarry has assessed reserves of limestone totalling 60 million tonnes. Expansion of the production facility in the future is possible.

- 3.5.3.7. Reserves have also been identified at Waggon and Alpha Creeks. Marl (used in the manufacture of cement), garnet, beryl, mica, potters clay and aggregate rock (used to make roads) are also plentiful.
- 3.5.3.8. The future of the mining industry in Buller will depend on a range of factors including commercial viability, which in turn is affected by overseas markets, mine and transport infrastructure development and environmental policy and control.

3.5.4. Tourism and Recreation

- 3.5.4.1. The District is well endowed with scenic and historic attractions and has significant land and water-based recreation assets. Tourism is regarded throughout New Zealand as a key area of economic growth with growth in visitor numbers occurring at a rate of 9.6% per year. The New Zealand Tourism Board is aiming for a figure of 3 million visitors to New Zealand by the year 2000, although even an increase to 2 million would still be significant.
- 3.5.4.2. The District's large areas of natural land also provide an extensive resource for low impact recreation for New Zealanders living in the District and from other parts of the country. Overseas backpackers are also visiting remote parts of the District. This recreational activity can be less intensive than mainstream tourism and needs little infrastructure to support it.
- 3.5.4.3. The Council recognises that tourism has significant potential to provide a long-term, sustainable income to many of the District's residents. While large visitor numbers (and associated development) can have potentially detrimental environmental effects, appropriate controls and balanced decision-making will ensure that tourism enables people and communities to meet their present and future needs.

3.5.5. Settlement Growth and Change

- 3.5.5.1. Westport is the major town and population centre of the District, and has gradually increased in importance as a tourist and holiday attraction. Reefton, to the south-east of Westport, is the second largest town. Some of the smaller settlements have become increasingly dependent on tourism, for example, Karamea and Punakaiki, while others such as Granity, Ngakawau, and Hector are still dependent on coal mining ventures. New ventures of a service nature serve to diversify the employment base.

- 3.5.5.2. The population of Buller District now stands at 10,512 people (1996 Census). The Council believes that there will be a growth rate in population of the order of 0.5% per year in the future. The population is also “ageing” and by 2011 the 50 year and over age group is expected to comprise over 31% of the population.
- 3.5.5.3. Unemployment is high. In 1996 the unemployment rate was 9.6% whilst nationally the rate was 7.7%. Small holdings and the demand for rural-residential properties are two major settlement trends as people seek to combine the advantages of rural lifestyles without the necessity to become involved in full-time farming.
- 3.5.5.4. The transportation network is vital to the sustainable management and development of the Buller District. The state of the harbour, rail, airport and roading infrastructure is a significant part of the physical environment for the movement of people and goods within and beyond the District.
- 3.5.5.5. Population centres are serviced and linked by vital infrastructure resources. These include transportation (road, rail, sea, air), communication, energy and servicing resources. Infrastructure resources have a high capital value with replacement costs in the millions. Provision of these services and resources has traditionally been that of Council and Government departments or agencies. However, privatisation of these functions is increasing so that a variety of commercially orientated organisations have servicing and infrastructure responsibilities.

3.5.6. Energy Development

- 3.5.6.1. There are no significant electricity generating plants in the District, although the potential for hydro-electric power schemes has been identified for a number of rivers in the Buller District and some preliminary investigations have been done. Significant hydro potential exists on the Ngakawau, Buller River tributaries, Whareatea, Ohikanui, Totara, Nile, Mokihinui and Waimangaroa Rivers, Mangatini Stream and Granity Creek. Some rivers, particularly the Ngakawau, have had detailed investigation of their capacity for hydro-electric power generation. The Council recognises that a number of these rivers have been identified for their high wild and scenic values, but is mindful of the need to promote energy independence and efficiency of energy supply in Buller District.
- 3.5.6.2. Other potential energy sources include use of the large coal reserves as fuel for a coal fired power station to produce thermal power generation. Geographical investigations and assessment reports have been done on possible sites. Potential for wind power generation has been considered, however, suitable sites appear to be limited due to wind patterns and existing technology. The development of any energy project will be closely related to national

electricity demand, pricing policies and the structure of the energy generation and supply industry. Due to the constraints on energy development, alternative energy conservation and generation technologies and techniques may require greater consideration in the future.