

Report 61/01

**Sustainable
Development in the
Electric Utility
Industry**

Sustainable development in the electric utility industry

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Sustainable Development

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Executive summary

Abstract

The electric utility industry is increasingly looking for strategies and actions to support sustainable development. This report, prepared for the World Business Council for Sustainable Development, looks at sustainable development principles and strategies as they apply to electric utilities, and illustrates these strategies through a series of short case studies.

Background

The aim of this report is firstly to situate the concept of sustainable development in the context of electricity utilities. Secondly, we present overall sustainable development objectives relevant to the electricity utility industry and illustrate these through case study examples of good practice by electric utilities.

WCED's definition of *sustainable development* is the most commonly used and a point of departure for making the concept operational: Sustainable development is:

“Development which meets the needs of the present without compromising the ability of future generations to meet their own needs”. (Our Common Future 1987: 8)

The concept of sustainable development is perhaps best defined through three constituent dimensions: Economic, environmental and social sustainability. We present below an indication of how these dimensions relate to electric power utilities.

Table A: Electric utilities and dimensions of sustainable development

Dimension	Effect	Mechanism
Economic	Value creation	Provision of goods and services
	Value distribution	Employment, taxation and dividends
	Multiplier effects	Procurement of goods and services
	Economic growth	Technological competence & innovation
Environmental	Pollution	Discharges from power generation plants
	Visual impacts	Physical assets in areas of beauty
	Biodiversity	Impact on natural ecosystems
	Resource depletion	Use of non-renewable resources
Social	Social welfare	Employment and supply of electricity
	Poverty impacts	Access to electricity
	Relocation	Construction of dams
	Other	Role as corporate citizen

In order to illustrate the ways in which electric utilities are responding to the challenge of sustainable development, we have documented a set of case studies dealing with a variety of topics. These are summarised below.

Table B: Case studies

Topic	Source material
Maintain international standards & best practice: Environmental management	Kansai, TEPCO, British Energy, Powergen, Ontario Power, Eskom
Integrate environmental (and social) issues into planning & decision making	TransAlta, Ontario Power, Eskom, BC Hydro
Develop low pollution technologies and measures	TEPCO, Kansai, Eskom, Exelon
Develop GHG strategies	TransAlta, Ontario Power, TEPCO, Kansai
Promote renewable energy	Western Power, EPCOR, Exelon, Powergen, Eskom, BC Hydro
Promote energy and resource efficiency	TEPCO, Ontario Power, Eskom, Exelon, BC Hydro
Environmental education & training	Eskom, Western Power, Exelon
Sustainable development reporting	Eskom, TEPCO, Ontario Power
Demonstrate responsible stewardship of natural resources	TEPCO, EPCOR, Ontario Power, TransAlta, Eskom, BC Hydro
Support nature conservation programmes	Kansai, Exelon, Eskom, Ontario Power
Support key social programmes	Eskom, Western Power, PowerGen
Expand access to electricity	Eskom
Consult stakeholders & provide information	EPCOR, TransAlta, Ontario Power, BC Hydro
Corporate Social Responsibility	TransAlta, Exelon, Ontario Power
Health, safety & employee welfare, and labour standards	British Energy, TransAlta, Exelon, Ontario Power
Support R & D and training	Kansai, Eskom, Ontario Power
Support business development	Ontario Power
Procurement	Ontario Power
Liabilities and risk management	Ontario Power

1 Introduction

Global environmental issues, particularly climate change, have brought about a change in the way the public and private sectors approach environment and development issues. The term sustainable development has been used as the ideal by which different groups should govern their behaviour.

While there may be a common understanding of the core concept of sustainable development, there is great difficulty in operationalising the concept, not least because governments have differing opinions on how to develop sustainably. A key concern has been a country's right to develop as it chooses. To a certain degree, this has led to paralysis at the level of international organisations, where debate on sustainable development, as a global and inter-generational concern, has conventionally been located. Despite this, many businesses have chosen to look at their operations, define what sustainable development means to them, and begun to operationalise their findings.

With many electric utilities facing increasing competition and market restructuring, increasing energy demands, and with increasing focus being placed on environmental and social responsibilities, this industry faces many new challenges. How utilities view and/or internalise sustainable development could have a large impact on both environment and development dimensions.

The aim of this report is firstly to situate the concept of sustainable development in the context of electricity utilities. Secondly, we present overall sustainable development objectives relevant to the electricity utility industry and illustrate these through case study examples of good practice by electric utilities.

Report structure

This report consists of three main chapters. Chapter 2 attempts to clarify important dimensions of the concept of sustainable development through explaining its origin, providing a brief synthesis of key elements of the concept, and presenting the World Business Council on Sustainable Development (WBCSD) view on sustainable development.

Chapter 3 builds on the discussion of sustainable development in chapter 2 and elaborates objectives, backed by strategies and actions, towards sustainable development for electric utilities across the world.

Chapter 4 illustrates with case studies examples of good practice on particular sustainable development issues by electric utilities as relevant to the principles and objectives identified in Chapter 3.

2 Clarifying the concept of sustainable development

This chapter aims to clarify the concept of sustainable development. There is a comprehensive and rapidly growing literature discussing sustainable development on a theoretical and practical level. On neither level does there appear to be a broad agreement on precise content and ways to move governments, citizens and corporations forward towards a sustainable future. Nevertheless, there is an increasing interest among the three stakeholder groups in environmental and social consequences of production and consumption activities and in methods of controlling these to the better of present and future generations. Instead of awaiting a general consensus on an operational definition, different groups are making their own pragmatic interpretations of sustainable development, and developing innovative approaches relevant to their circumstances.

We start out in section 2.1 by briefly summarising the origin of the concept, and move on in section 2.2 to explaining some of the many dimensions of sustainable development that are being discussed. The aim is not to give a comprehensive review of the debate, but rather to synthesise some of the key elements of a first step towards making the concept operational in a corporate context. Section 2.3 discusses the role of business in sustainable development. Section 2.4 closes the chapter by explaining the World Business Council of Sustainable Development's (WBCSD) view on sustainable development, which encompasses the key elements from the three previous sections.

2.1 The concept's origin

Sustainable development was an idea first espoused in the *World Conservation Strategy* produced by the International Union for the Conservation of Nature (IUCN)¹ in 1980. It focused on the ecological limits to human activities on Earth. Three ecological objectives formed the basis for sustainable development:

- maintain necessary ecological processes
- maintain genetic diversity
- use resources sustainably

¹ With the support of the World Wide Fund for Nature (WWF) and the United Nations Environment Programme (UNEP).

The World Conservation Strategy was one of many responses to the growing concern about the state of our environment, present in many countries since the 1960s (e.g. through Carson (1962)). Some landmark meetings, such as the 1972 UN Conference on the Human Environment and the 1992 Earth Summit in Rio, and certain influential publications, e.g. *Limits to Growth*, *Only One Earth*, *Our Common Future*, moved environmental issues forward on both private and public policy agendas.

Our Common Future by the UN World Commission on Environment and Development (WCED), has received much attention since its publication in 1987. The report may be interpreted as an attempt to unite two themes that for a long time have been opposed: environment and development. It was this report, backed by the Earth Summit's Agenda 21 that really brought the concept of sustainable development into the public debate, corporate language and academic journals. The report is broader in its focus than the World Conservation Strategy, in that it not only deals with the environment (for the environment's sake) but considers the human dimension as an integral part. This broader approach was partly chosen as a response to some of the critique of the World Conservation Strategy.

WCED's definition of *sustainable development* is the most commonly used and a point of departure for making the concept operational: Sustainable development is:

“Development which meets the needs of the present without compromising the ability of future generations to meet their own needs”. (Our Common Future 1987: 8)

2.2 The many dimensions of sustainable development

A first understanding of the WCED definition would suggest that there are natural limits to the present generation's endeavours and that exceeding these would compromise our children's ability to meet their needs. In economic terms, it is analogous to consuming your capital base² over time instead of only the *interest* it generates. But what do “development” and “sustainable” really mean? And to “whose” children is sustainable development an obligation, i.e. should we take both inter- and intra-generational considerations? Since the debate is often muddled by unclear or inconsistent applications of different terms, we discuss these questions briefly below.

The meaning of “development” is complex and culture dependent

By “development” is often meant improvement or progress, usually advances in the well-being of individuals in a society. Aspects central to well-being of people are generally *economic* (e.g. income, satisfaction of needs), *social* (e.g. equity,

² When economists refer to capital in connection with sustainable development they often mean the total of human-made capital and natural resources, and that we should live from the return on this capital. There is a difference of view on whether one should preserve the total capital available (including natural resources and human-made capital), or whether one should preserve the stock of natural resources. The latter is, of course, a much stricter requirement.

justice, culture) and *environmental* (e.g. nature amenities, clean air) dimensions. More precisely, development may mean a set of desirable economic, environmental and social goals that a society is striving to realise or maximise. These goals may in practice include increases in real income per capita, improvements in health care and education, more equitable distribution of resources, freedoms for individuals etc. Needless to say, these three categories are in practice inter-linked and overlapping, and the distinction here is made for analytical simplicity.

The exact types of goals for a society and its citizens may depend on the prevailing value systems in the country concerned, while some goals of satisfying basic needs are universal. Beyond basic needs, different countries typically put different weights on the economic, social and environmental dimensions of development. Developing countries may regard social and economic aspects as particularly important, while industrialised countries may value the environment higher. The difference partly relates to timescales – longer-term versus shorter-term perspectives. There are also significant differences within the two country groups, and between different stakeholders within individual countries.

This point may be important in practice when carving out sustainable development principles and objectives for electric utilities to adhere to, rooted as they are in different (and equally valid) corporate and culture/country specific value systems. A possible way around this, as will be dealt with in chapter 3, is to make a set of overall and general objectives from which a menu of strategies and actions may be derived. Types of strategies and actions may in turn be chosen according to which areas the priorities and expertise (or comparative advantage) of different utilities lie.

“Sustainable” – a term from 18th century German forestry

The term “sustainable” was used by the Germans in the 18th century to describe a long-term perspective on forestry, i.e. the extraction of timber that would sustain the forest’s capacity to regenerate in the long run. From the 1960s the term has been used in three increasingly broad ways (Lafferty and Langhelle 1995):

- as a purely *physical* concept, i.e. the use of a renewable resource so that the physical stock is maintained over time. This is the generalisation of the German use of the term to other renewable resources
- as a *biological-physical* concept, i.e. a broader concept applied to a larger system of resources or an ecosystem. It is harder to determine the effects of human use because of the complexity involved, and also because there may be tensions between individual resources and the ecosystem as a whole. The question arises of what exactly should be sustained? Is it the original ecosystem as a whole or the resource(s) humans choose to utilise?; and
- as a *social-physical-economic* concept used in a much broader social context. “Sustainable” is used in connection with the level of welfare in a society or for individuals, and it is this level which should be sustained and developed.

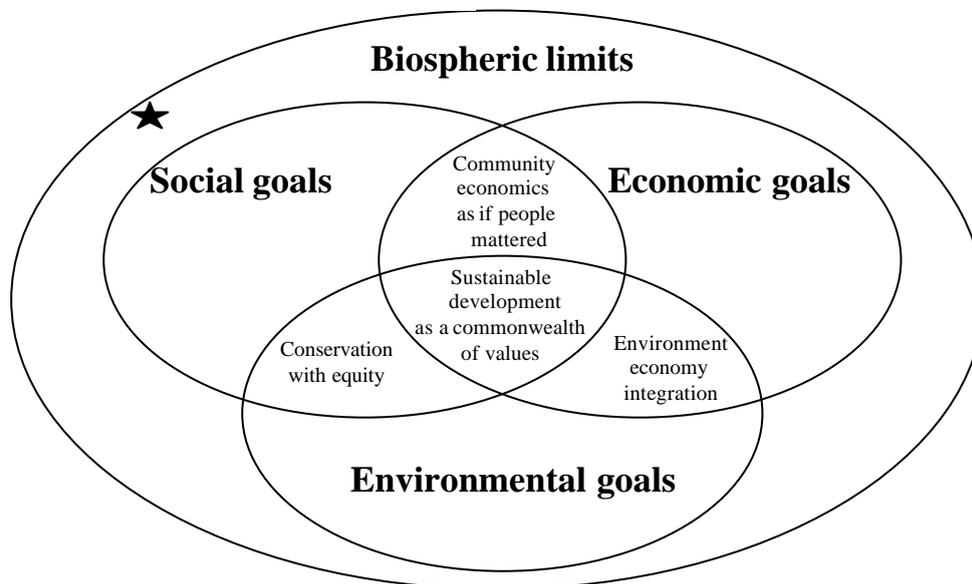
The two former uses do not, strictly speaking, make sense when applied to an exhaustible resource. The WCED and much of the international debate use the term in the last of the three ways.

Sustainable development: improvement of well-being within biospheric limits

For development to be sustainable, then, advancing our own well-being should not diminish our children's opportunities for well-being. Simplified, this means that development should ultimately be within *biospheric*³ limits. The biosphere is the global ecosystem, made up of a web of interconnected subsystems. In other words, all environmental impacts, no matter how local, may have the potential for affecting the global ecosystem. However, the global climate and biodiversity are central building blocks of the global ecosystem that have received much attention internationally in recent years.

The figure below illustrates the dimensions of development, within biospheric limits.

Figure 2.1 A systems perspective on sustainable development



Source: Sadler, 1988

* Value systems/policy frameworks

Sustainable development requires justice between and within generations

The minimum requirement for sustainable development is, according to WCED, that the biosphere is not put in danger from human activities. It is possible to argue that sustainable development should be understood purely as *physical* sustainability, i.e. not as a normative concept. WCED rejects this view and holds that the question of what is *physically* sustainable cannot be answered without considering the question of distribution of resources, advantages and disadvantages within a generation and *what* one wishes to maintain and uphold for the next. In other words, it is impossible to consider social justice between

³ Biospheric means the relatively thin life-supporting stratum of the Earth's surface, extending from a few kilometres into the atmosphere to the deep-sea vents of the ocean. The biosphere is a global ecosystem composed of living organisms (biota) and the abiotic (nonliving) factors from which they derive energy and nutrients.

generations without at the same time consider justice between people currently alive. Ultimately, it is a question of *whose* common future we are talking about, i.e. whose children will be given a chance to live and prosper.

The time and space dimensions of social justice as a goal of sustainable development is illustrated in the table below:

Table 2.1 Time and space dimensions of social justice in sustainable development

Time	Space	
	Nationally	Globally
Within generations	National justice within generations	Global justice within generations
Between generations	National justice between generations	Global justice between generations

Source: Lafferty and Langhelle (1995)

Of all these dimensions, particularly global justice within each generation in connection with the concept of sustainable development, has received scant attention. However, in an increasingly globalised world, this issue is moving up the agenda, for example illustrated by the increasing interest in Corporate Social Responsibility (CSR) issues.

Sustainable development: trade-offs or synergies?

We have so far not discussed whether environmental, social and economic goals of development may conflict. The WCED is relatively silent on potential trade-offs that may have to be made, and which hierarchy of values should govern our priorities in the cases where we cannot have it both ways. This question is also highly relevant for corporations that are committed to social, environmental and economic goals (see section 2.3).

It is hard to say anything meaningful about this on a general level, since whether conflicts arise is highly context specific and depends on level of aggregation (local, national, regional, global) or stakeholder in question (e.g. companies, organisations, governments, citizens etc.). Furthermore, situations are fluid and change over time. For example many companies experienced environmental regulations as conflicting with profits just a few years back, while today many companies see environmental improvements in their operations (often beyond compliance) as giving them a competitive edge.

It is, however, generally believed that for governments, companies and citizens there is a large potential for economic, environmental and social improvements simultaneously, i.e. win-win(-win) situations. Work towards realising this potential at any point in time may even increase (not exhaust) such opportunities in the future as the world moves rapidly forward.

Towards operationalising the concept

It is hard to make the concept of sustainable development more precise at this level of abstraction. The discussion in this subchapter was meant to clarify the

issues involved, but also emphasise the inherent complexity in making such a concept operational. Operationalisation of the concept means determining *what* are the goals or objectives to realise sustainable development. The next step is to say *how* these goals can be achieved, and measure progress e.g. through the use of indicators.

Some research effort has been devoted to making guidelines and principles for sustainable development in practice, applicable for the use by corporations, community groups, non-government organisations, governments, and international institutions. A well-known example of principles for (the assessment of progress towards) sustainable development is the so-called *Bellagio principles* (International Institute for Sustainable Development 1997). These ten principles deal with four aspects of sustainable development⁴:

- the establishment of a *vision* of sustainable development and clear goals that provide a practical definition of that vision in terms that are meaningful for the decision-making unit in question (Principle 1);
- the content of a sustainable development strategy and the need to merge a sense of the overall system with a practical focus on current priority issues (Principles 2-5);
- the key issues of a process towards sustainable development (Principles 6-8); and
- the necessity for establishing a continuing sustainable development capacity (Principles 9-10).

We reproduce the Bellagio Principles in their original form in Annex 1. We attempt to bridge theory and practice in chapter 3 by presenting overall sustainable development objectives for electric utilities generally in line with the Bellagio Principles, and possible strategies and actions to meet these objectives.

2.3 Business and sustainable development

The previous subchapter provided a broad and relatively general discussion of what sustainable development means (or should mean). But where does business fit into all of this? What should be the role and responsibilities of business (if any) in sustainable development? And how should businesses approach the idea of sustainable development? We will in this subchapter briefly discuss some key issues of the debate about business and sustainable development, starting with the role of business.

The role of business in sustainable development

Surely, as argued by Forest Reinhardt “companies aren’t in business to solve the world’s problems.” (Reinhardt 2001). That is true, but as Reinhardt also acknowledges, neither can questions of social responsibility be ignored. If we as a society have a duty to pursue social justice, then business – a prominent and

⁴ We change the formulation of the principles somewhat here to be applicable to “a strategy for sustainable development” rather than to the original “assessment of progress towards sustainable development”. We are of the opinion that the principles are general enough to be equally applicable to both.

powerful actor within society – has a duty to collaborate with other groups in pursuit of this goal (Starkey and Welford 2001). Put simply, the pursuit of profit must go hand in hand with the pursuit of justice.

Considering the strong and growing forces of globalisation and roll back of governments around the world through for example privatisation and deregulation, private corporations get increasing power and corresponding responsibilities. As Harmann puts it:

“Business has become, in this last half century, the most powerful institution on the planet. The dominant institution in any society needs to take responsibility for the whole...” (Willis W. Harmann 1990, quoted in Korten (2001))

To illustrate this quotation, statistics show that of the world’s 100 largest economies, 51 are corporations. The economy of Mitsubishi is larger than that of Indonesia, the world’s fourth most populous state. The combined sales of the world’s top 200 corporations are equal to 28 per cent of the world’s GDP (Korten 2001).

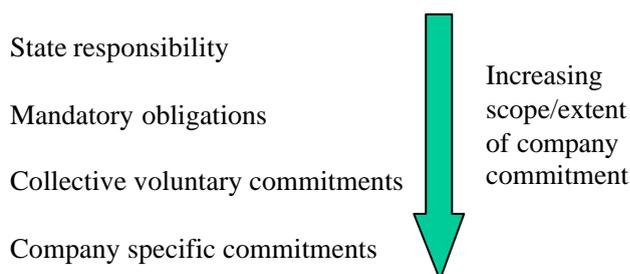
There is increasing understanding and acknowledgement that business should play an important role in contributing to sustainable development, and that business, now more than ever before, has the power to do so in a major way.

Having said that, businesses cannot and should not be involved in all areas of sustainable development. Sustainable development cannot be achieved by a single enterprise (or, for that matter, by the entire business community) in isolation from the rest of society. Sustainable development is a pervasive philosophy to which most participants of the global economy (including consumers and governments) must subscribe if we hope to meet today’s needs without compromising the ability of future generations to meet their own.

Obligations, responsibilities and commitments

A company’s response to the effects that it has, particularly on its social and environmental surroundings, will depend to a large extent on the country specific context. There are considerable differences between countries and companies in which elements of sustainable development are regarded as their responsibility and what are considered government responsibility. This is illustrated in Figure 2.2 below.

Figure 2.2 *Levels of commitment to sustainable development*



At one level, responsibilities lie with the state. For example, taxation is one mechanism for wealth distribution, and subjection to taxation is one way of a company fulfilling its role as a corporate citizen.

At another level, a company will be subject to mandatory obligations, for example by meeting water quality or emission targets, or in the interaction with employees. While these obligations will depend on the legislation and regulations in a specific country, there will typically be many common elements of this across countries.

Thirdly, there is the level of voluntary, but collective, commitments. The electricity industry, in a country, region or globally, may seek to establish a common set of commitments to environmental, social or economic goals. While these commitments lie outside the legal or regulatory sphere, they are frequently negotiated with the participation of government and/or trade unions, and represents a consensus approach to governance.

Finally, individual companies may make unilateral commitments to the goals of sustainable development. For example, these commitments may take the form of environmental targets for the company, funding commitments to social objectives or perhaps investment commitments in a certain region or technology.

Ideally, in the spirit of Agenda 21, a key document from the Earth Summit in Rio 1992, corporations should “think globally, and act locally”. In other words, contributing to sustainable development by a private corporation means realizing its global responsibility and acting upon it in its daily operations. In other words, companies should increasingly realize the truly global nature of sustainable development and gradually take on commitments which transcend the country specific context and are part of the global transition.

Business approaches to sustainable development

Businesses have approached the agenda of sustainable development in a multitude of ways the last 10-15 years. How corporations understand the term varies, but an attempt at a definition for the corporate context is made by IISD:

“For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.” (IISD 1992 Business Strategy for sustainable development: leadership and accountability for the ‘90s. ISSD, Winnipeg, Canada, p. 116.)

There is an ongoing debate within the business community whether strict environmental and social policies and practice give rise to a win-win situation, i.e. better environmental (and social) conditions and increased profits (see discussion in 2.2). Some of the channels for such a result have been seen to be product differentiation, managing social and environmental risks, managing competitors, saving costs, and redefine markets (Reinhardt 2001). This debate is in no way concluded, and most people agree that the win-win outcome cannot be generalized across a range of different sectors and business organizations.

Regardless of motivation for pursuing sustainable development strategies, Welford sees corporate contributions towards sustainable development as both a supply and a demand side issue, i.e. that corporations should also influence consumers (Welford 1997). The framework he presents for making sustainable development operational for business encompasses the 7 Es: environment, employment, economics, empowerment, ethics, equity and education. Table 2.2 depicts the framework:

Table 2.2 A framework for sustainable production and consumption

	Supply-side issues Managing sustainable production		Demand-side issues Influencing sustainable consumption	
	Supplier pressure	Own practices	Influencing choice	Managing provision (esp. Services)
Environment				
Employment				
Economics				
Empowerment				
Ethics				
Equity				
Education				

Source: Welford (199x)

The table indicates that sustainable development is relevant for both the company's supply and demand side. On the supply side, the left column in the table, the company can influence its suppliers (for example through requirements regarding environmental management systems) in addition to its own sustainable development practices. On the demand side, the right column in the table, the company can both influence the choices made by its consumers (for example through encouraging "green" products) or through ensuring that especially services are being delivered in a sustainable way to the consumer (managing provision).

As a starting point the company should be clear about its commitment to each of the 28 areas defined in the matrix. The vision of the company should be made explicit through its stated policy. The operationalization of the framework should be based on three stages – planning, evaluation, and review:

Planning

- Define the environmental context in terms of the objectives consistent with moves toward sustainable development in the 28 areas identified in the matrix
- Consider the appropriate potential measures, including priority areas, for the industry under consideration
- Select the measures by their appropriateness to their purpose, cost-effectiveness, comparability, and compatibility with other measures

Evaluation

- Evaluate the current position and set feasible targets
- Implement the measures through systems that collect and report the required information and communicate this to the relevant staff and stakeholders
- Monitor and verify results and communicate this in an appropriate way to ensure credibility with stakeholders
- Act on results, including identifying what changes are needed to improve the measures and results

Review

- Review the overall performance measurement system, establishing whether it works satisfactorily and whether there are new areas where measurement is necessary
- The process should then continue, starting again at stage one, with the aim of continual improvement

This framework is one example of how private corporations may approach the concept of sustainable development in practice. The next section summarizes the World Business Council for Sustainable Development's understanding.

2.4 The WBCSD approach to sustainable development

The WBCSD uses the WCED definition as the point of departure for how its member corporations should integrate principles of sustainable development into their operations. In its 1997 Global Scenarios Project (WBCSD 1997) three partly overlapping sustainability domains were identified; (1) economy and technology, (2) governance and equity, and (3) ecology and demography. These three elements were seen to be embedded in the prevailing myths about how the world works.

Sustainable development, as defined by WBCSD in its Strategy 2000 Document, includes three pillars:

- economic growth
- ecological balance, and
- social progress

This is what in business terms is called the triple bottom line⁵, i.e. that corporations should report results along economic, social and environmental dimensions: "Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but

⁵ "Triple bottom line" was allegedly coined by the English strategic management consultancy, SustainAbility.

against the triple bottom line” (WBCSD Definitions: www.wbcsd.com/aboutdfn.htm).

In other words, WBCSD sees the *role* of business in sustainable development as:

“the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the Earth’s estimated carrying capacity”. (WBCSD 1999)

The WBCSD has developed a number of industrial responses to the need to move toward more sustainable production, the most well-known being the work on eco-efficiency (i.e. producing more, with the use of less resources). Some of these responses are outlined in Box 2.1 below.

Box 2.1 Strategic industry responses to sustainability by WBCSD

- Waste elimination and reduction: zero waste
- Reduction of toxic dispersion: zero emissions
- Enhanced resource productivity: Factor 4, Factor 10
- Clean production: processes, technologies, products
- Increased energy efficiency
- Closed loops: re-use, remanufacturing, recycling
- Design for X: design for recyclability, disassembly, environment added to design for manufacturability and assembly, serviceability, repairability
- Extended product durability, functionality, flexibility
- Dematerialisation: shift from product to service information
- Product stewardship: taking environmental responsibility for products throughout the life cycle
- Transparency: environmental and social corporate reporting, and performance measurement
- Ethical production: human rights, workplace conditions and practices, safety, living wages

More recently (April 2001) the WBCSD presented an agenda for progress towards sustainable development (WBCSD 2001). The central medium of this agenda for change is the mobilization of strengthened market systems. WBCSD suggests seven keys to how markets can, and partially already does, encourage sustainability:

Table 2.3 Sustainability through the market

Seven keys to success	Seven value propositions
1. Innovate	Novel technical and social resources – new ways to improve lives while boosting business
2. Practice eco-efficiency	Economic benefit and environmental performance
3. Move from stakeholder dialogues to partnerships for progress	Shared understanding, aligned action and social inclusion
4. Provide and inform consumer choice	A different type of demand enhancing appreciation for values that support sustainability
5. Improve market framework conditions	A stable, corruption free, socio-economic framework that facilitates positive change
6. Establish the worth of Earth	Environmental conservation and promotion of resource efficiency
7. Make the markets work for everyone	Economic benefit and social cohesion

3 Sustainable development and electric utilities

This chapter attempts to start operationalising the concept of sustainable development for electric utilities. As the discussions in the previous chapter have demonstrated, it is not straightforward to move towards practice starting from a concept of such elusiveness and complexity. However, we believe that one way to go is to start by identifying certain overall sustainable development objectives for electric utilities, and from these derive a set of strategies and actions that could contribute to meeting the objectives (sections 3.2 and 3.3). First, we start out in section 3.1 with a description of the role of electric utilities in relation to sustainable development dimensions.

3.1 Electric utility operations and sustainable development dimensions

In developing an understanding of the significance of sustainable development to the electric utilities, it is useful to examine the scope of activities undertaken by these corporations.

Utility operations

Perhaps first and foremost, like other commercial enterprises, electric utilities add economic value. This is the underlying economic rationale for their existence and the basis of their commercial performance. The creation of wealth is achieved through the technical and commercial process involved in electricity generation, distribution and its subsequent application in end-uses. In addition, electric utilities distribute the value created – to employees through remuneration, to owners through dividends, and to the state via taxation.

However, electricity is not like any other commodity. Electric utilities provide value as a public service provider. Different from other commodities, it is impossible to store electricity for later use and a credible supply of electricity is a prerequisite for economic development, social security and public welfare. Even a short-term blackout may have tremendous negative social and economic impacts. Taken further, a reliable electricity supply may be an important pillar of keeping or restoring national, and eventually global, stability and peace. Hence, in addition to the conventional economic value, electric utilities offer value to society through providing a reliable electric service.

As a relatively large and important sector in a country's economy, the power industry has other important economic impacts. Electric utilities employ large numbers of people, and procure goods and services from other businesses. As such, electric utilities form part of the matrix of business activities that make up a modern economy, and their policies and practices have economic and social effects in their community.

As an infrastructure industry, the process of value creation is very much associated with the ownership and operation of assets. Naturally, it is the type, use and location of assets has important environmental implications. As is well known, different power generation technologies have different environmental implications and much of the attention in the energy-environment area has focussed on the impacts of power generation. Environmental impacts largely arise from the operation of power generation technologies. Atmospheric pollutants from power plants, including CO₂, are commonly the focus of much environmental debate, as is the handling and storage of by-products such as radioactive waste from nuclear power facilities. Other environmental effects arise from hydropower and its impact on river systems and wetlands, and the possible effect on biodiversity as a result. Lastly, depletion of non-renewable energy resources, the fossil fuels, may affect the distribution of resources between generations analogous to the erosion of a capital base. In addition, there are impacts from power transmission and distribution equipment, particularly where power is transmitted across areas of natural beauty. As a consequence of the technical nature of power generation, electric utilities are also repositories of technological competence and a source of innovation. Given the increasing recognition given to the role of technology and innovation in economic development, this is an important dimension to the relationship between electric utilities and the economy.

In their operations many electric utilities, particularly those involved in the distribution and retail of power, interact with large numbers of consumers. The level of availability and cost of service provision affects the level of social welfare and security, particularly given that many consumers demand for electricity is inelastic. That is, the cost of providing electricity is typically far below a consumer's willingness to pay for it. This difference contributes to welfare in a society.

Importantly, in many developing countries access to electricity remains low. Not only does this have a negative effect at the household level, but social services such as health and education are constrained as a result. In addition, electricity is widely regarded as a necessary, albeit insufficient, condition for economic development. Where utilities are engaged in electrification activities, this can be an important contribution to poverty alleviation both directly through household access, and indirectly through the effects on social services and business development.

Finally, and in summary, electric utilities are corporate citizens of the countries in which they operate. They contribute to the economic welfare of that country, have social responsibilities, and influence the physical environment surrounding their assets and operations.

Electric utilities and sustainable development

The discussion above allows us to examine the ways in which electric utilities relate to the three core dimensions of sustainable development: social, economic and environmental.

The table below summarises the nature of these interactions. We have categorised various effects under the three dimensions: economic, social and environmental. While much of the debate in relation to sustainable development in the power sector has focussed on the environmental dimension, it is also necessary to include the effects in the other two areas.

Economic impacts essentially arise from the important role of power utilities as providers of infrastructure, and the value creation inherent in their activities. Further, they contribute to wider economic activity and growth through their business interactions with suppliers, and their role as repositories of technological competence and innovation.

Social impacts arise from electric utilities role as an employer and in the provision of energy services to households. This is particularly important in developing countries where access to electricity is not universal, and where electrification forms part of a poverty alleviation strategy. Further, relocation of residents in areas where hydropower dams are built has attracted attention due to the obvious social consequences. However, dams may also yield many positive social impacts for local communities for example through flood protection and local business development. Finally, electric utilities are corporate citizens, and their approach to social responsibility will have a myriad range of social impacts.

Table 3.1 Electric utilities and dimensions of sustainable development

Dimension	Effect	Mechanism
Economic	Value creation	Provision of goods and services
	Value distribution	Employment, taxation and dividends
	Multiplier effects	Procurement of goods and services
	Economic growth	Technological competence & innovation
Environmental	Pollution	Discharges from power generation plants
	Visual impacts	Physical assets in areas of beauty
	Biodiversity	Impact on natural ecosystems
	Resource depletion	Use of non-renewable resources
Social	Social welfare	Employment and supply of electricity
	Poverty impacts	Access to electricity
	Relocation	Construction of dams
	Other	Role as corporate citizen

In working towards the construction of obligations and commitments in the area of sustainable development for electricity utilities, it is necessary to start at a definition of the relevant principles and objectives. From there it is possible to define possible strategies and actions. Section 3.2 will attempt to set out a framework for overall sustainable development objectives, and chapter 4 will illustrate the implementation of these through case study material.

3.2 Principles, objectives and strategies

In this section we present overall sustainable development principles and objectives for electric utilities, based on the Bellagio Principles. These are chosen because they are internationally well-known and general enough to be of relevance to different groups pursuing sustainable development, including electric utilities. We then propose specific strategies of relevance to electric utilities in the economic, environmental and social areas. We emphasise, again, that these three areas are interconnected and that the different principles, objectives and strategies may not be mutually exclusive.

3.2.1 Principles and objectives

It is possible to view sustainable development itself as a guiding principle for electricity utilities. However, in order to operationalise this over-arching principle, it is useful to identify certain key principles, and corresponding objectives, which will inform the development of strategies and actions for electric utilities. We list here a provisional set of such principles and objectives, broadly based on the Bellagio Principles:

Table 3.2 Sustainable development principles & objectives for electric utilities

Principle	Objective
Guiding vision and goals	Develop a clear vision of sustainable development and define the environmental objectives that define that vision
Holistic perspective	Adopt a holistic and integrated view of the role and impacts of utility operations
Precautionary approach	Adopt a precautionary attitude and modify electric utility operations where possible, consistent with scientific and technical understanding, to prevent serious or irreversible environmental degradation
Essential elements	Consider the essential elements of economic development, environmental quality and social equity in utility operations
Adequate scope	Adopt a time horizon long enough to capture both human and ecosystem time-scales where possible; and deal with a large enough space to capture local and long-distance impacts.
Practical focus	Develop practically oriented strategies, make use of standardised procedures and measurements, and target a limited number of activities.
Openness	Apply transparency in operations, including measurement and interactions with government and the public
Effective communication	Report on activities and progress, and disseminate information in an appropriate manner
Participation	Adopt a participatory approach to operations and evaluations
Ongoing assessment	Continually assess progress towards objectives, and re-evaluate strategies in the light of these evaluations.
Institutional capacity	Contribute to greater understanding and capacity of sustainable development and the role of electric utilities.
Efficiency	Initiate processes to measure and improve efficiency

3.2.2 Strategies

Drawing on the broad principles and objectives listed above, we present a set of strategies under the headings of environmental, economic and social. These strategies contribute to fulfilling the intent of the overarching principles and objectives stated in 3.2.1.

Environmental

Much of the debate in sustainable development has focused on environmental impacts. The following strategies represent a synthesis of discussion among project participants:

Table 3.3 Environmental strategies

Strategy	Comment
Comply with environmental regulations	All countries set certain environmental standards. At a minimum, an electric utility should comply with all these regulations as issued by central and local governments of the countries that the utility operates in.
Maintain international standards & best practice	Electric utilities should seek to bring their environmental management systems in line with internationally recognised and verified standards (e.g. ISO 14000) and international best practice.
Integrate environmental (and social) issues into planning and decision making	Electric utilities should seek to introduce environmental (and social) factors and procedures into corporate planning and decision making. In many cases this will involve environmental impact assessments, recognition of externalities (both positive and negative) and consideration of resource depletion in investment planning.
Develop GHG strategies	The global threat of human induced climate change puts a responsibility on electric utilities as large emitters of green house gases. Electric utilities should therefore develop strategies for dealing with these emissions.
Develop low pollution technologies and measures	Electric utilities manage the continual improvement of emissions to air, discharges to water, radiation and noise and develop cost-effective low pollution and environmental impact technologies.
Promote renewable energy	Electric utilities should seek to exploit opportunities to develop renewable energy, both in terms of their use to supply electricity and in research programmes.
Promote energy and resource efficiency	Electric utilities should seek to promote cost effective energy and resource efficiency in their own operations, among their customers, and in the broader economy. This implies reducing energy and material waste to a minimum, and recycle/reuse or dispose safely of remaining waste.
Undertake environmental education and training	Electric utilities should raise awareness and skills among employees and other stakeholders concerning environmental issues. In addition, utilities should contribute to education and training in environmental issues.

Table 3.4 Environmental strategies (cont.)

Demonstrate environmental leadership	Electric utilities should demonstrate environmental leadership by participating in national dialogue, setting standards for other industries, and supporting environmental initiatives.
Sustainable development reporting	Electric utilities should regularly report on their performance against “the triple bottom line”, to the extent possible, and should develop and use appropriate indicators to measure performance in an unbiased manner. External verification of data would add greater credibility and transparency.
Demonstrate responsible stewardship of natural resources	Electric utilities own and/or have access to vast amounts of land and large commercial and industrial assets. Utilities must be vigilant at every step in the process of asset management: from site selection and development (e.g., economic profiling, visual impacts), through effective use and maintenance (e.g., vegetation management, erosion minimization) to appropriate decommissioning (e.g., community and economic development redeployment).
Support key nature conservation programmes	Electric utilities should initiate or support existing conservation and biodiversity efforts related to impacts on natural habitats from utility operations.

Economic

Economic strategies are more closely attuned to traditional objectives of electric utilities. We present here a selection of such strategies:

Table 3.5 Economic strategies

Strategy	Comment
Add to shareholder value	Electric utilities should seek to add to shareholder value. This objective should govern all investments and operational planning, as well as mergers and acquisitions.
Deliver competitive return on assets/equity	In a similar manner, electric utilities should seek to meet targets for the return on assets and equity. Only if a minimum return can be achieved in the long term, will assets be maintained and so the supply of electricity sustainable.
Improve productivity and efficiency	Electric utilities should seek to improve productivity by seeking improved operational and investment efficiencies.
Apply transparent, fair and affordable prices	Electric utilities should seek pricing and market reforms that are fair and affordable
Support business development	Electric utilities should seek to support business development.
Support R&D and training	Electric utilities should seek to develop technological capabilities by supporting R&D and training programmes.
Procurement	Leverage buying power to improve environmental and social performance
Liabilities and risk management	Seek to reduce environmental liabilities and mitigate risks

Social

Social strategies are harder to identify with clarity. We present below a selection of common social strategies for electric utilities.

Table 3.6 Social strategies

Strategy	Comment
Improve public quality of life	Electric utilities should strive to improve the quality of life through electrification and value added services
Expand access to electricity	In developing countries, access to electricity remains low. Electric utilities can contribute to poverty alleviation through promoting access to electricity, particularly for services such as health and education.
Provide reliable service	Electric utilities should develop and maintain electricity supply and distribution systems to provide reliable service. This includes not only consideration of severe weather and aging utility infrastructure, but also institutional instability and potential social unrest.
Consult stakeholders and provide information	Electric utilities should consult stakeholders where appropriate, and make use of local government/community forums for achieving this. Information on the utility's actions and operations should be provided.
Support employment	In countries of under-employment, the development of small and medium businesses is a key strategy to create jobs – utilities can support this policy in their procurement practices.
Support key social programmes	The most important social issues will differ from country to country. Electric utilities should support initiatives in the high priorities, e.g. education, promotion and support for local industries, AIDS awareness.
Price power at affordable levels	Fuel poverty affects vulnerable communities, particularly in developing countries – electric utilities can contribute to alleviating this through pricing power at affordable levels.
Corporate Social Responsibility (CSR)	Electric utilities should develop policies and codes of conduct on CSR issues such as general human rights, indigenous rights, child and forced labour and non-discrimination
Health, safety and employee welfare	Electric utilities should strive towards high levels of health and safety standards in all aspects of operations, as well as generally high employee welfare and satisfaction.
Labour standards	Electric utilities should uphold freedom of association and the effective right to collective bargaining.

3.3 Actions towards sustainable development

The strategies stated in section 3.2 consist of a range of actions and activities that together contribute to reaching the overall objectives following from the Bellagio principles. While we do not intend to detail the full range of strategies that can be used to achieve the objectives outlined above, we will make use of case studies and examples to illustrate the different activities which may be part of the different strategies.

Chapter 4 will present these illustrations. We will attempt to collate case studies that cover a range of the objectives listed above, and will choose examples that may be regarded as the emergence of best practices. Further, these cases may be seen as the basis for other utilities to build their own strategies and programmes, learning from the experiences of others.

4 Case illustrations

In this final chapter we present a selection of case studies. These are arranged under 19 topics as shown in the table below. For most case studies, there are many utilities who undertake activities in the area. It has not been possible to reflect all of this, and we have been forced to select specific utilities in order to limit the amount of information to be presented.

Table 4.1 Case studies

Topic	Source material
Maintain international standards & best practice: Environmental management	Kansai, TEPCO, British Energy, Powergen, Ontario Power, Eskom
Integrate environmental (and social) issues into planning & decision making	TransAlta, Ontario Power, Eskom, BC Hydro
Develop low pollution technologies and measures	TEPCO, Kansai, Eskom, Exelon
Develop GHG strategies	TransAlta, Ontario Power, TEPCO, Kansai
Promote renewable energy	Western Power, EPCOR, Exelon, Powergen, Eskom, BC Hydro
Promote energy and resource efficiency	TEPCO, Ontario Power, Eskom, Exelon, BC Hydro
Environmental education & training	Eskom, Western Power, Exelon
Sustainable development reporting	Eskom, TEPCO, Ontario Power
Demonstrate responsible stewardship of natural resources	TEPCO, EPCOR, Ontario Power, TransAlta, Eskom, BC Hydro
Support nature conservation programmes	Kansai, Exelon, Eskom, Ontario Power
Support key social programmes	Eskom, Western Power, PowerGen
Expand access to electricity	Eskom
Consult stakeholders & provide information	EPCOR, TransAlta, Ontario Power, BC Hydro
Corporate Social Responsibility	TransAlta, Exelon, Ontario Power
Health, safety & employee welfare, and labour standards	British Energy, TransAlta, Exelon, Ontario Power
Support R & D and training	Kansai, Eskom, Ontario Power
Support business development	Ontario Power
Procurement	Ontario Power
Liabilities and risk management	Ontario Power

4.1 Environmental strategies

4.1.1 Maintain international standards and best practice: Environmental management systems

Introduction

In the same way companies have systems for accounting, budgeting etc, a company devoted to eco-efficiency needs an environmental management system (EMS) within which environmental performance goals can be set, managed and achieved. International EMS standards have been developed for voluntary use by different types of organizations in recent years. One such set of standards is the ISO 14000, where ISO 14001 is an EMS specification with guidance for use.

The ISO 14000 standards have been designed by the International Organization for Standardization (ISO) since 1991 to help enterprises meet their EMS needs. They consist of a set of documents that define the key elements of a management system that help an organization address the environmental issues it is facing. The management system includes the setting of goals and priorities, assignment of responsibility for accomplishing them, measuring and reporting on results, and external verification of claims. The standards do not set performance values. They provide a way of systematically setting and managing performance commitments. In other words, they are concerned with “how to” achieve a goal, not “what” the goal should be. A key characteristic of these standards is their voluntary nature, i.e. there is no legal requirement to use them.

Table 4.2 Progress towards ISO 14001 certification

Company	Progress
Kansai Electric Power	Several of the company’s thermal power stations are certified
TEPCO	Facilities with certification: Kannagawa Hydro Plant Construction Office, Yamashi Branch Office. Subsidiaries with certification: Tokyo Electric Power Environmental Engineering Co, Toshin Building Co, Kandenko Co, Takaoka Electric Mfg Co
British Energy	Facilities with certification: All UK power stations, the company’s two largest offices.
PowerGen	Electricity and gas elements of UK business are certified. Other certified business units: Cottan Development Centre, Powergen Energy Solutions, Powergen Combined Heat and Power, Property Services, Tapado do Outeiro power station (Portugal)
Ontario Power Generation	All major facilities are certified as well as Corporate EMS.

Progress towards the ISO 14001 standard

Environmental management at **Kansai Electric Power** in Japan is based on the principles of Total Quality Management. Based on the company’s environmental policies and action plans, all divisions, departments, and branches make their own plans and goals that they follow in their environmental improvement activities. They independently check and review the results of these activities. In order to improve the company’s EMS, in 1997 Kansai began building an EMS compliant

with ISO 14001 starting with the fossil fuel power stations. The result has been a vast improvement in the ability to conserve energy and resources and a higher awareness of these issues among employees. Based on these results Kansai began environmentally-oriented activities at Mihama Power Station (nuclear) in 1999 and at the electric power and sales offices during 2000. In 1999 the Miyazu Energy Research Centre and Himeji No.1 Power Station (both fossil fuel) achieved ISO 14001 certification from third party institutions. Kansai has continued in 2000 to make several more fossil fuel power stations ISO 14001 compliant.

The EMS in force at the branch offices and power stations of **Tokyo Electric Power Company (TEPCO)** in Japan has been in operation for nearly five years. In order to cope with increasingly and complicated environmental problems, TEPCO perceives the necessity to further improve the EMS and employ sophisticated environmental management techniques. Specifically, TEPCO makes it a policy to operate the existing system more efficiently and incorporate continual improvements. In addition, acquisition of ISO 14001 certification is considered to be one of the means by which TEPCO can receive a third party's objective evaluation. Between November 1999 and March 2000, the Kannagawa Hydro Power Plant Construction Office and the Yamanashi Branch Office gained certificates of the standard. Subsidiaries and affiliated companies, such as Tokyo Electric Power Environmental Engineering Co., Inc., Toshin Building Co., Ltd., Kandenko Co., Ltd., and Takaoka Electric Mfg. Co. Ltd., also acquired ISO 14001 certificates. TEPCO intends to continue making improvements in company-wide environmental management activities through the enhancement of the EMS.

All of **British Energy's** UK power stations and the company's two largest offices are now certified to ISO 14001. Torness was the latest site to gain certification, which it achieved in March 2000. The EMS at British Energy covers all aspects that could affect the environment, from resources used to waste produced. A key feature of the EMS is the identification of significant environmental impacts and the setting of appropriate environmental objectives and targets each year. Two of British Energy's sites, Sizewell and Eggborough, also have EMAS (the EU Eco-Management and Audit Scheme) accreditation, which additionally requires publication and external verification of a local environmental statement. In 2000, British Energy developed an Environmental Risk Assessment Process to formalize the identification of improvements to reduce environmental impacts. This uses a scoring mechanism to establish whether plant is high or low risk and whether the required barriers are in place to prevent pollution. This is a development of its existing ISO 14001 arrangements and is now being implemented at the company's sites and will assist the target setting process. British Energy took part in the Business in the Environment (BiE) survey of FTSE 250 Index Companies last year, which provides an external benchmark of environmental performance. British Energy was placed 14th (out of over 150 companies taking part) with a score of 89 per cent, compared to an FTSE100 average score of 73 per cent. In the utilities sector, British Energy had the top score amongst the electricity generators. British Energy has undertaken audits of its major contractors and worked to raise their awareness of the company's environmental standards. British Energy also began to assist its major customers in implementing ISO 14001 within their companies.

Powergen in the UK requires all business units with a significant impact on the environment to implement an EMS. PowerGen has designed its EMS to be flexible enough to be applied to all activities, from operating power stations through to running office buildings. The cornerstone of the EMS is the environmental policy statement. This outlines the company's vision and aims with regard to its impact on the environment. During 2000, Powergen re-issued its environmental policy statement to take account of the major changes in the make-up of the Powergen Group that have occurred over the last few years, such as the fact that it now runs a distribution network. The company also took the opportunity to simplify the wording of the statement, so that it can be easily understood by all stakeholders. For the first time, Powergen committed itself to exceeding, where possible, minimum legal requirements for environmental protection.

Powergen's EMS is fully compliant with ISO 14001, and achieved corporate certification to ISO 14001 for the electricity production and gas elements of its UK business on 1 January 1999. As part of its commitment to retaining this certification, a number of additional business units achieved certification for the first time during 2000. These included Cottam Development Centre, Powergen Energy Solutions, Powergen Combined Heat and Power (O&M), Property Services, and Tapada do Outeiro power station in Portugal. In addition, Killingholme power station successfully completed its first reassessment audit and is now certified for another three years. Powergen has a programme in place to ensure that its distribution business is certified by the end of 2001, and is now starting to work towards implementing the standard within LG&E in the US.

To ensure consistent performance across its generating fleet and continual environmental improvements from all its facilities, **Ontario Power Generation (OPG)** policy requires that all environmental management systems (EMS) be accredited under ISO 14001. In 1997, OPG's Darlington nuclear station was the first generating station in North America to become ISO registered. In 1999, OPG was one of the first electrical utilities in North America to achieve ISO 14001 accreditation at all of its major facilities. In 2000, OPG retained its accreditation for all its facilities and the Corporate EMS.

The following benefits have already been derived from the introduction of ISO 14001 certified EMS:

- year-over-year improvement in spills and regulatory compliance performance;
- achieved lowest-ever air emission rates in 2000;
- attained 100 per cent of corporate environmental performance targets in 2000;
- no significant environmental events (charges, investigations, orders, convictions, fines) reported since 1998;
- improvements in reporting and accountability systems, contractor management, risk management and strategic planning.

4.1.2 Integrate environmental (and social) issues into planning & decision making

Introduction

The move up the ladder of a company's commitment to sustainable development can go through phases of gradual improvements of environmental and social performance. The ideal end stage is a situation where principles of sustainable development are an integrated part of a company's business strategy and long term planning. In other words, considerations of environmental and social issues are proactively included in all business decisions, and influence the future path the company is taking. Many utilities are moving in this direction, often spurred by the global climate change issue.

Planning and decision making at TransAlta, Canada

The changes in business climate during the late 1980s and early 1990s mainly due to deregulation of the power markets, and the increasing concern about climate change, stimulated an intensive analysis and repositioning of TransAlta's corporate development strategy. Sustainable development emerged as one critical aspect of TransAlta's strategy for succeeding in the new world of being a player in an emerging deregulated market, concerned about the environmental and social impacts of energy production and consumption.

The risks associated with its high emission profile have stimulated TransAlta toward proactively integrating sustainable development considerations into all business decisions. TransAlta management has been working over the past 10-15 years to integrate sustainable development as a core element of the company's business strategy. As a result, TransAlta has gained international recognition as an energy company actively pursuing environmental initiatives, illustrated by the selection as a member of the Dow Jones Sustainability Group Indexes for the second year in a row. TransAlta's strategy is particularly illustrative for other companies and industries facing the need to be more sustainable when they have huge "sunk" costs in assets and infrastructure.

Two long-standing keys to TransAlta's approach are:

- Effective networking: broadly engaging stakeholders, and, in more focused forums, business partners, to understand needs, gain knowledge about the issues, and develop and test new concepts;
- Development and use of economic instruments: costing of CO₂ in-house (see case study on GHG strategies below).

Sustainable development at TransAlta has been consistently led by the President and CEO, with a high degree of company-wide involvement. TransAlta's vision, and its operationalisation, is largely a story of people and strong management: a visionary leader; a strategic Vice President of Sustainable Development; employees motivated into action; senior managers committed to implementation and provided with incentives and tools for change.

For managers, the sustainable development programme became more firmly operationalised when clear targets for performance were implemented.

Incentives/recognition/reward schemes were incorporated to include sustainable development targets, the CO₂ costing programme being the best-known incentive programme. Additionally, commitment of middle managers improved when leadership shifted to the business units, away from the corporate group. With tangible, measurable goals and objectives, and decision latitude, middle managers could perform in their own territory.

Planning and decision making at Eskom, South Africa

Eskom's Integrated Strategic Electricity Planning (ISEP) process is intended to provide the strategic framework for projections of supply-side and demand-side options that will need to be implemented to meet future energy needs.

The ISEP Steering Committee, a subcommittee of Eskom's Management Board, comprises four working groups, namely Demand Side, Supply Side, Integration and Externalities, and an Environmental subcommittee.

The ISEP process involves forecasting future energy requirements in conjunction with the load profile, which varies daily and seasonally, and determining an appropriate combination of identified demand-side and supply-side options in the form of plans. The economic factors, risk analysis and environmental assessments of all these plans are addressed and the preferred plan selected.

A component of the ISEP process is the consideration of environmental factors. The Environmental Co-ordination Group (ECG), a subcommittee of the ISEP Steering Committee, continued its work on integrating environmental issues into the ISEP process. A strategic environmental assessment (SEA) approach was adopted and the work programme defined by the steps required for an SEA. Investigations were carried out in the following areas:

- Environmental life cycle assessments
- Supply-side environmental siting issues
- Legislative changes and influences
- Greenhouse gas mitigation and climate change issues, including CDM opportunities
- Water quality and quantity considerations
- Integration of the Environmental Decision Support Framework and the Energy and Environment Roadmap into the ISEP programme
- Sensitivity studies on the ISEP plans and determination of environmental impact.

Planning and decision making at Ontario Power Generation, Canada

Sustainable development strategies are integrated into Ontario Power Generation (OPG)'s five-year business planning process to ensure continual progress towards sustainable energy development.

The following processes support this integration:

- OPG's sustainable energy development commitment has been clearly articulated and communicated to all employees;

- A Sustainable Development and Decision-Making course has been integrated into the leadership training for 500 of OPG's most senior managers;
- Environmental guidelines are incorporated into the annual business planning process; These guidelines establish the objectives set out by the company in areas pertaining to energy efficiency, biodiversity management, emissions reduction, R&D, waste management, etc.;
- Aspects of sustainable development are factored into the development of Business Case Summaries for all major investment decisions;
- A Sustainable Development Council of senior OPG executives is mandated to support the development of OPG's environmental and social responsibility agenda and to facilitate strategy implementation;
- Sustainable development strategies and implementation status are reviewed annually by OPG's Board of Directors;
- Performance pay for some 500 senior managers is linked to the company's environmental performance;
- Through "green procurement policies" OPG will use its buying power to leverage the availability of environmentally friendly products from suppliers;
- External benchmarking is used to identify best practices.

Planning and decision making at BC Hydro, Canada

BC Hydro has embarked on a new program focusing on triple bottom line decision-making at each of its hydroelectric facilities. In response to ever-increasing demands for the province's abundant water resources, Water Use Planning was jointly developed by BC Hydro, the British Columbia (provincial) government and the Canadian (federal) government, in consultation with First Nations and the public. The overall goal is to explicitly consider environmental, social and economic factors in operating decisions to find a sustainable balance between competing water uses.

In order to understand the nature and value associated with different uses of water, Water Use Planning involves open, inclusive decision-making process with governments and stakeholders. Participants apply their values and interests in explicitly trading off water use for hydroelectric, industrial, recreational, culture and community, flood management, and fish habitat under different possible operations. Participants are supported by a transparent decision structure, environmental and social research and technical analysis. They seek multi-party consensus on recommendations for water management at BC Hydro facilities. The resulting operational changes embody sustainable decision-making by incorporating economic, social and environmental interests.

To date, two plans have been completed, 13 are underway and the balance are scheduled to begin within the next year. Although Water Use Planning may result in reduced power generation at facilities, this cost is balanced against business value in terms of reduced regulatory costs and increased operational flexibility and stability as well as environmental and social benefits that reflect societal

values. In one case to date, the WUP resulted in improvements for all major interests.

4.1.3 Develop low pollution technologies and measures

Introduction

As a result of increasingly tight environmental regulation in western countries, companies have been stimulated and forced to develop better pollution control measures, including improved abatement and pollution control technologies, fuel switching etc. Many utilities have today much lower emissions to air and water than required by law, and improved pollution control measures is an important part of their sustainable development strategies. We look at several cases of controlling local air pollution, while leaving greenhouse gas strategies to a separate case study.

Measures to Control SO_x and NO_x in Thermal Power Stations at TEPCO, Japan

Major air pollutants released from thermal power stations include sulphur oxides (SO_x), nitrogen oxides (NO_x) and particles. The SO_x and NO_x emissions from TEPCO's thermal power stations (recorded in fiscal year 1999) remained as low as 0.14 grams/kWh and 0.22 grams/kWh of thermal power output (or 0.07 g/kWh and 0.10 g/kWh of total power output), respectively. These emissions are at very low levels compared with other developed countries worldwide. Control measures at TEPCO fall in three categories:

- *Fuel measures:* Use of fuels that are environmentally acceptable, such as low-sulphur fuel oil and crude oil, as well as LNG, which does not emit SO_x, soot and dust, and which is effective in reducing the emission of NO_x.
- *Facility measures:* Removal of pollutants using flue gas desulphurisation and denitrification facilities, electrostatic precipitators and other equipment, and control of the production of pollutants through improvements in combustion methods.
- *Operational measures:* Complete combustion control, monitoring of pollution sources, etc.

TEPCO has hitherto controlled **SO_x emissions** chiefly by applying fuel measures. As a result, the average sulphur content of fuels such as LNG and oil used at its thermal power stations is now at the very low level of 0.04 per cent (including the effect of flue gas desulphurisation). TEPCO has actively introduced low-sulphur fuel oil, such as Minas crude oil, in its power stations. In 1970 the company adopted LNG, a no-sulphur gas, to fuel its Minami-Yokohama Thermal Power Station. This was the first instance in the world that LNG was put into use as fuel for thermal power generation. At present, natural gas is in use at ten of TEPCO's thermal power stations, accounting for about 80 per cent of the fuel being burned for thermal power generation.

Regarding facility measures for SO_x control, flue gas desulphurisation facilities built on the wet lime gypsum process (whereby SO_x are removed from flue gas by reaction with lime) are installed in Units 1 and 2 of the Yokosuka Thermal Power

Station. Flue gas desulphurisation technology is intended as a supplement to fuel measures. More advanced flue gas desulphurisation systems will be set up at Hitachinaka Thermal Power Station and Units 5 and 6 of the Hirono Thermal Power Station, which is to be fuelled solely by coal.

TEPCO's efforts to control **NO_x emissions** from its thermal power stations include fuel, facility and operational measures. The company has been encouraging the use of LONG, a fuel that contains no nitrogen, burns evenly and hence is conducive to a reduction of NO_x emissions. Below are some typical methods by which NO_x production is controlled by restricting working temperatures within the burners of boilers and gas turbines.

- Methods for improving combustion by boilers
 - *Flue gas recirculation*: this method reduces the oxygen content of combustion air by mixing it with a portion of flue gas so as to slow down the combustion process
 - *Two-stage combustion*: Combustion air is led to the boiler in two stages (burner and over-airport) so that the combustion process can be slowed down
 - *Low-NO_x burner*: Burners which restrict the high-temperature burning zone are used
- Combustion improvement method for gas turbines
 - *Premixed combustion process*: Fuel and air are mixed in advance to achieve uniformity and stability of combustion
 - *Installation of flue gas denitrification facilities*: TEPCO has been making use of flue gas denitrification facilities. Flue gas denitrification facilities are now set up in several of TEPCO's thermal power stations: the Chiba Thermal Power Station and the Yokohama Thermal Power Station.

Pollution control at Kansai Electric Power Company, Japan

Like TEPCO, Kansai has highly developed measures to deal with SO_x and NO_x emissions using many of the same strategies. For example, by the end of 1999 Kansai had installed a total of 10 flue gas desulphurisation facilities at power stations with a total generating capacity of 3,330 MW. Together with the use of low sulphur fuel, these facilities are contributing greatly to the low levels of SO_x emissions at Kansai: the rate of SO_x emissions per unit of fossil fuel power generation is 0.08g/kWh. Kansai's measures to control NO_x emissions include firstly the improvement of the combustion system by combining the two stage combustion method and the exhaust gas recirculation combustion method, and by installing low NO_x burners. Furthermore, Kansai has converted the boilers at 14 out of 17 existing fossil fuel power stations to use LNG or high quality oils, which contain little nitrogen. In addition to improving combustion and using low-NO_x fuels, Kansai has more than 46 denitrification facilities with a total capacity of 15,380 MW. NO_x emissions per unit of fossil fuel power generation are 0.15 g/kWh, which is about half of the Japanese average (0.31 g/kWh).

The following provides an illustration of measures taken by Kansai in areas other than NO_x and SO_x emission control.

- To reduce the **emissions of particulates**, all boilers at Kansai are equipped with high efficiency electrostatic precipitators in order to achieve the lowest possible level of particulates.
- Measures to prevent **noise and vibration** from all areas of Kansai's operations include low-noise design, appropriate foundation design, indoor installation and appropriate equipment location.
- In the area of **chemical matters** a public system of Pollutant Release and Transfer Register (PRTR) has been in place in Japan since 1999. An important example is **dioxins** which conventionally have been dealt with through restrictions on incinerators. These restrictions have gradually been tightened also covering small incinerators in Japan. In addition to abiding by incineration laws, Kansai is striving to control the amount of waste material incinerated by for example replacing incineration with recycling of materials.

Emission controls at Exelon, United States

Exelon has a range of activities aimed at reducing emissions, including both conventional technologies, as well as other strategies.

Scrubber Technology Projects. Twenty years ago PECO Energy (Exelon subsidiary) installed scrubber systems at its Cromby and Eddystone power plants. The installation of the magnesium oxide scrubber systems was the first commercial one of its kind in the United States. The cost of building the scrubbers and magnesium oxide regeneration facilities was more than \$300 million. In addition to meet the acid rain requirements of the Clean Air Act amendments of 1990, the company and other joint owners of the Conemaugh Generation Station in western Pennsylvania installed scrubbers at the plant. This installation used a limestone system. In December of 1994, Conemaugh Unit 1 went on line with a scrubber system that reduced the unit's sulphur dioxide emissions by approximately 95 per cent. A similar system was installed at Unit 2 in the fall of 1995. Installation of the scrubbers made Conemaugh one of the first power plants in the country to be modified with scrubbers to meet all the mandates of the 1990 clean air amendments.

NO_x Emission Reductions. PECO Energy has undertaken several projects to lower emission of nitrogen oxide to the atmosphere. New coal burners and a Selective Non-catalytic Reduction System were installed at the Cromby Unit 1. Also, the company and its partners is investing approximately \$165 million to install a Selective Catalytic Reduction System (SCR) at both generation units for the Keystone power generation plant. The SCR system will reduce nitrogen oxide emissions by 90 per cent during the ozone season for each year of the 20 –year project life. The commercial operation date will be May 2003.

Additional NO_x emission limitations are expected beginning in 1999 as a Memorandum of Understanding (MOU) among the northeast Ozone Transport Commission states is implemented. This MOU will require up to a 65 percent reduction in NO_x emissions from electric generation and other large stationary sources when compared to a 1990 baseline. The MOU also calls for an additional reduction from covered sources of up to 75 percent from the 1990 baseline beginning in 2003.

Natural Gas Vehicles PECO Energy currently operates natural gas vehicles (NGVs) and nine compressed natural gas fueling stations in south-eastern Pennsylvania. NGVs can reduce ozone-causing emissions by up to 85 percent as compared to conventional gasoline powered vehicles. The Company's efforts to utilize and promote NGVs earned PECO Energy a Business for a Green America Award from the Pennsylvania Resources Council in 1995. The Company maintains leadership roles on the Department of Energy sponsored Greater Philadelphia Clean Cities programme and the Northeast Clean Corridors Project.

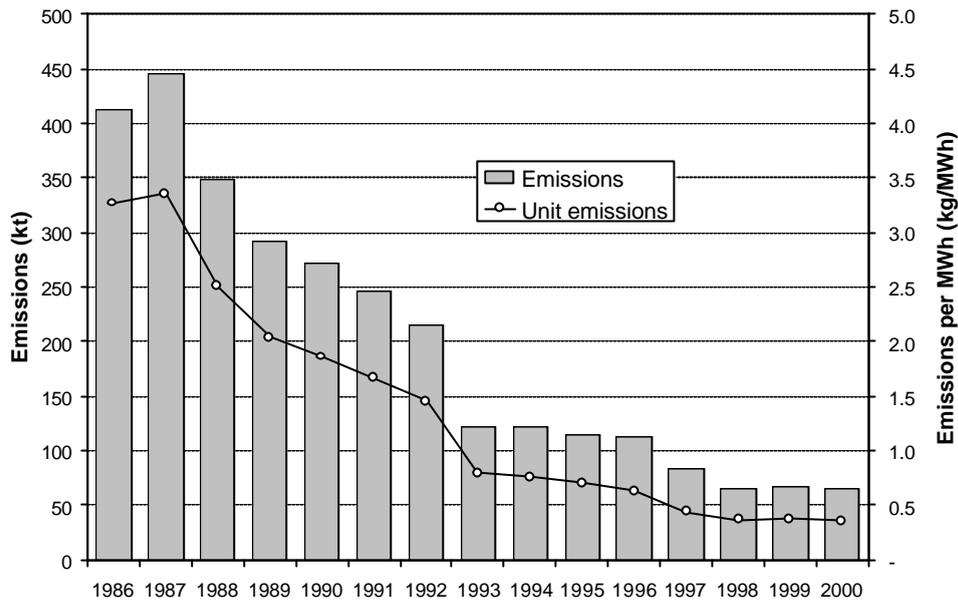
Environmental Protection Agency Natural Gas Star programme PECO Energy has entered into a partnership with the United States Environmental Protection Agency's (EPA) Natural Gas STAR programme. This programme encourages gas companies to voluntarily adopt technologies and practices that profitably reduce emissions of natural gas that contribute to the greenhouse effect. EPA's Natural Gas STAR programme has over 67 partners that represent the gas distribution, gas transmission and U.S. natural gas production industries. The programme has been credited with saving 26 billion cubic feet of methane. During 1997, PECO Energy estimates it saved almost ten million cubic feet of natural gas as a result of its participation in the programme. Some of the actions taken by the Company to reduce emissions include changes to distribution and transmission system practices and procedures, replacing emissions from landfill gas combustion are significantly lower than for comparable generation from fossil fuels.

Particulate emissions control at Eskom, South Africa

Eskom has focused on reducing particulate emissions from power stations, and has reduced relative emissions by 90 per cent over the last 15 years. Ambient measurement of SO_x and NO_x are consistently below national guideline levels.

Eskom has set an internal target to further reduce overall particulate emissions over the next five years to an average of 0.28kg/MWh sent out. A five-year strategy has been compiled in order to implement a programme to meet the internal target.

Figure 4.1 Eskom particulate emission reduction since 1986



4.1.4 Develop Greenhouse Gas (GHG) strategies

Introduction

A central element of the environmental impacts of electricity production acknowledged in recent decades, is the changing climate largely due to GHG emissions from fossil fuel combustion. Most utilities acknowledge this threat, and many implement GHG emission strategies to reduce their climate impact, also beyond mere compliance with environmental regulations in respective countries.

TransAlta's GHG strategy

TransAlta generates most of its electricity by burning fossil fuels such as coal and natural gas. A by-product of this form of generation is carbon dioxide. Hence, a central element of TransAlta's first sustainable development strategy, as mentioned above, was a strategy for controlling its GHG emission.

In 1994, TransAlta set a stabilisation goal to return GHG emissions to 1990 levels by 2000, in parallel with the target agreed at the conference in Rio (Earth Summit). This was instrumental in operationalising the commitment to sustainable development, as it required action by all TransAlta's business units.

One particularly advanced practice at TransAlta was a programme for costing CO₂ emissions internally as a signal and incentive for action. This involved creating an internal market for CO₂ emissions, whereby the generation side of the company would pay other business units for any emission reductions they were given as offsets. Internally, TransAlta began charging C\$2/tonne for CO₂ as a way of: changing people's thinking (to understand that CO₂ emissions have a cost); stimulating creativity; and providing an internal incentive to reduce. This internal emission trading programme was characterized symbolically as a "helping hand"

across business functions. As a result people began to look at operations in a different way. In some cases they found that it was possible to reduce emissions at no cost. Once the programme had mobilised people and changed their way of thinking, it was phased out.

In 1995, TransAlta submitted its “Greenhouse Gas Action Plan” in response to the Voluntary Climate Change and Registry (VCR) programme. It provided a five-point plan for achieving its goal of returning its net contribution of GHGs to the atmosphere to 1990 levels by 2000. The plan included:

- Improving the efficiency of TransAlta’s operations
- Promoting energy efficiency initiatives in customer operations
- Purchasing renewable energy
- Developing GHG offset projects, both domestically and internationally
- Developing cogeneration facilities to supply high-efficiency energy with lower overall emissions

In 2000, TransAlta met its 1994 commitment to reduce its Canadian net contribution of GHGs to the atmosphere to 1990 levels. By year-end 2000, TransAlta was 4.7 million tonnes below its 1990 level. TransAlta’s corporate net rate of GHG emissions per MWh has improved by 23 per cent since 1990.

TransAlta had a range of carbon offset and emission trading activities in 2000. Carbon offsets refer to domestic or international actions, apart from normal operations, that reduce, absorb or avoid GHG emissions.

The Uganda Cattle Feed Project is a unique offset project designed in accordance with the proposed Clean Development Mechanism (CDM) of the Kyoto Protocol. TransAlta is providing the Global Livestock Group Inc. with financing to manufacture, distribute and sell a feed supplement proven to improve the digestive process of cattle. The healthier cattle will emit less methane and produce better quality and greater quantity of milk and meat. Methane is a GHG 21 times more potent than CO₂. With this project TransAlta will receive rights to 28 million tonnes of CO₂ equivalent reductions over the next 32 years.

Another offset project in Canada selling fly ash from its coal-fired generation and replacing other ingredients in the production of cement, provided 97,000 tonnes of CO₂ offsets.

Furthermore, TransAlta carried out two groundbreaking emission trades in 2000. The first was the world’s first trans-Atlantic trade with the German electric company Hamburg Electric. TransAlta purchased emission reductions for the equivalent of 24,000 tonnes of CO₂. The second major trade was a 210,000-tonne CO₂ equivalent emission reduction credit sale to the U.S. integrated oil company Murphy Oil.

In addition, TransAlta’s GHG emission reduction activities in 2000 included purchase of renewable energy in Alberta through the Small Power Research and Development Act. Through this programme, TransAlta has signed long-term power purchase contracts at legislated prices with a number of independent renewable energy providers. TransAlta’s gas-fired power plants also contribute

emission reductions by reducing the need to run more carbon-intensive generation such as coal.

A proposal for a second phase of TransAlta's GHG strategy was put forward in March 2000. The proposal suggests reducing TransAlta's Canadian net CO₂-emissions from existing operations to zero by 2024. Using a combination of carbon offsets, emission trading, new technology and investments in renewable energy, TransAlta believes it is possible to neutralize or eliminate its net contribution to global warming.

Ontario Power Generation's GHG strategy

Ontario Power Generation's (OPG) commitment to stabilize net GHG emissions at 26 Tg by 2000 was made in 1995 by its predecessor company, Ontario Hydro, to support Canada's international pledge to reduce GHG emissions.

OPG met this target despite a 72 per cent increase in fossil fuel generation since 1997 as a result of its Nuclear Improvement programme. OPG achieved its stabilization objectives through the implementation of its GHG Action Plan. The plan, first developed in 1995, is updated and submitted annually to Canada's Climate Change Voluntary Challenge and Registry Inc. OPG's most recent plan for 1999 earned the designation of "Gold Champion Level Reporter". OPG's GHG management plan is based on five programmes:

- Reducing GHG emissions through nuclear improvement; OPG's Nuclear Improvement programme involves returning four reactors at its Pickering plant to service beginning in 2002. These reactors are capable of supplying 15 TWh of electricity and displacing 13 million tonnes of CO₂.
- Reducing GHG emissions through efficient use of energy; In 1999, Natural Resources Canada awarded OPG the National Energy Efficiency Award in recognition of its five-year, 1,750 GWh reduction in internal energy consumption. OPG's energy savings target for each of the next four years is equivalent to 3 per cent of its annual energy use.
- Reducing GHG emissions with emissions trading; In 2000, OPG offset 30 per cent of its GHG emissions by applying 12.5 million tonnes of CO₂ Emission Reduction Credits, of which 2.5 million tonnes were generated from improvements in internal energy efficiency.
- Reducing GHG emissions with green power; and OPG has committed to quadrupling its green power capacity to 500 MW by 2005 and added 13 MW of green power in 2000.
- Reducing GHG emissions through carbon sequestration. OPG's GHG strategy includes the planting of 1.6 million native trees and shrubs over the next five years. This initiative is expected to offset 900 thousand tonnes of CO₂ over the lifetime of the trees.

Tokyo Electric Power Company's GHG strategies

TEPCO, as a power producer, has implemented various CO₂ emission reduction measures both on supply and demand sides of electricity. In 1996, the Federation of Electric Power Companies (FEPC) in Japan established Environmental Action Plan in which FEPC's target is set to reduce CO₂ emissions intensity by

approximately 20 per cent from the 1990 level to about 0.3kg-CO₂/kWh in 2010. Keidanren, Japan Federation of Economic Organization, also set its target to mitigate CO₂ emissions from the industrial and energy converting sector below the level of 1990 in 2010. As a member of these organizations, TEPCO has been making utmost efforts to meet these targets.

TEPCO's measures to mitigate CO₂ emission include the following activities.

Supply side interventions

- Expanded use of non fossil energy sources: Promotion of an optimal generation configuration centering around nuclear and diffusion of renewable energy sources.
- Effective energy uses: Improvement of thermal efficiency of thermal power generation and reduction of the transmission and distribution loss rate.

Demand side interventions

- Energy conservation: Support for customers' energy conservation efforts and promotion of load levelling.

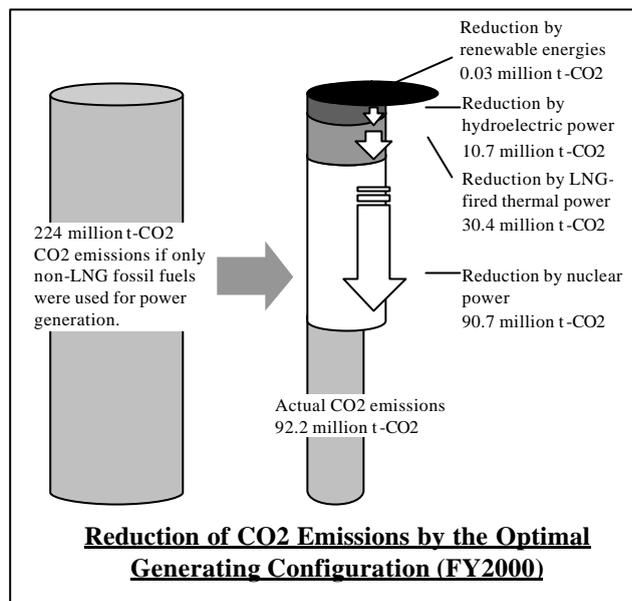
Other activities

- International cooperation: Participation in the Prototype Carbon Fund of the World Bank and implementation of plantation projects in Australia.
- Technology development: Technologies for absorption and fixation of CO₂.
- Cutback of greenhouse gases other than CO₂.

Among the above measures, the nuclear power development is regarded by TEPCO the most effective and practical measure to reduce CO₂ emissions. Regarding the CO₂ emissions during the whole process of power generation from construction to operation, nuclear power generation releases substantially lower emissions than thermal power generation. LNG fired combined cycle power stations make smaller emissions compared with other thermal power stations.

TEPCO estimated its CO₂ emission reductions by various types of generation in FY 2000 on the assumption that only non-LNG fossil fuels were used for power generation. In FY 2000, TEPCO maintained a high capacity utilization rate of nuclear power at approximately 80 per cent and estimated CO₂ reductions by nuclear power was 90.7 million t-CO₂. This was almost as same as the aggregate CO₂ emissions from TEPCO's all power generation installation in the same fiscal year.

Figure 4.2 TEPCO's strategy for GHG emission reductions



Expansion of LNG fired thermal power is an also effective means to reduce emissions and reduction by LNG-fired thermal power reached 30.4 million t-CO₂, which was about 30 per cent of the actual emissions.

TEPCO has introduced some programmes to promote the use of renewable energies such as purchases of surplus power from renewable energies and a Green Power Fund. Those programmes contribute to the substantial expansion of use of renewable energies but CO₂ reduction by renewable energies was only minimal.

As a result of both supply and demand side measures, the carbon intensity of electricity by TEPCO improved from 0.38 kg-CO₂/kWh in 1990 to 0.33 kg-CO₂/kWh in 2000.

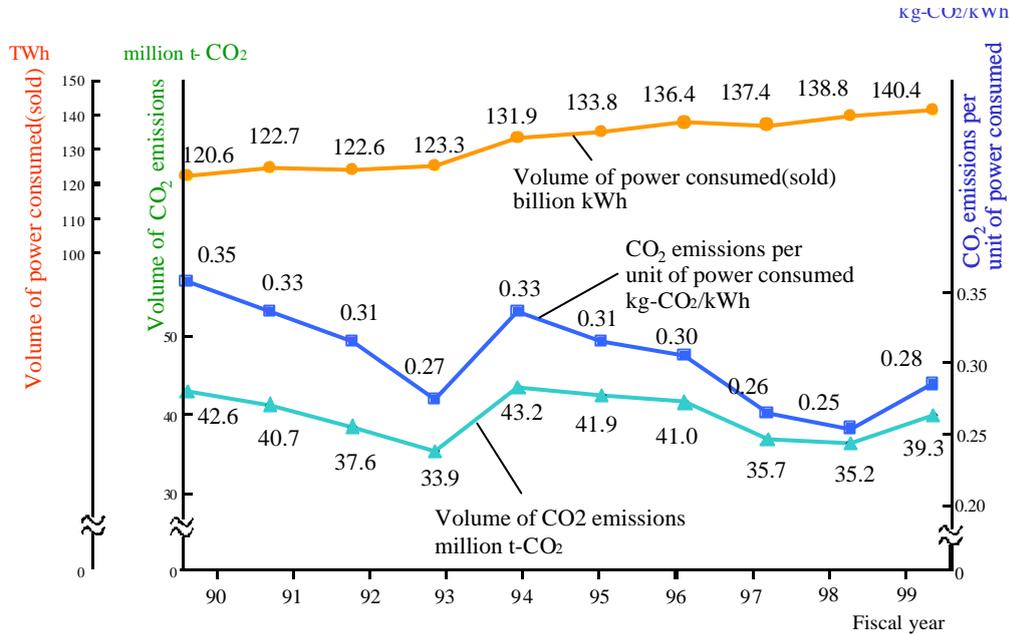
In February 2000, TEPCO founded TEPCO Forests Australia Pty. Ltd. as a wholly owned subsidiary in New South Wales, Australia to launch a plantation project for the purpose of absorbing and sequestering atmospheric CO₂. In 2000, the project started with an area of some 1,000 hectares and is planned to expand the area to a range of 10,000 to 40,000 hectares in 10 years. TEPCO expects to obtain 30,000 tons of carbon offsets every year through this plantation project with an area of 10,000 hectares. In March 2001, TEPCO set its own target to reduce CO₂ emissions intensity by approximately 20 per cent from the 1990 level to about 0.31 kg-CO₂/kWh in 2010.

Kansai's GHG strategy - ERA

Kansai aims to reduce CO₂ emission through a strategy termed ERA – an acronym for **Efficiency** (in energy use), **Reduction** (of GHG emissions from electric power supply) and **Activities Abroad** (measures in other countries to offset emissions at home).

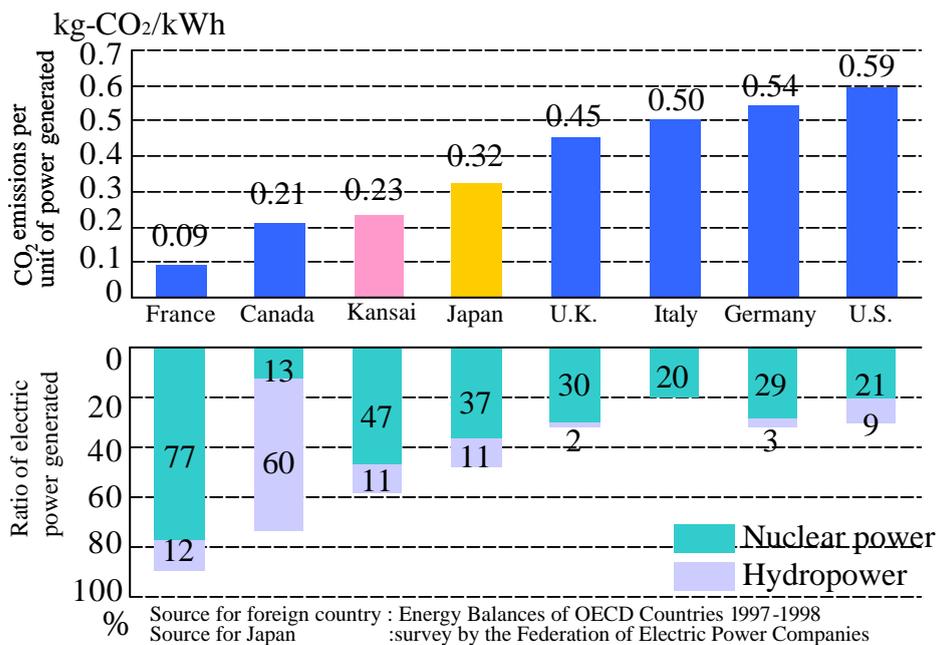
As a result of this strategy, CO₂ emissions in fiscal 1999 amounted to 0.28 kg-CO₂/kWh, a reduction of approximately 8% over fiscal 1990 despite the 16% increase of electrical power consumed (sold). The target for 2000 is 0.30 kg-CO₂/kWh.

Figure 4.3 GHG emission reductions at Kansai



Kansai Electric's CO₂ emissions per kWh are lower than those of most Western nations, just above France with its high nuclear power ratio and Canada with its high hydropower ratio.

Figure 4.4 Comparison of unit GHG emissions across countries

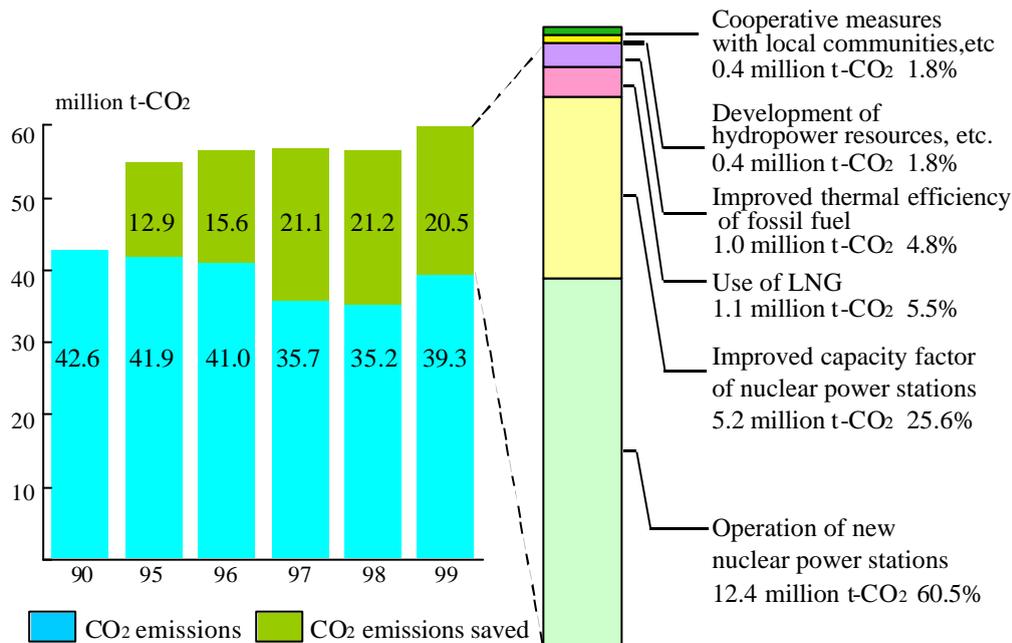


CO₂ emissions saved at Kansai were approximately 20.5million tCO₂ in fiscal 1999 as compared to fiscal 1990 levels. This is equivalent to approximately 2% of Japan's total CO₂ emissions – 1.23 billion t-CO₂ – in fiscal 1997.

Nuclear power generation accounted for approximately 90% of the total reduction, primarily due to the start-up of Units 3 and 4 at the Ohi Power Station (nuclear) after 1990 and the increased generation of nuclear power owing to the improved capacity utilization factor at nuclear power stations .

Other measures to reduce CO₂ emissions include improved thermal efficiency at fossil fuel power stations, use of LNG, and development of hydropower resources.

Figure 4.5 Source of GHG emission reduction savings at Kansai



4.1.5 Promote renewable energy

Introduction

Traditional fossil fuel based electricity production has significant environmental impacts of both a global and local character, notably GHG emissions, sulphur and particulate emissions, and various impacts of mining for coal, gas and oil. An additional concern is that fossil fuels are inherently exhaustible, in time spans relevant for humans. The major alternatives to fossil fuels today are nuclear and hydro power which carry environmental, health and safety concerns of their own. A response to these concerns, has been research into renewable energy technologies. A result of these global efforts is that a steadily increasing proportion of electric utilities' power production comes from renewables such as wind, solar, bioenergy, and small scale hydropower – important for moving towards a sustainable energy future.

Renewable and alternative energy at Western Power, Australia

A key action in the Australian Government's greenhouse response is the 2 per cent Renewable Energy measure which will legally require electricity retailers to source an extra 2 per cent of electricity requirements from renewable energy sources. In addition, the Western Australian State Government unveiled its "Green Power" policy in December 1999 and Western Power launched NaturalPower.

NaturalPower allows Western Power customers to choose to take all or a proportion of their electricity from renewable sources by paying a 3c/kWh premium.

Western Power is already advanced in developing new renewable energy generation for these initiatives. Western Power's renewable energy focus is on wind, bioenergy and to a lesser extent, solar technologies. This has been determined based on past experience, availability of renewable energy sources and the comparative costs of available renewable energy technologies. The following are some examples of initiatives at Western Power, starting with **wind power**:

- A 22 megawatt wind farm at Albany is under implementation. The wind farm will save about 75,000 tonnes of greenhouse gas emissions per year.
- A further two 230 kilowatt wind turbines and associated control system were added to the single turbine installed in Denham in 1998, and the resulting wind farm will save about 1,500 tonnes of greenhouse gas emissions per year.
- Western Power will also construct a 75 kilowatt wind farm at Exmouth. The three Western Australian designed and manufactured wind turbines will save about 100 tonnes of greenhouse gas emissions per year.
- Western Power formed a joint venture company, the Wind Energy Corporation, whose aim is to develop wind turbine installations throughout Australia.

In the area of **bioenergy** an approval to proceed with a one megawatt demonstration Integrated Wood Processing (IWP) plant at Narrogin was granted by the Western Power Board. The plant will produce renewable electrical energy, eucalyptus oil and activated carbon from the wood and leaf material of purpose-grown plantations of mallee trees. The extensive tree planting encouraged to supply feedstock will address two of Australia's most pressing environmental concerns, global warming and farmland salinity. The plant will take twelve months to construct and is being supported by grants from the Australian Greenhouse Office and the Department of Industry, Science and Resources.

In the area of **solar power**, the construction of the pre-production solar concentrator photovoltaic system was completed in June 2000 at Rockingham. The parabolic mirrors of this system concentrate sunlight onto photovoltaic cells so that the output of a conventional system is achieved with only one twentieth of the cell area. Electrical output from the grid-connected system will be available to Western Power customers purchasing NaturalPower and will save about 35 tonnes of greenhouse gas emissions per year. This plant was built by a consortium comprising Western Power, Solahart and the Australian National University and was supported by funding from the Australian Greenhouse Office and the Western Australian Alternative Energy Development Board.

Western Power has also a Renewable Energy Buyback Scheme (REBS). The scheme allows for residential customers with renewable energy systems installed in their homes to sell their excess electricity to Western Power's system. However, the take up rate has been slow due to the high cost of purchasing and installing renewable energy systems. The REBS has received more interest since the inception of the Australian Greenhouse Office's rebate for photovoltaic

systems, managed by the Office of Energy in Western Australia, with 350 enquiries to date. This rebate offers substantial assistance to people interested in setting up a photovoltaic system on their homes.

Green Power at EPCOR

EPCOR's **Green Power programme** was launched in 1999, offering customers the opportunity to support more environmentally friendly power options. For every unit of Green Power purchased, one unit of fossil fuel generated power is displaced. EPCOR's Green Power programme offers four levels of participation through ECO- PACKs (see box below) and EPCOR's portfolio of Green Power production sources grew in 2000 to include solar and small hydro.

EPCOR also signed a ten year agreement with the Peigan Utilities Corporation to purchase 100 per cent of the Green Power generated from a planned 750 kilowatt wind turbine to be located on the Peigan Nation Reserve near Brockett in southern Alberta. Power produced from the turbine will be available for purchase in 2001.

EPCOR's customers who supported the Green Power programme contributed in 2000 to reduced emissions amounting to:

- 2 tonnes of carbon dioxide
- 6 tonnes of sulphur dioxide
- 4 tonnes of nitrogen oxides
- 1 tonnes of particulates

The Green Power programme is EcoLogo certified, which means that EPCOR must purchase Green Power from only EcoLogo certified generators. As part of the requirement for certification, EPCOR conducts internal audits to match Green Power sales against Green Power purchases. This information is submitted annually to the administrators of the EcoLogo programme. In addition to the annual audit, monthly audits are done between the Green Power generators and EPCOR to ensure sales and purchases balance.

EPCOR ECO-PACKs

ECO-PACKs are blocks of EcoLogo certified green energy generation that customers can purchase through EPCOR's Green Power programme. ECO-PACK amounts are based on the average monthly power consumption of residential household in Edmonton. Green Power customers pay a premium in addition to their monthly power bill:

- \$5 per month for 10% Green Power
- \$10 per month for 25% Green Power
- \$20 per month for 50% Green Power
- \$40 per month for 100% Green Power

Under the auspices of Environment Canada's Environmental Choice programme, certain methods of power generation qualify to be verified and EcoLogo certified. Formally called renewable low-impact electricity and subject to stringent guideline requirements, qualifying fuel sources include biomass, water, wind and solar. For example, a biomass fuel source such as wood-waste must be sourced from an operation with sound Environmental Management Systems in place.

EPCOR's participation in a **solar power** demonstration project in 1995 was a relatively early effort to assess the feasibility of solar-electric technology. A solar array was placed on the roof of the Howell-Mayhew Cold Climate House in west Edmonton to assess its potential and any barriers to development. It was found that during an average year, 70 per cent of the home's energy could be solar generated with the remainder supplied through traditional connections.

In 1996 EPCOR continued its work with solar power with the installation of a 13.4 kW grid-connected solar electric system on the roof of EPCOR Centre in downtown Edmonton. The output from the array was added to EPCOR's Green Power programme portfolio in 2000, producing 11,873 kWh.

For several years, EPCOR Water Services has been equipping its portable field office trailers with solar panels. These trailers are used to provide office, washroom and cooking facilities for field crews conducting repairs and maintenance on EPCOR's water distribution infrastructure. The panels are used to charge batteries that supply power to operate ventilation fans, the water pump for the washroom and drinking water supply and interior lighting for the trailer.

Renewable and alternative energy at Exelon, USA

Exelon supports **landfill gas** to energy recovery. Methane is generated through the decomposition of organic waste and is 21 times more potent a greenhouse gas than carbon dioxide. Landfills generate 36 per cent of methane gas emissions associated with human activities, the most from any single source. Large landfills must either flare the gas to dispose of it or burn it to produce electricity. Utilizing landfill methane to generate electricity produces less environmental impact than burning coal, and has the added benefit of capturing an energy source that otherwise would have gone to waste. Exelon operates two plants in Pennsylvania, USA, that utilize landfill gas to generate electric power. Exelon was awarded a 1997 Governor's Environmental Excellence Award for its landfill gas projects.

In addition, ComEd, a subsidiary of Exelon, offers a renewable energy product called **EcoPowerSM**. EcoPowerSM renewable certificates represent the environmental attributes of electricity produced by a renewable resource. Currently, ComEd obtains these certificates for purchases of electricity generated from landfill gas. Retail energy suppliers buy renewable EcoPowerSM certificates from ComEd and combine them with commodity electricity to provide a renewable energy product for sale to end-use customers. EcoPowerSM from ComEd will fully satisfy the renewable energy requirements of Chicago, Illinois, USA in the largest US municipal renewable deal and 95 per cent of requirements of the US Environmental Protection Agency (EPA) labs in Cincinnati, Ohio, USA. Moreover, a portion of the premiums from EcoPowerSM sales is directed into a reinvestment fund to support new renewable energy development in Illinois.

Power Team, the wholesale marketing division of Exelon's generation subsidiary, now has the largest **wind** portfolio east of the Mississippi River. This year alone, the company has entered into separate power purchase agreements to market the output of three new wind farms. Exelon also has a 225kW wind turbine at its educational facility, The Power House. This turbine has generated close to 1.5 GWh since its installation in May 1995.

Exelon Corporation has a scheme similar to EPCOR's Green Power programme, called "**Environmentally Preferable Generation**". Exelon recently completed an in-depth assessment of its power plants in Pennsylvania and Maryland to quantify the life cycle impact that they have on the environment. Based on the evaluation performed, it has been determined that the electricity generated by Exelon in the PJM Power Pool has less of an impact on the environment than the average impact of other plants in the region. The assessment was conducted by an independent third party (Scientific Certification Systems) and is based on the internationally recognized environmental standard ISO 14042. This standard evaluates not only impacts directly related to the power plant's operations, but also upstream and downstream issues such as mining impacts and waste disposal. As a result of this process, 11 per cent of Exelon's PJM generation is now certified as "Environmentally Preferable". This certification process allows consumers to be more informed about the impact their electricity consumption has on the environment.

In the area of **renewable energy**, ComEd provides renewable information to its customers via a website and the "Capture the Power" information kit. ComEd is involved in 3 important renewables initiatives:

- ComEd committed \$250 million to **Illinois Clean Energy Community Foundation**, which was established to encourage pollution prevention, energy efficiency, clean coal technology research, nature conservation and renewable energy in Illinois.
- In partnership with the City of Chicago, ComEd has dedicated \$12 million to support the installation of clean **solar energy** within the city over the next 5 years. Half of the fund will be directed towards purchasing photovoltaic (solar electric) panels from a Chicago-based manufacturer (thus also supporting economic development initiatives) for installation throughout Chicago, including a solar power station to open on a former "brownfield" site on Chicago's west side.
- ComEd launched the **Wind and Photovoltaic Generation Pricing Experiment**, a programme designed to encourage the use of renewable technologies by business and residential customers. Customers can sell excess electricity from their renewable systems to ComEd. To facilitate this programme, ComEd developed concise and customer-friendly "Interconnection Guidelines" for 40kW or smaller systems. ComEd also offers residential customers a choice of standardized photovoltaic systems along with complete installation and multi-year service support through the Solar Connect IllinoisTM programme.

PowerGen's offshore wind farms, UK

PowerGen is one of the UK's leading developers and owner/operators of wind farms through PowerGen Renewables, a joint venture with the Abbot Group. PowerGen currently has interests in 14 operational wind farms in the UK and Ireland with a total capacity of almost 80 MW.

Locating wind farms out at sea allows PowerGen to make use of the UK's offshore wind resource, which is the largest in Europe. Figures from the Department of Trade and Industry suggest that about one-third of the UK's

electricity needs could be supplied by offshore wind energy. PowerGen has been pursuing the potential of offshore wind projects for a number of years and is part of the consortium that developed the UK's first offshore wind farm, off the coast at Blyth in Northumberland. Partners PowerGen Renewables, Shell Renewables, Nuon UK and AMEC Border Wind invested a total of £4 million in the project, which was officially opened by the UK Minister for Energy in December 2000.

The site consists of two of the world's most powerful wind turbines, each with a capacity of 2MW. Together, these turbines are capable of supplying the needs of 3,000 homes. They are located about 1km off the Blyth coast, and are built to withstand fierce winds and waves of over 6m in height. In-depth environmental impact assessments were completed during the planning of the project to minimise disturbance to local wildlife during both construction and operation.

Renewable energy in rural areas - Eskom, South Africa

Eskom initiated the South African Bulk Renewable Energy Generation (SABRE-Gen) programme in 1998. Eskom has been involved with renewable energy technologies for some time, through various non-grid electrification initiatives. However, it was felt that a vehicle was required to enable the evaluation of multi-MW, grid connected generation systems, to determine whether they could provide viable solutions to South Africa's future electricity needs. This led to the initiation of the SABRE-Gen programme. The programme's ultimate objective is to evaluate whether utility scale, renewable electricity generation, is a viable supply-side option for Eskom and South Africa. There are currently four components under the SABRE-Gen programme, namely bio-energy, solar thermal electric, wave and wind.

A joint venture between Eskom and Shell International Renewables Ltd is targeting electrification for about 50 000 homes in isolated South African rural communities. The project involves the installation of a pre-paid solar system with battery storage. The solar system utilised features four high-efficiency fluorescent lights and an outlet for direct current black and white television and a radio.

Local shops are used as the outlets for the purchase of pre-payment cards and local people are trained to do the system installation and maintenance, thus promoting job creation in the communities. To date 6,000 systems have been installed and customer satisfaction is high. The success of the project was due to the combined efforts of the private sector, a public utility, Transitional Local Government and the local rural communities. The Eskom-Shell Solar Home System Ltd South Africa was selected as a winner of the international Climate Technology Initiative (CTI) Leadership Award during 2000.

Renewable and alternative energy activities at BC Hydro

Part of BC Hydro's hydrogen initiative, the Canadian Hydrogen Infrastructure Program (CHIP) proposes creating a series of projects designed to demonstrate the technical and commercial feasibility of hydrogen production and fuelling stations for light- and heavy-duty vehicles. These projects will help BC Hydro and its project partners (including both industry and government partners) to better understand the logistics and risks associated with the production and distribution of hydrogen, as well as helping to influence the transportation market to move to

the utilization of on-board, gaseous hydrogen as a fuel, rather than reformed hydrocarbons. If the demonstration program is successful, it will demonstrate to vehicle manufacturers, petroleum retailers and the general public that distributed, gaseous hydrogen fuelling is safe, practical and economic. A key aspect of CHIP is that the stations will be capable of fuelling at 10,000 psi - the pressure required to give hydrogen-fuelled vehicles a travel range competitive with that of gasoline-powered vehicles.

BC Hydro plans to produce gaseous hydrogen fuel electrolytically, using renewable energy sources (initially, using electricity generated by the company's hydroelectric facilities). This is the cleanest way to produce hydrogen gas. The first CHIP station is currently under construction.

4.1.6 Promote energy and resource efficiency

Introduction

Not only high efficiency and low-waste in *production* of electricity is important for increasing the contribution of the electricity sector to sustainable development. Utilities also have a responsibility that production efficiencies gained are not lost in inefficient end-use. Efficient end-use has partly to do with technologies (efficient appliances) and partly with environmental awareness and knowledge among users. Utilities can be instrumental in both areas through external environmental education and providing information about (and selling) efficient appliances, insulation etc. This section provides examples of both energy and resource efficiency internally as well as in end-use.

Ontario Power Generation's internal energy efficiency programme

Ontario Power Generation (OPG) was the first recipient of the Natural Resource Canada, National Energy Efficiency Award for its energy savings programme. As a wholesaler of electricity, OPG sells to large industrial customers and municipal utilities who in turn sell to residential customers. OPG does not sell directly to residential customers. As a result OPG's energy efficiency efforts are focussed in three areas:

- reducing internal energy consumption;
- providing energy services to large industrial customers; and,
- stimulating energy efficiency through advocacy, education and information programmes.

In 2000, OPG's internal energy use was 6,400 GWh for an energy intensity factor of 95.5. Total cumulative energy savings since OPG began its energy efficiency programme in 1994 are well over 2,100 GWh. OPG's energy savings target for each of the next four years is equivalent to 3 per cent of its annual energy use.

In 1999, Natural Resources Canada awarded OPG the first National Energy Efficiency Award for a five-year energy efficiency programme that realized \$70 million in annual cost savings. Furthermore OPG's Energy Savings programme earned emission reduction credits totalling over 2 million tonnes of carbon dioxide, sulphur dioxide and nitrogen oxide valued at over \$10 million.

OPG provides energy service advice to its large industrial customers, upon request. OPG also supports external initiatives that stimulate energy efficiency through advocacy, education and information programmes. The following initiatives are provided as examples:

- **Training new leaders** in energy efficiency management: OPG is partnering with Seneca College and the Canadian Institute for Energy Training to support a unique, independent study programme for energy managers. OPG also supports student awards in the programme.
- **Energy efficient buildings**: To encourage energy efficiency in the building sector, OPG sponsored the Ontario Lung Association Health House Award to recognize the environmental benefits of home energy savings.
- Helping students and their families **learn about energy and water conservation**: OPG co-sponsors, with Enbridge Consumers Gas, the *LivingWise* programme. This programme teaches ways to conserve energy and water and comes with a "technology kit" containing a low-flow showerhead, faucet aerator and energy-efficient nightlight.
- Encouraging **OPG employees to apply energy efficiency measures** where they live: GreenSaver "lunch and learn" sessions provide information about energy savings opportunities at home. GreenSaver Home Energy Audits are offered to employees as a means to save money, through energy conservation.
- **Creating an on-line resource**: With the Canadian Energy Efficiency Alliance, OPG helped to sponsor a project to establish an "On-Line Energy Efficiency Centre" at <www.energyefficiency.org>. The aim of the site is to provide users with easy access to information and resources related to energy efficiency.

Resource efficiency and recycling at TEPCO, Japan

Resource efficiency is, together with energy efficiency, an important measure to reduce the utilisation of natural resources in electricity production. TEPCO has a high focus on internal energy efficiency as well as the education and diffusion to consumers of energy-efficient appliances and equipment. In addition, TEPCO strives to become more resource efficient in its own operations. The following provides examples in the area of resource efficiency.

In fiscal year 1999, the recycling rate at TEPCO rose one percentage point from the previous year to 94 per cent. The improvement was brought about by the increased production of concrete scraps, which are more readily recycled, and the reduced output of sludge, which is more difficult to recycle. TEPCO also cut back on the amount of waste disposed of by landfill in 1999 by about 1,300 tons compared with the previous year.

TEPCO finds that a medium-range approach to recycling is needed in the recycling of waste. As such, TEPCO has set specific targets in carrying out its recycling programmes, the current being: "hold down the amount of waste disposed of by landfill to less than 17,000 tons and attain a 93 per cent recycling rate in fiscal year 2001". The targets were set in 1997, based on the amount of waste output at the time and the expectations of new recycling technologies to be developed in subsequent years. TEPCO out-performed the targets in both 1998

and 1999, and is now planning to set even higher targets. TEPCO is committed to reduce the output of waste in general, and particularly shellfish, thermal insulation material scraps and sludge, and recycle the waste into useful products.

Some examples of recycling activities at TEPCO include:

- Scrapped wires are recycled as conductors for power distribution lines. TEPCO is among the leaders in the world in the development of recycled aluminium wire.
- Insulator scraps are recycled into aggregate for construction material and, because of their good abrasion resistance, into road indication materials (such as white lines). Tokyo Electric Power Environmental Engineering Co. Inc., a wholly owned TEPCO subsidiary, has turned insulator scraps into commercial products, such as china and porcelain, benches and tiles.
- Concrete scraps that result from the demolition of existing facilities and asphalt scraps are crushed and recycled into roadbed materials.
- Underground distribution cable ducts undergo quality re-evaluation and when found suitable, are reused for selected purposes. Those which are found unsuitable for reuse are crushed, mixed with other new materials and used as materials to produce reclaimed ducts.

Energy efficiency at Eskom, South Africa

Bonesa, a joint venture under the Eskom Enterprises banner, promotes efficient lighting technologies that will reduce power demand and provide significant environmental benefits while reducing electricity bills for consumers.

The IFC / GEF Efficient Lighting Initiative (ELI) is a three year programme supported by the International Finance Corporation (IFC) and funded by Eskom and the Global Environment Facility (GEF) to accelerate the penetration of energy-efficient lighting technologies into emerging markets in developing countries. Bonesa as local implementing agency in South Africa is positioned to support the international vision through implementing local educational, marketing and awareness programmes. Residential lighting in South Africa is highly coincident with peak load demand. Projects have included compact fluorescent lamp (CFL) promotions in conjunction with a supermarket chain, marketing to its own employees, and additional marketing efforts targeting schools. In addition, Eskom has been running an energy efficient lighting awareness campaign through its ElektroWise programme. This initiative is information-based, including data sheets informing customers how they can reduce their lighting load and save money.

Resource efficiency at Exelon, United States

Exelon Corporation (PECO and ComED) has embarked on a wide range of initiatives that focus on energy and resource efficiency. Listed below are several of those initiatives.

The Community Energy Cooperative The Cooperative offers new ways to think about energy to improve the electrical system, reduce costs to consumers and make communities active partners in shaping their energy future. The

Cooperative, located in Chicago, is a new membership organization that enables communities to control their energy use and costs and to benefit from changes in energy technology and regulations. The Cooperative was launched in June 2000 by the Center for Neighborhood Technology (CNT), with initial support from ComEd for a three-year start-up period. CNT is developing the Cooperative, drawing upon over 20 years of experience building stronger, sustainable urban communities. The Cooperative will provide its members with affordable access to new technologies that can reduce energy use and lower costs. These technological changes will reduce peak demand in summer, saving money.

Because reducing peak demand means less system construction and less expensive energy supplies, ComEd will pay the Cooperative for energy saved. That payment will be returned to the members in the form of more affordable technology and contributions to community development projects.

Resource Recovery Activities During 1994, PECO Energy formed its Resource Recovery Division to better manage its excess, obsolete and scrap materials, supplies and equipment in an environmentally responsible manner. In an effort to reduce costs and meet regulatory guidelines on waste disposal, the Resource Recovery Division works with company business units to evaluate waste streams and implement waste reduction strategies. These strategies may involve tasks such as recycling, identifying new markets for materials, changing product packaging specifications to reduce waste, identifying alternative products with preferable environmental properties, and/or modifying work practices.

The following are some of the recent environmental and economic benefits associated with the Resource Recovery Division's activities in 1997:

- **Non-ferrous metal.** Approximately 1.5 million pounds of non-ferrous metal was recycled.
- **Iron.** Three million pounds of light and heavy iron was recycled.
- **Plastic pipe.** In 1997, the company began recycling plastic pipe used in its gas distribution system. On an annual basis, the company expects to recycle approximately 200 tons of plastic pipe.
- **Cable.** Cable on rotted wooden reels was re-wound on used wood reels and returned to company stock, avoiding the purchase of new reels and materials.
- **Cable reels.** A programme to return cable reels to vendors was implemented.
- **Wooden pallets.** The purchase of new wood pallets was avoided by using old wood pallets from several company sites.

Coal Combustion Coproducts During 1997, 100 percent of PECO Energy's coal combustion coproducts (fly ash, bottom ash, settling basin ash and flue gas desulphurisation coproduct) from the three coal units it operates in south-eastern Pennsylvania went to beneficial use. The primary use of combustion ashes was related to sewage sludge solidification and mine reclamation. The Company continues to increase the amount of fly ash utilized for high value markets such as for flowable fill (a light strength concrete-like material used in construction and road work applications) and for use as a hazardous waste remediation bulking

agent. In 1997, 32 percent of the fly ash generated was utilized for such higher value applications.

Approximately 40 percent of the flue gas desulphurisation coproduct (associated with the operation of coal plant “scrubbers” which remove SO₂ from flue gases) removed during 1997 was sold as a constituent of fertilizer for certain plants that need magnesium and sulphur.

By putting coal combustion coproducts and flue gas desulphurisation coproducts to beneficial use, the need for landfill space is dramatically reduced and the Company is able to significantly reduce its waste disposal costs.

Low Level Radiological Waste Reduction PECO Energy has placed great emphasis on reducing waste generated from its nuclear operations, specifically low level radioactive waste. Despite its stable form and low impact to the environment, PECO Energy has reduced its volume 95 percent since 1985 to approximately 5,000 cubic feet per year (equivalent in size to a home’s two-car garage).

Volume reduction has been attained through innovations in plant reactor chemistry, elimination of disposable protective clothing and packaging material used in the plant and testing laboratories, and application of new technologies which allow waste to be processed into smaller more stable forms. As a result, the PECO Energy nuclear sites have met the industry “Year 2000” goals for waste reduction three years ahead of schedule.

In addition, ComEd has demonstrated the value of life cycle management and saved approximately \$9.4 million dollars through initiatives to reduce low-level radioactive waste volume. While clean-up campaigns at ComEd’s various nuclear generating stations produced far more pre-processed low level radioactive waste in 1997 as compared with 1996, only 33,000 cubic feet of disposal volume remained after processing, due to new volume reduction initiatives.

Energy and resource efficiency at BC Hydro

In 1989 BC Hydro launched Power Smart – an energy efficiency initiative – as part of a strategy to defer the need for new generating facilities. The program has achieved its original aim of helping to meet the needs of a growing population, and also provides environmental benefits. Current annual energy savings are about 2,300 GWh, equivalent to 1.2 million tonnes in avoided GHG emissions. Since 1989, Power Smart has helped to avoid 9.8 million tonnes of GHG emissions.

The menu of programs for residential, commercial and industrial customers has evolved as the energy efficiency marketplace has matured. Power Smart has worked with manufacturers, retailers and contractors to make, sell and install more energy-efficient products, while also working to create customer demand. Power Smart has also successfully influenced government legislation and building codes to raise energy efficiency standards in British Columbia. Current programs target existing and new residential and commercial buildings, as well as large industry.

Rising natural gas prices and customers' concerns about energy costs have provided an opportunity to extend Power Smart. February 2001 saw the launch of the Power Smart Home Energy Learning Program (h.e.l.p.), featuring an on-line Home Energy Profile which produces a customized analysis of a customer's energy use with suggested energy savings measures, as well as product promotions and consumer information. During fall 2001, e.Review will be added, an on-line energy assessment program for commercial buildings. New programs directed to the industrial sector are also being introduced.

4.1.7 Undertake environmental education and training

Introduction

An important part of bringing society onto a sustainable development path is education in general and environmental education in particular. Educating employees, customers and the wider public is not only valuable in itself, but is often of crucial importance for the sustainable development strategies of companies. The internal education of employees creates awareness, motivation, and understanding of the vision of sustainable development as well as at later stages providing room for concrete improvements in resource use, efficiency etc. External education (i.e. of customers and the wider public) first of all helps promoting the values to which the company subscribes, and may change behaviour and eventually increase the willingness to pay for more sustainably produced electricity.

Environmental education and awareness at Eskom, South Africa

Environmental education is viewed as an important focus area, adding effectiveness to Eskom's commitment to integrated environmental management. To ensure a co-ordinated approach, the Environmental Education Working Group (EEWG) was established in Eskom during 1998.

Eskom also investigated the Virtual University Project, a consortium project run by the World Business Council for Sustainable Development. The objective of the project is to provide a structured distance-learning framework built primarily for Internet/Intranet use. Eskom also participated in a dialogue with the Parliament Portfolio Committee on Environmental Affairs and Tourism. This involved the presentation of Eskom's Strategic Electricity Plan at a Conference on Environmental Security in Africa, hosted by the Global Legislators Organisation for a Balanced Environment (Southern Africa Branch).

Eskom's Generation Group has identified environmental aspects and carried out various initiatives including EMS and legal workshops. The Transmission Group has identified critical topics for which formal environmental education programmes will be developed. The Distribution Group developed an environmental training matrix for all staff. The matrix stipulates applicable courses to be undertaken by staff in relevant positions and serves to ensure that environmental training is integrated into all aspects of the business. Various internal environmental courses were presented to employees throughout the Distribution Group, including an introduction to EMS and how it is being

integrated in Eskom, as well as the procedures to be followed when faced with bird electrocutions and oil spillages.

During 1999, the African Centre for Energy and Environment (ACEE) was established. This is a joint initiative between Eskom and the Electric Power Research Institute (EPRI) and aims at capacity building and technology transfer within the environmental field. During 2000, a global climate change conference, aimed at creating awareness within the industrial sector, was held. The success of the conference led to a collaboration between ACEE and the Industrial Environmental Forum, which hosted a climate change business breakfast. Two courses on environmental performance measurement and environmental lifecycle decision-making were also presented by EPRI. Further, a water re-use symposium was hosted jointly with the University of Pretoria and the International Life Sciences Institute.

Environmental education at Western Power, Australia

Western Power's flagship for education is its World of Energy hands-on learning centre. This year more than 51,000 children participated in the energy education programmes provided through World of Energy, 26 per cent more than the previous year. Students visiting the centre are engaged in active learning which occurs in small groups facilitated by Science Interpreters. A further 2,000 country children in Kalgoorlie, Albany, Geraldton and Bunbury regions participated in Western Power's Travelling Greenhouse Workshop.

In addition, the World of Energy provides a series of exhibits that involve the human activity to produce energy, for example children can ride a bike and measure the amount of energy they have created. Shock Proof, a school programme featuring a teaching kit focusing on electrical safety in the home and community, was presented to 32,000 primary and secondary school children this year, integrated into their school curriculum. A part of this programme included a competition to design a fun game that communicated a serious safety message. More than 120 primary and secondary school students entered the competition.

The Western Power Solar Cook Off was conducted at the World of Energy as part of Science Week in May 2000. School children from 16 primary schools participated in a cooking competition using solar cookers designed and built with the assistance of their teachers. Awards were given in various categories with Bullsbrook District Primary School winning the Overall Best Award.

The World of Energy is a showcase for Western Power and its environmental initiatives. The site has a large display covering the Greenhouse Effect, Wetlands Rehabilitation, the Endangered Plant Rescue Programme and the Hotham-Williams Western Power Greening Challenge, the largest volunteer tree planting programme of its kind in Australia. The World of Energy is working towards producing its own power through renewable energy from wind and solar sources.

The 1999 Solar Model Car Challenge, in its eighth year, attracted 43 entries from secondary schools from around Western Australia. The three most successful teams were sent to the Australian-International Model Solar Car Challenge in Adelaide in October 1999.

Western Power is a long term supporter of the State's Young Australian of the Year Awards. They sponsor the Science and Technology Award that recognises and honours the work of young people in the areas of Science and Technology. Another youth focused venture, the Creative Energy Challenge, a joint Western Australian Farmers Federation/Western Power initiative, is a competition that challenges young farmers between the ages of 15 to 35 to provide ideas and thoughts on the future of their industry.

Exelon

Exelon Corporation is committed to energy and environmental education and has created numerous centres that offer many programmes for the public. Both ComEd and PECO Energy have historically invested in energy and education initiatives:

Limerick Energy Information Center. The centre is the educational facility offering exhibits and presentations on energy and nuclear power – in particular the operation of the Limerick Generation Station, Exelon Generation's nuclear facility in eastern Pennsylvania.

Muddy Run Information Center. The information centre is located in the Muddy Run Park that is adjacent to the Muddy Run Pumped Storage Plant. The Park contains 700 acres of woodlands and a 100-acre lake. This facility is located next to the Conowingo Hydroelectric Plant, a 512 MW power capacity plant. The Conowingo plant also has an information centre that provides tours of the plant and educational programmes on energy and environmental subjects.

The ComEd Power House This energy education centre is one of America's premier facilities for communicating the principles and uses of all forms of energy. Opened in 1992 on the banks of Lake Michigan near the Illinois-Wisconsin border, the large two-story structure hosts about 50,000 people annually.

A guest's education begins with the design of the building, conceived by the internationally known architect Stanley Tigerman. He succeeded in creating a structure that includes all of the resources necessary to display exhibits and host programmes, yet demonstrate how energy is used in a building by exposing all heating, ventilating, cooling, and lighting systems. All of this equipment, pipes, and wiring are colour coded, clearly labelled and explained.

The Franklin Institute. Through the year 2002 PECO will have contributed more than \$1 million to the Franklin Institute. Part of the Institute's mission is to perpetuate the legacy of Ben Franklin. This is achieved through the Franklin Institute Awards, Ben Franklin National Memorial, and the Journal of the Franklin Institute. The history and mission calls for the Institute to work toward the public understanding of science and the promotion science education and achievement. In addition to the Electricity Hall, which demonstrates how electricity works and its uses, PECO this year sponsored a "KidsScience" programme.

4.1.8 Sustainable Development Reporting

Introduction

Companies in most countries have for some time been required by law to inform important stakeholders, including tax and environmental authorities, of financial and to some extent environmental performance, e.g. through annual reports. Increasingly, the role and responsibility of companies in society is seen to widen, and the importance of credible and thorough reporting of also social, ethical and environmental performance to a broader community of stakeholders, has come to the fore. Reporting criteria also along these other dimensions are increasingly being introduced into company practices through legislation or through international guidelines or standards, developed in cooperation with auditing groups. An important set of international guidelines is given by the organization Global Reporting Initiative, which advocates the so-called “triple bottom line”. The following case studies focus on a subset of the broad communication utilities maintain with stakeholders on sustainable development issues – their annual sustainable development reporting.

Ontario Power Generation’s 2000 Towards Sustainable Development Report

Ontario Power Generation (OPG) has been publishing environmental/sustainable development reports annually since 1989. The report is widely distributed to a range of OPG stakeholders including Federal and Provincial members of parliament, faculties of environmental studies and NGOs. It is also available on the Internet. In addition to these reports, the company produces and distributes to all its employees an 8-panel brochure that summarizes the company's sustainable development performance. Employees can also access more detailed information about the company's initiatives and performance on its Intranet site. To inform the general public, the company produces a 16-page supplement entitled *Toward Sustainable Development - Putting our Energy to Good Use*, which is distributed, to 450,000 homes in Ontario.

Periodically OPG also publishes and distributes issue specific brochures such as its *Clearing the Air* brochure, which answers questions about Ontario's air quality and electricity use and its *Reducing Greenhouse Gas Emissions* and *Carbon Sequestration and Biodiversity Management* brochures. In 2001, OPG also published and widely distributed a 37-page report on its Corporate Citizenship programme initiatives.

Eskom’s Towards Sustainability: Environmental Report 2000

Eskom’s Annual Report “Towards Sustainability: Environmental Report 2000” is a good example of how far many companies have come in the area of sustainable development reporting. Eskom has also received the Gold Award for corporate environmental reporting from KPMG/University of Pretoria for the 1999 environmental report and the Silver Award for environmental disclosure in an annual report.

The Environmental Report 2000 contains relevant information for all stakeholders, and is independently audited by the firm Environmental Impact

Management Services (Pty.) Ltd. The auditing strengthens the reliability of the information provided in the report.

The report is easily accessible in that the language is kept relatively free of technical terms, and in the extensive use of tables, figures and photos. Eskom's policies in the different areas are clearly communicated, and targets and indicators to track performance are reported.

TEPCO's Environmental Action Report 2000

TEPCO's Environmental Action Report, the ninth edition, is a comprehensive document of near 200 pages. The report opens with a preface, a declaration of TEPCO's environmental policy and a summary of the report. These are followed by a chapter on the framework to tackle environmental problems, containing subchapters on environmental management regulations, divisions and departments at TEPCO responsible for environmental affairs, environmental management system, and environmental accounting. The environmental accounting section contains detailed cost estimates for all major environmental activities at TEPCO.

The report includes a range of environmental indicators in two main categories:

- *main environmental impacts*: CO₂, SO_x and NO_x, radioactive substances and waste, general waste, CFCs;
- *environmental preservation measures*: energy use, afforestation and nature conservation, indicators concerning other activities.

The report also covers TEPCO's commitment to tackling global environmental problems in the areas of global warming and the protection of the ozone layer, as well as TEPCO's commitment to environmental protection in local communities. Since TEPCO has a number of nuclear stations, the report also describes the commitment to dealing with environmental problems involved in nuclear power, both from a safety and health, and an environmental perspective. The rest of part one of the report contains chapters on R&D, education on energy and the environment, safety and social contributions, international cooperation, and an thorough chapter on TEPCO's efforts to contributing to "building a resource-recycling society" through internal recycling efforts and informing communities.

4.1.9 Demonstrate responsible stewardship of natural resources

Introduction

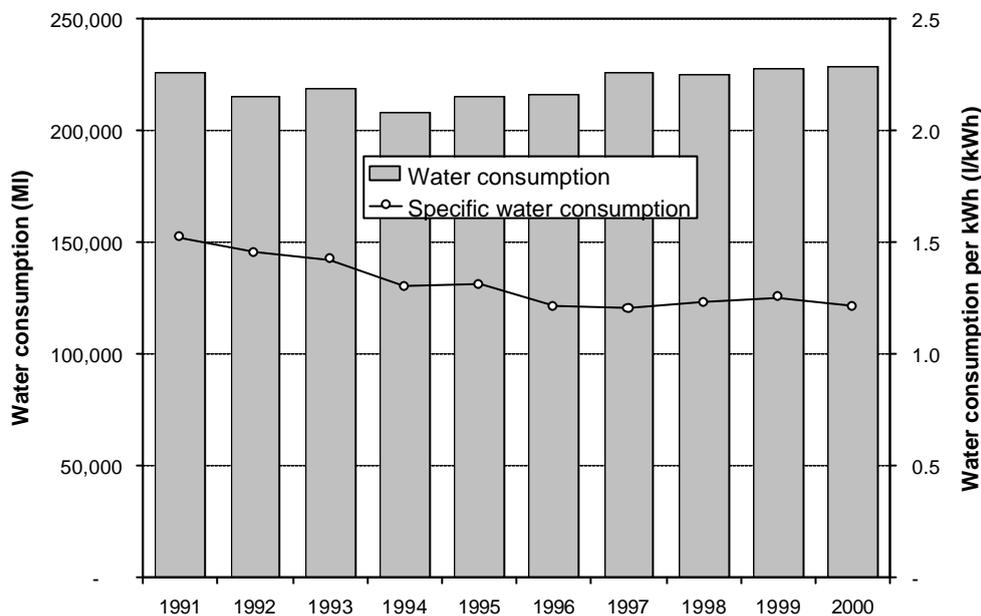
Scarcity of water and deteriorating water quality world wide is emphasized by experts as a (or perhaps *the*) major challenge for sustainable development in the years ahead. Water is essential for the survival of humans and other organisms, and it cannot be substituted by any other resource. Therefore it is essential to work towards sensible industrial and domestic water use, as well as very low levels of pollution and ecosystem effects in rivers, lakes and sea water. Electric utilities interact with water resources in a range of ways, and have therefore a particular responsibility for the sustainable use of this invaluable resource.

Presented here are three case studies of water management, as well as other examples dealing with stewardship of natural resources.

Eskom's water quality programme

Southern Africa is a dry region and water availability is a key sustainability issue. Electricity generation consumes a large amount of water (approximately 2 per cent of water consumed in southern Africa), and Eskom has a responsibility to conserve this resource. Eskom are world leaders in the development of dry cooling processes for power plants, and have constructed the largest dry cooling plants in the world.

Figure 4.6 Water consumption at Eskom



Water Treatment, Processing and Watershed Protection at EPCOR, Canada

In the area of **water treatment and processing** EPCOR's purification process is designed to meet or exceed all government requirements and to ensure that all drinking water provided to customers is clean and safe to drink. EPCOR's process results in a better than 99 per cent removal of bacteria in the system. EPCOR Water Services has a multiple-barrier, full water treatment system encompassing clarification, filtration and disinfection. Strict monitoring of water quality is a continuous process. Unchlorinated water never leaves the plant and any problems with equipment can be identified and corrected within minutes. Still, in the event of a problem, communications systems are in place with Alberta Environment and the Capital Health Authority enabling a quick and effective public warning system. EPCOR reports on its water quality performance, for example in its "2000 EPCOR Water Quality Report for Edmonton".

EPCOR is also involved in **watershed protection**. EPCOR obtains its source water from the North Saskatchewan River that originates at the Columbia Ice Fields in the heart of the Rocky Mountains. During its travels, the river may pick

up soil particles, oil, road salt, organic materials, pesticides, excess fertilizers and other materials. Although the drinking water treatment process removes these contaminants from the river water, EPCOR adopted a watershed protection programme aimed at reducing the amount of contamination that makes its way to the river.

Through its commitment to watershed protection, EPCOR is the driving force behind the formation and success of a number of water quality oriented groups such as the North Saskatchewan Watershed Alliance and the River Water Quality Task Force.

EPCOR was instrumental in the formation of the multi-disciplinary watershed monitoring and awareness project managed by Alberta Agriculture, Food and Rural Development. The project was designed to identify the source of parasites in the river, including identifying the prevalence of these parasites in the river water, sewage effluent and in wildlife and agricultural animals. The study also sampled raw and treated water at municipal water treatment plants upstream from Edmonton. The research will help producers, municipalities and wildlife managers reduce parasite levels in surface waters, ultimately ensuring a cleaner source for drinking water.

Measures to curb and utilize effluent at TEPCO

TEPCO has effluent treatment facilities installed at all of its thermal power stations. All effluent at each of these power stations is treated collectively, mainly through a process (known as “coagulating sedimentation method”) that removes contaminants from the effluent by precipitating it with a coagulant in the treatment facility. As a result, the contamination level of effluent discharged from any of TEPCO’s thermal power stations (including waste water from equipment cleaning and cooling and sewage resulting from employees’ daily activities) is kept well below regulatory standards set under the Water Pollution Control Law and those specified in the applicable ordinances of local public bodies.

Another water related problem TEPCO is dealing with is the discharge of heated water into the sea. TEPCO’s thermal and nuclear power stations take in seawater for use as coolant. This cooling water is warmed during the cooling process, and is discharged into the sea as thermal effluent. One of the methods adopted to lessen the influence of thermal effluent on the environment is through a deep seawater intake system, which takes cold seawater from the lower layer in the summer when the surface temperature rises, to lessen any difference in temperature. This temperature difference of inflow and outflow is being kept down to less than 7°C in TEPCO’s thermal and nuclear power stations that were built or renewed during or after the mid-1970s. Moreover, marine life around the power stations has been monitored over a long period of time to investigate the possible impact of this thermal wastewater on the marine environment. So far, no particularly significant environmental impact has been observed. TEPCO will continue to improve thermal efficiency of thermal power generation as an effective means of minimizing the amount of waste heat from thermal effluent. For instance, in the advanced combined cycle power generation technology in Units 7 and 8 of Yokohama Thermal Power Station, the quantity of thermal effluent has decreased to nearly 60 per cent of the level recorded at steam power plants of the same capacity.

Meanwhile, TEPCO is exploring ways of using thermal effluent for useful purposes. Currently, thermal effluent from the Fukushima Daiichi Nuclear Power Station is used effectively for the seedling production and intermediate breeding of marine products at two of its neighbouring institutions – the Fukushima Prefecture’s Cultivation Fisheries Centre and the Fukushima Prefecture’s Marine Nursery Laboratory. In the local town of Ohkumamachi, the Fisheries Promotion Corporation of Ohkumamachi is raising and marketing a flatfish nursery using thermal effluent. Since 1996, thermal effluent from Futtsu Thermal Power Station has been used at the prawn nursery and production facilities constructed by Chiba Prefecture in Futtsu City.

Reclamation of mined land at TransAlta

Mining represents TransAlta’s main impact on land. TransAlta owns two open pit coal mines in Alberta and one in Washington State. The Alberta mines, Whitewood and Highvale, cover approximately 16,440 hectares while the Centralia mine covers approximately 5,930 hectares.

TransAlta has reclaimed mined land since 1962, 11 years before provincial guidelines were established. Standards now require mined land to be reclaimed to a level that has an equivalent capability to support its pre-mining use. Approximately 38 per cent of former mined land at TransAlta’s three mines had been reclaimed by the end of 2000. TransAlta has reclaimed 33 per cent of Highvale and about 76 per cent of Whitewood, most of which has been officially certified as complete. The greater percentage of reclaimed land at Whitewood is a result of the mine's age and the ability to sequence reclamation operations immediately following mining at a single pit operation. Highvale and Centralia are multiple-pit operations which require larger areas for ongoing mine work.

When TransAlta took over Centralia, only 680 hectares of formerly mined area had been reclaimed since 1971. TransAlta has put in place an ambitious reclamation plan with goals of reclaiming more than 200 hectares in 2001 alone.

TransAlta's reclaimed lands now support a wide variety of uses such as agriculture, woodlands, wildlife habitat, recreation and wetlands. In Alberta, reclaimed areas have been leased to local farmers and in some cases, the original landowners. The farms produce cereal crops like barley, oats and canola and hay crops for livestock. Local ranchers have established several pasture areas on the reclaimed land and are successfully grazing and watering cattle. Elk, deer, coyotes, sharp tailed grouse and osprey inhabit areas reclaimed for wildlife.

TransAlta’s award winning project, East Pit Lake, formerly part of the Whitewood mine, saw the transformation of a once open-pit coal mine into a 47-acre lake surrounded by more than 300 acres of rolling hills. The lake was developed to sustain a sport-fishery complete with reefs, bays and inlets that contribute to habitat diversity and biological productivity. The lake is a favourite fishing location for avid trout fishermen and is now managed by the local Fish and Game Association. The lake supports a variety of wildlife and waterfowl and is home to a pair of nesting Ring Necked Loons each season. Areas of the West Pit at Whitewood have now also been reclaimed and transformed into ponds that support a variety of waterfowl and have also been stocked with trout.

In Centralia, TransAlta is returning the land to timberlands and wetland habitat, and is in discussions to develop a wetland area for waterfowl habitat. Reclaimed areas at Centralia also support a wild herd of Roosevelt Elk as well as Blacktailed Deer.

Ontario Power Generation

Ontario Power Generation (OPG) generating facilities occupy large tracts of land bordering lakes and waterways in some of the most important ecological areas in Ontario. In 1995, the company introduced a Biodiversity Policy, the first of its kind in the North American utility industry, which requires it to minimize its impact on natural areas and to restore or replace habitats that have been impacted. Guided by this policy, each of OPG's major facilities has undertaken bioinventories and assessments for species at risk and has developed site habitat management plans.

Four of OPG's major sites have had their management plans independently certified by the U.S. based Wildlife Habitat Council (WHC). Two of these sites were the winners of major international awards from the WHC.

OPG has extended its natural resources stewardship programme well beyond the boundaries of its facilities and is partnering with regional conservation authorities, environmental protection groups and communities to restore natural habitats and protect species at risk.

OPG's partnership with the Toronto and Region Conservation Authority, for example, lead to the creation of a new Reforestation and Biodiversity programme within the "Living City Campaign". As a founding member of the programme, OPG supports reforestation activities in the region that will help to restore clean air and water, and much-needed habitat for declining species.

In 2001, OPG was the first Canadian utility to receive the Washington, D.C.-based National Hydropower Association Achievement Award for Outstanding Stewardship of America's Rivers.

BC Hydro

BC Hydro, in partnership with the Government of British Columbia, has established three Compensation Programs addressing fish and wildlife impacts caused by hydroelectric generating facility construction.

Combined, the Peace-Williston, Columbia Basin and Bridge Coastal compensation programs encompass all of BC Hydro's hydroelectric generating facilities. The first two were set up to meet requirements of BC Hydro's Water Licenses, while the latter was undertaken voluntarily to cover facilities in the rest of the province. Each compensation program is financially sustained by a perpetual capital fund; total annual funding for the three programs is approximately \$6 million CDN.

Compensation programs are directed by Steering Committees comprising a representative each from BC Hydro and the B.C. Ministry of Water, Land and Air Protection. These are joined by public and First Nation representatives, who liaise with their local communities to bring forward ideas, concepts – and any concerns.

Activities vary between programs, and range from biological research and species inventory, to on-the-ground mitigation projects and very complex, multi-year recovery plans for endangered species. To provide just a few examples, Peace-Williston fish biologists are spearheading a recovery effort for an endangered species, arctic char. In the Columbia, a recovery program was launched last year for the Columbia White Sturgeon.

The Columbia Program is also delivering one of the largest lake restoration projects in the world, in Kootenay Lake. By replacing nitrogen and phosphorus impounded by the dams, lake productivity dramatically increased – total Kokanee salmon stocks jumped from 10 million in 1992 to nearly 35 million in 2000.

4.1.10 Support key nature conservation programmes

Introduction

Many electric utilities are involved in nature conservation, either directly related to their operations through restoration of land around facilities or mining sites, protecting birds from transmission lines, river system management connected to hydro dams etc., or through supporting organizations or initiatives which work with conservation. Both are important contributions from electric utilities to sustainable development.

Green zoning measures at Kansai Electric

Kansai Electric aims to grow forests at its business locations which are as close to nature as possible and which are highly beneficial in preserving the local environment. To do this as quickly as possible, Kansai Electric is creating and managing green zones based on an ecological system that enables forests to grow quickly by laying good quality soil and grow dense and mixed vegetation using saplings of natural trees which adapt to the local environment. As a result, the green zones of many of Kansai Electric's power stations, including the Himeji No. 2 Power Station (fossil fuel), are inhabited by birds, insects and small animals. While emphasizing ecological green zoning as a fundamental principle, Kansai Electric also makes efforts to provide an aesthetically pleasing environment for local residents by planting the public trees and flowers of the cities where the power stations are located.

In the green zones of its power stations, Kansai Electric is creating a natural environment that local residents can enjoy complete with insects such as dragonflies and fireflies. At the end of fiscal 1999, green zone areas totalled 409 hectares. With the addition of the natural forests around Kansai Electric's hydropower stations, the total green zone area is 7,851 hectares.

Exelon's Land and Water Stewardship programme

Exelon's land stewardship initiatives include maintenance (along with 6 other utilities) of the 650-acre Merrill Creek Reservoir and 2,000 acres of environmental preserve. The reservoir serves as a water source for the utilities during periods of low water flow. Exelon is also steward of 9,000 acres of land along the lower Susquehanna River. Many areas such as the Muddy Run Park,

Fisherman's Park and Shures Landing Wildflower have been set aside to provide numerous recreational activities for the public to enjoy.

Exelon entered into an agreement with the Bucks County Audubon Society to expand the Honey Hollow Environmental Education Center and preserve nearly 200 acres in Solebury Township. The land was purchased by Exelon in the late 1960s as part of a transmission line project. Exelon also placed a conservation easement on the 112-acre Hendrick Island, located on the Delaware River, selling and contributing it, along with access land along the shoreline, to the Heritage Conservancy. The Conservancy then transferred the Island to the Commonwealth of Pennsylvania for inclusion in the Delaware Canal State Park. Several property holdings along the Susquehanna River and in Bucks County have been enrolled in the Nature Conservancy's Natural Areas Registry programme in Pennsylvania and the Maryland Natural Heritage programme. Exelon has committed to protecting these areas, which contain rare and endangered plant and animal species.

In cooperation with the Maryland Department of Natural Resources, the Pennsylvania Game Commission and the Nature Conservancy, Exelon protects and preserves the Bald Eagle Sanctuary below the Conowingo Dam. This wintering area provides protection for the nesting and roosting habitats of the Bald Eagle as well as many other indigenous birds.

ComEd has restored nearly 500 acres of natural prairies on its buffer lands and rights-of-way. Exelon continued these efforts with a maintenance burn at a 30-acre site adjacent to a generating station in partnership with the stewardship organization, Pheasants Forever. Controlled maintenance burns replicate the natural cycle that occurs when lightning ignites a prairie fire. They are designed to stimulate native plant growth, remove competing vegetation and clear the ground for additional seeding.

Since a significant number of all electric service interruptions result from tree limbs coming into contact with electric facilities, Exelon has found that a comprehensive vegetation management programme to enhance safe and reliable energy delivery is a must. PECO Energy's, an Exelon subsidiary, professional vegetation management consultants strive to minimize the number of tree-related power interruptions and to educate the public regarding proper tree selection and pruning near electric facilities. PECO Energy participates in the Green Lane Right-of-Way Research and Demonstration project comparing the impacts of a special right-of-way maintenance technique on vegetation and wildlife versus other methods. The technique produces an area free of trees and tall shrubs under the transmission wires with transition zones at each edge of the right-of-way where shrubby plant cover is maintained.

Exelon's water efforts include the Susquehanna Migratory Fish Restoration project. Exelon has operated a fish lift facility (West lift) at the Conowingo Hydroelectric Station on the Susquehanna River, USA, since 1972. In addition, construction of a fish passage facility further east (East lift) was finished by spring 1991, and has operated to pass fish into the Conowingo Pond since 1997. Furthermore, fishways have been completed at three upstream dams to ensure upriver migration. Lift and passage operations are a continuing part of private, state, and federal cooperative efforts to restore American shad and other migratory

fish to the River. In the year 2000, a record number of American shad (153,546) passed through the East lift and into the Conowingo Pond. In addition, there were 9,785 American shad lifted at the West lift facility for hatchery tank spawning and study. In the year 2001, a telemetry study will be conducted to track American shad during part of their migratory journey. The information gained during this study should allow biologists to determine where and when the fish are moving. This study is being sponsored by the Conowingo Hydro Station, Exelon's Peach Bottom Atomic Power Station, Holtwood Hydro Plant and the US Fish and Wildlife Service.

Additionally, Exelon installed wedge-wire screens at the water intakes to its Eddystone generating station which protects Delaware River fish from harm as up to 440,000 gallons of river water circulate through the plant each minute. These screens offer superior protection and eliminate fish impingement. They are also used at the Point Pleasant Pumping Station and Perkiomen Creek water intakes which provide water to Exelon's Limerick Generating Station. Such screens are also used at the Merrill Creek Reservoir.

Finally, in the area of land redevelopment, Exelon has forged a partnership with Preferred Real Estate Investments, Inc. (PREI) for the Chester Waterfront Redevelopment Project encompassing approximately 90 acres of riverfront property in the City of Chester in south-eastern Pennsylvania. This property, located along the Delaware River, is the site of the historic Chester Generating Station (retired). Exelon will donate seven acres of riverfront land to the City of Chester for expansion of an adjacent park.

Biodiversity protection at Eskom

Animals have been introduced to areas around power stations in Eskom to increase awareness of natural ecosystems and the environment. These areas, originally contractors' yards, mining areas and ash disposal sites are rehabilitated to a stage that they can support indigenous animals. The artificial and natural water systems around stations also serve to attract birds to the areas, and serve as refuges during drought and other time of stress. Staff are encouraged to partake in biodiversity assessments and clean up programmes to develop a pride in their stations.

Eskom's partnership with the Endangered Wildlife Trust (EWT), initiated in 1996, has strengthened over the last year. The partnership, initiated to minimise biologically significant impacts in the country, also aims to educate stakeholders on the implications of interactions and the integration on efforts to manage interactions between birds and electrical infrastructure.

Since 1 August 1996, when the telephone reporting service was instituted, until December 2000, 1,333 wildlife interactions, i.e. collisions, electrocutions and pollution-related incidents, have been reported at 468 localities. To date, 33 localities have been identified as being in need of mitigation action. Of these, approximately 60 per cent have been completed. The Eskom/EWT partnership also conducted the National Crane Census during 2000. The project aimed at determining the numbers of cranes and population trends. Through the Eskom/EWT partnership and other initiatives, significant progress has been made in the development and testing of devices aimed at reducing bird collisions and

electrocutions. The bird flapper, a disk designed for attachment to power lines under live-line conditions to improve the visibility of the line, has been further refined and initial results show significant reductions in bird mortalities.

Eskom is represented as a trustee on the Ekangala Grassland Trust, which aims at conserving a million hectares of high-altitude grassland in Southern Africa. This area is an important water catchment area for Eskom, and is home to many endemic species. The Trust is in the process of facilitating funding to meet its first set of objectives, namely data gathering and community involvement.

Tree planting by Ontario Power Generation, Canada

Ontario Power Generation (OPG)'s Biodiversity Policy first introduced in 1995 commits OPG to manage its activities in a manner that encourages, the continued existence of native species, and the ecosystems upon which they rely. This commitment can be illustrated by OPG's Carbon Sequestration and Biodiversity Management programme. As part of this programme, OPG has committed to plant 1.6 million native trees and shrubs and to reforest at least 800 hectares in southern Ontario by 2005, with a minimum base planting of 200,000 trees annually thereafter. In its first year, since the programme was initiated in the spring of 2000, over 600,000 trees and shrubs will have been planted.

The programme is focused on obtaining the greatest possible benefits by strategically targeting conservation priorities such as reconnecting fragmented landscapes, aiding in the recovery of species at risk and enhancing riparian habitats.

The programme's success is largely due to the establishment of strategic partnerships with conservation authorities and NGOs across southern Ontario including:

- The Toronto and Region Conservation Authority [200,000 plantings]
- City of Toronto [2,300 plantings]
- Long Point Region World Biosphere Reserve [40,000 plantings]
- Niagara Escarpment World Biosphere Reserve [51,000 plantings]
- Essex Region Conservation Authority [54,750 plantings]
- Essex Field Naturalists Club [52,200 plantings]
- Conservation Halton [23,400 plantings]
- Credit Valley Conservation Authority [51,200 plantings]
- Kettle Creek Conservation Authority [100,000 plantings]
- Trees Unlimited [84,000 plantings]
- Eastern Ontario Model Forest [373,000 plantings]

It is through these partnerships that OPG ensures the ongoing management and monitoring of the plantings. OPG has also leveraged its programme by engaging others to participate in significant woodland protection and reforestation activities in southern Ontario. Environment Canada and the U.S. Environmental Protection

Agency recently recognized OPG's efforts with the Success Story of the Year Award at the SOLEC 2000, State of the Lakes Ecosystem Conference.

4.2 Social strategies

4.2.1 Support key social programmes

Introduction

For many decades, and before environment and development became important issues worldwide, companies have considered it as an important part of their role as corporate citizens to contribute to the well-being of local communities, through giving charities, scholarships or other types of support to disadvantaged groups. Today, such community programmes are still considered an important part of companies' contributions to sustainable development, through reaching a much broader set of causes and often going beyond the local community.

Eskom's contributions to development

During 2000, six clinics (1999: seven) were electrified from Eskom's Development Foundation funds. In addition, Eskom managed projects for the Department of Health and certain transitional local councils, whereby one clinic (1999: six clinics) and three schools (1999: eleven schools) were electrified. In addition to contributing to **electrification** (see section 4.2.2), in itself an important element of South Africa's development efforts, Eskom also works in other areas to improve poor and disadvantaged people's lives.

Eskom supports **black economic empowerment** in South Africa. As part of its procurement policies and managerial support programme, Eskom supports small, medium and micro enterprises and large black-owned businesses.

Eskom Development Foundation (ESDEF) focuses on **job creation**, probably the single most important need of the country. This has the effect of reducing unemployment and developing entrepreneurs. The foundation also focuses on skills development, a major need in South Africa. Emphasis on skills development is likely to have several benefits, the key one being the development of human resources. Eskom's social investment initiatives are carried out through the vehicles of community development; small business development; electrification of schools and clinics; education portfolio and donations. Particular emphasis was given to the development of rural communities, women and disabled people. Job-creation initiatives were undertaken through small business development support.

Eskom has continued to contribute to the national and international fight against **HIV/AIDS**. In February 2000, the South African Business Council on HIV/AIDS was re-launched with Eskom's support. Eskom provides leadership to the Southern African Development Community utilities' HIV/AIDS committee and has committed \$4.2 million to the vaccine development research of which \$2.1 million was paid during 2000. Eskom's HIV/AIDS programme has received two international awards, a South African award, and has two "Best of Series" documents developed by international bodies.

Community partnerships at Western Power

In a joint initiative with Channel 7, Western Power provides display lighting to the lemon-scented gums along Fraser Avenue in Kings Park for special days during the year including Christmas, Anzac Day and Australia Day. In addition, Western Power promotes responsible use of electricity and supports a Christmas Lights Competition.

Western Power is the major sponsor of the Western Warriors team. The Western Power regional junior cricket development programme is also a very popular association. For six months each year, full-time regional cricket officers conduct coaching clinics for children in the Goldfields, Mid West, South West, Wheat Belt, Great Southern and country districts. Other youth sporting activities in regional areas that are in partnership with Western Power include Country Netball clinics in association with WA Netball and the Goldfields Football League.

The Western Australian Symphony Orchestra's programme of 'Symphony Under The Stars' concerts is supported by Western Power as the principal sponsor. These concerts were held at the Kings Park Tennis Club in 2000 and provided a valuable contribution to cultural activities in the community.

Western Power Assist Scheme is funded by Western Power and administered by Anglicare on behalf of the WACOSS (The Western Australian Council of Social Services) Emergency Relief Agencies Forum. The scheme provides financial assistance for disadvantaged Western Power customers' accounts to be applied at the discretion of emergency relief agencies as part of an annual assistance package.

PowerGen

Powergen is involved in a variety of projects to meet the needs of local people. These include:

Tackling fuel poverty: The accepted definition of 'fuel poverty' is the need for a household to spend more than 10 per cent of their income on fuel. More than six million households in the UK suffer from fuel poverty and are unable to afford adequate heat and light.

Fuel poverty arises from the combination of low incomes and poor energy efficiency in homes. PowerGen supports the charity National Energy Action and works with them to tackle the problem in the East Midlands. Since 1992, PowerGen has provided funding of over £1 million to long-term projects which ensure practical and detailed energy advice is made available to those communities that need it most. These projects include:

- The **Derby Energy Awareness Project**, which promoted energy awareness and energy efficiency through advice, presentations and training events for community groups and relevant professional personnel. It also promoted referrals for grant assistance and the take-up of any other grants available.
- The **Rural Energy Awareness Project**, which promoted energy awareness through energy advice, presentations and energy awareness training in North Kesteven and Boston in Lincolnshire.

- The **Leicester Warm and Healthy Homes Project**, which commenced in January 1999 and runs until March 2002. The project is funded by Powergen with support from Leicester City Council and aims to demonstrate the contribution which improved energy efficiency can make to tackling health problems which result from living in cold and damp homes. In particular, the project targets ethnic minority communities and families with young children.
- The recently launched **Mansfield WARM Project**, which is a joint project with Mansfield District Council. The project aims to demonstrate the contribution that energy efficiency can make to tackling fuel poverty within a coalfield community and will benefit the local community in Mansfield.

Electric blanket testing: Each year, more than 5,000 fires are caused in the UK as a direct result of unsafe electric blankets. Many of the victims are older people. PowerGen has teamed up with Age Concern to research the problem, test blankets used by older people and offer free replacements for faulty blankets.

In 1999, 30 local Age Concern centres organised testing sessions in the East Midlands, Kent, Hertfordshire, Humberside and Wales. In just four weeks early in the autumn of 1999, nearly 4,000 blankets were tested. Over half were found to be faulty and were replaced, potentially saving lives. This scheme received the support of the Department of Trade and Industry, and was repeated in 2000.

The William Walton Trust: Powergen has been the corporate sponsor of the William Walton Trust, a charity promoting education projects through the music of the composer William Walton, since 1995. The collaboration between Powergen and the Trust specifically aims to facilitate creative music-making in schools that have little music provision.

Over the years, PowerGen has supported projects involving thousands of schoolchildren in London, Liverpool, Coventry, Deeside and Nottingham. The project gives schools the opportunity to work with renowned orchestras on a range of activities, including concerts, drama workshops and teacher training.

4.2.2 Expand access to electricity

Introduction

Electrification is often regarded as one of the major factors in bringing developing countries onto a sustainable development path for the future. Not only does electrification give health and welfare benefits to end-users and environmental benefits for society at large, but it can spur important economic growth in marginal areas. For electric utilities based, or investing, in developing countries contributing to electrification in that country may be seen as a major contribution to sustainable development.

Eskom's electrification programme

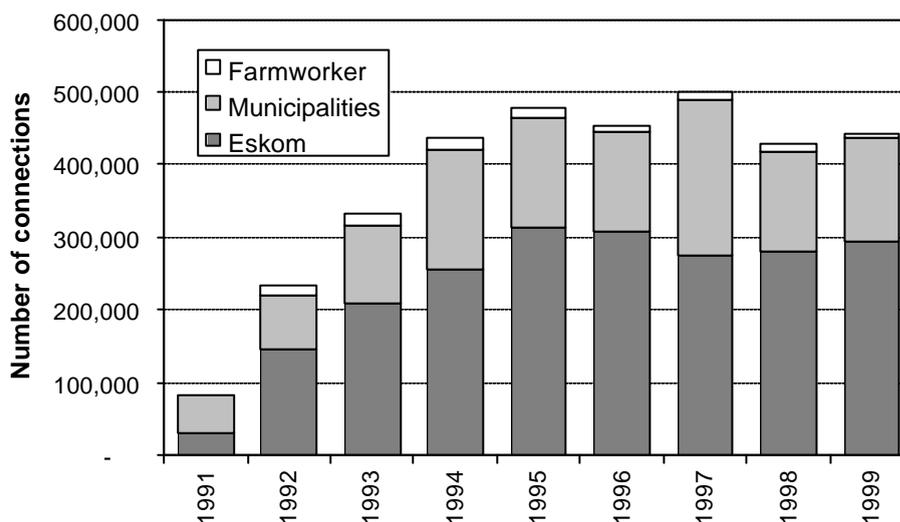
In 1994 Eskom committed itself to connecting 1,750,000 additional homes by the year 2000. This formed part of Eskom's commitment to the new South African Government's reconstruction and development programme – a broad set of activities intended to improve the social and economic well-being of South

Africa's population. Government set overall targets for electrification of 2,500,000 additional homes receiving electricity, which means that Eskom took responsibility for achieving 70 per cent of the total national target.

In fact, Eskom had initiated its electrification programme in 1991, and had been steadily increasing the annual number of households electrified in the years leading up to 1994. Nevertheless, the objective of connecting close to 300,000 households per annum was a challenging one for the utility.

Eskom was able to achieve the electrification targets it set itself, while at the same time making a significant real reduction in electricity prices. These two achievements represent a major contribution from Eskom to social and economic development in the country. Access to electricity in urban areas is now over 90 per cent and around 40 per cent in rural areas, giving a national level of access of around 65 per cent - almost double the level in 1991. Eskom has committed itself to continuing its electrification programme through an additional 600,000 new connections over the next three years.

Figure 4.7 Eskom's electrification programme – number of connections



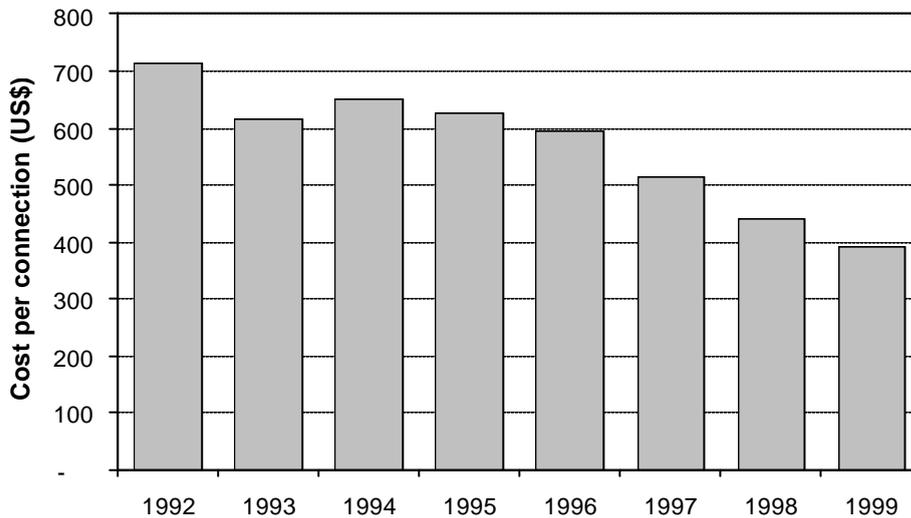
In addition to the electrification of households, Eskom has focussed on providing electricity to rural schools and clinics. In certain cases, this has been achieved with the use of off-grid technologies (principally solar power), and Eskom is now extending into offering electricity services from solar power to individual households in partnership with Shell.

In addition to representing a powerful symbol of development, access to electricity has brought a number of positive environmental and economic benefits to isolated communities. Apart from the added convenience and versatility of electricity, it has also brought the possibility of new income generating activities into rural communities. In addition, the process of electrification itself has created jobs and business opportunities for sub-contractors. In areas where people have traditionally relied on coal or fuelwood for energy resources, access to electricity can make a significant impact on indoor pollution levels, as well as improving safety by reducing the risk of fires and burns. Nevertheless, in poor rural

communities the transition to a greater reliance on electricity can take several years, and the benefits of electricity may emerge only slowly over time.

Reducing the cost of connection has been an important factor in Eskom's electrification programme. It is widely expected that revenues from electrification customers are insufficient to meet the costs of installing new infrastructure. Consequently, it has been important to minimise the costs of connection as far as possible. Seen another way, reduced capital costs allow the investment resources to benefit more households. Eskom has managed to reduce the average cost of electrification by almost 50 per cent since its programme begun. This was achieved as a result of exploiting economies of scale and developing technical innovations in network design, distribution structures, conductor cables and lower cost metering equipment. South Africa has been at the forefront of developing electronic prepayment metering systems which have simplified metering and billing systems in rural areas considerably.

Figure 4.8 Eskom's electrification programme – cost per connection



4.2.3 Consult stakeholders and provide information

Introduction

Increasingly, and especially since the Brent Spar issue, it has been clear that companies must move their stakeholder dialogue beyond government policy-makers and regulators to ensure broader societal approval for their operations. Companies which master stakeholder dialogue and consultation will be well positioned to tackle the challenges of moving business and consumers towards a sustainable society.

Stakeholder consultation and dialogue at EPCOR

Public Advisory Committees to EPCOR are charged with providing input and advice to EPCOR. They were established to fill the role of an independent advisory body with a mandate to provide feedback to EPCOR on issues affecting the community and EPCOR customers. To provide a relevant and productive

forum for discussion, the committees actively recruit members from a diverse cross section of the institutional community and business organizations, unions, and public members. Annual Reports highlighting the activities undertaken by the Public Advisory Committees are produced and available to the public.

The **Strathcona Industrial Association** was established in 1974 with a mandate to work with the community, city and county to ensure a safe and healthy working and living environment. Along with nine other companies with operations in east Edmonton and west Strathcona County, EPCOR is a member, participating in the Environment Committee and Community Awareness Emergency Response (CAER). The Environment Committee addresses environmental matters and manages the ambient air network of seven continuous and 21 static emissions monitoring stations. CAER provides an opportunity for dialogue between community and industry representatives. Local residents can obtain information about safety, health and the environment through a CAER newsletter, an information line or CAER fairs held several times a year.

Stakeholder relations at TransAlta

TransAlta interacts with a number of major external stakeholder groups including: environmental non-governmental organizations, industry peers, individuals and groups in our host communities as well as the regulatory bodies and political leadership that govern operations. The company's stakeholders are defined as those who are directly affected by TransAlta's presence, and those that live in the communities where it operates. Stakeholders may also be defined by the requirements of its operating permits and by virtue of the formal or informal influence they may exert on the company. A few examples of stakeholder consultations are provided below.

In November 2000, TransAlta broke ground on the site of a \$400-million, 650 MW power project in **Sarnia, Ontario**. The key stakeholders in the area include customers (Dow Chemical, NOVA Chemical (Canada) and Bayer) and the employees of Dow and Bayer that will be joining TransAlta, provincial and municipal political leaders and regulators, the Amjiwnaang First Nation (Chippewas of Sarnia), other local industries and environmental groups like Pollution Probe and the Ontario Clean Air Alliance.

TransAlta's discussions with these stakeholders centred on employment issues, environmental considerations, economic issues and the siting of related transmission facilities. Over a period of six months TransAlta held three open houses and dozens of individual meetings. Full commercial operation of the new plant is expected by October 2002.

TransAlta's three Alberta coal-fired generating facilities and two mines are located in the Wabamun Lake area near the Village of Wabamun, 70-kilometres (43 miles) west of **Edmonton**. A significant portion of TransAlta's stakeholder relations effort is focused on the communities connected with these operations. TransAlta is committed to understanding local issues and is working with stakeholders to address their concerns through ongoing, open dialogue. A number of stakeholder committees are established to facilitate this dialogue.

Over the past year, consultations with stakeholders resulted in a number of conditions for the renewal of TransAlta's environmental operating permit for the Wabamun power plant. The permit, granted in November by Alberta Environment, incorporated many of the issues and concerns of stakeholders including the establishment of a Wabamun Lake advisory committee for information sharing and a forum for public consultation on all of TransAlta's activities in the Wabamun Lake area. TransAlta is currently working with area stakeholders to build this committee. The first meeting is expected in the spring of 2001. Other conditions of the permit include nearly \$30 million in environmental improvements to the plant and the expansion of the Wabamun Lake Water Treatment Plant.

COKE, a community-run committee open to residents of the Keephills community, was formed in 1977 to represent the community in the proposed extension of the Highvale mine permit and the original development of the Keephills power plant. It was the first local advisory group created in response to a resource development in **Alberta**, and continues to meet each month. As a recognized public voice in the Keephills area, the committee's mandate is to monitor opinions and attitudes of Keephills' residents towards development in the area, communicate community concerns to TransAlta, Parkland County and Alberta Environment, and share information with community residents. COKE represents the Keephills area on the Keephills Power Project Steering Committee.

TransAlta owns and operates 13 hydroelectric facilities on the Bow River and North Saskatchewan River systems of Alberta. Hydroelectric facilities can generate a number of stakeholder concerns including the potential impact of operations on fish habitat and water level for recreational use of resident rivers. TransAlta meets regularly with interested stakeholders. TransAlta's stakeholder consultations continue to be translated into action, and the company has continued to work on its voluntary Fish Habitat Enhancement Initiative on Canmore Creek and has initiated a new project on Jumpingpound Creek near Cochrane. These initiatives seek to mitigate TransAlta's net impact on water bodies affected by, or located near, hydropower operations. A series of studies moved into the recommendation phase in 2000, including studies on the Kananaskis River and the seven-year-old University of Calgary Lower Kananaskis Lake Fishery Monitoring Project. 2000 also saw the creation of a new non-profit stakeholder group called the North Saskatchewan Watershed Alliance. This group, dedicated to promoting river basin stewardship, is a growing partnership between many groups and individuals, with initial organizational direction provided by Epcor, TransAlta and Trout Unlimited.

Ontario Power Generation

Ontario Power Generation (OPG) is instilling a culture within its organization based on the precept that stakeholder consultations inevitably lead to better outcomes. This is being reinforced with OPG's senior managers as part of leadership training. A sustainable development decision-making module underscores, in a workshop setting, the importance of strong stakeholder relations to OPG's commercial success. The course is designed to demonstrate how existing and emerging issues place multidimensional and often-competing demands on decision-making, especially in a deregulated and competitive electricity market.

On a practical level, OPG works closely with local communities and citizen groups to ensure that their interests and concerns are respected in the operation of its facilities. At each of its nuclear facilities, OPG has established public advisory councils that meet regularly with management to discuss issues that are pertinent to the community.

A more direct communications approach is being taken with the residents of Pickering, Ontario where OPG intends on returning to service four laid up nuclear reactors. In the fall of 2000, over 300 OPG employees joined in the Pickering Neighbourhood Walk, visiting over 16,000 households in the Pickering and Ajax areas to help explain the company's plans to return the Pickering A units to service and to seek community feedback. This unprecedented stakeholder consultation exercise was instrumental in the Canadian Nuclear Safety Commission's acceptance on Pickering Nuclear's Environmental Assessment and opened the way to the first unit's restart (subject to licensing) in 2002. The Pickering Neighbourhood Walk was successfully repeated in May of 2001.

The Madawaska River Management Review is another example of OPG's stakeholder consultations. This three-year tripartite review brought together a wide range of Madawaska River stakeholders who had divergent economic, social, cultural and recreational interest. Working with the Ontario Ministry of Natural Resources and an advisory committee area constituents, OPG was instrumental in identifying sustainable solutions to issues that affected the health of fish and aquatic ecosystems, recreation and tourism, hydroelectric generation and flood control.

Stakeholder consultation at BC Hydro

The province of British Columbia is home to 197 First Nations bands. BC Hydro has facilities on at least of 168 of these bands' reserve lands, which means that much of the electricity consumed in B.C. must cross First Nations' legally titled land to reach customers around the province. As well, changing legal and political realities are providing B.C.'s First Nations with greater control over activities in broader areas considered "traditional territory." Responding to these developments, BC Hydro began in 1993 to take a comprehensive approach to Aboriginal relations, in order to mitigate potential risks to our current operations and future growth. The objective is to establish mutually beneficial relationships with Aboriginal people that will be recognized as models for others to follow.

A variety of programs and initiatives have been created. BC Hydro has been negotiating directly with several tribal groups and bands to resolve past issues concerning alleged impacts of Hydro facilities on their environment, their culture and their way of life. BC Hydro facilitates the participation of First Nations in consultations involving projects, programs and permit applications; promotes economic development opportunities for First Nations; has developed a cross-cultural training program that has been taken by more than 4,700 Hydro employees, as well as by employees of more than 100 outside organizations; and operates a corporate outreach program involving grants to various Aboriginal social initiatives and a scholarship program.

4.2.4 Corporate social responsibility (CSR) approaches

Introduction

Corporate social responsibility (CSR) is a relatively new term, and there is yet no international agreement of what it should mean or how it should relate to sustainable development. Inherently, CSR is about the broader role and responsibility a company has in society, i.e. it is closely related to the meaning of sustainable development for business. CSR has often been used for the social dimension, and particularly to describe the responsibilities western companies have when investing and expanding their operations into developing or transitional countries. A whole range of issues of an ethical, social or environmental character, have to be dealt with one way or another. Examples include issues of human rights, corruption, labour standards, gender and race discrimination, relocation of people, environmental health and conservation.

Most electric utilities have their main operations at home, since many are, or have until recently been, public utilities with a main goal of providing electricity to the national population. This goal remains, but deregulated energy markets have opened up for, and to some extent required, a more international orientation from electric utilities, and therefore an emerging need to address CSR issues.

CSR at TransAlta

TransAlta has growth ambitions outside Canada (for example in Mexico) and acknowledges in its recent Sustainable Development Annual Report that

“One of the challenges associated with becoming a multinational company has been venturing out to new countries and cultures. TransAlta remains committed to being a good neighbour in our host communities – we always try to do the right thing, but what that thing is, is often not as clear as one might think.”

TransAlta understands it needs a “social contract to operate” and interprets its “social responsibility” as a

“...bond between TransAlta and our employees, host communities and other stakeholders to do right by them – to listen and act in a manner that respects their rights, needs and livelihood.”

TransAlta has stated in its report that it will develop a complete CSR strategy by the end of 2001, including an updated Corporate Code of Conduct. TransAlta’s legal department consulted with leaders in its business and peers in industry for guidance in updating the Code. The Code will, when completed, address issues including respect, ethics, environment, health and safety management, social responsibility, financial controls and records, compliance with laws, respect in the workplace, conflict of interest, competition and insider trading.

CSR at Exelon

Exelon has developed a Code of Business Conduct – a “roadmap” for all employees on how to conduct business both legally and ethically. As a point of departure the Code states four values – boldness, creativity, accountability and

commitment. The latter two deal with Exelon's commitments to the environment and society at large.

The Code of Business Conduct covers legal and business conduct issues and is maintained and developed by Exelon's Ethics and Compliance Office. The legal section of the Code provides guidance on issues of antitrust, copyrights and trademarks, employment (fair treatment, harassment, safety and health, workplace violence and weapons, drugs and alcohol), environment, government relations, "insider information" and securities trading, international trade (e.g. corruption issues), and regulatory rules of conduct.

The section on business conduct deals with issues of accountability, community relations, company assets, competitive information, conflicts of interest, customers, diversity, political activity, privacy, records and reports, reporting violations and retaliation, sales and marketing, and finally, supplier relationships.

The two sections provide guidance on what employees should and should not do in the different areas. The Code acknowledges that it cannot cover all areas that employees may encounter, and it therefore recommends that employees ask the following questions before taking action in specific situations:

- Is it legal or ethical?
- Does it conform to Exelon's company policy?
- How would my actions appear to my supervisors, peers, subordinates, friends, or the public if reported in the news media?
- Does it make me feel uncomfortable?

CSR at Ontario Power Generation

Ontario Power Generation (OPG) believes its corporate objectives will be achieved, in part, by projecting a brand image reflective of its solid performance as a socially responsible energy generator. OPG's commitment to Corporate Social Responsibility (CSR) includes engaging employees, partnering with stakeholders and supporting the communities in which it operates.

OPG initiatives designed to engage employees in its transformation include:

- The establishment of a Chief Ethics Officer position and Ombudsman's office.
- A newly revised *Code of Business Conduct* and on-line training programme.
- The launch of a new leadership development programme for senior managers.
- A new employee recognition programme for outstanding employee contributors.
- Financial and commercial orientation seminars for all employees.
- The establishment of programmes to enhance workplace safety and employee wellness.

- New outreach programmes designed to recruit and retain a diverse and highly competent workforce.

In addition to its employees, OPG counts among its key stakeholders investors, regulators, interest groups, customers and the communities in which it operates. Developing and maintaining lasting relations with these stakeholders is of strategic importance to the company. Related initiatives include:

- OPG's Corporate Citizenship programme (CCP). This programme sponsors community-based initiatives that have linkages with the company's strategic goal to become a sustainable energy company. These initiatives fall under the broad categories of environment, education and community.
- OPG's Charity Campaign. This employee-led campaign raises fund for over 1400 charities across Ontario, including the United Way, the Canadian Cancer Society, and the Hospital for Sick Children. In addition, OPG provides four employees for a three month period to assist the United Way of Greater Toronto fund raising campaign.
- Community outreach strategies including *Neighbourhood Walk* and open houses.
- Comprehensive communication programmes including nuclear report cards, newsletters, annual CCP and Sustainability Reports and information brochures.
- Community Advisory Committees established to enable regular dialogue between the company and members of the communities in which OPG operates.
- Partnerships with academic institutions and special interest groups.

4.2.5 Health, safety & employee welfare, and labour standards

Introduction

A holistic sustainable development vision should not only be concerned with the wider role of the company in society, but also make sure that the company's internal affairs are consistent with the overall vision. Important social elements at a workplace include the health and safety of employees in all types of operations and their general welfare at work. Having high standards in this area underline that the company is seriously committed to implementing sustainable development principles in all areas of operations.

Health and safety at British Energy

British Energy's **occupational health** service is committed to preserving and promoting good health and to preventing ill health caused by working conditions.

Health surveillance covers all staff, going well beyond the statutory requirements for radiation workers. It combines the basic principles that the individual should be fit for work and the work fitted to the individual. During this year the programme of Task Related Health Assessments has been extended across all

sites; these are regular preventative health assessments that link health, work, lifestyle and health promotional aspects into one holistic approach.

As part of British Energy's emphasis on safety it operates drug and alcohol policies which include unannounced random testing of any person with unescorted access to sites. These are combined with education and support programmes.

There have been improvements this year to company policies on working hours and working alone; including consideration of the health implications. In support of the company's policy on mental health, a new risk assessment tool has also been developed to help managers identify and address causes of stress at work.

British Energy continued to fund research into the effects of radiation. This includes the National Childhood Cancer Study, the Scottish Case Control Study of Childhood Leukaemia and Cancer and a programme of radiobiological research administered by the United Kingdom Co-ordinating Committee for Cancer Research. British Energy supports the work of the National Registry for Radiation workers (NRRW), administered by the National Radiological Protection Board, as the main focus for UK research into the health effects of ionising radiation on workers.

British Energy's **sickness absence rate**, although higher than last year, remains low in comparison with national levels (2.5 per cent compared to national average of 3.4 per cent). There was one report of disease under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations in 2000. This was a case of non-Hodgkin's lymphoma. It is not believed to have been work-related.

British Energy's **safety management** arrangements are an integrated part of the general management process. All staff are involved in maintaining and improving safety standards. Formal consultation is through Health and Safety Committees (HESACs) at all locations. These are playing an increasing role in helping to improve safety culture and developing new approaches to health issues.

In the area of **nuclear safety** British Energy has had a steady improvement in the number of unplanned automatic reactor trips. The unplanned automatic trip rate is a measure of the quality of reactor operations. Performance in 1999/2000 is the best yet achieved (1.33 average number of unplanned automatic shutdowns per 7,000 hours of reactor operation). Staff at all levels in the organisation has been involved in the improvement. Plant has been upgraded and on-load testing procedures optimised to reduce the risk of plant transients.

Employee welfare measures at TransAlta

TransAlta has realized the importance of employee welfare and satisfaction, and offers a wide range of flexible benefits to employees. TransAlta's reward philosophy is to recognize superior performance with superior pay, provide individuals with a choice of benefits to best meet their personal needs and provide a wide range of rewards to reflect the variety of employee needs. The following provides examples of flexible benefits offered to TransAlta employees.

TransAlta has a **Leadership Development Programme** designed to recruit and train talented young professionals for eventual leadership positions in the company. The programme runs for 14 to 16 months with candidates engaged in four, three-to four-month rotations within different departments.

In Canada, TransAlta offers a **flexible benefits** programme from which employees can choose the best combination of options to suit their personal needs. These options include: seven independent benefit choices with at least three options each (more than 25 options in total), prescription medication plan with a drug card, and a variety of health spending account options.

All permanent employees have the opportunity to **purchase shares** through the Employee Share Purchase Plan that offers employees an interest-free loan for up to 30 per cent of their base salary to purchase common shares from the open market. In each of the last two years the company has awarded stock options to all employees.

TransAlta contributes an amount equal to 10 per cent of each employee's base salary to his or her personal **pension** account. Vesting occurs after two years of continuous employment.

TransAlta employees are eligible for an annual **incentive bonus payment** based on the achievement of corporate and department goals. TransAlta pays a competitive market-driven base salary. Non-union employees are paid within broad pay bands that allow for differences in pay based on performance. TransAlta also offers other rewards such as management awards, education assistance and scholarship for children of employees.

TransAlta presents 48 post-secondary **scholarships** annually to children of TransAlta employees. These scholarships are awarded on the basis of academic performance and may be used for post-secondary education in a community college, university or technical school.

Ontario Power Generation

All of OPG's operating facilities are located in Ontario, Canada. As such, OPG is must comply with all Canadian and Ontario provincial labour laws.

OPG upholds and supports freedom of association and collective bargaining. About 90 per cent of OPG's workforce is unionised and labour relations seen as critical to achieving corporate objectives. During 2000, new collective agreements designed to speed marketplace success were reached in a cooperative manner with the two unions that represent the majority of employees. Tripartite teams consisting of representatives from management and the two unions were also established. One of the early successes owing to these partnerships was the finalization of a corporate-wide *GoalSharing* programme, an incentive plan believed to be the most extensive in the industry. In 2000, this programme ensured that virtually all employees shared in OPG's operating profits.

OPG has in place policies and codes of conduct that specifically address employee safety and health, workplace diversity, harassment and violence. To ensure the

quick resolution of disputes, OPG has established an independent Ombudsman's office.

4.3 Economic strategies

4.3.1 Support R&D and training

Introduction

Technology cannot on its own solve the environmental and social problems faced by a growing world population. However, most people see the development of new and more efficient technologies as an essential part of the solution. So too, with energy resources. A large part of the current electricity production will have to utilize other sources of energy in the not too distant future. Research and development of technologies which can use resources more efficiently, and technologies which can utilize renewable resources are essential for a sustainable future.

Table 4.3 R&D expenditure

Electric Utility	R & D Exp. (USD)	Total revenues (USD)	R & D share of revenues (%)
British Energy	27 ⁶	3038	0,89
EPCOR	Not stated	1421 ⁷	-
Eskom	22 ⁸	2960	0,74
Exelon	Not stated ⁹	-	-
Kansai	N/A	-	-
Ontario Power Generation	39	1058	0,037
Powergen	Not stated	5994	-
Tepco	Not stated	42260	-
TransAlta	Not stated	1033	-
Western Power	Not stated	733 ¹⁰	-

Source: All figures are taken from respective annual reports.

R&D at Kansai

Kansai has realized the importance of developing new energy supply technologies. In addition Kansai is involved in R&D in the area of CO₂ absorption to combat global warming. Below is an overview of some R&D activities at Kansai, starting with new energy supply technologies.

⁶ An exchange rate of 1.43 GBP to the USD is used for British Energy and Powergen.

⁷ An exchange rate of 0.65 CAD to the USD is used.

⁸ An exchange rate of 0.12 Rand to the USD is used.

⁹ Because of recent merger (and therefore no annual report for the company), comparable figures must be compiled by Exelon through its subsidiaries.

¹⁰ An exchange rate of 0.52 AUD to the USD is used.

Superconductivity technology could potentially bring about a revolution in all areas of future society. Superconducting generators improve efficiency over traditional generators and also improve power system stability. Accordingly, incorporating superconducting generators leads to resource conservation by reducing the use of fossil fuels and contributes to energy conservation through improved stability of electric power systems, thereby enhancing transmission capacity. Kansai Electric is engaged in basic research to determine the possibility of applying superconductivity technology in power generation apparatus, in preparation for a superconduction power generation system in the 21st century, and participating in the Japanese Government's superconductivity development project for the purpose of finding solutions to utilize superconducting generators.

Fuel cells, a system which generates electricity directly through a hydrogen and oxygen chemical reaction, are expected to develop into a new power generation system. This is an efficient method of low energy conversion loss, enabling fuel diversification using fuels such as natural gas, methanol and coal. Kansai Electric is conducting an elementary technical development of the Molten Carbonate Fuel Cell and the Solid Oxide Fuel Cell, two next-generation fuel cells with high power-generation capacity and superior utilization of exhausted waste heat. The goal of Kansai Electric is to apply these cells to be used in the electric power sources of the future.

Increasing the scale of **nature's CO₂ absorbing capacity**, such as the tropical rainforests, is an important and cost-effective way to achieve reduction of GHGs. Kansai Electric has from the early 1990s been carrying out R&D on technology that can fully apply the principles of the Kyoto Mechanisms such as the Joint Implementation and the Clean Development Mechanism.

Although we tend to think that tropical rainforests can replenish themselves quickly, this is unfortunately not the case. Because the temperature in the tropics is high, organic matter dissolves quickly and is dispersed into the air as substances such as CO₂ and CH₄ (methane). This means there is only a thin layer of soil with few nutrients. Against this background, Kansai Electric and Gadjah Mada University in Indonesia have been carrying out international joint research since 1992 under the Tropical Rainforest Restoration Technology Development Project. Under this project, researchers make use of the symbiotic relationship between lauan and micro-rhizal mushrooms in order to raise the number and growth rate of the seedlings. To date, the researchers have found that the use of these fungi have been effective in doubling the tree size growth and in increasing the number of trees by five times. In 1998, the experimental forest area was increased to 60 hectares, and in this forest researchers have been testing technology for improved afforestation, developing afforestation support technology such as agroforestry (a method of afforestation in which the forest is managed while planting and harvesting agricultural crops so as to eliminate the necessity of slash and burn farming), and attempting to improve soil by confining CO₂ using charcoal.

R&D at Eskom

Research, Development and Demonstration (RD&D) is the custodian of Eskom research funding and in 2000, managed the allocation of R141 million in five research categories, namely: end-use; future technology; integrated energy systems; asset and product performance enhancement; and environmental

research. These categories support the sustainable development of Eskom's business, while maintaining strong ties with external research initiatives. Various collaborative studies with industrial and academic partners are undertaken which support the growth of South Africa's technological capabilities.

The management of research is an iterative process that combines strategic planning, business management and research application. Environmental Research is aimed at addressing the environmental needs of Generation, Transmission and Distribution and also plays an important role in long-term strategic planning and decision-making.

Fuel cells at Ontario Power Generation, Canada

One of the steps being taken by Ontario Power Generation (OPG) is to support the development of cost-effective, low emission technologies. One example is OPG's participation in a two-year project to build and operate the world's largest precommercial solid oxide fuel cell power plant. OPG is co-funding the project with the Canadian government, Siemens Westinghouse Power Corporation and the U.S. Department of Energy.

Fuel cells produce virtually no NO_x and SO₂ emissions because they use an electrochemical process rather than combustion to convert natural gas to electricity. CO₂ emissions are also reduced by more than 50 per cent compared with coal-fired generation. The fuel cell demonstration plant is being constructed at Toronto-based Kinectrics Inc., OPG's independent science and engineering services company.

OPG also sponsors a number of research programmes established to develop technologies that will reduce emissions from coal combustion and advanced emission-free electricity generation. These include research into high-efficiency, zero emission coal technologies with the Zero Emission Coal Alliance, GHG capture and sequestration in deep ocean aquifers, emission scrubbing technologies and research into mercury emission control technologies with the U.S. Department of Energy.

In 2001 the company announced the creation of OPG Ventures Inc. a new subsidiary that will invest \$100 million over the next three years in alternative electricity generation and related technologies.

4.3.2 Support business development

Ontario Power Generation (OPG)'s vision incorporates the long-term goal of becoming a sustainable energy company. One of the steps being taken by OPG in pursuit of the economic component of this objective is to support the development of alternative generation technologies and related business services.

In 2001 OPG announced its intention to invest in emerging energy and leading-edge energy technologies through a new subsidiary company. OPG Ventures Inc. will invest \$100 million over the next three years in viable companies that have alternative electricity generation and related technologies in the advanced start-up stage or beyond.

In November 2000, OPG announced a 10-year, \$1 billion information technology agreement with New Horizon System Services, a joint venture between OPG and Cap Gemini Ernst & Young. The new company plans to offer information technology services to OPG and throughout the North American electrical industry.

In August 2000, OPG and C-Sat Technologies created Kinectrics Inc., a new independent science and engineering services company. OPG currently owns 90 per cent of Kinectrics, whose projects include building and testing the world's largest precommercial solid oxide fuel cell power plant.

Another e-commerce joint venture saw OPG and Toronto Hydro Corporation form EBT Express in October 2000. This company is the first in North America to provide centralized electronic data management and transaction services to local distribution companies and energy retailers. Within the first six weeks of operation, EBT Express had captured over 24 per cent of Ontario's meter base of 3.6 million customers.

In September 2000, OPG announced plans to quadruple its green electricity generation capacity to 500 MW by 2003. A new operating division, OPG Evergreen Energy was created to oversee the company's expanded green power programme. Recently, OPG announce that in partnership with British Energy (Canada) Ltd., it will construct a 10 MW wind farm at a site adjacent to lake Huron.

4.3.3 Procurement

Ontario Power Generation's (OPG) \$1.4 billion purchasing power provides the company with opportunities to encourage suppliers and contractors to operate in an environmentally responsible manner. OPG's Supply Chain Excellence programme has made it possible to incorporate environmentally responsible procurement, risk management and energy-efficiency factors into more of its purchasing decisions.

New procurement policies require that buyers of goods and services take into account internal life-cycle factors such as packaging, storage, emissions, toxicity, disposal and energy use in procurement decisions. This is facilitated by a restructured supply chain management group whose responsibilities include all levels of the supply chain from product design, specifications, requisitions, sourcing, procurement and storage to investment recovery and disposal.

Corporate Minimum Standards for Contractor Environmental and Safety Management were introduced to guide contractor selection based on the environmental and safety risks. These standards require OPG project managers to identify the environmental aspects and assess the risks associated with the work to be done prior to contract tendering. The standards specify that high-risk jobs will only be awarded to contractors that have environmental management systems consistent with ISO 14001.

OPG has also put its major suppliers on notice that it will increasingly favour those that are ISO 14001 certified.

To facilitate the procurement of goods and services that are environmentally responsible, environmentally friendly products are identified in OPG authorized product selection catalogs. Supply Chain Management also has the authority and ability, through centralized procurement, to specify environmentally preferred commodities that are cost competitive based on an internal life-cycle analysis. These include products such as fuels, solvents, electronic devices, office furnishings and paper products.

Specific examples of green procurements include:

- Recycled paper
- Energy Star compliant electronic devices such as photocopiers and printers.
- Energy efficient lighting
- Product lease and take-back contracts e.g. computers, refillable toner cartridges
- Water-based paints
- Low-emission vehicles
- On-line ordering

Other initiatives are underway to optimise packaging, storage and the procurement and use of products containing hazardous and toxic chemicals.

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ANNEXES

Annex 1: The Bellagio Principles

The so-called Bellagio Principles for Assessing Progress Towards Sustainable Development were developed by staff from the International Institute of Sustainable Development and a group of international experts in 1996. The principles serve as recommended guidelines for the whole process including the choice and design of indicators, their interpretation and communication of results. They are intended for use in starting and improving assessment activities of different types of actors, including private corporations. We enclose the principles here as underlying sustainable development principles for the objectives, strategies and actions we propose for electric utilities in chapter 3.

1. Guiding vision and goals

Assessment of progress toward sustainable development should:

- be guided by a clear vision of sustainable development and goals that define that vision

2. Holistic perspective

Assessment of progress toward sustainable development should:

- include review of the whole system as well as its parts
- consider the well-being of social, ecological, and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts
- consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, in monetary and non-monetary terms

3. Essential elements

Assessment of progress toward sustainable development should:

- consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate
- consider the ecological conditions on which life depends

- consider economic development and other, non-market activities that contribute to human/social well-being

4. Adequate scope

Assessment of progress toward sustainable development should:

- adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision-making
- define the space of study large enough to include not only local but also long distance impacts on people and ecosystems
- build on historic and current conditions to anticipate future conditions - where we want to go, where we could go

5. Practical focus

Assessment of progress toward sustainable development should be based on:

- an explicit set of categories or an organising framework that links vision and goals to indicators and assessment criteria
- a limited number of key issues for analysis
- a limited number of indicators or indicator combinations to provide a clearer signal of progress
- standardising measurement wherever possible to permit comparison
- comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate

6. Openness

Assessment of progress toward sustainable development should:

- make the methods and data that are used accessible to all
- make explicit all judgements, assumptions, and uncertainties in data and interpretations

7. Effective communication

Assessment of progress toward sustainable development should:

- be designed to address the needs of the audience and set of users
- draw from indicators and other tools that are stimulating and serve to engage decision-makers
- aim, from the outset, for simplicity in structure and use of clear and plain language

8. Broad participation

Assessment of progress toward sustainable development should:

- obtain broad representation of key grass-roots, professional, technical and social groups, including youth, women, and indigenous people - to ensure recognition of diverse and changing values

- ensure the participation of decision-makers to secure a firm link to adopted policies and resulting action

9. Ongoing assessment

Assessment of progress toward sustainable development should:

- develop a capacity for repeated measurement to determine trends
- be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently
- adjust goals, frameworks, and indicators as new insights are gained
- promote development of collective learning and feedback to decision-making

10. Institutional capacity

Continuity of assessing progress toward sustainable development should be assured by:

- clearly assigning responsibility and providing ongoing support in the decision-making process
- providing institutional capacity for data collection, maintenance, and documentation
- supporting development of local assessment capacity

Annex 2: Principles from Montreaux meeting

This text was drafted by project participants at their meeting held in Montreaux on 27 March 2001.

ENVIRONMENTAL

- Legislation
- EMS
- Integration of environmental factors into planning and decision making
- Policy development and implementation
- Precautionary principle
- Renewable energy and energy efficiency
- Educate employees
- Measure and report on performance
- Demonstrate environmental leadership

ECONOMIC

- Operational efficiencies
- Price of electricity
- Revenue targets
- ROE
- Shareholder value and dividends

SOCIAL

- Price of electricity
- Provision of essential services
- Stakeholder interactions including government and communities
- Foundations and support of social issues eg AIDS

Annex 3: WBCSD project participants

COMPANY	CONTACT	ADDRESS	E-MAIL
British Energy – UK	Chris Anastasi	United Kingdom Tel :+44 207 389 3408 Fax +44 207	chris.anastasi@british-energy.co.uk
EPCOR – Canada	Don Lowry	EPCOR 16 th floor, 10065 Jasper Ave Edmonton, Alberta T5J 3B1 Tel 780 412-7823	dllowry@epcor.ca
Eskom	Wendy Poulton	Tel +27 11 800-2634 Fax +27 11 800-2938 Cell +27 82 8297602	Wendy.poulton@eskom.co.za
Exelon	Jan Freeman	Tel +91 215 841 4275 Fax +91 215 519 1616	Jan.freeman@exeloncorp.com
Kansai – Japan	Toru Yamanaka substituting Mr. Suda (LD)	Manager, Global Environment Group Kansai Electric Power Co. 3-3-22, Nakanoshima, Kita- ku, OSAKA, JAPAN 530- 8270 TEL : +81-70-5788-0494 FAX : +81-6-6441-3549	K410917@kepcoco.jp
Ontario Power Generation - Canada	Helen Howes	Tel: +1 416 592-1658	helen.howes@ontariopowergeneration.com
PowerGen- UK	Bill Kyte	PowerGen UK Westwood Way Westwood business Park Coventry CV4 8LG Tel : +4424 7642 4225 Fax : +4424 7642 5226	dr-william.kyte@pgen.com
Tokyo Electric Power Corporation- Japan	Yasuo Hosoya	Tel : 0081 3 3501 81 11 Fax: 0081 3 3504 15 70	t0230714@pmail.tepco.co.jp
TransAlta Corporation – Canada	Bob Page	TransAlta Corporation T1-902, Box 1900 Station M 110-12 th Avenue S.W. Calgary, Alberta Canada T2P 2M1 Tel +1 403 267-4774 Fax +1 403 267-7372	bob_page@transalta.com
Western Power – Australia	Nenad Ninkov	10 th floor 363 Wellington Street Perth Australia 6000 Tel +8 93266572 Fax +8 93266287	nenad.ninkov@wpcorp.com.au