DEDICATED TO MAKING A DIFFERENCE

Sustainability in the electricity utility sector

World Business Council for Sustainable Development

table of contents

executive summary

I – BACKGROUND: WHY TACKLE THIS TOPIC?

Electricity is more than energy. It is a vital component of infrastructure and an essential part of modern day life. It plays a critical role in the economies of most countries. Electric power has become a prime mover for productivity, wages and jobs throughout the world; and the lifeblood of what is now being referred to as the new global economy.

Looking to the future, electricity will play an even greater transformative role in the 21st century. Electricity-based innovation is supporting increasingly sophisticated global, real-time networks for communication, finance, trade and technology development. Electricity is driving new technologies – ranging from lasers to microprocessors – that will make possible continuous improvements in industrial productivity and efficiency in the century ahead. Electricity will act as a catalyst for business development in a number of sectors.

Yet, despite these vital contributions, the sector faces some significant and wide-ranging hurdles. For example:

- Will key shifts in market conditions, such as increased competition, affect environmental performance?
- How will the industry maximize the viability and profitability of existing assets while ensuring adequate (and competitive) investment in the next generation of technology? Are stakeholder expectations valid, realistic, and achievable? How does a company know this?
- How will electricity be provided to the 2 billion people currently without access?

Business leaders of the electric utility industry felt there was a pressing requirement to determine how electricity needs will be met in a sustainable manner – a path forward that allows socially responsible corporate practices to co-exist and flourish alongside economic growth.

II – THE PLAYERS

Against this background, eleven companies with broad geographic representation agreed to support and participate in this project. Convened through the World Business Council for Sustainable Development, they included: BC Hydro (Canada); British Energy (United Kingdom); EPCOR (Canada); Eskom (South Africa); Exelon Corporation (United States); Kansai Electric Power Company (Japan); Ontario Power Generation (Canada); Powergen (United Kingdom); Tokyo Electric Power Company (Japan); TransAlta

Corporation (Canada); and Western Power Corporation (Australia). The work was co-chaired by the Chairman of Eskom, Reuel Khoza and the President & CEO of Ontario Power Generation, Ron Osborne.

The project benefited from a third-party review team with substantial expertise on this topic. This team validated the contents of this report and ensured both developed and developing country perspectives were included. John Drexhage, International Institute for Sustainable Development (Canada), chaired the third party review group.

III – ISSUES AND CHALLENGES

This project took stock of the key sustainable development issues and challenges facing the electricity industry. Different electricity production technologies as well as how electrical systems are operated to meet electricity demand are described. Key shifts in market conditions, such as competition in the electricity sector, technology advancements, and rising expectations of stakeholders are also highlighted.

A range of principles and strategies were identified, and industry innovative practices among the project members were surveyed. The report contains a detailed description of over 80 examples of how participating companies addressed the realities of everyday dilemmas and highlights how differing national and company circumstances drive strategic direction. The report concludes with a discussion of the many substantive questions and challenges that will influence the nature of sustainable energy strategies in the future.

PARTICIPATING COMPANIES

- **BC Hydro (Canada)**
- **British Energy (United Kingdom)**
- **EPCOR (Canada)**
- **Eskom (South Africa)**
- **Exelon Corporation (United States)**
- **Kansai Electric Power Company (Japan)**
- **Ontario Power Generation (Canada)**
- **Powergen (United Kingdom)**
- **Tokyo Electric Power Company (Japan)**
- **TransAlta Corporation (Canada)**
- **Western Power Corporation (Australia)**

IV – KEY TRENDS AND FINDINGS

The points below highlight initiatives, actions or trends that respond to sustainable development challenges. These contributions neither encompass all of the innovative efforts or thinking of individual utilities - nor do they claim to represent achievement of the goal of sustainable development. Rather, we regard these findings as the emergence of some of the current innovative practices in our industry.

Economic contributions

> Electricity companies are leveraging investment in research, development and marketing of new sustainable energy technologies and customer offerings.

> New energy sources and new emission-reduction technologies that promise to influence the way in which electricity is generated in the future are gaining momentum e.g. fuel cell technology and energy storage systems.

> In developing countries, research initiatives can and should include technology diffusion efforts as well as innovative approaches to ensure cost effective and relevant technology development.

> Many companies are conducting long-term strategic planning initiatives and ensuring that sustainable development issues are integrated into their future investment decisions.

> Some utilities use their considerable purchasing power, and their procurement practices to encourage suppliers and contractors to operate in an environmentally responsible manner and others support small, medium and micro enterprises from disadvantaged sectors of the economy.

> Some companies are developing new businesses to contribute to the financial component of their core business. Examples include the establishment of venture capital subsidiaries and business services companies.

Environmental Strides

> Tighter environmental controls and increased stakeholder expectations have prompted electric utilities to invest in effective pollution-control technologies.

> Many electric utilities are now taking early action by implementing greenhouse gas (GHG) emission strategies, in the absence of any legislative requirements.

- Many electric utilities are setting up low impact renewable power programs, establishing performance targets, and committing to provide specific amounts of renewable electricity demand within specific time frames.

- The participating electric utilities are improving their own internal efficiencies of electricity generation and distribution.

- All companies that use nuclear generation are working with the government or regulatory agencies in their countries to find a long-term solution for the spent fuel produced at their generating stations – either direct disposal of spent fuel, or re-processing of the spent fuel and the disposal of the residual high level radioactive waste, or a combination of these two options.

- International Environmental Management System standards, like ISO 14001, are important strategic tools being used by the electricity sector to manage environmental risks more systematically, and in going beyond compliance to strive for continual improvement.

- Many companies produce sustainable development reports that expand upon their environmental, economic and social performance.

- Many electricity companies are undertaking nature conservation initiatives directly related to the impact of their generating operations on the local environment.

Social Challenges

- Some electric utilities are only now focusing their attention on the broader issues of corporate social responsibility.

- Electrification is a major factor in bringing developing countries onto a sustainable development path for the future. Not only does electrification provide health and welfare benefits to end users, and provide environmental benefits for society at large, but it can spur important economic growth. Electric utilities that contribute to electrification in developing countries are making a major contribution to sustainable development.

- Electric utilities are now acknowledging that they must also gain broader societal acceptance for their operations, particularly in the communities where their facilities are located.

- There is an increasing expectation among the public at large that the business sector should contribute to the well being of society. Community-based support will continue to be a significant priority for electricity companies.

- The social sustainability of companies also involves adopting and promoting ethical business practices. Many electricity companies are beginning to formalize codes of conduct as part of their commitments to corporate social responsibility.

- Companies reported on a number of progressive workplace initiatives to protect the well being of their employees, such as programs to balance the demands of work and home life, preventative health assessments, safety management, diversity, harassment, flexible benefits and co-operative union/management relations.

These examples should be regarded as the emergence of some current innovative practices in our industry and, hopefully, the basis for all utilities to learn from the experience of others, and be motivated to build upon and expand these initiatives in support of sustainable development.

V – THE CHALLENGES AHEAD

Despite the progress that has been made, it is clear that there is more work to be done in this sector. There are two obvious areas requiring work. First, there are ongoing requirements to find innovative ways to continue the integration of sustainable development practices into existing operations. The second area for consideration is on seeking support for future energy options that meet the needs of stakeholders as well as the realities of the electric utility sector, including increased competition in the sector.

With respect to improving existing operations, the following are some of the challenges identified through this analysis:

- looking for innovative ways to supply and increase access to affordable electricity in developing countries, including infrastructure development, innovative financing, etc;

- investigating how demand side management (DSM) options (e.g., efficient lighting and heating) can assist with affordability of electricity and poverty alleviation;

- identifying additional mechanisms to integrate sustainable development thinking into the decision-making of our businesses;

- expanding supply chain management to further environmental and social goals of the business;

- focusing more on issues of corporate social responsibility and considering the views of all stakeholders, including employees, regulators, community leaders, critics, suppliers, and academics/scientists; and

- expanding the use of partnerships in addressing sustainable development issues.

Seeking support from stakeholders on future generation and transmission options will be another challenge for the sector. While each country will have its own priorities with respect to future energy options, we see the following as some of the challenges ahead:

- exploring the potential of extending the life of existing assets based on environmental, social, and economic considerations;

- balancing the economies of scale of large, centralized plant versus the inherent flexibility of smaller, decentralized investments;

- resolving with government and other stakeholders the barriers related to investment in new technologies with lower environmental impacts than existing generation (i.e., renewable energy, clean coal technologies, nuclear technologies);

- continuing to invest in research into new technologies that will assist with making the step change necessary to move the sector further down the sustainable development path;

- finding ways to make economic DSM investments more widespread; and

- exploring new ways to engage stakeholders in discussions on future energy options.

Despite an increasing reliance on electricity options such as wind, solar, and biogas, for the foreseeable future (i.e., twenty to thirty years hence) coal, nuclear, large hydroelectric, and gas will continue to be the major bulk electricity fuel options. Each has its own sustainability challenges. Issues of long-term storage and disposal of spent fuel or high level radioactive waste, if reprocessing of the spent fuel is performed, will need to be resolved to retain nuclear as a viable future energy option. The development of clean coal technologies and carbon sequestration techniques will be critical to continued use of coal. Flooding of ecosystems and relocation of populations are some of the limitations of large-scale hydroelectric development, which will need attention if future development is to occur. Gas, although a cleaner fuel than coal, is still carbon-based and issues of availability and cost will need to be addressed. None of these generation options is without environmental or social issues.

The way forward holds significant challenges for the electric utility sector, not only those challenges of implementing sustainable development practices into the business, but also doing so at a time when the business environment is undergoing fundamental, unprecedented change. Electric utilities are confronted by a number of uncertainties associated with evolving government regulations, market restructuring, customer preferences, and technological innovation.

The way in which companies tackle environmental and social issues in future may also change. In a world of escalating demands for transparency and stakeholder engagement, dialogue will need to be broad and inclusive of a range of stakeholders. In an increasingly interconnected and globalized world, these stakeholders must include customers, regulators, governments, electricity-sector watchdog agencies, environmental NGOs, and academics/scientists. These groups influence decision-makers and will be engaged in the debate about future energy options, particularly as governments debate future energy direction and individual utilities seek changes to their operating licenses and make long-term investments in new technologies.

The environmental and social pressures facing electric utilities are complex and do not respect national boundaries and the investments expected of companies in response to these pressures are substantial. Sharing information on innovative practices, and partnering with other companies in research and development, holds the most promise for great inroads toward sustainable energy futures.

This project has allowed the member companies to take a critical look at their current operations, benchmark their progress against other utilities and define what additional challenges lie ahead. The future progress towards a more sustainable path will be a complex process and unique for each member company. However this body of work has laid the foundation for future efforts and will in itself contribute to the overall knowledge in the sector, as well as assist other utilities with strategic decision-making.

background
and introduction

The World Business Council for Sustainable Development (WBCSD), based in Geneva, is a coalition of 160 companies united by a shared commitment to sustainable development. Its members are drawn from more than 30 countries and 20 major industrial sectors.

The organization benefits from a thriving global network of national and regional business councils and partner organizations, including close to a thousand business leaders from the developing world.

The electric utility members of the WBCSD identified the need for a member-led project to address sustainable development issues specific to the electricity sector. Many countries today look to electricity as an essential service, supporting needs of individuals, businesses and industry. Looking to the future, electricity will be central to supporting further economic growth. There is a pressing requirement to determine how electricity needs can be met in a sustainable manner – a path forward that allows socially responsible corporate practices to co-exist and flourish alongside economic growth.

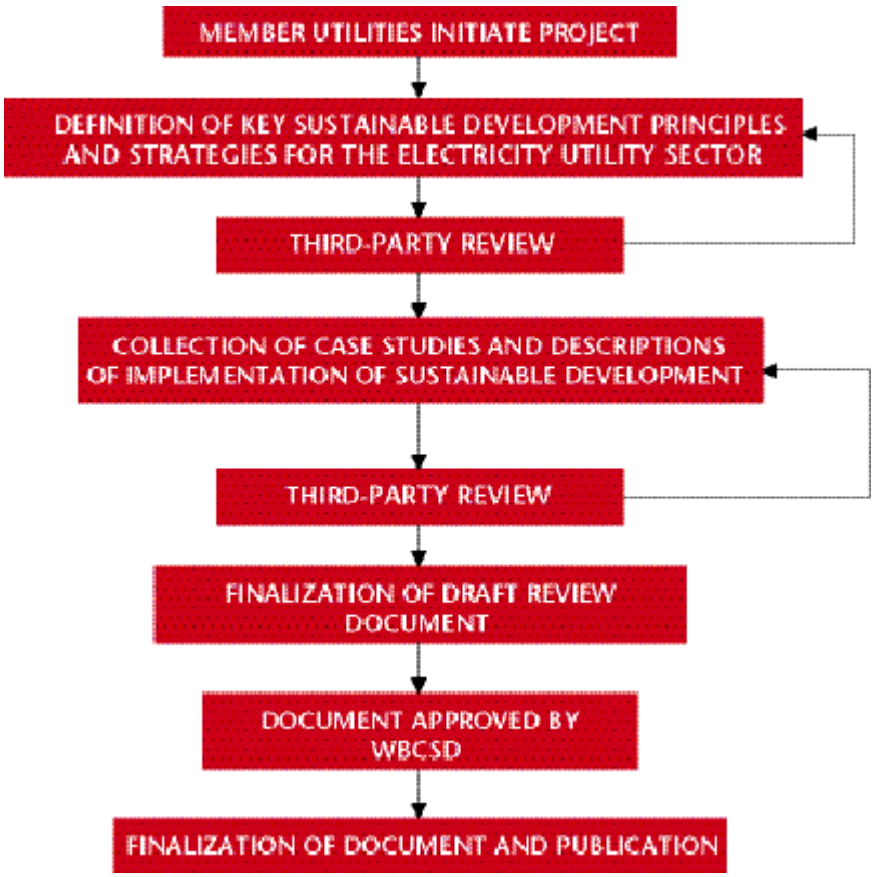
In support of this challenge of identifying sustainable options for the electric utility sector, eleven utilities participated in Phase One of the sustainability project, commencing in 2001:

- BC Hydro (Canada)
- British Energy (United Kingdom)
- EPCOR (Canada)
- Eskom (South Africa) - Project Co-chair
- Exelon Corporation (United States)
- Kansai Electric Power Company (Japan)
- Ontario Power Generation (Canada)- Project Co-chair
- Powergen (United Kingdom)
- Tokyo Electric Power Company (Japan)
- TransAlta Corporation (Canada)
- Western Power Corporation (Australia)

The members of the project recognize that only one member company was from a developing country. While many sustainable development issues are common to utilities anywhere, some specific to developing countries may be less well explored in this document.

Phase One of the project (Figure 1.1) explored sustainable development issues and challenges facing the electricity industry, beginning with an assessment of sector-specific principles and objectives. To help the electricity sector advance its sustainability objectives, the project identified a range of strategies, and surveyed industry best practices amongst the project members emerging at the onset of the 21st century. The report summarizes the project findings, and concludes with an examination of major, foreseeable challenges confronting electric utilities, including the liberalization of electricity markets, future generation requirements, and next-generation options.

Figure 1.1 Phase One process



The sharing of resources required to produce this report has generated a worldwide network of expertise on sustainable development in the electricity sector, including an all-important compendium of current innovative practices amongst the project members. These examples by no means encompass all of the innovative efforts of individual utilities to accomplish similar objectives and manage their own, unique circumstances. Neither do these practices represent achievement of the goal of sustainable development. Rather, the examples should be regarded as the emergence of some current innovative practices in our industry and, hopefully, the basis for all utilities to learn from the experience of others, and be motivated to build upon and expand these initiatives in support of sustainable development.

We would like to thank the members of the third-party review team who validated the contents of this report. Their combined expertise in the fields of sustainable development and the electricity sector, in both developed and developing countries, represented a significant contribution.

The participants from **North America** were:

> John Drexhage (Jim Leslie): International Institute for Sustainable Development (Canada) (Chair), and

> Steve Gehl: Electric Power Research Institute (United States)

From Europe

> Malcolm Grimston: The Royal Institute of International Affairs (United Kingdom), and

> Christian Egenhofer: Centre for European Policy Studies (Belgium)

From Japan

> Dr. Tadashi Aoyagi: Mitsubishi Research Institute (Japan)

From developing countries

> Dr. Rajandra K. Pachauri: Tata Energy Research Institute (India)

> Professor Ogunlade Davidson: Energy and Development Research Center, University of Cape Town (South Africa)

This project also gained critical impartiality from its association with the WBCSD, as well as access to the organization's comprehensive network of contacts in government, business and society. These are the kinds of co-operative efforts that will generate momentum for change in both public policy and industry behavior. Other member-led sustainable development projects occurring under the auspices of the WBCSD include mobility, forestry, mining and minerals, and the cement industry. ECON[1], is also recognized as coordinating the development and discussion of the principles and strategies in Sections 3 and 4 and providing input into Section 5 on examples of sustainable development practices by member companies.

Structure of the Document

By way of introduction, **Section 2** of the report provides an overview of the challenges facing the electricity utility sector. Different electricity production technologies are profiled and key shifts in market conditions are highlighted which, together, present the context confronting the electricity sector.

Section 3 describes the economic, social and environmental dimensions of sustainable development as they relate to the electric utility sector.

In **Section 4**, the report presents principles, objectives and strategies with a view to guiding the electricity sector along the path of sustainable development.

In **Section 5**, specific examples of member company activities are highlighted to illustrate a range of actions that are being taken as part of sustainable development.

The report concludes with a discussion in **Section 6** of the many substantive questions and challenges that will influence the nature of sustainable energy strategies in the future.

[1] ECON Centre for Economic Analysis
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challenges facing the electricity industry

The electric utilities that participated in this WBCSD project have all accepted the challenge of plotting a course to achieve sustainable development. None of the member utilities has yet achieved this goal. Yet all participants are on a path to get there.

This chapter describes in more detail the operational context and the market challenges facing the electricity sector on the road to sustainable development.

2.1 – INDUSTRY OVERVIEW

2.1.1 – The Role of Electricity

Electricity is more than energy. It is a vital component of infrastructure and an essential part of modern day life. It plays a critical role in the economies of most countries. Electric power has become a prime mover for productivity, wages and jobs throughout the world; and the lifeblood of what is now being referred to as the new global economy.

Since Edison's day, the influence of electricity has been so pervasive that the U.S. National Academy of Engineering voted the "vast networks of electrification" as the number one engineering achievement of the 20th century. It ranked ahead of automobiles, broadcasting, telecommunications, computers and even health care in terms of its impact on the quality of life in the 20th century. Electrification has been the major factor in cleaning up cities, improving the efficiency and productivity of industry and business, and improving the efficiency of natural resource consumption.

Largely as a result of electrification, energy intensity (energy consumed per unit of economic value) has been declining steadily on a global scale at about 1% per year over the last century. Carbon intensity (carbon per unit of energy) has been declining at a rate of about 0.3% per year over the same period. While some two billion people around the world still do not have access to electricity, electricity progressively increased its share of energy consumption during the 20th century to nearly 40% in the Organization for Economic Co-operation and Development (OECD) nations (EPRI, 2002).

Exelon's Limerick Generating Station (2 Units, 2400 MW)

2.1.2 – Electricity Generation Options

There are a number of supply-side options for generating electricity.

The principal generating technologies include fossil fuels, hydroelectric power, and nuclear. (Table 2.1). Whether a generation option is selected in any specific market depends upon a number of factors. Some of the most important factors are listed below.

Availability of natural resources

Many countries are constrained in their choice of electricity generation options on the basis of resource availability and supporting infrastructure. For example, in arid and semi-arid countries, the potential for hydroelectric generation is limited. In countries with low levels of insolation, solar generation will be constrained.

National or regional energy policies

The choice of generation technologies across jurisdictions may also reflect local government preferences, in light of national security concerns, public opinion, resource development issues, and employment and trade priorities.

Reliability of generation supply

Electricity is a unique commodity. It is produced and consumed almost simultaneously. Generally speaking, the amount delivered must be in constant balance with the amount consumed because storage capabilities are limited.

In light of the fact that consumers cannot store electricity at the place of use, each jurisdiction must arrange for an energy mix to ensure that a reliable supply will be available to them upon demand. Some generation

Table 2.1 Current supply-side options

Fossil fuels
Coal
Gas
Oil
Orimulsion
Renewables
Hydroelectric
• Dams with storage reservoirs
• Run of river
Wind
Geothermal
Solar
Biomass
Wave and Tidal
Nuclear

technologies, such as wind, solar, wave and run-of-river hydroelectric, are in some cases intermittent or seasonal in nature and therefore cannot supply electricity continuously to meet the on-demand requirements of consumers. These supply options are, however, well suited to adding low impact supplies, as complements to more traditional electric power sources.

Access to technologies and requirement for capacity building

Varying degrees of access to technologies, technological sophistication and labor proficiency are required to build and operate different supply-side options. As a result, countries and companies may favor generation technologies that can be supported by the local infrastructures and technological and human resources.

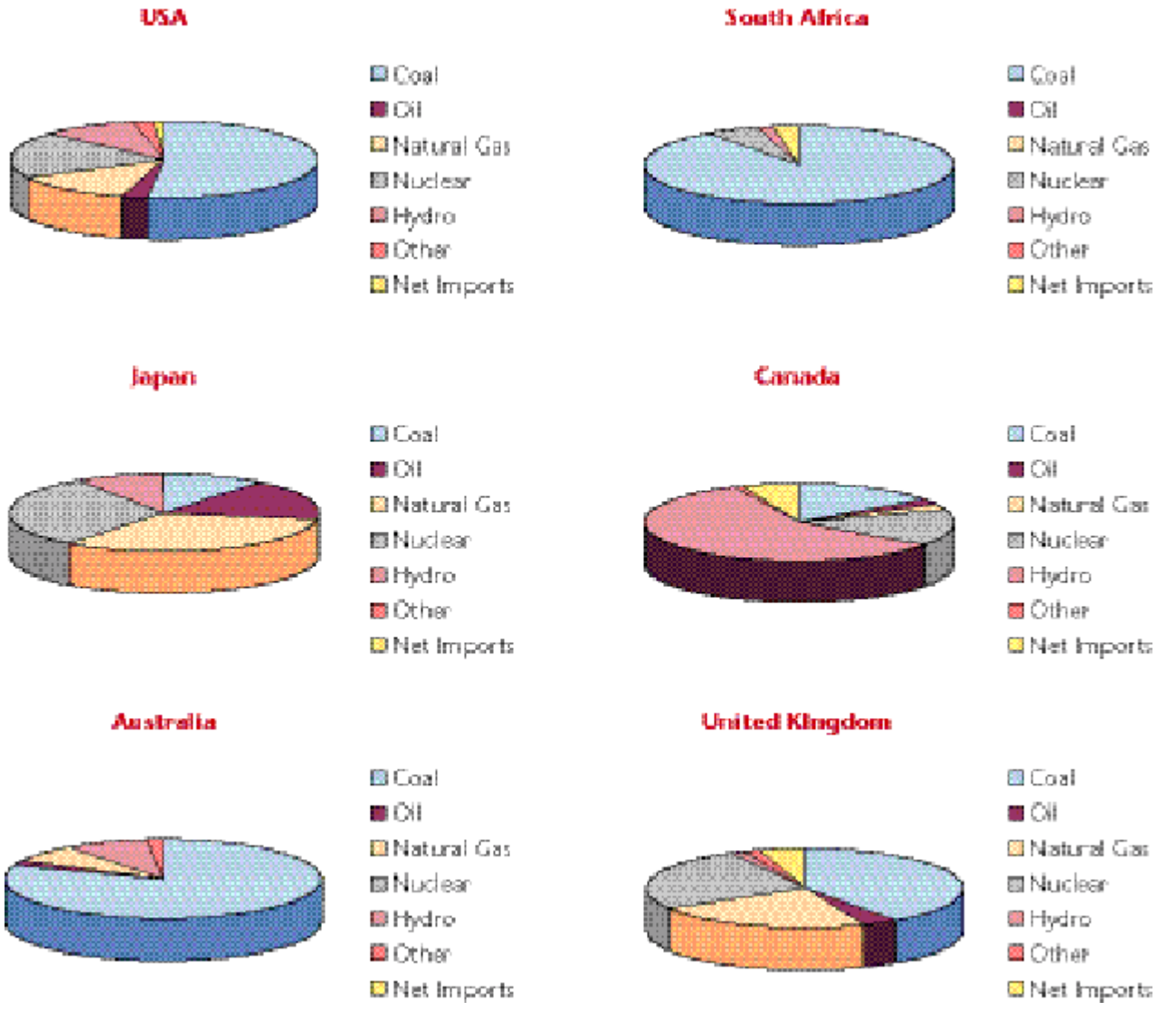
Cost and the availability of capital

Cost and the availability of capital are critical issues in all countries, and influence the nature of generation projects developed. In developing countries where affordable electricity is particularly important, and access to capital may be limited, the development of more capital-intensive generation options are often foregone in favor of lower cost generation offering shorter payback periods.

Global Electricity Mix

Figure 2.1 depicts the mix of electricity generating sources found in electricity portfolios in the United States, Japan, Australia, South Africa and Canada. Each jurisdiction's energy mix illustrates how these issues have been balanced in these countries (World Energy Council 1996). For example, in Australia, the United States and South Africa, the availability of coal resources has resulted in high utilization of coal for electricity generation. In Canada, there has been significant development of their hydroelectric potential.

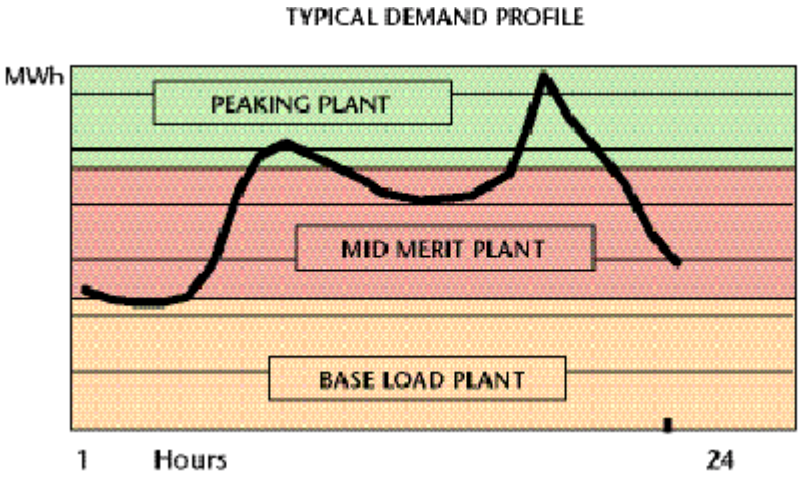
Figure 2.1 Total electricity supply by source (TWh) of six countries ***(Source: World Energy Council, 1996)***



2.1.3 – Meeting Electricity Demand

Figure 2.2 illustrates an example of a pattern of electricity demand on a hypothetical 24-hour day. To meet this demand, or load profile, the utility must run different types of plants including base load plants, peaking plants and mid-merit plants. Different technologies and plant operation regimes can be used to meet the varying demand for electricity throughout the day.

Figure 2.2 A typical profile of electricity demand for a 24-hour weekday



- Base load plants typically have low variable costs. They can run 24 hours a day at relatively constant levels, typically 80 to 90% of the time, when allowing for outages for maintenance.
- Mid-merit plants tend to be brought on line as required by the profile of electricity demand, and may run 40% to 70% of the time.
- Peaking plants are required for very short periods – less than 20% of the time – to supply power when demand is at its highest.

The distinction between capacity and energy is a critical factor in the above example of a load profile. A power plant may be commercially available – that is, it has capacity – but may not be able to provide energy at the required time, due to various constraints and the inability to store electricity. For example, a wind generation facility may have the capacity to generate a fixed amount of electricity, but inadequate wind conditions may prevent it from generating the electricity when it is needed. Unless alternative generating sources, or storage options are available at that very moment, customers' electricity needs may not be met. Alternatively, a power plant may be required to provide necessary capacity during peak energy periods, but have underutilized capacity when demand drops.

A way of optimizing generation options is to store energy (i.e., pumped storage, compressed air energy storage and batteries) using baseload power sources. This results in efficiency improvements and optimal utilization of plant.

Energy efficiency measures that reduce demand, especially peak demand, can reduce underutilized peaking capacity. Load-shifting technologies are also used to move demand to non-peak periods. Some examples of demand-side management interventions are shown in Table 2.2.

Table 2.2 Current demand-side options

• Energy efficiency
• Load management
• Strategic load growth
• Interruptible supply agreements

The construction of new generating capacity involves relatively long lead-times. The time required to plan, purchase, build and commission new plant depends on the technology employed. For example, the lead-time from design to full operation of a nuclear plant in Canada is about 13 years, while a gas-fired co-generation plant is three years. In Japan, the lead-time from inception to full operation of a nuclear power plant is approximately 15 years, while an oil-fired plant is nine years. In Australia, lead times are about 5 years for coal-fired plants, and about 3 years for gas-fired, co-generation plants.

2.2 – CHALLENGES FACING THE INDUSTRY

In each jurisdiction the evolving market regimes, industry structures and regulatory frameworks, will together influence the way in which we manage our businesses, operate our existing portfolios of traditional generation technologies, and invest in new plant and technologies.

2.2.1 – Demand Side Challenges

In supplying power in the coming century, electric utilities face growing expectations to decouple economic growth from natural resource consumption and environmental footprints. Demand for electricity is escalating against a backdrop of an unprecedented call to action to safeguard broad environmental and social interests. Efficiently provided electric power is critical to real advances in global sustainability. Leading electric utilities have

recognized this opportunity and have initiated some progressive steps.

Looking to the future, an even greater transformative role for electricity is anticipated in the 21st century. For many nations of the world, electricity will be relied on to accelerate economic growth and further improve the quality of life of their citizens.

Electricity-based innovation is supporting increasingly sophisticated global, real-time networks for communication, finance, trade and technology development. Electricity is driving new technologies – ranging from lasers to microprocessors – that will make possible continuous improvements in industrial productivity and efficiency in the century ahead. Electricity will act as a catalyst for business development in a number of sectors.

2.2.2 – Market Conditions

Historic

At the turn of the 20th century, most electric utilities were local or regional businesses that had developed around a small number of generating sources, sometimes only one. With the rapid growth of industrialization, these small utilities were merged into larger ones, and often nationalized by state or provincial governments. Now larger utilities were able to invest in large, centralized generating stations and produce more electricity at lower prices for consumers. The economic life of most generating stations was 40 years, and in the case of hydroelectric plant, upwards of 100 years. The type of generation built was primarily a function of resource availability, cost, projected demand and government approval, since most utilities were state-owned and highly regulated. Utilities also invested in large transmission and distribution systems to move electricity to their customers.

Current

Although some electric utilities continue to operate as monopolies, there is an increasing trend towards deregulation of the electricity sector. Competition is expected to result in greater efficiencies and lower prices. Shareholder equity can also provide the necessary capital to maintain and expand the infrastructure as demand continues to grow.

Looking Ahead

In supplying power, the energy market will increasingly affect decisions taken by electric utilities and regulatory structures in which they operate.

The trend towards competition in the electricity sector is worldwide. Deregulation occurred about 10 years ago in the United Kingdom, parts of Australia and some European countries; approximately five years ago in some parts of the United States and in the Canadian province of Alberta. Deregulation occurred in the province of Ontario in Canada in May 2002 and in Japan, deregulation of the retail electricity sector was implemented in March 2000. The pace at which deregulation occurs will vary depending on the specific circumstances of individual countries.

Many electric utilities operate as monopolies, and are obligated to plan for and provide electricity for all customers. Utilities operating as monopolies typically offer the full line of services from generation, transmission, distribution, through to retail sales to end-use customers. Transmission and distribution are often perceived as natural monopolies and continue to be regulated even where deregulation has occurred. For other companies, strategies for meeting energy demand must be developed within a context of liberalized electricity markets. For these companies, learning to compete in deregulated, or soon-to-be-deregulated, markets means becoming more efficient, reducing costs and increasing revenues by calling for competitive bids, negotiating supply contracts, or both.

As part of electricity deregulation, there has been a trend toward functionally separating utilities into discrete companies responsible for specialized lines of business. Ownership of utilities also varies, with a mix of publicly-owned and privately-owned companies.

The pace and scope of deregulation has influenced the business direction of some member companies. Powergen in the U.K., for example, is a generator of electricity, a wholesaler and retailer of gas, electricity and telecommunications throughout the country, and a distributor of electricity in a limited area. It has divested many of its utilities in developing countries, but recently acquired an integrated utility in the United States. Contrast this to TransAlta in Alberta, Canada, which has divested its transmission and distribution networks and is now primarily a wholesaler of coal- and gas-fired generation in Canada, the United States and Mexico. As a result of deregulation, Exelon in the United States is divided into separate affiliates (business units), including generation, transmission and distribution to end users, natural gas delivery and other businesses. Other utilities such as Kansai Electric Power Company and Tokyo Electric Power Company in Japan, and Eskom in South Africa, are still vertically integrated companies,

meaning they generate electricity, distribute and sell electricity to their end-use customers. Other utilities, such as EPCOR, not only generate and distribute electricity but are also involved in water and gas distribution. Table 2.3 below shows the structures of the member companies and illustrates the variety of activities in which they are involved.

The liberalization of electricity markets will make it necessary for the sector to refocus traditional approaches to issues and asset management, human resources and long-term planning. Table 2.4 identifies some of these management challenges and highlights how they may affect the way in which issues of sustainable development will be addressed in the future.

However, there are other implications of market liberalization, which have profound implications – some positive, some negative – for sustainability within the electricity supply industry. These include, the issue of obligation to supply, which is more difficult to deal with in competitive markets. In a competitive marketplace, a shorter rate of return and market flexibility will be the key drivers in making the next generation investment decision. This will favor life extension of existing plant, construction of generation options with shorter lead times and distributed generation options.

Globalization is also having an impact on the electricity sector. Historically, electricity utilities were nationally based. Today, however, some electricity companies have interests in both developing and developed countries around the world.

2.2.3 – Technology and Energy Mix

The large, centralized generating stations constructed by many utilities in recent decades have provided economies of scale. Longer transmission lines and associated technologies were also required due to the smaller number of larger power stations. Storage of electricity at the point of use continues to elude researchers. Battery technologies have advanced considerably, and methods of storing resource capability, such as reservoirs, do exist. However, the electricity storage capabilities of these technologies are relatively small.

New technologies will allow many companies to diversify their current supply mix making it a more flexible, sustainable and responsive system keeping in mind there are some constraints around diversification, including each country's unique resource and economic conditions as well as security of supply. For developing countries, the transfer of technologies can help them to leapfrog to new technological levels, enabling them to meet their energy requirements in a more sustainable manner. There is also a need for developing countries to develop and adapt technologies for their specific needs and circumstances. Other conditions include investment conditions, the degree of competition and state-ownership, functioning of capital markets, management capacity and political will. It will also be necessary to identify more efficient and cost-effective ways of utilizing both non-renewable and renewable resources, as well as ways of reducing their impact on the environment. Many electricity utilities are currently engaged in research in these areas and are striving to define an optimal energy mix for their company or country.

Decisions to extend the life of existing plant or invest in new generation options are influenced by many factors, including the availability of capital, fuel cost and availability, stricter environmental regulations and, more recently, security issues. Significant technological advances in electricity production, transmission and use are also affecting management decision-making. For example, advances in gas turbines and

Table 2.3 Structures of member utilities, December 31, 2001

Company	Generation	Transmission	Distribution	Commercial Enterprises	Electricity Trading
BC Hydro	X	X	X	X	X
British Energy	X				X
EPCOR	X		X	X	X
Eskom	X	X	X	X	X
Exelon	X	X	X	X	X
Kansai	X	X	X	[1]	
Ontario Power Generation	X			X	X
Powergen	X		X	X	X
TEPCO	X	X	X	X	X
TransAlta	X			[1]	
Western Power	X	X	X	X	X

[1] Information not available at time of going to print

(See Appendix A for more detailed information on the member utilities)

combined heat and power generation technology have provided economies of scale and reduced the optimum size of power plants; distributed generation options are beginning to replace centralized supply sources. In addition, the generation mix of utilities is changing and diversifying.

Decisions regarding specific technologies and energy mix are complex and difficult, and must take into consideration numerous, sometimes conflicting factors. These decisions often have long-term implications, and as a result many utilities and countries have used scenario planning to manage risks and ensure sustainability. The rapid pace of technological change makes this task even more complex. Often, technological change outpaces the lifetime of the current asset base, opening up the risk of stranded assets.

The fact remains that energy research is declining in many parts of the world. If the electricity sector is to meet the challenges of future generations, research into new technologies must continue. At the same time, new and innovative approaches to global partnering and collaboration must evolve to leverage the enormous costs of research and development.

2.2.4 – Customer and Stakeholder Expectations

Electricity utilities today have many stakeholders. They interact with governments, customers, communities, non-governmental organizations (NGOs) and many others, and must frequently manage diverse and conflicting expectations. One of the challenges for the industry is balancing changing stakeholder expectations with current long-term technology choices, which may have a life cycle of 25 to 100 years.

The financial sector is a very important stakeholder for electric utilities, and their expectations and requirements are more stringent than in the past. Financial institutions today have a much broader base of issues to consider in their lending decisions, including issues relating to sustainable development.

Electric utilities today are also responsible for more transparency in their communications with stakeholders. Many utilities produce environmental or sustainability reports, or publish disclosures in annual financial reports. In addition to records of performance, the reports often detail performance goals that provide benchmarks for the utility's progress towards a more sustainable future.

One of the most important stakeholders is obviously the customer, whose needs have also become more complex. For example, a utility's demand profile can change if certain customers require electricity during peak periods. In today's competitive environment, utilities must be able to provide electricity at a level of price, quality and reliability that the customer demands. In developing countries, where the development of energy infrastructure is key to development, utilities must strive to provide universal access to affordable electricity.

Table 2.4 Management challenges arising from liberalization of electricity markets

Management aspect	Current focus	New challenges
Assets	Own and operate	New arrangements, leases, partnerships
Expertise	Technical engineering	Diversified skills base including marketing, trading risk management
Planning	Central (i.e. state or country based)	Market driven (i.e., price of electricity determines the next-generation option to be built)
Return on investment	Long (i.e., 40 years)	Short (i.e., 2 to 5 years)
Issues	Local/Regional	Global
Diversified products	Electricity only	Electricity, gas, technology, etc.

electric utilities

and sustainable development

There are few, if any, precedents for electric utilities to follow in putting the concept of sustainable development into practice. Before defining possible sustainable development strategies and actions for the industry, it is necessary to consider the multidimensional roles and obligations of electric utilities as providers of infrastructure (i.e., generation and transmission plant, telecommunication networks). In this capacity, electric utilities interact with the three core dimensions of sustainable development: environmental, social and economic. The nature of these interactions provides necessary context for defining relevant sustainable development principles, objectives and strategies, and the actions that will maximize benefits for all stakeholders.

3.1 – DIMENSIONS OF SUSTAINABLE DEVELOPMENT

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

Environmental

Different power generation technologies have different environmental implications. For example, fossil-fuelled generation results in emissions to the air; nuclear power raises issues regarding the handling and storage of radioactive waste; and hydropower can have environmental consequences such as impacts on river systems, wetlands and biodiversity. The transmission and distribution of power in itself also has environmental impacts.

Social

In addition to conventional economic value, electric utilities are providers of a commodity that is different from any other, yet has come to be regarded as an essential service to the public. Electricity supply is even a factor in maintaining national and global stability and peace. While electricity cannot be stored for later use, a consistent, reliable supply of electricity is a prerequisite for economic development, social security and public welfare. In many developing countries where access to electricity remains low, social services such as health and education are constrained. Those electric utilities that are engaged in extending electrification are making an important contribution to alleviating poverty, both in the individual household and at the societal level, as well as having a positive effect on the environment.

Economic

Electric utilities are part of the commercial matrix that comprises a modern economy. The industry creates economic value through the technical and commercial processes involved in the generation and distribution of electricity, and its subsequent application in end uses. Electric utilities redistribute this value at the community level and at the broader societal level; for example, through remuneration to employees, dividends to owners and taxation to the state. As a relatively large sector in a country's economy, the electricity industry creates a significant number of jobs, both directly in its own operations and indirectly through the procurement of goods and services from other businesses.

As a consequence of the technical nature of power generation, electric utilities are repositories of technological competence and a source of innovation, both of which contribute to economic development. This adds another important dimension to the relationship between electric utilities and the economy.

Some of the relationships between electric utilities and the three fundamental dimensions of sustainable development are summarized in Table 3.1.

Table 3.1 Electric utilities and selected dimensions of sustainable development

Dimension	Effect	Mechanism
Environmental	Emissions	Discharges from power generation plants
		Decrease in low-level emissions as a result of electrification
	Visual impacts	Physical assets in areas of beauty
	Biodiversity	Impact on natural ecosystems
		Enhancing biodiversity by conservation measures
	Resource depletion	Use of non-renewable resources and precluding their availability for future generations
Social	Social welfare	Employment and supply of electricity
	Poverty impacts	Access to electricity
	Relocation	Construction of dams
	Other	Role as corporate citizen
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 and innovation

Principles, objectives and strategies

The member companies of this sustainable development project chose to use the Bellagio Principles as a backdrop for the proposed sector-specific principles and objectives. The Bellagio Principles are sufficiently well known in international circles and general enough to be of relevance to electric utilities throughout the world (see Appendix B for the Bellagio Principles).

The strategies discussed under each of the three core elements of sustainable development – economic, environmental and social – are guidelines suggested for the electricity sector to help companies internalize key aspects of sustainable development.

4.1 – PRINCIPLES AND OBJECTIVES

Although sustainable development may be viewed as the guiding principle, it is useful to identify key principles and objectives to inform the development of strategies and actions that are most meaningful for electric utilities in pursuing their sustainable development goals.

Table 4.1 presents a provisional set of principles and objectives, broadly based on the Bellagio Principles.

4.2 – STRATEGIES

This report covers a range of environmental, social and economic strategies for the electricity industry. These strategies are put forward as illustrative strategies, and by no means preclude other approaches that may be helpful or necessary to promote sustainable development. They strategies outlined below do encompass, however, a range of actions and initiatives that, together, can move the industry closer to sustainable development objectives consistent with the Bellagio Principles.

The structures chosen by an particular government for their electricity supply markets is highly relevant to these issues – reserving tranches for renewables, placing emphasis on reliable supplies etc. Hence, it is critical for electricity supply industries to work with governments in ensuring that appropriate structures are adopted to reach sustainable objectives.

Table 4.1 Sustainable development principles and objectives for electric utilities

Principle	Objective
Guiding vision and goals	Develop a clear vision of sustainable development and define the 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/ 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 standardized 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.

4.2.1 – Environmental Strategies

Much of the early debate around sustainable development has focused on environmental impacts. The environmental strategies in Table 4.2 represent a synthesis of the discussion among the representatives of the member companies that participated in this project.

Table 4.2 Environmental strategies

Strategy	Comment
Comply with environmental regulations	All countries set certain standards. At a minimum, an electric utility should comply with all these regulations as issued by central and local governments of the countries where the utility operates.
Implement environmental management systems	Electric utilities should seek to bring their environmental in line with internationally recognized and verified standards (e.g. ISO 14000).
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 utilization in investment planning.
Develop low pollution technologies and measures	Electric utilities should strive to manage the continual improvement of emissions to air, discharges to water and noise abatement and develop cost-effective, low-pollution and environmental impact technologies.
Develop GHG strategies	The risks raised by the climate change issue puts a responsibility on electric utilities as emitters of greenhouse gases to develop GHG strategies.
Promote renewable energy development	Electric utilities should seek to exploit opportunities to develop renewable energy, both in terms of their use, to supply electricity, and in research programs.
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 recycling/reusing or disposing 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.
Demonstrate environmental leadership	Electric utilities should demonstrate environmental leadership by participating in dialogues, 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,” and should develop and use appropriate indicators to measure performance. External verification of data would add greater credibility and transparency.
Support key nature conservation programs	Electric utilities should initiate or support existing conservation and biodiversity efforts related to impacts on natural habitats from utility operations.

4.2.2 – Social Strategies

Social strategies can be more difficult to clarify than environmental strategies. Table 4.3 presents a selection of commonly accepted social strategies for electric utilities.

Table 4.3 Social strategies

Strategy	Comment
Expand access to electricity	In many 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.
Support key social programs	The prioritization of social issues will differ from country to country. Electric utilities should support initiatives in the high-priority categories, e.g., education, promotion and support for local industries, health education, including AIDS awareness.
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 underemployment, the development of small – and medium – size businesses is a key strategy to create jobs. Utilities should support this policy in their procurement practices.
Price power at affordable levels	Fuel poverty affects vulnerable communities, particularly in developing countries. Electric utilities should contribute to alleviating this through pricing power at affordable levels.
Support ethical business practices	Electric utilities should develop policies and codes of conduct and company practices in relating to employees, customers, suppliers and other stakeholders.
Promote 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.

4.2.3 – Economic Strategies

Economic strategies for the industry are closely aligned with meeting objectives that have traditionally been associated with electric utilities. Table 4.4 highlights a number of these strategies, which contribute towards the long-term viability of the electricity sector.

Table 4.4 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	Electric utilities should seek to meet targets for the return on assets and equity. Assets will only be maintained, and likewise a supply of sustainable electricity, if a minimum return can be achieved in the long term.
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 and noting the need to sustain electricity supply to disadvantaged communities and support industrial development in developing countries.
Support R&D and training	Electric utilities should seek to develop technological capabilities by supporting R&D and training programs.
Support business development	Electric utilities should seek to support business development.
Procurement	Electric utilities should seek to leverage buying power to improve supply chain management.
Liabilities and risk management	Electric utilities should seek to reduce liabilities and mitigate risks.

actions by member companies

This chapter examines some of the ways that electric utility members of this WBCSD project are beginning to integrate the concept of sustainable development into their operations around the world.

Specific examples of actions taken by member companies are described in the three core areas: environmental, social and economic.

The illustrations that follow highlight only some of the actions being taken by selected utilities to respond to the sustainable development strategies identified in Section 4.2. These examples by no means encompass all of the innovative efforts of individual utilities to accomplish similar objectives and manage their own, unique circumstances. Neither do they claim to represent achievement of the goal of sustainable development. Rather, they may be regarded as the emergence of some current practices in our industry and, hopefully, the basis through which all utilities may learn from the experience of others.

5.1 – ENVIRONMENTAL STRATEGIES

Within the electricity sector, different power generation, transmission and distribution technologies have different environmental implications and hence companies have different strategies.

The environmental strategies that member electric utilities are using to pursue their sustainable development goals are drawn from the full list of environmental strategies identified in Table 4.2.

5.1.1 – Implement Environmental Management Systems

International Environmental Management System standards, like ISO 14001, are an important strategic tool being used by the electricity sector to manage environmental risks and commitments more systematically. EMS models are especially important in enabling organizations to consistently meet their compliance targets, as well as strive for continual improvement. Third-party audits are increasingly being used to confirm rigorous implementation of the standard. As individual companies become more familiar with EMS, they are discovering new ways to expand its scope and customize its use in all areas of their organizations. The companies that are members of this project are at varying stages of EMS development and implementation.

OPG was one of the first electricity companies in North America to have all its major facilities certified under the ISO 14001.

EXAMPLES OF MEMBER COMPANY ACTIONS

TEPCO introduced a company-wide EMS conforming to ISO 14001 in 1996. With the implementation of the EMS, branch offices, power stations and construction offices have been improving their environment management. A number of TEPCO's offices and stations and its affiliated companies have already been certified to ISO 14001 between 1999 and 2001.

Kansai introduced ISO 14001 to its fossil fuel stations in 1997. The result has been a major improvement in energy and resource conservation, as well as a high level of awareness among employees of the importance of conservation.

Eskom has committed to achieve company-wide compliance with ISO 14001 by the end of 2002. Individual groups have produced action plans setting out group specific goals and objectives in support of achieving the 2002 target. An external audit will be conducted during 2003 to assess the extent of compliance. Eskom's Corporate Environmental Affairs office was certified to ISO 14001 during 2001.

Two of **British Energy's** facilities are accredited by the EU Eco-Management and Audit Scheme, under which they must publish an externally verified, local environmental statement. In 2000, the utility received independent confirmation of its overall environmental performance; it ranked 14th among more than 150 companies participating in the Business in the Environment survey of FTSE 250 Index Companies, and ranked first among electricity generators.

Powergen's EMS, which was implemented in 1992, is flexible enough to be applied to all of the utility's activities, from operating power stations to running office buildings. The utility has revised its environmental policy statement, the cornerstone of its EMS, to reflect structural changes in the organization, such as the incorporation of a distribution network. All of Powergen's UK and Asian businesses are accredited to ISO 14001.

Ontario Power Generation was one of the first electrical utilities in North America to achieve ISO 14001 accreditation at all of its facilities. OPG's Darlington station was also the first nuclear plant in North America to be ISO registered. The results are measurable and include: improved spills and regulatory compliance performance; lowest-ever air emission rates in 2000; success in attaining 100% of corporate environmental performance targets in 2000; and no significant environmental events (such as charges, investigations and orders) since 1998.

Exelon has embarked on a comprehensive Strategy for the Environment, which involves 15 company-wide teams focusing on the development of a strategy that supports sustainable business growth while benefiting the environment. A significant part of this effort includes the benchmarking of leading environmental best practices and the assessment and development of recommendations for adopting ISO 14001 EMS standard/certification.

5.1.2 – Integrate Environmental (and Social) Issues into Planning and Decision-Making

Senior executives must lead the way in developing the clear vision and defining principles of sustainable development that characterize an organization. How

EXAMPLES OF MEMBER COMPANY ACTIONS

TransAlta is networking with stakeholders and business partners to obtain a clear understanding of their needs and concerns. Economic instruments are also being used to stimulate awareness and support for sustainable development. For example, TransAlta has a program to charge back the costs of in-house CO_2 emissions to their sources within the organization (see "Develop Greenhouse Gas strategies," Section 5.1.4). Senior managers at TransAlta are assigned clear performance targets for sustainable development, which are in turn supported with various economic and recognition incentives. TransAlta made the Dow Jones Sustainability Group Index in 2001 for the third year in a row.

Eskom's Integrated Strategic Electricity Planning (ISEP) process is intended to provide strategic projections of supply-side and demand-side options to be implemented to meet long-term load forecasts based on Eskom's obligation to supply electricity. It provides the framework for Eskom to investigate a wide range of new supply-side and demand-side technologies with a view to optimizing investments and returns. The ISEP8 plan provides many economically and environmentally acceptable options for flexible and timely decision-making. The focus is to provide as robust a plan as possible, taking into account the objectives of Eskom and the shareholder. Specific attention was given to those uncertainties that would influence decisions on the timing and mix of new capacity. Environmental issues continue to be integrated into the ISEP process using the strategic environmental assessment approach that was initiated during 2000. Focus was on environmental life cycle assessments, site-specific studies, water-related issues and climate change considerations.

At **Ontario Power Generation**, sustainable development strategies are integrated into the company's key business processes. Sustainable development is integrated into all major investment decisions, in training for senior managers and in its Code of Business Conduct and annual award programs. Performance pay for employees is linked to the company's environmental performance. Environmental guidelines are incorporated into the annual business planning process, including objectives in areas such as energy efficiency, biodiversity management and emissions reduction.

At **BC Hydro**, a new approach to Water Use Planning focuses on triple bottom-line decision-making at each of their hydroelectric facilities. In response to increasing demands for British Columbia's water resources, this new process was jointly developed by BC Hydro with government and in consultation with First Nations and the public. The overall goal is to explicitly consider environmental, social and economic factors to better understand the values associated with different uses of water, and to find a sustainable balance between competing water uses. Open, inclusive decision-making processes allow participants to 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. For BC Hydro, costs of reduced power generation at facilities 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.

successfully the vision and principles are subsequently incorporated into the organization's business strategies will have a significant impact on the company's real progress toward sustainable development.

Electricity companies are rethinking the fundamentals of power generation, including their planning and decision-making processes. Global climate change has been one important catalyst for the change process; emerging deregulation of the electricity industry is another. Examples of some innovative company initiatives are outlined below.

5.1.3 – Develop Low-pollution Technologies and Measures

Tighter environmental controls and increased stakeholder expectations have prompted companies to invest in effective pollution-control technologies and measures to allow them to continue to operate their existing plant. Measures adopted by member utilities to reduce air emissions from their thermal power stations range from displacing fossil-fuelled generation with low-emission generation sources, to fuel-switching and implementing combustion controls and post-combustion emission reduction technologies.

EXAMPLES OF MEMBER COMPANY ACTIONS ON AIR EMISSIONS

Fuel Switching

At **TEPCO** and **Kansai Electric Power**, fuel switching to burn more natural gas and low-sulfur fuel oil has enabled both companies to significantly reduce their emissions of sulfur oxides (SOx) and nitrogen oxides (NOx). Today, natural gas accounts for about 80% of the fuel that TEPCO burns in its thermal power generating stations. TEPCO's emissions of NOx and SOx are at very low levels as compared to electricity companies in other developed countries of the world.

Pollution Control Technologies

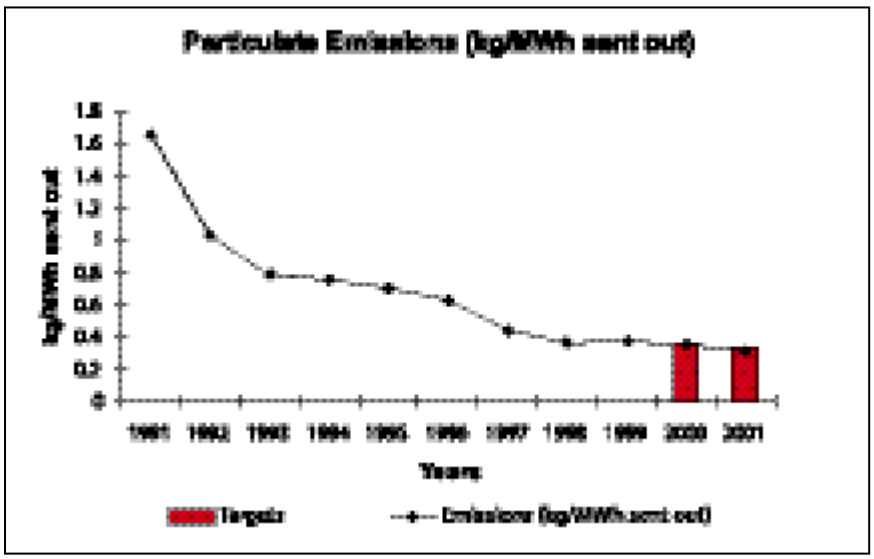
TEPCO and **Kansai** have supplemented their fuel-switching strategies by installing low-pollution technologies such as flue gas recirculation, two-stage combustion and low-NOx burners that reduce NOx emissions by restricting the working temperatures in boilers and gas turbines. TEPCO and Kansai also use flue gas desulphurization systems (scrubbers) to reduce SOx emissions and flue gas denitrification to reduce NOx emissions from the boilers and gas turbines at their facilities.

Exelon installed magnesium oxide scrubber systems at two fossil-fuelled power plants, in what was the first commercial application of its kind in the United States. Later, in order to meet 1990 U.S. Clean Air Act Amendments, Exelon and other owners, installed a limestone system of scrubbers on two units at the Conemaugh Generation Station in Pennsylvania which was one of the first power plants in the U.S. to be equipped with scrubbers. These units are achieving a 95% reduction in sulfur dioxide emissions.

Exelon and its partners, as well as **Ontario Power Generation**, are investing about $165 million (US) and $250 million (CND), respectively, to install Selective Catalytic Reduction (SCR) technology on some of their coal-fired generation units by 2003/2004 to meet more stringent regulations. The SCR systems reduce emissions of nitrogen oxide by up to 90% on those units.

Eskom has succeeded in reducing its relative emissions of particulates by approximately 80% over the last 10 years (see Figure 5.1). The technologies employed include electrostatic precipitators, bag filters and flue gas conditioning. Eskom has set an internal target to further reduce its overall particulate emissions to an average of 0.28 kg/MWh sent out, by the end of 2003, as part of a five-year strategy initiated in 1998.

Figure 5.1 Eskom particulate emission reduction since 1991



See also Sections 5.1.4 and 5.3.1 for further investments in technology responses.

5.1.4 – Develop Greenhouse Gas Strategies

Many electric utilities are now taking early action by implementing GHG emission strategies and programs in the absence of any legislative requirements. Each company deals with GHG issues in ways that reflect their own unique generation mix and national circumstances. For some companies investment in nuclear, advanced coal, large-scale hydro and natural gas are key elements of their GHG strategies. Company strategies take into consideration the potential impact of such actions on competitive advantage, costs, policy, the time scale over which the strategy is being implemented, and the availability of technological solutions.

All member companies are actively involved in the GHG policy discussions in their home countries and engaging their employees on this issue.

The following table lists the efforts that several utilities are taking in order to implement those strategies.

Table 5.1 Illustrative examples of climate change initiatives taken by selected electric utilities.

Company	Objective	Avoid CO_2 Emissions		Reduce CO_2 Emissions			Remove CO_2 from Atmosphere
		Generation Mix Includes Hydroelectric and Nuclear	Invest in Renewable energy	Improve Internal Energy Efficiency	Provide Energy Efficiency to Customers	Purchase Emission Credits	Invest in Carbon Sequestration Projects
TransAlta	Stabilize at 1990 levels by 2000 – Bettered target CO_2 emissions from Canadian plants = zero by 2024	Some hydroelectric Some hydroelectric	Yes	Yes	Yes	Yes Yes	Yes Yes, particularly geologic sequestration
Ontario Power Generation	Stabilize at 1990 levels by 2000 – Met target Stabilize at 1990 levels post 2000	Yes, both nuclear and hydroelectric Plans to restart a 2000 MW nuclear plant towards the end of 2002	Yes Yes	Yes Yes	Yes, but customers claim savings Yes, as above	Yes Yes	Yes, particularly forest carbon sequestration Yes
Tokyo Electric Power Corporation	Reduce carbon intensity in 2010 by 20% from 1990 levels	Yes, nuclear plant avoided 90.7 million tones of CO_2 in 2000	Yes	Yes, improved thermal efficiency and reduced transmission and distribution line losses	Yes, primarily load leveling of customers' demand	Yes	Yes, 10,000 hectare plantation in New South Wales, Australia
Kansai Electric Power Company	Reduced Emissions by 8% in 1999, compared to 1990 levels	Yes, nuclear (two nuclear units started up) and hydroelectric and LNG plant	Yes	Yes, Energy Reduction program			Yes, Activities Abroad Program
EPCOR	Annual targets since 1994 Secure 75,000 tones of GHG reductions and offsets in 2000	Yes, hydroelectric	Yes	Yes		Yes	Yes Both forest carbon and soil carbon sequestration.
Eskom	Not applicable - non-Annex 1 country	Yes, PBMR and increased hydro access in region Examining potential for CDM projects in South Africa	Yes SABRE-Gen Examine potential for CDM projects in South Africa	Yes Examine potential for CDM projects in South Africa	Yes, DSM program Examine potential for CDM projects in South Africa	Not applicable - non Annex 1 country	R&D phase Examine potential for CDM projects in South Africa
Exelon	To continue participating in reporting programs, greenhouse gas demonstration projects and carbon exchange programs	Yes, both hydroelectric and nuclear.	Yes, invested in green power	Yes	Yes	No	Yes, tree planting activities
Western Power	Reduce carbon intensity	Fuel switching and investment in low carbon intensity generation technologies	Yes		Yes - advisory		Yes

All the project members are undertaking independent research or contributing to collaborative programs on climate change related issues. These research programs vary from studies on the negative impact of climate change and response measures, to investing in new technologies, such as clean coal technologies, and investigating options for emissions trading and opportunities under the Clean Development Mechanism and Joint Implementation.

5.1.5 – Promote Renewable Energy Development

Renewable energy includes large and small hydropower, wind energy, solar energy, marine energy such as waves and tidal, biomass energy and geothermal energy. With the exception of large hydropower, which is currently the major source of renewable energy, these sources make up only a small fraction of the electricity being generated by member companies.

Renewable Power Production

Hydropower remains a competitive generation option for many countries, however the costs associated with many other renewable power development projects remain higher than those associated with conventional generation. Nonetheless, many electricity companies around the world are setting up renewable power programs, establishing performance targets, and committing to provide specific amounts of renewable electricity demand within specific time frames.

Drivers for the investments in renewable power are diverse. Some investments are arising from restructuring and merger settlements. Electric utilities have also invested in renewable power in order to develop a new revenue stream, in response to customer demand to diversify their current energy mix, and to contribute to corporate brand. Most of the investment in renewable power has been done on a voluntary basis and not in response to renewable portfolio standards or renewable quotas set by government. Some governments are now imposing or considering such quotas or standards.

Some utilities are leveraging their marketing and technological expertise in dealing with new renewable energy sources by forming partnerships and joint ventures to achieve their sustainable development goals. Examples include Powergen's renewables joint venture with the Abbot Group, which has made it one of the U.K.'s leading owner/operators of wind farms, and TransAlta's partnership with VisionQuest Windelectric Inc. of Calgary in developing a 40 MW wind farm.

Table 5.2 illustrates some of the renewable power programs being implemented across the member companies.

Exelon's Somerset Wind Farm (9 MW).

Table 5.2 Illustrative examples of renewable power programs of selected electric utilities

Company	Goal	Wind projects	Landfill gas projects	Bioenergy projects	Solar projects	Small Hydro[1]	Wave/tidal projects
Powergen		Interests in 14 operational wind farms in U.K. and Ireland (80 MW)					
Western Power	750 GWh per annum of renewable energy by 2010	•22 MW Albany wind farm •25 kW wind turbines in isolated locations •230 kW machines with fly-wheel storage	Purchases from landfill gas plants	1 MW demonstration Integrated Wood Processing plant	Pre-production solar concentrator plant		
BC Hydro	At least 10% of new electricity demand by 2010	10 MW wind energy project on Vancouver Island by 2003	Electricity Purchase Agreement for one 5 MW IPP project	Electricity Purchase Agreement for 2 IPP projects totaling 8 MW		17 Electricity Purchase Agreements for a total of 87 MW	3 MW ocean wave energy on Vancouver Island by 2004
Exelon	$274 million to support wind and solar under restructuring and merger settlements	6 projects for total of 186.83 MW	5 projects for total of 187.8 MW	1 project for total of 20 MW	15 projects for total of 0.43 MW	11 projects for total of 92 MW	
Ontario Power Generation	500 MW by 2005	•600 kW wind turbine •1.8 MW wind turbine •10 MW wind farm in partnership with British Energy (Fall 2002)	Purchases 3.5 MW from a landfill gas plant	Purchases 2.5 MW from organic waste composting plant	5 kW solar array on the roof of Head Office	138 MW among 30 plants	
EPCOR		Weather-dancer 1 Wind Project	Clover Bar landfill gas plant since 1992		13.4 kW solar array on the roof of EPCOR Center		
TEPCO	735 kW PV and 3.3 MW geothermal power plant by 2010	800 kW wind turbines and purchases of 4,400 MWh (2.5 MW) from wind power plants			•709 kW PV power plants •PV power purchases of 18,500 MWh (62 MW)		
TransAlta		40 MW wind farm with VisionQuest Windelectric Inc					
Eskom		3.2 MW experimental wind farm	Research program underway	System Johansson Gasifier – a 150 kW pilot plant	•Solar homes units provided through rural electrification project •Pre-feasibility study on a 100 MW solar thermal plant •Dish Stirling demonstration plant in 2002	•661 MW from 16 plants •Research program underway	Research program underway

[1] Many of the member companies have invested in large hydro power schemes, for example Ontario Power Generation, BC Hydro and Tokyo Electric Power. Eskom imports hydro power and is involved in exploring the hydro potential in the southern African region, see Section 5.2.1.

Marketing renewable power

As this section describes, electricity companies must also come to terms with the need to stimulate consumer awareness and acceptance of renewable energy.

They are doing so through innovative product branding and marketing programs – like ComEd's EcoPower (ComEd is a subsidiary of Exelon) and EPCOR's Eco-Packs. Eskom is launching renewable energy programs in isolated, rural locations in South Africa, and bringing electricity to people for whom electricity has in the past been more a concept than a reality.

Research in Renewable Power

A number of companies are also engaged in research into new renewable options as noted in the following examples.

Two of the three hydrogen/CNG fueled vehicles at Powertech Labs' (Subsidiary of BC Hydro demonstration fueling).

EXAMPLES OF MEMBER COMPANY ACTIONS

EPCOR launched a green power program in 1999 that encourages its customers in Edmonton, Canada, to support more environmentally friendly power options. EPCOR's residential customers can choose to purchase blocks of green energy generation, called ECO-PACKs. The size of each "pack" is based on the average monthly power consumption of the household. Customers pay a premium for the ECO-PACK on top of their monthly power bill, ranging from $5 to $40 per month for 10% to 100% green power, respectively. EPCOR's green power program is EcoLogo-certified under the guidelines established by the federal government to formally recognize low impact power. In 2000, EPCOR customers who supported the green power program contributed to reducing carbon dioxide emissions by 2 tons; sulfur dioxide by 6 tons; nitrogen oxides by 4 tons; and particulates by 1 ton.

Exelon's subsidiary ComEd is offering a renewable energy product, EcoPower, that is based on electricity generated from landfill gas. Retail energy suppliers can buy renewable EcoPower certificates from ComEd and combine them with commodity electricity to provide a renewable energy product for sale to end-use customers. EcoPower is able to fully meet the renewable energy requirements of Chicago, Illinois. It is the largest municipal renewable energy deal in the U.S.

Through another ComEd program – the Wind and Photovoltaic Generation Pricing Experiment – business and residential customers are able to sell their excess renewable energy to ComEd. ComEd has built in customer-friendly "Interconnection Guidelines" for systems smaller than 40 kW. The company also offers residential customers standardized photovoltaic systems, with complete installation and multi-year service support available though the Solar Connect Illinois programs. And in partnership with the City of Chicago, ComEd has dedicated $12 million to support the installation of solar energy in the city over the next five years. Solar systems have already been installed at several museums in Chicago. The solar systems to be installed as a result of this investment will produce 900,000 kilowatt hours of electricity annually.

EXAMPLES OF MEMBER COMPANY ACTIONS

Renewable Energy Research in South Africa

Eskom launched the South African Bulk Renewable Energy Generation (SABRE-Gen) program in 1998 to evaluate viable renewable energy solutions to meet South Africa's future electricity requirements.

The program has four components: bioenergy, solar thermal electric, wave and wind.

Eskom set out in 1997 to assess the viability of large grid-connected concentrating solar technologies for South African application. NREL, in the US, was contracted to undertake a screening study to select the most promising technologies from the list of technologies and its variants that were available at the time. The study identified two technologies, the Central Receiver and Parabolic Trough for further investigation.

In 1999, the SABRE-Gen project, Concentrating Solar Power, received a Global Environmental Facility (GEF) grant for a prefeasibility study to assess the viability of these technologies under South African conditions. The study assessed the viability of these two technologies in terms of operating as peaking plant with storage and both were found to be suitable. The full feasibility study will focus on determining, with the suppliers, the detailed costs for each technology. The technology, which offers the most in terms of promoting the use of local industry, will be favored as far as a demonstration facility is concerned.

Research into Hydrogen Infrastructure

BC Hydro has developed a strategy that in the short to medium term focuses on providing merchant hydrogen to wholesale and large retail customers, and in the long term on supplying hydrogen as a fuel for the hydrogen-fueled transportation market. BC Hydro is currently producing hydrogen by electrolysis at its prototype hydrogen fueling station for component testing purposes, as well as for fueling three hydrogen/CNG internal combustion engine vehicles. This near term focus on wholesale and large retail market will serve to build BC Hydro's hydrogen business now and provide an immediate return on investment. The longer-term focus on the transportation market will position BC Hydro well to take advantage of the enormous opportunity, which the hydrogen and fuel cell transportation market represents.

Methane Capture

EPCOR is undertaking research with the University of Alberta on ways to optimize methane capture from landfill gas projects.

5.1.6 – Promote Energy and Resource Efficiency

Internal Energy Efficiency

Electricity companies around the world are thinking differently about how they themselves use energy. By improving the internal efficiencies of electricity generation and distribution, the industry is helping to preserve important natural resources and reduce electricity costs to consumers. Some companies, like Ontario Power Generation and TEPCO, are keeping internal pressure on the issue by establishing energy-saving and waste-reduction targets.

Prawn nursery and production facilities at TEPCO's plant

EXAMPLES OF MEMBER COMPANY ACTIONS

Ontario Power Generation has an established multi-year track record in internal energy efficiency. The company's total cumulative energy savings for the corporation since starting its energy efficiency program in 1994 are well over 2,100 GWh. In 2000, OPG's internal energy use was 6,400 GWh for an energy intensity factor of 95.5. OPG continues to encourage employees to find new energy efficiencies, by setting up energy-saving targets. Specifically, the company's target for each of the next four years is equivalent to 3% reduction of its annual energy use. In 1999, the Canadian government awarded OPG the first National Energy Efficiency Award for a five-year energy-efficiency program that realized $70 million in annual cost savings. Moreover, energy savings at OPG earned Emission Reduction Credits totaling over two million tons of carbon dioxide, sulfur dioxide and nitrogen oxide, valued at over $10 million.

TEPCO is promoting thermal energy efficiency though its first Advanced Combined Cycle (ACC) generation system at its Yokohama Thermal Power Station in 1996. The new technology achieved a rate of 49% at HHV in thermal efficiency, an energy saving well above that of the 43% achieved by the Combined Cycle system. Subsequent installations of ACC systems at three other TEPCO thermal power stations increased their average thermal efficiency in 2000 to 41.1%, a 0.5% increase compared with 1999.

Building Consumer Awareness of Energy Efficiency

Consumers, too, are beginning to think differently about how they use energy. Electricity companies have a stake in encouraging more consumers to control their energy use – for example, by taking advantage of a wide range of energy-efficient technologies and appliances on the market. It is important that energy savings on the generation and distribution side are not lost during end use.

Programs like BC Hydro's Power Smart, Eskom's Efficient Lighting Initiative, and Exelon's Community Energy Cooperative are examples of creative, effective ways that the electricity industry is participating in the consumers' change process.

EXAMPLES OF MEMBER COMPANY ACTIONS

Eskom is building consumer awareness of energy efficiency through the co-funding of the three-year Efficient Lighting Initiative, which will accelerate the penetration of energy-efficient lighting technologies into emerging markets in developing countries. Eskom's joint venture company, Bonesa, is implementing local educational, marketing and awareness programs in South Africa. Marketing programs include a compact fluorescent lamp promotion in conjunction with a supermarket chain. As well, since residential lighting demands in South Africa are highly coincident with peak loads, Eskom has set up an energy-efficient lighting campaign – in conjunction with its ElectroWise program – which provides information to customers about how they can reduce their light load and save money.

The Community Energy Cooperative, a new organization supported by **Exelon**, enables communities to control their energy use and costs, and to benefit from changes in energy technology and regulations. Members get affordable access to new technologies that can reduce energy use and lower costs. These technological changes will reduce peak demand in summer, saving system construction and expensive energy supply costs. Exelon will pay the Cooperative for energy saved, in the form of more affordable technology and contributions to community development projects.

BC Hydro's energy-efficiency initiative, Power Smart, is part of the company's strategy to defer the need to build new generating facilities. The program successfully achieved its original aim of helping to meet the needs of a growing population, with current annual energy savings at about 2,300 GWh, and the equivalent of 1.2 million tons in avoided GHG emissions. Since 1989, Power Smart has helped to avoid 9.8 million tons of GHG emissions. 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 for them. Rising natural gas prices and customer concerns about energy costs led to the launch of the Power Smart Home Energy Learning Program (h.e.l.p.) in 2001, which features an on-line home energy profile for customized analysis of a customer's energy use, and suggests energy savings measures, product promotions and consumer information.

Since **Ontario Power Generation** does not sell directly to residential customers, its energy-efficiency programs are focused on large industrial customers, as well as advocacy, education and information programs. To encourage energy efficiency in the building sector, the company sponsored the Healthy House Award to recognize the environmental benefits of home energy savings. OPG co-sponsors in some of its station communities, LivingWise, an educational program which teaches students and their families ways to conserve energy and water. An attached "technology kit" contains a low-flow showerhead, faucet aerator and energy-efficient nightlight. OPG's GreenSaver "lunch and learn" sessions and Home Energy Audits encourage employees to adopt residential energy-efficiency measures. The company is also co-sponsoring an On-Line Energy Efficiency Center through the Canadian Energy Efficiency Alliance to provide users with easy access to energy efficiency information.

Waste Management

The companies involved in this project must manage a range of wastes associated with the operation of their power plants. These range from radioactive waste to fly ash and bottom ash from coal-fired generation, to conventional waste.

Recycling

TEPCO is committed to reducing its output of waste in general, and particularly industrial wastes such as scrapped wires, insulator scraps, concrete scraps and underground distribution cable ducts. **Exelon** and its subsidiary have been active in managing waste material in an environmentally responsible manner and in recycling coal combustion co-products.

Stewardship of Water Resources

Stewardship of water is one of the most urgent natural resource challenges of the 21st century. Increasing scarcity and deteriorating quality of water resources are creating real cause for concern about the sustainability of this finite resource. Water sustains life on the planet, and no other resource can replace it. In co-operation with both the public and private sector, the electricity industry continues to support environmental research that contributes to the sustainable development of water resources around the world.

EXAMPLES OF MEMBER COMPANY ACTIONS

Six of the eleven companies, **British Energy**, **Eskom**, **Exelon**, **Kansai, Ontario Power Generation**, and **TEPCO**, operate nuclear power plants. Spent fuel is either stored on-site in water-filled bays or in licensed, dry storage containers. Monitoring of these bays or containers for leaks or discharges is part of the requirement of the operating license for these plants. The bays and dry storage containers are also regularly audited by the International Atomic Energy Agency to ensure that all spent fuel is accounted for and is securely stored.

All companies are working with the government or regulatory agencies in their countries to find a long-term solution for the spent fuel produced at their generating stations – either direct disposal of spent fuel, or re-processing of the spent fuel and the disposal of the residual high level radioactive waste, or a combination of these two options.

Many have funded research and development into long-term disposal options. All of the companies have established and are contributing money to segregated funds for the future disposal of spent fuel or high level radioactive waste from reprocessing of the spent fuel and the decommissioning of their nuclear power plants.

Exelon exemplifies corporate commitment to reducing waste from nuclear facilities, specifically low-level radioactive waste. Exelon reduced its volume of low-level radioactive wastes by 95% since 1985, through innovations in plant reactor chemistry, elimination of disposable protective clothing and packaging material and application of new technologies. As a result, Exelon's nuclear sites met the industry's "Year 2000" goals for waste reduction three years ahead of schedule.

Exelon, through its business units has historically been very active in marketing its coal combustion co-products. By putting coal combustion co-products and flue gas desulphurization co-products to beneficial use, the need for landfill space is dramatically reduced – as are the costs of waste disposal. For example, during 1997 100% of Exelon's coal combustion co-products (fly ash, bottom ash, settling basin ash and flue gas desulphurization co-product) from three coal units went to beneficial use. The primary use of combustion ashes was related to sewage sludge solidification and mine reclamation. In 1997, 32% of the fly ash that Exelon generated was utilized for higher-value applications. Approximately 40% of the flue gas desulphurization co-product (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 sulfur. Currently, Exelon actively tries to expand markets for these co-products and estimates that it saves hundreds of thousands of dollars annually by selling scrubber waste into the fertilizer and stabilization markets as well as returning the coal by-products to reclaiming mine areas.

Spent fuel from nuclear power generation contains as much as 97% reusable uranium and plutonium, and by recovering and reprocessing such spent fuel, we can reuse the material as nuclear fuels to sustain natural resources. Uranium ore extracted from mines is turned into fuels for nuclear power generation through processes such as refining, conversion, enrichment and fabrication, and after three to four years in a nuclear reactor, nuclear fuel is removed as spent fuel. In the reprocessing process, recyclable plutonium and un-reacted uranium are extracted from spent fuel by chemical treatment, and recycled and reused as MOX fuel (Mixed Oxide Fuel). These series of operation is called the «nuclear fuel cycle», and **TEPCO** is taking positive steps toward the realization of MOX fuel utilization in light water reactors as a means of recycling limited uranium resources.

EXAMPLES OF MEMBER COMPANY ACTIONS

At **TEPCO**, scrapped wires are recycled as conductors for power distribution lines. Insulator scraps are recycled into aggregate for use in construction materials, and because of their good abrasion resistance, they are used in road-indication materials such as white lines. A TEPCO subsidiary has turned insulator scraps into commercial products such as china, porcelain and tiles. Concrete and asphalt scraps resulting from the demolition of company facilities are crushed and recycled into roadbed materials. Underground distribution cable ducts – when found unsuitable for reuse – are crushed, mixed with other new materials and used to produce reclaimed ducts. TEPCO outperformed its targets from 1998 to 2000, and has set even higher targets for the years ahead. TEPCO achieved a 94% recycling rate in 2000. TEPCO's new target is to raise the recycling rate to 100% by 2005.

Exelon, formed a Resource Recovery Division in 1994 to better manage 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 division works with the business units to evaluate waste streams and implement waste reduction strategies. Strategies may involve tasks such as recycling, identifying new markets for materials, changing product-packaging specification to reduce waste, identifying alternative products with preferable environmental properties and modifying work practices. In 1997, 1.5 million pounds of non-ferrous metal, 3 million pounds of iron, and 200 tons of plastic pipes were recycled. As well, used cables and cable reels were returned to company stock and vendors, respectively.

Matimba, one of Eskom's dry cooled powerstations

EXAMPLES OF MEMBER COMPANY ACTIONS

Watershed protection

EPCOR is committed to outperform legislated water quality standards wherever possible through its watershed management. The company obtains its source water from the North Saskatchewan River, which originates in the Columbia Ice Fields in the heart of the Canadian Rocky Mountains. The river picks up contaminants in its travels, such as soil particles, oil, road salt, pesticides, to name a few. Through its watershed protection program, EPCOR not only treats the river water to remove these contaminants; it helps to prevent contaminants from entering the river at all. EPCOR was also instrumental in the formation of a multidisciplinary watershed monitoring and awareness project designed to identify the source of parasites in the river. Research from this project will assist agricultural producers, municipalities and wildlife managers in reducing parasite levels in surface water, ultimately ensuring a cleaner source for drinking water.

Water conservation

The quantity of energy produced by **Eskom's** coal-fired power stations between 1989 and 1999 increased by 29%, while the corresponding increase in water consumption was only approximately 1.0%. Eskom generates more than 95% of South Africa's electrical energy and more than half of the electricity used on the African continent. Eskom has introduced two of the largest dry-cooled power stations in the world, resulting in the saving of more than 200 million liters of water per day that would normally be lost through evaporation. Technologies for dry ashing systems and water desalination (reverse osmosis and electrodyalysis reversal) have also been researched and implemented and contributed to reductions in water use.

Thermal effluents

TEPCO utilizes a variety of methods to lessen the influence of thermal effluent on the environment, including a deep-seawater intake system that draws cold seawater from lower depths in the summer months. The company continues to improve its thermal efficiency, so as to minimize the amount of waste heat that it generates. At the same time, TEPCO continues to explore opportunities for the constructive, useful application of thermal effluent. Currently, TEPCO uses thermal effluent from its Fukushima Daiichi nuclear station and Futtsu thermal power station to facilitate seedling production and breeding of marine products such as flatfish and prawns.

Since electricity generation utilizes water, companies continue to focus on conserving water resources. This is especially critical for energy producers in countries with scarce water resources, such as South Africa. Access to water and water availability remains a key factor in ensuring the sustainability of development in southern Africa. Another water resource challenge encountered by some electricity generators is the impact on the environment of waste heat from thermal effluents.

5.1.7 – Undertake Environmental Education and Training

A long-term approach to educating society about sustainable development in general, and environmental issues specifically, is required to raise public consciousness of its importance to this and future generations. Many electricity companies provide financial support for programs and campaigns that address issues relating to energy and the environment. Some companies have even established permanent public exhibits focused on energy and environment, such as Western Power's World of Energy. As employers, electricity companies also have a responsibility to educate and train their employees to perform their jobs in an environmentally responsible manner.

EXAMPLES OF MEMBER COMPANY ACTIONS

Western Power believes that educating children in environmental concerns and responsible energy use can improve the lifestyles of all communities. World of Energy, a hands-on environmental learning center, is Western Power's flagship for education. More than 50,000 children a year participate in its energy education programs. A further 2,000 children in rural regions participate through Western Power's Travelling Greenhouse Workshop. World of Energy is a showcase for information on the environment, with displays covering the Greenhouse Effect, Wetland Rehabilitation, Western Power's Endangered Plant Rescue Program and the Hotham-Williams Western Power Greening Challenge – the largest volunteer tree-planting program of its kind in Australia. In the future, World of Energy plans to produce its own power through wind and solar sources on site.

Exelon supports numerous institutions and programs that help educate and enhance the quality of life in the communities where it does business. In Philadelphia, Exelon provides funding for the Franklin Institute, which helps to perpetuate the legacy of Ben Franklin by helping to increase public understanding of science and promoting science education and achievement. The Electricity Hall demonstrates electricity and its uses. Also, Exelon's Sustainable Development Fund has allocated $2.5 million to renewable energy education to help consumer education on electricity from renewable sources. Examples of projects supported by this Fund include: (1) the development of professional teams to advise local governments and school districts about clean building design, (2) the education of commercial and industrial customers about clean energy, and (3) the support for the development of a website, television advertisements, and promotional articles for renewable energy.

In 1993 **TEPCO** started *Observe Nature-in-Pairs*, an environmental education program, to provide participants with opportunities to come into contact with and learn about nature, especially the significance of environmental protection. The concept underlying the program is that individuals can become more passionate about nature and learn more readily if they are accompanied by someone else, perhaps a parent, child or friend. The program includes a Nature Observation Tour of green tracts at thermal and nuclear power stations, helping to build closer ties between the company and consumers. TEPCO also hosts an environmental education workshop for teachers who want to use these unique nature observation techniques in their school curriculum.

Eskom promotes resource management training through partnering with organizations such as the Southern African Wildlife College, which are aimed at building sustainability in South Africa. Through the college, Eskom assists in training resource personnel throughout Africa about Environmental Management Systems and resource management. Eskom's partnerships with the Wildlife and Environment Society of Southern Africa, and Food and Trees for Africa, are helping to develop capacity for energy-related projects and food planting at rural schools. These programs can contribute to the sustainability of the schools by reducing energy costs and improving quality of life through food provision and job creation.

5.1.8 – Sustainable Development Reporting

It is becoming common practice for electricity companies to produce annual environmental reports that communicate their performance to a broad range of stakeholders. Moreover, many companies are choosing to voluntarily produce sustainable development reports that expand upon their environmental, economic and social performance. The "triple bottom line" standard is internationally accepted by organizations such as the Global Reporting Initiative, whose goal it is to promote comparability of sustainability practices by standardizing corporate reporting.

Third-party verification of corporate performance reporting is becoming the norm; some companies have already taken this important step. Many companies also have internal reporting systems, which monitor on-going progress and performance.

EXAMPLES OF MEMBER COMPANY ACTIONS

Since 1989, **Ontario Power Generation** (and formerly Ontario Hydro) has published annual environmental and, more recently, sustainable development reports. The company considers its workforce a key audience for sustainable development information, and as a result employees can turn to a variety of sources – including the company intranet site. The publicly available Internet site carries the full text of OPG's *Towards Sustainable Development: 2000 Progress Report*. OPG issued a supplementary brochure to half a million households, which summarizes the Progress Report. OPG has identified a need to produce periodic reports that can target specific issues to designated audiences. The company to answer stakeholder questions regarding greenhouse gas emissions and biodiversity recently published brochures. OPG's biannual Corporate Citizenship Program report describes initiatives that enhance quality of life in communities where the company operates.

Eskom's 2001 Annual Report - Embracing Sustainable Development is aimed at a more integrated approach to sustainability reporting, covering aspects of, among others, economic, social and environmental issues. The Eskom Annual Report and Eskom Environmental Report have been combined in terms of international trends of integrated reporting. In 2000 Eskom issued the Eskom Annual Report, Eskom Enterprises Annual Report and the Eskom Environmental Report. The company's 2000 Report received the Gold Award for the best Corporate Environmental Report in the South African Category from KPMG, and its Gold Award for the Best Sustainability Reporting in an annual report (Public Entities Category). Eskom's environmental reporting contains information relevant to all stakeholders, which is independently audited.

TEPCO's "Environmental Action Report", in ninth edition, is a 200-page document that details cost estimates for all of TEPCO's major environmental activities and a range of environmental indicators covering Main Environmental Impacts and Environmental Preservation Measures. The report covers global issues such as global warming and protection of the ozone layer, and community environmental concerns. It addresses nuclear power and its relationship to the environment, health and safety, energy and environment education, international cooperation, as well as TEPCO's leadership in building a resource-recycling society. The latest Environmental Action Report 2001 describes the detailed results of TEPCO's efforts in accordance with triple bottom line comprising the environmental, social and economic aspects.

EPCOR has been active in publicly reporting its environmental and sustainable development activities over the last decade. Starting with one-page reports in the local newspaper, which is distributed to over 100,000 households in the Edmonton region, the reporting has grown and matured with time. In 2000 EPCOR published a triple bottom line report consisting of two companion documents:

- the 2000 Annual Environment and Sustainable Development Report, and
- the 2000 Annual Corporate Report.

Powergen has published annual environmental reports since 1992 and its first internet sustainability report in 2002.

Table 5.3 Reporting activities of selected electric utilities

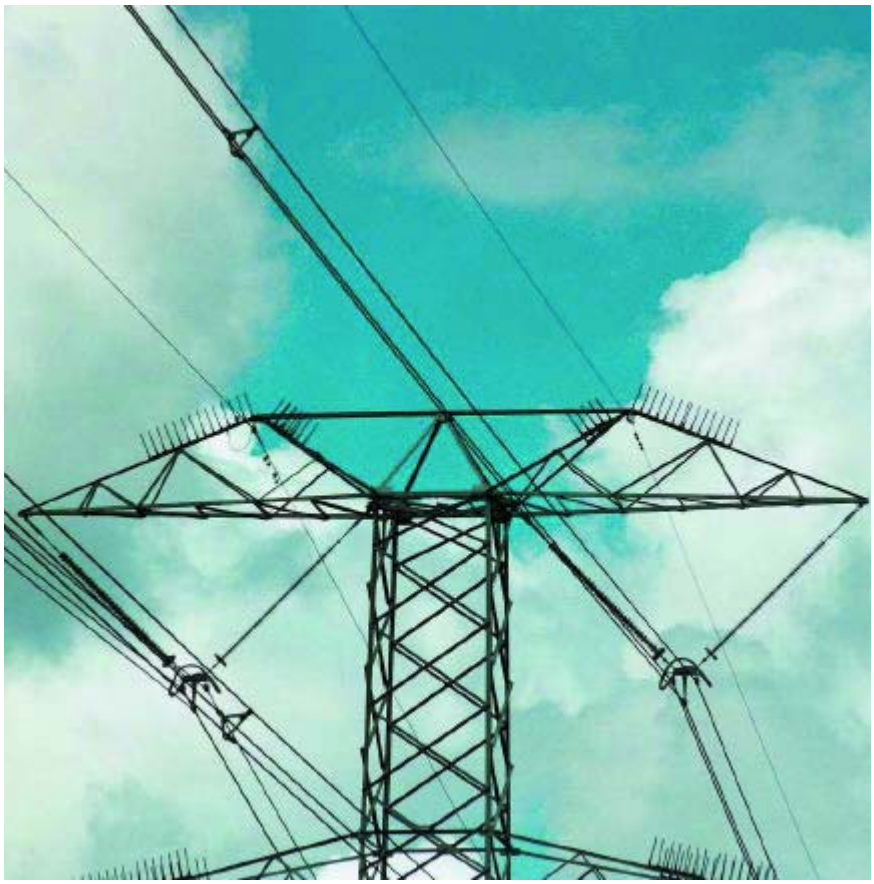
Company	Environment/SD Report	Integrated with Annual Financial Report	Audited by Third Party	Distributed to Employees and Stakeholders	On Internet site	Date First Report Published
BC Hydro	Yes	Aligned with Annual Report	No	Pre 2002, Yes, after 2002 available on-line and summary report available	Yes	Environmental report 1992, Triple Bottom Line report 1999
EPCOR	Yes	Yes	Environmental report, no	Yes	Yes	1994 (as Edmonton Power)
Eskom	Yes	Yes, First combined report in 2001	Yes	Yes	Yes	1996
Exelon	Yes	Yes	No	Yes	Yes	
Ontario Power Generation	Yes	Some SD material in annual Financial report	Yes	Yes	Yes	1989 (as Ontario Hydro)
Powergen	Yes	Yes, some material in Annual Financial Report	Yes	Yes	Yes	1992
TEPCO	Yes	Yes, some material in Annual Financial Report	No[1]	Yes	Yes	1992
Western Power	Yes	Yes	No	Yes	Yes	1996

[1] The TEPCO Advisory Committee on Environmental Affairs, which is an external committee consisting of 6 acknowledged experts, reviews the report and the report is revised according to their opinions. Their views are summarized and published in the report.

5.1.9 – Support Key Nature Conservation Programs

Land Conservation and Biodiversity

Many electricity companies are undertaking nature conservation initiatives directly related to the impact of their generating operations on the local environment. For example, Exelon has undertaken extensive land stewardship initiatives. Eskom has introduced indigenous animals to lands surrounding its power stations. Ontario Power Generation is conducting ecological assessments at each of its facilities to identify significant local species and habitats that could be adversely affected by its operations, so that the company can initiate remedial strategies if required.



Power line – bird guards installed by Eskom

EXAMPLES OF MEMBER COMPANY ACTIONS

Exelon's stewardship initiatives include co-maintenance of the 650-acre Merrill Creek Reservoir in New Jersey and some 2,000 surrounding acres as an environmental preserve; stewardship of 9,000 acres along the Susquehanna River in Pennsylvania; and preservation of land that the company purchased in the late 1960s as part of a transmission line project. Several of Exelon's property holdings have been enrolled in the Nature Conservancy's Natural Areas Registry program in Pennsylvania and in the Maryland Natural Heritage program. Exelon has committed to protect these areas, which are home to rare and endangered plant and animal species.

Exelon has restored nearly 500 acres of natural prairies on its buffer lands and rights-of-way. Exelon has supplemented these efforts with a maintenance burn at a 30-acre site adjacent to one of its generating stations, 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.

Ontario Power Generation's Biodiversity Policy commits the company to manage its activities in a manner that encourages the continued existence of native species and the ecosystems upon which they rely. The company's Carbon Sequestration and Biodiversity Management program is one example of how OPG is applying its Biodiversity Policy. As part of this program, OPG has committed to plant 1.6 million native trees and shrubs and to reforest 800 hectares in southern Ontario by 2005. The program targets conservation priorities such as reconnecting fragmented landscapes, which will aid in the recovery of species at risk and enhance riparian habitats. By building strategic partnerships with conservation authorities and NGOs, OPG ensures the ongoing management and monitoring of the plantings.

Included in the 18,000 hectares of forested land owned by **TEPCO** is the western half of Oze Marsh, one of Japan's best-known highland marsh environments and a destination for hundreds of thousands of visitors each year. Unfortunately, the very popularity of Oze Marsh has threatened its existence, as increasing foot traffic stripped large stretches of the marshland of vegetation. TEPCO has taken steps to restore a considerable portion of the marshland; more than 50 kilometers of wooden walkways have been laid to give hikers access to the area while protecting it from destruction. Moreover, TEPCO has undertaken public education programs in an effort to educate people in better ways of living in harmony with nature.

Kansai Electric Power has adopted "green zoning" as a fundamental principle of its strategy to preserve the environment around its electricity facilities. The company's green zoning activities are based on an ecological system that involves the planting of indigenous saplings in good-quality soil. The resulting dense mixed vegetation adapts easily to the local environment and fosters the speedy development of native forests. The green zone surrounding Kansai Electric facilities totals more than 7,800 hectares. The company also provides support for the planting of trees and flowers in communities where its electricity stations are located.

Electricity generator **TransAlta** has achieved marked success in reclaiming open pit coal mines to support a wide variety of uses: agricultural, woodlands, wildlife habitat, recreation and wetlands. In one award-winning project, East Pit Lake, TransAlta transformed what was once an open-pit mine in Alberta, Canada, into a 47-acre lake surrounded by hundreds of acres of rolling hills. The lake sustains a sport fishery, and supports a variety of wildlife and waterfowl, including a pair of nesting Ring Necked Loons that return each season.

Achieving sustainability goals through partnerships

Many companies are going further to strengthen their contribution to nature conservation, by forming innovative strategic partnerships with non-government organizations and corporate and community groups.

As Eskom has illustrated, partnerships between electricity companies and NGOs are an important means of empowering organizations and communities to jointly address sustainability issues.

Western Power is working through partnerships to address priority issues in Western Australia, where historical clearing of deep-rooted native plant species has brought about one of the country's greatest environmental concerns: increased groundwater salinity. The resulting waterlogging, erosion and salinization has caused a decline in remnant bushland and loss of biodiversity and agricultural land. Western Power is promoting revegetation to redress the water balance and preventing the spread of salinity. The widespread, long-term effect of the problems requires a co-operative approach to land care.

EXAMPLES OF MEMBER COMPANY ACTIONS

In 1996 **Western Power** developed the biggest volunteer-based revegetation project in Australia, the "Greening Challenge." The project focuses on a 600,000-hectare river catchment some 200 kilometers from Perth, Western Australia's capital city. Western Power formed a partnership with the community, farmers and local and state governments to plan effective planting of over 80 species of native trees and shrubs on degraded land in the catchment, with the Greening Challenge providing the seedlings and logistical support. Volunteer planters were originally Western Power people and their families, but the project now draws an army of helpers each year from the general public and community and business groups. One million tree seedlings were planted between 1996 and 1999. With additional funding from the Australian government, the new Greening Challenge target is four million seedlings planted by 2002. The program has become a catalyst for other revegetation efforts in the area.

With the support of governments in Western Australia, **Western Power** is undertaking a program to replace all power poles and overhead distribution lines with underground power. As well as eliminating unsightly poles and wires, undergrounding reduces the exposure of vegetation to power lines, improving electricity reliability, and removing the need for tree pruning and removal. Over 20,000 homes and businesses will be converted to underground power during 2001 and 2002.

In partnership, **Eskom** and the Endangered Wildlife Trust have made significant progress in developing and testing devices that reduce bird collisions and electrocutions. The partnership has developed an internationally recognized center of excellence, focusing on improving the quality of supply of electricity and reducing the impact on biodiversity in southern Africa – and there have been financial savings for Eskom. In the fullest sense, the partnership is helping to ensure that the impacts of infrastructure on biodiversity in the region are sustainable. Eskom is also a trustee of the Ekangala Grassland Trust, which aims to conserve a million hectares of high-altitude grassland in southern Africa. The trust aims to co-ordinate existing activities in the area and proclaims the area as a biosphere in terms of the UN Man and the Environment Program.

BC Hydro, in partnership with the Government of British Columbia, has established three Compensation Programs addressing fish and wildlife impacts caused by the construction of hydroelectric facilities. Each of the three compensation programs is financially sustained by a perpetual capital fund, with total annual funding of approximately $6 million. Representatives of the public and First Nations, who liaise with their local communities to bring forward ideas and concerns, join them. Activities range from biological research and species inventory, to on-the-ground mitigation projects and complex, multiyear recovery plans for endangered species; for example, a recovery effort for char – an endangered species – and for the Columbia White Sturgeon.

BC Hydro is also undertaking 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.

5.2 – SOCIAL STRATEGIES

The first priority of electric utilities has been to address the environmental impacts of their operations; the second priority was to strengthen relationships in the communities where they operate. Consequently, some electric utilities are only now focusing their attention on the broader issues of corporate social responsibility. The notion of maintaining the "license to operate" is becoming quite entrenched with electric utilities' practices, and at the same time, there is a recognition that more must be done.

This section highlights five social strategies that are aligned with the electricity industry's overall sustainable development objectives. They are drawn from the broader list of social strategies introduced in Table 4.3. For each social strategy, examples of specific initiatives developed by member companies to contribute to the well being of society, are provided.

5.2.1 – Expand Access to Electricity

Access to electricity is not typically an issue for electric utilities that operate in developed countries. While there may be customers who are remote from a transmission grid, electrical connection of that customer is a relatively simple transaction. This issue is more acute for utilities operating in developing countries. Electrification is a major factor 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 provide environmental benefits for society at large, but it can spur important economic growth. Electric utilities that contribute to electrification in developing countries are making a major contribution to sustainable development.

EXAMPLES OF MEMBER COMPANY ACTIONS

Electrification in South Africa

The provision of electricity leads to job creation and a subsequent rise in disposable income in a community. Electrification of schools and houses is highly likely to lead to increased education and productivity levels. The supply of electricity can lead to a decrease in the harvesting of firewood with resultant biodiversity implications. A decrease in respiratory disease will result due to the reduction of domestic fuel burning. The relative efficiency of using electricity will reduce the overall emission of pollutants and therefore decreases the level of ambient air pollution.

Prior to 1994, only 12% of the population in South Africa had access to electricity. The South African government, the electricity distribution industry and **Eskom** committed to electrify 2.5 million households by 2000. Since the start of Eskom's electrification program in 1991, the company has invested approximately US$ 700 million and electrified 2.6 million homes in South Africa. An Eskom/Shell joint venture project has installed solar homes systems. Over 90% of urban areas, and more than 40% of rural areas, are now electrified.

To bring affordable electricity to communities, Eskom was able to reduce the cost per connection through a comprehensive program that included more extensive community information programs and the development of a prepayment meter. To counter the problem of costs associated with greater distances from the established grid, there are new initiatives to promote the use of non-grid energy such as solar power (see Section 5.1.5).

Contributing to the New Partnerships for Africa's Development (NEPAD) Initiative

This new African initiative is a pledge by African leaders, based on a common vision and a firm and shared conviction, that they have a pressing duty to eradicate poverty and to place their countries, both individually and collectively, on a path of sustainable growth and development, while actively participating in the world economy. **Eskom** is contributing to NEPAD through the development of projects related to the strengthening of Africa's energy infrastructure. These proposed projects include the development of an interconnected African grid, thus promoting development and increasing access to energy. A proposed renewable energy supply side project is to restore the capacity of the Zongo and Sanga hydroelectric facilities in the Democratic Republic of the Congo from 17 MWe to 87 MWe. In addition, interconnecting the two facilities (12 km), refurbishing the transmission system for power delivery to Kinshasa, and repairing the access roads is under consideration.

5.2.2 – Support Key Social Programs

Contributions by the business sector to the well being of the communities where they operate are not new. Particularly in recent decades, companies in every business sector have endeavored to be good, active corporate citizens, by donating time and resources to social causes that resonate with their organization. The electricity sector is no exception.

There is an increasing expectation among the public at large that the business sector should contribute to the well being of society. Community-based support will continue to be a significant priority for electricity companies. At the same time, globalization is creating a broader set of causes and calls for action that may widen expectations for the industry in the years ahead. The following examples demonstrate the depth and complexity of social issues being addressed by some in the electric utilities in the 21st century.

EXAMPLES OF MEMBER COMPANY ACTIONS

HIV/AIDS

Eskom considers the implementation of their HIV/AIDS response strategy to be a focus area for the business and, as a result, it was included as a key measure in the human resources sustainability index. Response strategies developed from a 1999 surveillance study were implemented as an integral part of the business plans. The key focus areas remained education, communication, care and support, self-awareness and the management of associated risks. A new surveillance study will take place in 2003.

Eskom has continued to contribute to the national and international fight against HIV/AIDS, and has joined forces with other corporate organizations in this fight, through the SA Business Coalition on HIV/AIDS and the Global Business Council. Eskom also participates in the leadership of the South African Development Community utilities' HIV/AIDS committee. Eskom committed R30 million ($3 million USD) to vaccine development research, of which R7,5 million ($ 0.75 million USD) was paid during 2001 (2000: R15 million or $ 1.5 million USD) through the Eskom Development Foundation, with the balance payable in 2002. Eskom received the HIV/AIDS Champions Award 2000 in recognition of its outstanding contribution to the fight against HIV/AIDS.

Fuel Poverty

The accepted definition of "fuel poverty" is the need for a household to spend more than 10% of their income on fuel. More than six million households in the U.K. suffer from fuel poverty and are unable to afford adequate heat and light. For the past decade, **Powergen** has provided funding of more than £1 million ($1.5 million USD) to long-term projects that provide energy efficiency advice and training to communities that need it most.

Each year, more than 5,000 fires in the U.K. result from unsafe electric blankets, and many of the victims are older people. Powergen has teamed up with Age Concern to test blankets used by older people and provide free replacements if they are faulty, potentially saving lives.

Employee-Based Charity Campaign

More than 30 years ago, **Ontario Power Generation**'s predecessor, Ontario Hydro, introduced an innovative social program to the organization called the Charity Campaign. After all these years, the Campaign is still a trademark event at OPG each fall, with special events arranged to remind employees about community needs and social responsibility. Volunteer canvassers solicit pledges from their colleagues, who in turn have the option of directing their donation to the charity of their choice. The pledges are collected through employee payroll deductions that are received and distributed by the Charity Trust, a registered, not-for-profit vehicle. In 2000 OPG's charity campaign raised $2.3 million to support a cross section of societal needs, with the greatest proportion of funds directed to health organizations.

As well as its own Charity Campaign, OPG supports Canada's largest annual fundraising campaign, the United Way. Each year, the company sponsors three to four employees to work directly with the United Way of Greater Toronto for 15 weeks to help plan and implement more than 1,200 workplace fundraising campaigns.

Corporate Citizenship

Exelon Corporation, headquartered in Chicago, firmly believes in a strong commitment to corporate citizenship as part of its overall business strategy. The company's involvement and investment in the communities in which it operates demonstrates this commitment. For example, Exelon was one of the first companies to join other energy companies across the U.S. and overseas to establish The Power of America Fund in response to the tragedy on September 11, 2001. This industry-wide campaign was developed to ensure future educational assistance to the surviving dependents of the 9/11 terrorist attacks. The objective of the fund is to make sure that the dependents left behind are not cut off from the opportunity for a college education due to the death of their parent or parents. Exelon contributed $500,000 toward the campaign. Also, Exelon contributed $1.5 million to the Chicago Park District for a three-year environmental partnership. The alliance will help restore many of the Park District's natural areas and also create a citywide signage program. The signage will be located at 46 park sites and will highlight natural areas and their environmental significance. The partnership also includes an Exelon Environmental Fellowship program that provides a full-time educator to promote environmental awareness in the Chicago Public Schools.

5.2.3 – Consult Stakeholders and Provide Information

Companies will continue to comply with government-approved standards, but they must also gain broader societal acceptance for their operations, particularly in the communities where their facilities are located. Mastering this new, multidimensional area of stakeholder dialogue with often-competing issues is necessary for electricity companies in navigating their way toward sustainable development.

John Marczak, Project Manager and Eva Marczak, Senior Technical Officer at Pickering Nuclear generating Station spent many evenings visiting 2,400 homes in the Pickering areas as part of OPG's Neighbourhood Walk Program. Over 300 employee volunteers visited 28,000 households in 2000 and 2001.

EXAMPLES OF MEMBER COMPANY ACTIONS

EPCOR has set up Public Advisory Committees to obtain feedback and advice on operational issues that might be affecting the community and its customers. The committees comprise representatives from a cross section of institutions and the business community, unions and the general public. Annual reports highlight the initiatives of the Public Advisory Committees and are available to the general public.

The Strathcona Industrial Association in Alberta, Canada works with the City of Edmonton and community to ensure safe and healthy working and living environments. EPCOR is a member of the association's Environment Committee that addresses environmental issues and manages a network of air monitoring stations. EPCOR is also a member of Community Awareness Emergency Response, which sets up opportunities for dialogue between community members and industry representatives.

A significant portion of **TransAlta**'s stakeholder relations is focused on communities in the Wabamun lake area of Alberta, Canada, where the company has coal-fired generating facilities and mines. As a result of stakeholder consultations, many of the stakeholder issues and concerns were incorporated in TransAlta's environmental operating permit in 2000, including the establishment of a Wabamun lake advisory committee both for information sharing and as a forum for public consultation on TransAlta's activities in the area. Other conditions included the expansion of the Wabamun lake water treatment plant.

Ontario Power Generation works closely with local communities and citizen groups to ensure their interests and concerns are respected in the operation of its facilities. At each of its nuclear facilities, OPG has established public advisory committees that meet regularly with company management to discuss issues that are pertinent to the community.

OPG has taken a direct approach to communicating with the residents of Pickering, Ontario, where the company intends to return laid-up nuclear reactors to service. In the fall of 2000, over 300 OPG employees joined in the Pickering Neighborhood Walk, visiting over 16,000 households in the area to explain the company's plans to return the units to service and to obtain community feedback. This unprecedented stakeholder consultation was instrumental in opening the way for the first unit to restart in 2002. The Pickering Neighborhood Walk was repeated in summer 2001, and a similar walk was organized at the company's Nanticoke Generating Station in fall 2001 to discuss air quality issues.

Another example of OPG's success in stakeholder consultations is the Madawaska River Management Review. The three-year tripartite review brought together the Ontario Ministry of Natural Resources, OPG and a wide range of Madawaska River stakeholders with divergent economic, social, cultural and recreational interests. 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.

BC Hydro began in 1993 to take a comprehensive approach to Aboriginal relations, in order to mitigate potential risks to current operations and future growth. The province of British Columbia, on the west coast of Canada, is home to almost 200 First Nations bands. BC Hydro has electricity facilities on at least 168 of these bands' reserve lands, which means that much of the electricity the company produces must cross First Nations' legally titled land to reach customers around the province.

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 and promotes economic development opportunities for First Nations. In addition, it has developed a cross-cultural training program for its own employees, as well as for employees of more than 100 external organizations; and operates a corporate outreach program involving grants to various Aboriginal social initiatives and a scholarship program.

5.2.4 – Support Ethical Business Practices

The social sustainability of companies also involves adopting and promoting ethical business practices. As outlined below, many electricity companies are beginning to formalize codes of conduct as part of their commitments to corporate social responsibility within their organizations, and are giving stakeholders a preview of what it will mean for them.

EXAMPLES OF MEMBER COMPANY ACTIONS

TransAlta's international growth ambitions (for example, Mexico) have been a catalyst for the organization to examine what being a good neighbor in host communities really means. TransAlta understands that it needs a social contract to operate, but as the company's recent Sustainable Development Annual Report says, "We always try to do the right thing, but what that thing is, is often not as clear as one might think." The report defines 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 committed to develop a CSR strategy in 2001, including an updated Corporate Code of Conduct. The code will address issues such as ethics, environment, social responsibility, health and safety, respect in the workplace, conflict of interest and insider training.

Exelon Corporation's Code of Business Conduct is a road map for employees on how to conduct business, and includes four specific values: boldness, creativity, accountability and commitment. Exelon's Code of Business provides guidance on what employees should and should not do on matters of both legal and business conduct. The legal section, for example, provides guidance on issues of antitrust, copyrights and trademarks, employment, environment and international trade. The business conduct section addresses issues of accountability, community relations, customers, diversity and political activity.

Eskom has a written business conduct policy dealing with ethics, which was endorsed by the Council and the Board. The chief executive is the custodian of ethics, with Eskom's Financial Controller the caretaker, across Eskom. The focus on the business conduct policy has raised awareness of the need of ethical behavior across the organization.

Ontario Power Generation believes that it can better achieve its corporate objectives by projecting a solid image as a socially responsible energy generator. The company's commitment to CSR includes employees.

For employees, OPG has designed initiatives to engage them in the company's transformation process. OPG created a Chief Ethics Officer position and revised the Code of Business Conduct that builds on principles of integrity, excellence and citizenship, and provides guidelines for ethical business behavior. Programs to enhance workplace safety and employee wellness; and outreach programs to recruit and retain a diverse and highly competent workforce are also in place. OPG's Employment Equity and Diversity Policy directs the company to create a workforce that reflects the diverse populations of the communities where the company operates. Groups designated for employment equity are women, visible minorities, aboriginal people and people with disabilities.

5.2.5 – Health, Safety and Employee Welfare

Companies are recognizing their responsibilities to contribute to the well being of communities where they operate and to the betterment of society at large. Just as important to a holistic vision of sustainable development, however, is the responsibility that companies have to protect the well-being of their employees, through policies and codes of conduct that address employee safety and health, workplace diversity and harassment. The following are examples of progressive workplace initiatives: preventative health assessments and safety management at British Energy; flexible benefits at TransAlta; and tripartite negotiations at Ontario Power Generation.

EXAMPLES OF MEMBER COMPANY ACTIONS

British Energy's employee preventative health assessment takes a holistic approach by considering each individual's health, work, lifestyle and health promotional aspects. The company has introduced a new risk assessment tool to help managers identify and address causes of stress in the workplace.

All British Energy employees are engaged in maintaining and improving safety standards, because safety management practices are integrated with general management processes. Formal Health and Safety Committees at all locations play a key role in improving safety culture and developing new approaches to health issues. Health surveillance for radiation workers extends well beyond statutory requirements.

TransAlta utilizes a reward philosophy to recognize superior performance with superior pay, and provides a choice of benefits and rewards to best meet personal needs. In Canada, the company offers a flexible benefits program from which employees can choose the best combination of options to suit their personal needs. Through the Employee Share Purchase Plan, all permanent employees are eligible for interest-free loans to purchase the company's common shares from the open market. For the past two years, TransAlta has awarded stock options to all employees. The company contributes an amount equal to 10% of each employee's base salary to his or her personal pension account. Employees are also eligible for an annual incentive bonus payment based on the achievement of corporate and department goals. The company offers other rewards such as education assistance and scholarships for children of employees.

Ontario Power Generation supports freedom of association and collective bargaining. About 90% of OPG's workforce is unionized, and the company views labor relations as critical to achieving corporate objectives. In 2000, new collective agreements designed to speed success in a deregulated market were reached in a co-operative manner with unions that represent the majority of employees. Tripartite teams consisting of representatives from management and two unions were set up. One of the early successes of these partnerships was a corporate-wide Goal Sharing program, an incentive plan believed to be the most extensive in the industry. In 2000 this program ensured that virtually all employees shared in OPG's operating profits. OPG has in place policies and codes of conduct that address employee safety and health, workplace diversity, harassment and violence.

Eskom has numerous processes, forums and agreements in place with employees and unions. A new bargaining agreement was signed in 2000 and participation structures renewed. Eskom also undertook to enable all Eskom employees to own a home. At the end of 2000, 21,400 of the 32,832 Eskom employees owned a home, and 1,680 received a rental subsidy. Eskom also committed to enable all Eskom employees to become literate. The illiteracy rate has improved from 45% to less than 10% at the end of 2000.

Exelon's Work/Life Balance Initiative recognizes that Exelon employees frequently face demanding and harsh conditions and pressures while working to keep the lights on and improve productivity. Exelon leadership decided to focus attention on what the company can do to assist employees' attempts to balance the demands of work and home life. Using surveys, focus groups and professional research, Exelon is developing a company-wide philosophy, and instituting clear guidelines, in an effort to help achieve this difficult balance. For example, a high degree of importance is placed on a simple concept: respect. Exelon expects all employees to treat each other with dignity, decency and courtesy. Recognizing employee contributions to the company is encouraged, as well. But in a more practical application of the new philosophy, all leaders, at all levels, are encouraged to institute more efficient planning practices and prioritizing, in an effort to minimize the disruption of operational demands on the personal lives of its employees. In this ongoing effort, all Exelon employees are encouraged to take part in applying these principles and philosophy in areas throughout the company.

5.3 – ECONOMIC STRATEGIES

This section of the report highlights electricity sector activities that contribute to the third and final core dimension of sustainable development – the economy.

5.3.1 – Support R&D

Technology on its own cannot solve all the environmental and social problems of a growing world population. Nonetheless, it is certainly part of the solution. Research and development of technology that helps world populations to use natural resources more efficiently or precipitates wider use of renewable energy resources is key to achieving sustainable development on the planet.

The electricity industry is working on its own or in partnerships and joint ventures, through subsidiary companies, or by funding academic research, to address sustainable development issues. One example is Kansai Electric and Gadjah Mada University in Indonesia which are undertaking a rainforest project.

EXAMPLES OF MEMBER COMPANY ACTIONS

Superconductivity technology

The increased efficiency of superconducting generators has the potential to increase the internal efficiency in the generation of electric power and thereby to reduce the use of fossil fuels. Moreover, since superconducting generators improve the stability of electric power systems, which in turn enhances transmission capacity, they could contribute to energy conservation. **Kansai Electric** is researching the potential application of superconductivity technology in power generation systems, a possible forerunner to superconduction power generation in the 21st century.

Energy Storage

TEPCO has developed a sodium-sulfur (NAS) battery for energy storage systems to level off the difference between daytime and nighttime electricity consumption, thereby reducing plant and equipment investment by effectively utilizing the existing electric service facilities and making better use of low-cost electricity generated at night. The NAS battery has high energy density about three times the level of lead batteries and, in addition, features a compact size and long service life. The new battery has also attracted attentions as an uninterrupted power supply and emergency power supply as well. TEPCO plans to start the services of sales, lease, installation and maintenance of NAS battery system while continuing demonstration tests on the operability and maintainability.

Tropical rainforest restoration

Increasing nature's capacity to absorb CO_2 – such as via tropical rainforests – is an important, cost-effective way to reduce greenhouse gases. The challenge is that tropical rainforests cannot replenish themselves quickly. In 1992, **Kansai Electric** and Gadjah Mada University in Indonesia set up the Tropical Rainforest Restoration Technology Development Project to conduct international joint research into experimental forest areas. Researchers are testing technology for improved afforestation and soil conditions.

Research at Eskom

The South African Centre for Essential Community Services, established by **Eskom** and EPRI, aims to identify, develop and implement technologies that improve the quality of life in South African communities. Key projects include water filtration using the slow sand water filtration process, demonstration of the reverse osmosis technology at the Ga-Mokwathi Village, the Solar Water Heatbarrow and the sterilization of medical waste. The Solar Water Heatbarrow is a solar heating technology that combines a water heater and a water transporter that can be operated by children. Field tests on the unit are currently being conducted. Eskom and TEMM International are currently developing the business case.

Research at Exelon

Exelon is engaged in research to develop a transformer extender technology that uses waste heat from the transformer and stored off-peak electricity for the cooling process. Called the TREXCO Transformer Extender, this technology will increase the amount of power a substation system can safely and reliably deliver. Also, this technology uses no CFCs or any other material that is harmful to the environment. Exelon will sponsor a technology demonstration project during 2002. In addition, Exelon is proposing to advance an integrated demonstration of a nuclear-based hydrogen supply for application to the transportation sector. If successful this approach will create a large-scale carbon-free manufacturer of hydrogen in order to gain major benefit of transition to a fuel cell-powered, hydrogen-fueled transportation sector.

Solar Water Heatbarrow

Investment in future technologies is, in general, modest when compared with research into shorter-term operational issues. Thus more effort will be required in future in key technologies and the development of co-operative research programs that will leverage limited research monies.

Particularly in developing countries, research and development initiatives can and should include technology diffusion efforts to help ensure that the participants in the energy value chain understand the technology and can use it to the best effect within their social and economic reality.

Fuel cells

Fuel cell technology has the potential to become a cost-effective, emission-free source of electricity. Fuel cells produce virtually no NOx and SO_2 emissions because they use an electrochemical process. CO_2 emissions are also reduced by more than 50% compared with coal-fired generation.

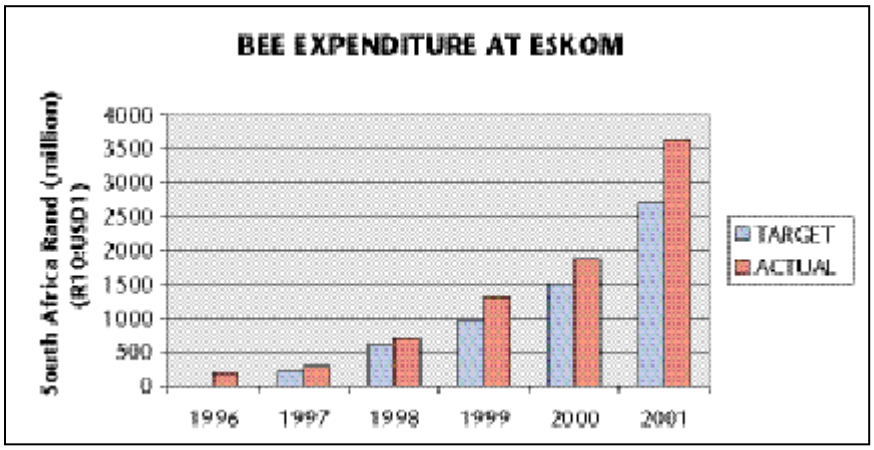
5.3.2 – Support Business Development

A number of companies are developing new businesses to contribute to the financial component of their core business. Examples from Ontario Power Generation, Exelon and Eskom are profiled below.

5.3.3 – Procurement

Ontario Power Generation and Tokyo Electric Power Company (TEPCO) and Eskom are member companies that are using their considerable purchasing power to encourage suppliers and contractors to operate in an environmentally responsible manner. Eskom's support for black business is integrated into its procurement policies and managerial support program.

Figure 5.2 Black Economic Empowerment (BEE) at Eskom



EXAMPLES OF MEMBER COMPANY ACTIONS

Kansai Electric is researching the Molten Carbonate Fuel Cell and the Solid Oxide Fuel Cell, two next-generation fuel cells with power-generation capacity and superior utilization of exhausted waste heat.

Ontario Power Generation is participating in a two-year project to build and operate the world's largest pre-commercial solid oxide fuel cell power plant. Co-funders of the project are OPG, the Canadian and U.S. governments, and Siemens Westinghouse Power Corporation. This 250 kW fuel cell demonstration plant is being constructed in Toronto.

Western Power supports fuel cell technology research through its shareholding in Ceramic Fuel Cells Limited, based in Melbourne. The company is currently focused on developing a 40 kW prototype solid oxide fuel cell for market entry.

EXAMPLES OF MEMBER COMPANY ACTIONS

Ontario Power Generation is strengthening the economic component of its sustainability objectives by supporting the development of alternative generation technologies and related business services. In 2001, the company 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 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.

Eskom is a vertically integrated operation that generates, transmits and distributes electricity. Eskom Enterprises, the wholly owned subsidiary of Eskom, together with its subsidiaries, serves as a means by which all the non-regulated activities of Eskom, both inside and outside South Africa, are carried out. Eskom Enterprises' core lines of business are infrastructure development, energy business operations, specialized energy services and the pursuit of key opportunities in related or strategic businesses, such as information technology and telecommunications.

Exelon's business development subsidiary Exelon Enterprises was designed to build on company expertise and assets in the areas of energy, energy services, and infrastructure management in order to benefit customers and shareholders. Within Exelon Enterprises is Exelon Capital Partners, which was established to invest in new entrepreneurial companies with technologies and applications for the deregulated energy marketplace. It primarily seeks to invest in expansion stage companies or companies that have commenced commercial operations. Typically, Exelon Capital Partners invests $1 to $2 million for a minority stake in each portfolio company. Target markets include distributed generation, energy control management and monitoring, renewables and clean technologies, and powerline communications.

EXAMPLES OF MEMBER COMPANY ACTIONS

Supply Chain Excellence

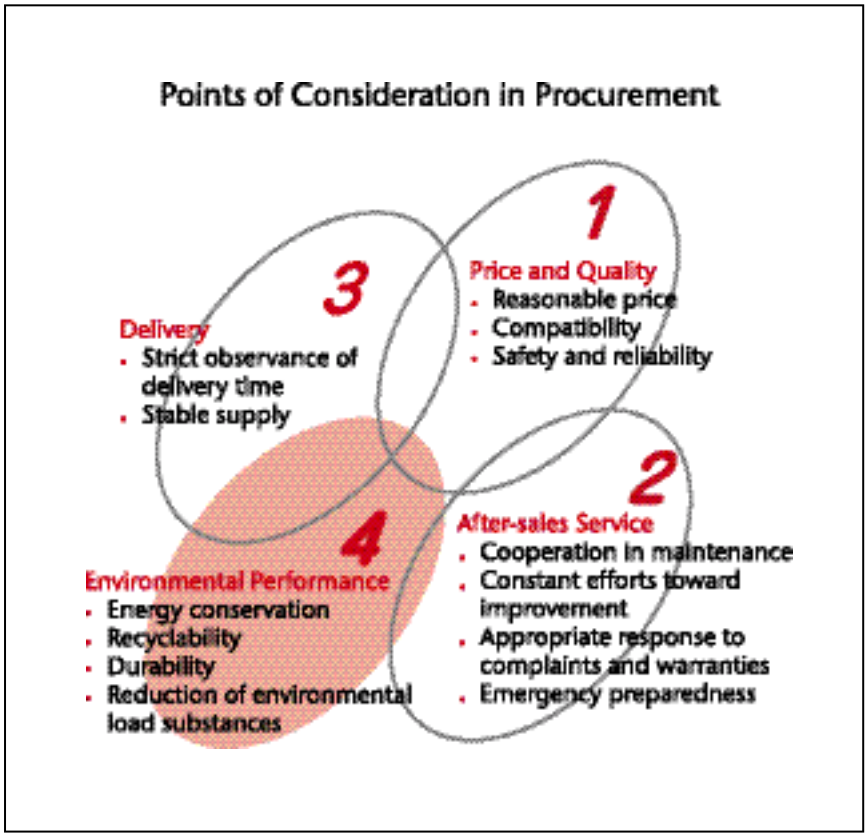
Ontario Power Generation's Supply Chain Excellence program makes it possible to incorporate environmentally responsible procurement, risk management and energy-efficiency factors into many of the company's purchasing decisions. Procurement policies require that OPG's buyers of goods and services take into account internal life-cycle factors such as packaging, storage, emissions, toxicity, disposal and energy use when making their procurement decisions. Corporate Minimum Standards for Contractor Environmental and Safety Management were introduced to guide contractor selection based on the environmental and safety risks. The standards specify that high-risk jobs will only be awarded to contractors that have environmental management systems consistent with ISO 14001. Supply Chain Management also has the authority to specify environmentally preferred commodities that are cost-competitive based on an internal life-cycle analysis, including products such as fuels, solvents, electronic devices, office furnishings and paper products.

Green procurement and purchasing guidelines

Starting in 2002, **TEPCO** will make its materials and equipment procurement decisions in accordance with its Green Procurement and Purchasing Guidelines. TEPCO's policy is based on fundamental principles that include "care for the environment" along with openness, fairness, compliance with laws and regulations, mutual trust and social contribution. The guidelines invoke two methods of assessment in the hiring decision: an environmental management assessment of contractors' environmental performance and an assessment of the product's environmental suitability.

Black Economic Empowerment (BEE)

As part of its procurement policies and managerial support program, **Eskom** supports small, medium and micro enterprises (SMMEs) and large black businesses by the procurement and supply of goods and services from black businesses, thereby contributing to black economic empowerment.



Points of consideration in procurement in TEPCO

the way forward

Previous sections in this report have provided a snapshot of the environmental, social and economic actions being taken by some electric utilities as they proceed on a path towards the long-term goal of sustainable development. All the participants in this report acknowledge, though, that there is still much work to be done. Nonetheless, the electric utilities that participated in this project are resolved to find sustainable solutions that meet the world's need for electricity.

6.1 – KEY AREAS OF PROGRESS

As illustrated by the actions described in previous sections, significant progress has been made by the member utilities participating in this project in a number of areas:

- improving resource use and reducing the environmental impacts of current operations with the intent of continuing to run existing plant, but with lower environmental impact than today;
- improving environmental performance by implementing environmental management systems, including tracking and reporting on progress;
- working in partnership with other businesses and stakeholders to find solutions to existing environmental problems;
- implementing programs to sustain and improve biodiversity;
- investing in research and development into new and advanced technologies that will assist in making the step change necessary to move the sector further down the sustainable development path;
- supporting increased access to affordable electricity in developing countries, including infrastructure development;
- strengthening the relationship in the communities in which the member companies operate;
- donating time and resources to social causes that resonate with the organization;
- adapting and promoting ethical business practices in our organizations; and
- protecting the well being of employees, through policies that address safety and health, workplace diversity, and harassment.

6.2 – FUTURE CHALLENGES

Despite the progress that has been made, it is clear that there is more work to be done in this sector. Two obvious areas requiring work are first, finding innovative ways to continue the integration of sustainable development practices into existing operations and second, seeking support on future energy options that meet the needs of stakeholders as well as the realities of the electric utility sector, including de-regulation.

With respect to improving existing operations, the following are some of the challenges identified through this analysis:

- looking for innovative ways to supply and increase access to affordable electricity in developing countries, including infrastructure development, innovative financing, etc;
- investigating how DSM options (e.g., efficient lighting and heating) can assist with affordability of electricity and poverty alleviation;
- identifying additional mechanisms to integrate sustainable development thinking into the decision-making of our businesses;
- expanding supply chain management to further environmental and social goals of the business;
- focusing more on issues of corporate social responsibility and considering the views of all stakeholders, including employees, regulators, community leaders, critics, suppliers, and academics/scientists; and
- expanding the use of partnerships in addressing sustainable development issues.

Seeking support from stakeholders on future generation and transmission options will be another challenge for the sector. While each country will have its own priorities with respect to future energy options, we see the following as some of the challenges ahead:

- exploring the potential of extending the life of existing assets based on environmental, social, and economic considerations;
- balancing the economies of scale of large, centralized plant versus the inherent flexibility of smaller, decentralized investments;
- resolving with government and other stakeholders the barriers related to investment in new technologies with lower environmental impacts than existing generation (i.e., renewable energy, clean coal and nuclear technologies);
- continuing to invest in research into new technologies that will assist with making the step change necessary to move the sector further down the sustainable development path;
- finding ways to make economic DSM investments more widespread; and

> exploring new ways to engage stakeholders in discussions of future energy options.

Despite an increasing reliance on electricity options such as wind, solar, and biogas, for the foreseeable future (i.e., twenty to thirty years hence) coal, nuclear, large hydroelectric, and gas will continue to be the major bulk electricity fuel options. Each has its own sustainability challenges. Issues of long-term storage and disposal of spent fuel or high level radioactive waste from reprocessing of spent fuel will need to be resolved to retain nuclear as a viable future energy option. The development of clean coal technologies and carbon sequestration techniques will be critical to continued use of coal. Flooding of ecosystems and relocation of populations are some of the limitations of large-scale hydroelectric development, which will need attention if future development is to occur. Gas, although a cleaner fuel than coal, is still carbon-based and issues of availability and cost will need to be addressed. None of these generation options is without environmental or social issues.

The way forward holds significant challenges for the electric utility sector, not only those challenges of implementing sustainable development practices into the business, but also doing so at a time when the business environment is undergoing fundamental, unprecedented change. Electric utilities are confronted by a number of uncertainties associated with evolving government regulations, market restructuring, customer preferences and technological innovation.

As has been documented in this report, companies have adopted their own strategies and initiatives as appropriate for the industry structures and environments in which they operate. The drivers for change may differ across jurisdictions and different utilities are in different stages along the path to sustainability. Recognizing that the challenges and the gaps are different for all of us, and responses must therefore be tailored to meet individual circumstances, a path of continued collaboration holds the most promise for sustaining collective efforts of electricity utilities.

Looking to the future, the beneficial role of partnerships and sharing of experiences should not be underestimated. The challenges are large. The environmental and social pressures facing companies are complex and do not respect national boundaries. Further, the investments expected of companies in response to these pressures are substantial. Sharing information on best practices, and partnering with other companies in research and development, holds the most promise for greater inroads toward sustainable energy futures.

The way in which companies tackle environmental and social issues in future may also change. In a world of escalating demands for transparency and stakeholder engagement, and in order for the sector to effectively address these challenges, dialogue will need to be broad and inclusive of a range of stakeholders. In an increasingly interconnected and globalized world, these stakeholders must include our customers, regulators, governments, electricity-sector watchdog agencies, environmental NGOs, and academics/scientists. These groups influence decision-makers and will be engaged in the debate about future energy options, particularly as governments debate future energy direction and individual utilities seek changes to their operating licenses and make long term investments in new technologies.

This project has allowed the member companies to take a critical look at their current operations, benchmark their progress against other utilities and define what additional challenges lie ahead. The future progress towards a more sustainable path will be a complex process and unique for each member company. However this body of work has laid the foundation for future efforts and will in itself contribute to the overall knowledge in the sector, as well as assist other utilities with strategic decision making.

The electricity sector is not unique in the challenges it faces. As noted by John Elkington, co-founder of SustainAbility, a United Kingdom-based sustainable development (SD) consultancy:

"The evolution of sustainable corporations is no further along than aviation was when Wilbur and Orville were still running their cycle shop. Just as their dreams seemed impossible to most people, so do the dreams of SD pioneers today. But expect explosive growth in sustainable experimentation in the next decade. Many of these experiments will involve new technology, but an even greater number will involve 'soft innovation', focusing on new forms of strategic thinking, new styles of networked commerce, and radically new triple bottom line management systems, accountancy procedures and reporting and communication process."

GLOSSARY

Base load	The minimum load experienced by an electric utility system over a given period of time.
Daily Peak	The maximum amount of energy of service demanded in one day from from a company or utility service.
Demand-Side Management (DSM)	A technology or program that encourages customers to use electricity differently.
Deregulation	The introduction of competition into the electricity market as opposed to a delivery of electricity in a monopoly situation
Distributed Generation	Generation built near a new load center rather than running transmission or distribution lines from a centralized plant.
Electric Utility	A legal entity that owns and/or operates facilities for the generation, transmission, distribution, or sale of electric energy.
Energy efficiency	Programs that reduce electricity consumption.
Integrated Resource Plan (IRP)	A comprehensive and systematic blueprint developed by a supplier, distributor, or end-user of energy who has evaluated demand-side and supply-side resource options and economic parameters and determined which options will best help them meet their energy goals at the lowest reasonable energy, environmental, and societal cost.
Interruptible Loads	Loads that can be interrupted in the event of capacity or energy deficiencies on the supplying system.
Interruptible Power	This refers to power whose delivery can be curtailed by the supplier, usually under some sort of agreement by the parties involved.
Kilowatt-hour (kWh)	The basic unit of electric energy equal to one kilowatt of power supplied to or taken from an electric circuit for one hour.
Load Management	Influencing the level and shape of demand for electrical energy so that demand conforms to present supply situations and long-run objectives and constraints.
Load Profile	Information on a customer's usage over a period of time, sometimes shown as a graph.
Load Shifting	A load shape objective that involves moving loads from peak periods to off-peak periods. If a utility does not expect to meet its demand during peak periods but has excess capacity in the off-peak periods, this strategy might be considered.
Maximum Demand	Highest demand of the load within a specified period of time.
Megawatt	One thousand kilowatts or one million watts.
Megawatt-hour (MWh)	One thousand kilowatt-hours or one million watt-hours.
Off-peak	Periods of relatively low system demands.
Peak Demand	Maximum power used in a given period of time.
Peaking Capacity	Generating equipment normally operated only during the hours of highest daily, weekly, or seasonal loads; this equipment is usually designed to meet the portion of load that is above base load.
Supply-side	Technologies that pertain to the generation of electricity.

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APPENDIX A

DETAILS OF MEMBER COMPANIES

Details as of 31 December 2001

NAME	**BRITISH COLUMBIA HYDRO AND POWER AUTHORITY (BC HYDRO)**
Operating Capacity[1] (MW)	11,133
Energy Sales (net[2] GWh)	72,031
Number of Customers	1,411,333 residential; 180,607 light industrial and commercial; 131 large industrial; 3,042 other; 174 electricity trade
Revenues (USD[3] million)	$4,970 ($7,889 million Cdn)
Commercial Enterprises	**BC Hydro International (BCHIL)** – a wholly owned subsidiary of BC Hydro, providing technical and management expertise to the electrical power industry worldwide (BCHIL business operations were suspended in 2002). **Powerex** – BC Hydro's power marketing subsidiary **Powertech Labs Inc** – BC Hydro's research and development subsidiary, providing high-tech research and technology solutions internationally **Westech Information Systems Inc** – BC Hydro's high-tech subsidiary company (Negotiations are currently in progress to divest Westech and other shared services into a joint-venture partnership).

Notes:

1 Does not include plant capacity that is laid up or mothballed

2 Net of any electricity consumed in the production of electricity

3 Canadian dollar conversion of $.63 per US dollar

NAME	**EPCOR UTILITIES INC.**
Operating Capacity (MW)	1,888.3 (Operational) 576 (Under Development)
Energy Sales (net[1] GWh)	Not publicly available.
Number of Customers	>1,500,000
Revenues (USD[2] million)	$2,346
Commercial Enterprises	**EPCOR Generation Inc** – EPCOR Generation Inc. owns and operates three previously regulated generating stations with total gross capacity of 1,701 megawatts (MW). **EPCOR Power Development Corporation** – EPCOR Power Development Corporation owns, in whole or with partners, merchant generating stations built after January 1, 1996. **EPCOR Energy Services Inc** – EPCOR Energy Services Inc. provides electricity and natural gas retail services to more than 600,000 residential, business and industrial customers across Alberta.

EPCOR Merchant and Capital L.P. – EPCOR Merchant and Capital L.P. (EMC), a wholly-owned subsidiary of EPCOR and headquartered in Calgary, is a provider of energy products and services to the large industrial and wholesale markets in Alberta, British Columbia, Ontario and the Pacific Northwest. EMC manages EPCOR's consolidated energy book within established guidelines.

Union Energy Inc – Union Energy Inc. provides service to more than 900,000 customers in Ontario, Manitoba, Alberta and British Columbia. A pioneer in the deregulated energy services sector, Union Energy rents water heaters and supplies and services heating and air conditioning systems.

EPCOR Distribution Inc. and EPCOR Transmission Inc – EPCOR Distribution Inc. and EPCOR Transmission Inc. provide electrical distribution in Edmonton and transmission in Alberta. EPCOR Transmission Inc. makes up approximately nine per cent of the provincial transmission revenue requirements.

EPCOR Water Services Inc – EPCOR Water Services Inc. provides water services to approximately one million people in Edmonton and Western Canada.

Notes:

[1] Net of any electricity consumed in the production of electricity

[2] Canadian dollar conversion of $.63 per US dollar

NAME	**ESKOM**
Operating Capacity (MW)	Total Nominal Capacity Excluding Mothballed sites 36,208
Energy Sales (net[1] GWh)	181,511 GWh
Number of Customers	3,000,000
Revenues (USD[2] million)	2,374
Commercial Enterprises	**Eskom Enterprises** – Eskom Enterprises was formed as part of the South African government's initiative to restructure Eskom and the new company's strategic intent is to become a pre-eminent energy and related services business in Africa, one having global stature. This Eskom subsidiary, formed to develop and commercialize Eskom's non-regulated activities, has been operating officially since 1 January 2000. Its core lines of business are • Infrastructure development including asset creation, project management, consulting services and research and development • Energy business operations including management contracts, operating, maintenance and refurbishment contracts and purchase of operating entities. • Specialised energy services including electricity, gas and equity investments in related services. • Key opportunities in related or strategic businesses – including IT and Telecommunications • Transporting and trading primary energy sources The operational structure of Eskom Enterprises comprises of the following: • Eskom Enterprises Africa • Investment Division • Technology Services International

- Rotek Industries
- Pebble Bed Modular Reactor (PBMR)
- Primary Energy Division
- Commercial Division
- Telecommunications Division
- IT Services Division

Notes:
1 Net of any electricity consumed in the production of electricity
2 South African Rand conversion of R.09 per US dollar

NAME	**EXELON**
Operating Capacity (MW)	41,330
Energy Sales (GWh)	202,000
Number of Customers	5.0 million electric customers 475,000 gas customers
Revenue (USD million)	$15,104
Commercial Enterprises	**Exelon Enterprises** was designed to build on Exelon expertise and assets in the areas of energy, energy services, and infrastructure management in order to benefit customers and shareholders. Within Exelon Enterprises there are several business units that finance entrepreneurial companies with technologies and applications for the deregulated marketplace and provide infrastructure services for electric, gas, telecommunications and cable utilities in the United States.

NAME	**ONTARIO POWER GENERATION INC.**
Operating Capacity[1] (MW)	22,600
Energy Sales (net[2] GWh)	122,000
Number of Customers	100 large industrial customers + 90 local distribution companies + Hydro One
Revenues (USD[3] million)	$3,930
Commercial Enterprises	**OPG Ventures Inc** – a venture capital subsidiary investing in entrepreneurial companies or energy technology funds focussed on innovative energy efficiency and environmentally friendly technologies **New Horizon System Services Inc** – a joint venture providing information technology services to the electricity sector (sold to joint venture partner in 2002) **Kinetrics Inc** – an independent science and engineering services company of which OPG owns 90% (sold to 10% partner in 2002)

Notes:
1 Does not include plant capacity that is laid up or mothballed
2 Net of any electricity consumed in the production of electricity
3 Canadian dollar conversion of $.63 per US dollar

NAME	**POWERGEN Plc (2001)**
Operating Capacity (MW)	20,273
Energy Sales (net[1] GWh)	63
Customers	UK = 3.4 million US = 1.2 million
Revenues (GBP million)	£5,659

Note:

[1] Net of any electricity consumed in the production of electricity

NAME	**TOKYO ELECTRIC POWER COMPANY INC.**
Operating Capacity[1,2] (MW)	71,496
Energy Sales (net[3] GWh)	275,540
Number of Customers	Tokyo Metropolitan Area and surrounding prefectures. (Total 27 million customers in households, business and industrial sector)
Revenues (USD[3,4] million)	$38,400
Commercial Enterprises	**My Energy Corporation** – a joint venture providing a packaged service as designing, construction, operation, and maintenance for on-site generation systems. **Japan Facility Solutions, Inc** – a joint venture providing ESCO Service, diagnosis and consulting, renewal and renovation project, and sales and leasing of environmental goods and systems. **Tokyo Energy Research Co., Ltd.** – a joint venture providing environmental education, energy related research, and energy-saving consultation for households and small store buildings. **Japan Natural Energy Company Limited** – a joint venture providing green electricity to the consumer and a "Certification of Green Power" as a proof of buying green electricity. **TEPCO Forests Australia Pty. Ltd.** – a wholly-owned subsidiary company in Australia investing in the afforestation project in NSW, Australia to sequester atmospheric CO_2 for climate change mitigate.

Notes:

[1] Includes purchased power from other power companies

[2] As of 31 March, 2002

[3] As of fiscal 2001 (from 1 April 2001 to 31 March 2002)

[4] Japanese yen conversion of 130 yen per US dollar

NAME	**WESTERN POWER CORPORATION**
Operating Capacity (MW)	3,255
Energy Sales (GWh)	12,000
Number of Customers	811,000
Revenues (USD[1] million)	$834
Commercial Enterprises	**Joint Ventures** – Western Power is party to separate equal share joint ventures that constructed and operates a 120MW cogeneration facility adjacent to an alumina refinery, a gas pipeline and a remote power station serving a vanadium mine. **Wind Energy Corporation** – a company established to build and operate wind farms on interconnected electricity grids and hybrid power systems for remote and regional applications (50% ownership by Western Power). **Integrated Power Services Pty Ltd.** – a company established to provide energy services to the mining process industry and utilities service sector (50% ownership by Western Power).

Notes:

[1] Australian dollar conversion of $.53 per US dollar

APPENDIX B – BELLAGIO PRINCIPLES

Background

In 1987, the World Commission on Environment and Development (Brundtland Commission) called for the development of new ways to measure and assess progress toward sustainable development. This call has been subsequently echoed in Agenda 21 of the 1992 Earth Summit and through activities that range from local to global in scale. In response, significant efforts to assess performance have been made by corporations, non-government organizations, academics, communities, nations, and international organizations.

Who Developed the Principles?

In November 1996, an international group of measurement practitioners and researchers from five continents came together at the Rockefeller Foundation's Study and Conference Center in Bellagio, Italy to review progress to date and to synthesize insights from practical ongoing efforts. The attached principles resulted and were unanimously endorsed.

What is Their Use and Who are the Users?

These principles serve as guidelines for the whole of the assessment process including the choice and design of indicators, their interpretation and communication of the result. They are interrelated and should be applied as a complete set. They are intended for use in starting and improving assessment activities of community groups, non-government organizations, corporations, national governments, and international institutions.

Overview

These principles deal with four aspects of assessing progress toward sustainable development. Principle 1 deals with the starting point of any assessment - establishing 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. Principles 2 through 5 deal with the content of any assessment and the need to merge a sense of the overall system with a practical focus on current priority issues. Principles 6 through 8 deal with key issues of the process of assessment, while Principles 9 and 10 deal with the necessity for establishing a continuing capacity for assessment.

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 organizing 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
- standardizing 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 judgments, 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

ABOUT THE WBCSD

The World Business Council for Sustainable Development (WBCSD) is a coalition of 160 international companies united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress. Our members are drawn from more than 30 countries and 20 major industrial sectors. We also benefit from a Global Network of 38 national and regional business councils and partner organizations involving more than 1,000 business leaders globally.

Our mission

To provide business leadership as a catalyst for change toward sustainable development, and to promote the role of eco-efficiency, innovation and corporate social responsibility.

Our aims

Our objectives and strategic directions, based on this dedication, include:

Business leadership: to be the leading business advocate on issues connected with sustainable development.

Policy development: to participate in policy development in order to create a framework that allows business to contribute effectively to sustainable development.

Best practice: to demonstrate business progress in environmental and resource management and corporate social responsibility and to share leading-edge practices among our members.

Global outreach: to contribute to a sustainable future for developing nations and nations in transition.

Disclaimer

This report is released in the name of the WBCSD. Like other WBCSD reports, it is the result of a collaborative effort by members of the secretariat and executives from several member companies. Drafts were reviewed by members of the project and a third party review team.

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