DEVELOPING SUSTAINABLE DEVELOPMENT INDICATORS FOR THE ELECTRIC UTILITY INDUSTRY

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ABSTRACT

There is a pressing requirement to determine how electricity needs can be met in a more sustainable manner. Although many electric utilities have begun developing strategies for addressing the challenge of sustainable development, there are ongoing needs to find methods of measuring progress with respect to the economic, environmental, and social impacts of electric utilities. Fundamental to this task is the creation and implementation of sustainable development indicators.

This paper presents a proposed Sustainable Development Indicator (SDI) Design Process for electric utilities in an effort to advance this ongoing work. The development of this protocol was based on collaboration with an electric utility and also involved extensive consultation with external expertise. Systemized through unique process flow charts, it provides a proactive, flexible, and transparent approach to developing and implementing indicators.

The six step process to create sustainable development indicators at an electric utility is: (1) conduct a needs assessment; (2) conduct process planning; (3) develop a draft set of indicators; (4) test and adjust the indicators; (5) implement the indicators; and (6) review and improve the indicators. To address the most urgent needs of the electric utility industry, particular emphasis is devoted to the third and fifth steps. With these points in mind, the SDI Design Process will provide a rationale basis for improved design of sustainability indicators at electric utilities.

Keywords: sustainable development, indicators, integrated management systems, sustainable development indicator design process, electric utilities, industry

1.0 INTRODUCTION

Electricity is an essential part of everyday life. This resource has become one of the backbones of the modern economy upon which a myriad of other activities are directly dependent. Looking to the future, electricity will play an even greater transformational role in the 21st century (WBCSD, 2003).

However, there are a number of sustainable development challenges, including various economic, environmental, and social issues, associated with the generation, transmission, and distribution of electricity. For example, these operations invariably lead to a variety of short and long-term impacts including disturbance of the landscape, emissions to the air, and depletion of resources. Stakeholder demands for increased transparency, continued technological innovation, and increasing trends towards deregulation mean that these and other issues must be addressed at a time when the industry is undergoing unprecedented change (WBCSD, 2002a).

These concerns have caused the electric utility sector to begin developing strategies for addressing the challenge of sustainable development. At the international level, the "Sustainability in the Electricity Utility Sector" project, initiated by the World Business Council for Sustainable Development (WBCSD, 2002a), is the most prominent illustration of this effort. Ongoing efforts are also observed at the national level. For instance, the Canadian Electricity Association (CEA) has encouraged its members to do more on the sustainability front through initiatives such as its Environmental Commitment and Responsibility (ECR) Program (CEA, 2003).

Building on the most widely-accepted definition of sustainable development (WCED, 1987), the underlying challenge for any industry is to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. More specifically, the challenges facing the electric utility industry can be organized into two areas (WBCSD, 2002a). The first challenge is to find innovative ways to continue the integration of sustainable development practices into existing operations. The second challenge is to identify future energy options that meet the needs of stakeholders as well as the realities of the electric utility sector. While the efforts noted previously have provided a starting point, there are ongoing requirements to effectively measure progress towards these goals. Fundamental to this task is the creation and implementation of sustainable development indicators.

This paper contributes to these challenges by proposing a Sustainable Development Indicator Design Process specifically tailored to the electric utility industry. Developed in collaboration with one of Canada's largest electric utilities, Manitoba Hydro, the protocol articulates a methodology for the creation of indicators at an electric utility. Since one of the greatest challenges in moving sustainable development forward is the need to develop an accepted methodology for the creation of the indicators, this protocol addresses a critical need in the electric utility industry.

2.0 SUSTAINABLE DEVELOPMENT INDICATORS IN THE ELECTRIC UTILITY INDUSTRY

Energy issues are a prominent component of numerous indicator development efforts at the international (for example, United Nations, 2003), national (Environment Canada, 2003), regional (Minnesota Milestones, 2002), and community (Sustainable Calgary, 2002) levels. However, a review of published literature revealed few well established efforts devoted to developing indicators for electric utilities.

In existing indicator programs, there are several shortcomings that must be addressed. In particular,

- it is often unclear how the indicators were developed,
- most programs focus primarily on environmental issues and,
- aside from producing a report, little guidance is provided in the actual implementation of the indicators.

These observations, consistent with the conclusions of Veleva and Ellenbecker (2001) in their paper on indicators of sustainable production, support the need for a transparent methodology focusing on the development and implementation of indicators for the electric utility industry.

2.1 The need to clarify how indicators are developed

The need for greater transparency in the creation of sustainable development indicators has been cited by numerous sources including Dudok van Heel et al. (2002), the WBCSD (2001), and the GRI (2002). This principle is also heavily emphasized in one of the most influential guides to indicator development, the Bellagio Principles for Assessment (available in Hardi and Zdan, 1997). If the indicators are not developed in a transparent manner that involves key stakeholders where appropriate, the legitimacy of any set of indicators will be severely undermined.

While there are several methodologies for the development of community indicators (see, for example, Norris et al., 1997, Walter and Wilkerson, 1998, and Valentin and Spangenberg, 2000), there are currently few well-established development processes particularly suited to a corporation, much less an electric utility. There is a need for a broadly applicable methodology that emphasizes transparency and stakeholder involvement in the development of the indicators. Guidance is particularly needed in the selection of the indicators and how to implement them in practice.

2.2 Existing indicators for electric utilities

The original issue of sustainable development has widened from its initial focus on environmental protection to recognizing a balance must be found between economic, environmental, and social issues (Isaksson and Garvare, 2003). In the electric utility industry, sustainable development has its roots in addressing environmental issues. It is therefore not surprising that most indicator programs in the industry are heavily focused on environmental indicators.

On the national level, the Canadian Electricity Association (CEA) provides an illustration of this shortcoming; typical in existing indicator frameworks for electric utilities. The CEA has developed a limited set of environmental performance indicators in support of its Environmental Commitment and Responsibility (ECR) Program (CEA, 2003). However, although these indicators do measure some aspects of environmental performance, they do not adequately consider economic or social issues.

In response, some utilities have gone beyond the CEA indicators and have begun to incorporate certain indicators suggested by the Global Reporting Initiative (GRI, 2002) into their reporting programs. A listing of the utilities applying some of the GRI indicators is available on the GRI website (GRI, 2003). A general framework for corporate sustainability reporting, the GRI is widely recognized as the most prominent international standard in corporate sustainability reporting. However, though the GRI indicators serve as useful guidelines, the work on the indicators is still in its infancy and indicators specific to the electric utility sector are still required.

In its "Sustainability in the Electricity Utility Sector" report, the WBCSD recognized the need for additional mechanisms to integrate sustainable development into the decision-making of the business (WBCSD, 2002a). However, the development of sector specific indicators was beyond the scope of the recently completed Phase 1 of the project.

2.3 Implementing sustainable development indicators

One criticism of most existing indicator programs is they provide little advice on integrating indicators with existing structures (Morse et al., 2001). Most of the published literature focuses on how to create a sustainable development report rather than how to integrate the indicators into existing management systems. As previously mentioned, the Global Reporting Initiative is the most prominent of these guidelines, but useful guidelines on preparing a sustainable development report are also offered by the WBCSD (2002b) and Stratos (2001), among others. Each of these programs emphasizes the need to report on the "triple bottom line" of environmental, economic, and social performance.

However, effectively implementing sustainable development indicators requires more than simply reporting on sustainability. They require integration with the overall management scheme (Isaksson and Garvare, 2003). For insight into how this deficiency may be addressed, it is suggested electric utilities draw on published literature and experience pertaining to integrated management systems (IMS).

There are three general approaches to implementing an IMS: (1) integrating function- or stakeholder-specific management system standards (including ISO 9001, ISO 14001, OHSAS 18001, and SA 8000); (2) integrating function- or stakeholder-specific management systems; and (3) integrating measurement and management systems. Karapetrovic (2002, 2003) argues that the solution points in the direction of a methodology for the integration of internal management systems while Wilkinson and Dale (2001) argue that an integrated standard is favoured.

For the purpose of implementing sustainable development indicators, it is argued that the former approach is more practical. Since existing management system standards continue to evolve and new standards will continue to appear, a "true IMS" should encompass whatever additional systems emerge in the future (Karapetrovic, 2002). The ultimate goal of these integration efforts is one system, many standards (Karapetrovic, 2003) with sustainable development indicators being an important measurement component of that management system. Although the challenge of integrating sustainability thinking into business processes is significant, it is a necessity if true implementation is to be achieved.

3.0 METHODOLOGY

In order to address these issues, a three-phased research program was devised with the following objectives:

1. To design and evaluate a process for creating sustainable development indicators in an electrical utility context;
2. To develop sustainable development indicators for the transmission system of electric utilities; and
3. To develop an integrated management system model that incorporates a system of sustainable development indicators.

The first phase of the project is complete. Research on the second and third phases is ongoing. As a complement to an extensive literature review, the first phase involved consultations with expertise at one of Canada's largest electric utilities, Manitoba Hydro. For additional perspective, external experts were also involved. Key

steps in the consultations included discussions of elements that must be a part of any process and several critical reviews of draft processes. To validate the selected process, a face validity test of key steps was conducted. During the face validity test, the consultations with internal and external expertise focused on the major high voltage transmission system at Manitoba Hydro. Lines operating below 115 kV and stations were excluded.

4.0 A SUSTAINABLE DEVELOPMENT INDICATOR DESIGN PROCESS FOR ELECTRIC UTILITIES

This section presents a proposed Sustainable Development Indicator (SDI) Design Process for electric utilities. It provides a proactive, flexible, and transparent approach to developing and implementing indicators that is strongly linked to the principles of continuous improvement and is systemized through unique process flow charts. The six-step process is depicted in Figure 1.

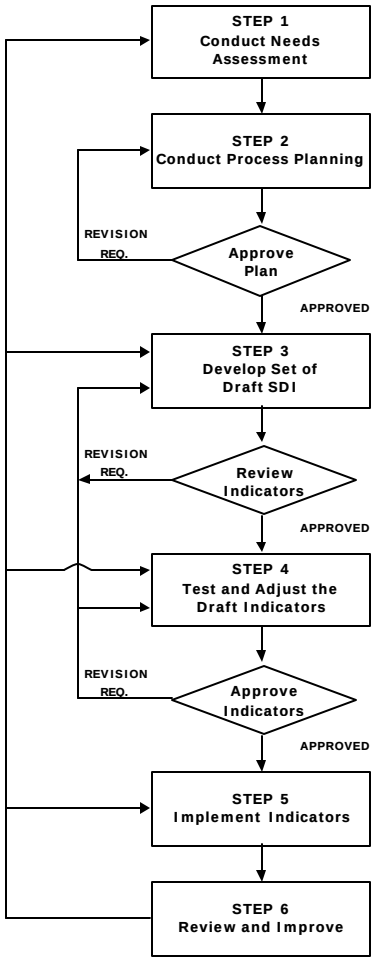

FIGURE 1
OVERVIEW OF THE SDI DESIGN PROCESS

Representing a consensus amongst the consultation participants, Figure 1 provided the basis for more detailed descriptions of the specific steps. Since they

represent the most pressing requirements for the electric utility industry, the most thorough explanations are provided for Steps 3 and 5. Throughout the descriptions, the following points should be kept in mind:

1. *Key stakeholders must be involved throughout the entire process.* The key internal and external stakeholders should accept the indicators as a fair representation of the system. Some of the key stakeholder groups any utility will need to consider include employees, investors, customers, governments, suppliers, industry organizations, local communities, NGOs, the general public, and other groups having a special interest, such as aboriginals. Keeping in mind there will be different stakeholders for different stages of the process, stakeholder concerns must be addressed through meaningful consultation.

2. *The manner in which the indicators are produced is just as important as the indicators themselves.* While the final set of indicators is important, the value of the organizational learning and change that takes place over the course of their development should not be underestimated. Much of the value of any indicator set resides in the actual assessment and development of the indicators themselves (Walter and Wilkerson, 1998).

3. *It is the process that is transferable, not the indicators.* This protocol provides a common structure for the development of indicators, not common indicators. Although sets of standardized indicators serve as useful reference points, it is recommended the organization go through the development of the indicators from the first principles (Keeble et al., 2003). Note that any process will often be iterative and flexibility must therefore be allowed.

4.1 Step 1: Conduct Needs Assessment

Since needs are implicitly linked to people, this step will involve consultation with key stakeholders. Though at this stage of the process the organization may focus on the needs of internal stakeholders, additional perspective may be gained by involving key external stakeholders as well. Key items that should be addressed include clarifying the current situation, identifying what it is the utility needs to do better, and how best to meet the needs of those who will utilize the final results.

4.2 Step 2: Conduct Process Planning

The key activities necessary to complete Step 2 include identifying the process proponent, forming a working group, developing a purpose and scope, developing an action plan, and obtaining the approval and commitment from top management. Though the titles of the individual sub-steps may vary, each of the activities in Step 2 have been described at length elsewhere (see, for example, Bryson, 1995).

4.3 Step 3: Develop a Set of Draft Sustainable Development Indicators

Step 3 is the stage where the initial set of sustainable development indicators is developed. While there is no universally accepted formula for creating indicators, the key components associated with the completion of Step 3 are identified in Figure 2. Guided by expert input, these tasks should involve professionally facilitated consultation with the key internal and external stakeholders.

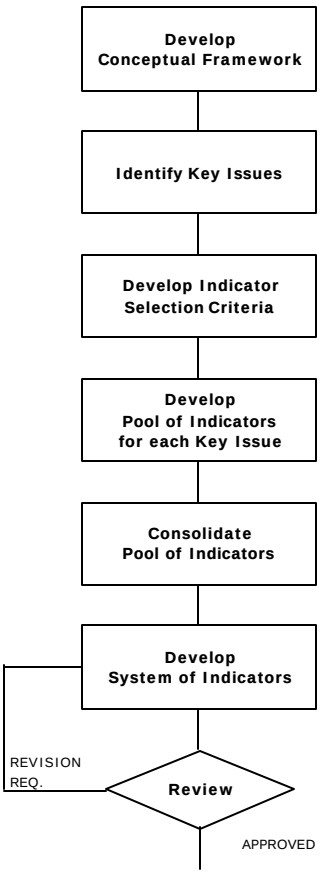

FIGURE 2
OVERVIEW OF STEP 3 IN THE SDI DESIGN PROCESS: DEVELOP A DRAFT SET OF SDI

As illustrated in Figure 2, the first task is to develop a conceptual framework. Some existing models that may prove useful at this stage include: the economy-environment-society framework, the economy-environment-ethics framework (Isaksson and Garvare, 2003), the pressure-state-response framework (Segnestam, 2002), the capital stocks approach (Meadows, 1998), the ethics-conservation-cooperation-competition framework (Walter and Wilkerson, 1998), and effectiveness-thrift-margin framework (Nilsson et al., 1998). In the design of the most appropriate framework for their needs, it is recommended the working group consider characteristics such as: the framework's effectiveness as a communication tool, its relevance to the system under examination, its compatibility with existing indicator programs in the industry, and its ability to address all of the issues critical to the sustainability of that system.

The next task is to identify the key issues to be addressed by the indicators. This will likely require several iterations of structured brainstorming, consolidation, and prioritization. As a starting point, criteria for prioritizing the key issues could include: level of public interest, regulatory requirements, management's informational needs, relationship to mission, vision, and goals, ease of identifying an indicator, and future liability implications. In any case, it is important the key issues provide a balanced representation of the entire system under examination. Organized according to the

environment-economy-society framework, an example of key issues for a transmission system is available in Table 1. The key issues were developed in consultation with internal and external expertise during the face validity test of the SDI Design Process.

TABLE 1
KEY ISSUES FOR MANITOBA HYDRO'S TRANSMISSION SYSTEM

Environment	Economy	Society
• Vegetation Management Practices	• Benefits to Customers and Stakeholders	• Employee and Public Safety
• Public Involvement	• Cost Issues	• Equity
• Potential Contamination	• Governance and Management Issues	• Community Relations
• Changes to Habitat	• Risk to Livestock	• Electromagnetic Field (EMF)
• Loss of Forest Cover		• Private Property and Land Uses
• Increased Access		• Education and Training
		• Aesthetics

Developing a set of indicator selection criteria is the next step. The criteria are needed to help to guide the indicator development process and will provide the working group with a means to assess each of the proposed indicators. While the identification of the specific criteria for any one project is always at the discretion of those involved, a starting point is provided by the many existing examples (see, for example, Spangenberg et al, 2002 and Veleva and Ellenbecker, 2001). In the face validity test, the following criteria were selected by Manitoba Hydro:

- *Understandable*: the indicators should be clear, transparent, and unambiguous
- *Actionable*: improvement should be within reasonable control of the utility
- *Relevant*: the indicators must focus attention on issues relevant to the system and be useful in decision-making
- *Credible*: only those indicators possessing reasonable grounds (e.g. scientific, traditional, or community knowledge) for belief should be included
- *Illustrative*: any indicator should be sensitive to change and be capable of illustrating those changes
- *Provide linkages*: since sustainable development is a concept attempting to integrate environmental, economic, and social concerns, the indicators should reveal the company's progress towards this goal.

Having completed the previous tasks, the working group should be prepared to develop proposed sustainable development indicators for each key issue. Initially, focus

will be devoted to creating a pool of indicators on which subsequent indicator development will be based. During this process, the working group will heavily draw on a range of sources including: the knowledge of the participating stakeholders and experts, previously published sets of indicators (see, for example, GRI, 2002), and existing internal measures. For example, consider the pool of indicators in Table 2. Developed in the face validity test consultations, they provide an illustration of the range of indicators that may be developed during brainstorming for any particular key issue.

TABLE 2
EXAMPLE POOL OF INDICATORS FOR VEGETATION MANAGEMENT PRACTICES

- Kg Chemicals Used/Land Area
- Percent of Right of Way (ROW) Treated with Chemicals
- Ratio of Soil Residual Herbicides vs. Non-Residual
- Hectares Contracted with Chemical Treatment vs. Hectares Contracted with using Mechanical or Hand Clearing
- Cycle Time for Vegetation Management
- ROW Cleared vs. ROW Width
- Hectares of ROW Maintained/Total Hectares of ROW
- Cost per Year of Chemical Treatment vs. Cost per Year of Non-Chemical Treatment
- Hectares Treated Biologically
- Total Research Dollars Spent on Non-Chemical Vegetation Management Practices per Year/Total Dollars Spent on Vegetation Management Practices per Year
- Hectares/Treatment Practices
- Opportunities for Aboriginals
- Total Area ROW/Total Electricity Transmitted
- Total Area ROW/Design Capacity of Transmission System
- Minutes of Outages Caused by Trees
- Number of Complaints per Year (Re: Vegetation Management)
- Public Responses to Herbicides Announcements
- Hectares of Secondary Land Use

As with the list of key issues, it will be necessary to consolidate the initial list of indicators. Although there is no ideal number of indicators, the indicators must be both useful and manageable. Similar to the development of the proposed pool of indicators, expert input will be particularly important during this stage. An illustrative example set of consolidated indicators is presented in Table 3. Like the previous examples, the consolidated indicators were developed in consultation with internal and external expertise during the face validity test.

TABLE 3
EXAMPLE CONSOLIDATED INDICATORS FOR VEGETATION MANAGEMENT PRACTICES

- Minutes of Outages Caused by Vegetation
- Hectares Managed per Total Land Base by Practice
- Cycle Time by Method of Vegetation Management
- Percentage of Total Research Dollars Spent on Non-Chemical Vegetation Management Practices per Year
- Public Responses to Herbicide Program Announcements

The consolidated pool of indicators provides the base to build a system of indicators that will be useful for management and reporting purposes. This could include aggregating the indicators. Although aggregation remains an emerging area of study, particularly in the area of providing weights to the various issues, aggregated indicators may have a greater impact on the minds of decision-makers. If aggregation is used it must always be possible to see how the aggregate indicator has been computed. As an illustrative example of the system of indicators, consider the example in Table 4.

TABLE 4
EXAMPLE SYSTEM OF INDICATORS FOR VEGETATION MANAGEMENT PRACTICES

Required Information

1. Costs of Outages
- Minutes of outages caused by vegetation
- Cost of outage per minute
- Cost of outages caused by vegetation

2. Costs of Outage Prevention
- Hectares managed per total land base by practice
- Cycle time by method of vegetation management
- Life cycle cost per hectare managed by practice
- Cost of increasing frequency of vegetation management by practice

Indicator

- Cost of preventing outages by method vs. cost of outages

Although it is recognized further refinements are necessary to the examples provided by the face validity test, they do illustrate the types of indicators that may be generated in the full application of the process.

In the final sub-step of Step 3, the working group will review the indicators. Particular care must be taken to ensure that the indicators present an integrated representation of sustainable development. There should be a balance between environmental, economic, and social indicators and interdependencies within the system of indicators should be highlighted. This review should lead to either directions for further research or approval to move on to the next step in the process.

3.4 Step 4: Test and Adjust Indicators

Given the diversity of opinion expressed by the stakeholders participating in Step 3, it is possible some revisions to the list of proposed indicators will be necessary. With that in mind, a process for testing and adjusting the indicators is illustrated in Figure 3.

Throughout the completion of Step 4, it is especially important that the motivation for adjusting the indicators is transparent. To minimize potential misunderstandings, all key stakeholders should be, at a minimum, kept informed of the proceedings. Doing otherwise could undermine the legitimacy of the indicators. At this point, obtaining buy-in from key stakeholders, including top management, is particularly critical since the set

of indicators considered here will form the basis for what will likely be the most time-consuming aspect of the SDI Design Process, implementation of the indicators.

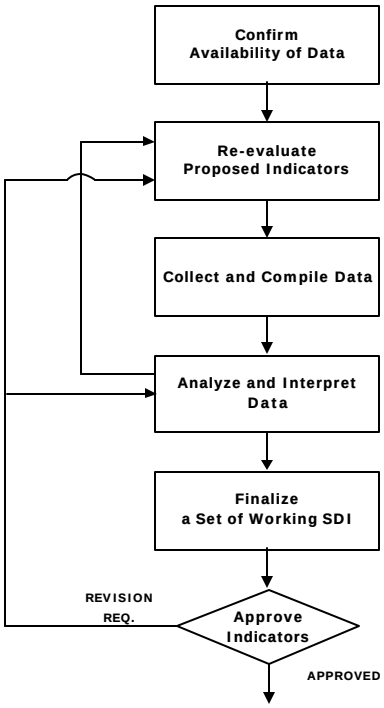

FIGURE 3
OVERVIEW OF STEP 4 IN THE SDI DESIGN PROCESS: TEST AND ADJUST INDICATORS

3.5 Step 5: Implement Indicators

If they are to be of any further use, the indicators must be implemented in a manner that strives to address the specific needs of potential audiences. To ensure this process is successful, careful planning and preparation will be required. Figure 4 depicts a generic process to help structure the implementation of the indicators.

Always maintaining a sense of practicality, some of the critical decisions the working group will need to make in Step 5 include determining: how to communicate the indicators to the interested parties, how to link the indicators to existing initiatives within the corporation, whether the implementation of the indicators should be immediate or staggered over time, and how to address the unique organizational challenges to be faced throughout the actual implementation itself.

In most cases, the implementation of the indicators is currently accomplished through the production of a sustainable development report. Although it may still be desirable to prepare a stand-alone report, particularly for external reporting, it is suggested that the utility consider the development of an integrated management system (IMS) that contains a module on sustainable performance. This approach maximizes the integration of the indicators with existing organizational systems and provides the greatest chance the indicators will be used in decision-making.

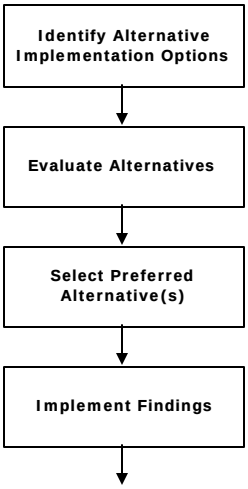

FIGURE 4
OVERVIEW OF STEP 5 IN THE SDI DESIGN PROCESS: IMPLEMENT INDICATORS

The development of a system to align sustainable development indicators within an IMS is itself a process. Although, the development of IMS remains an emerging discipline, there are models available to help structure the effort. Using a systems approach, Karapetrovic (2003) has developed one such model for the implementation of IMS. Among the key steps in the process are: the initiation of the process, determining what standards to draw on, integrating standards requirements, performing a gap analysis, and the alignment and integration of shared processes. As in the SDI Design Process, it also includes a step requiring the review and improvement of the system.

3.6 Step 6: Review and Improve

The iterative nature of the process is represented in Figure 1 by the feedback loops connecting Step 6 to the others. In order to support the required process of continuous improvement, a system of governance is needed to monitor the indicators and identify when and how improvements should be undertaken. Considering the original working group is unlikely to be a permanent entity, it is critical the necessary financial and human resources are assigned to address these challenges and ensure the indicators remain relevant to the system they are intended to represent.

4.0 CONCLUSION

There is increasing pressure on electric utilities to conduct their activities in a manner that balances social, environmental, and economic issues. This pressure has come from all forms of stakeholders, including investors, customers, governments, NGOs, and the general public, looking for increased transparency, accountability, and responsibility. With these pressures in mind, many utilities have made a commitment to apply the principles of sustainable development to their operations.

However, in order to move from rhetoric to tangible action and implementation, the concept of sustainable development must be translated into practical terms that people can understand. Sustainable development indicators provide a means to measure

progress with respect to key environmental, economic, and social issues. In doing so, they can guide decisions towards more sustainable development, link sustainability issues with other initiatives, identify opportunities to improve, promote organizational learning, and enhance transparency in external reporting. However, the development of sustainable development indicators remains an emerging discipline and there is a need for sector-specific indicators as well as processes for the creation of these indicators.

This paper contributes to these needs by providing a transparent, flexible plan for the development and implementation of sustainable development indicators in the electric utility industry. Developed in collaboration with a major electric utility, the authors propose a six-step model: (1) conduct a needs assessment; (2) conduct process planning; (3) develop a draft set of sustainable development indicators; (4) test and adjust the indicators; (5) implement the indicators; and (6) review and improve the indicators. To address the most urgent needs of the electric utility industry, particular emphasis was devoted to the third and fifth steps in the protocol.

The work presented here is a part of an ongoing research program. Using the six-step model, the authors are currently leading a research team in the development and implementation of sustainable development indicators for the transmission system of a major Canadian electric utility. This ongoing research program should offer a basis for further improvements to the methodology.

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