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# Ontario Low Impact Stakeholders' Alliance

# Options for Environmental Rating of Electricity

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## Introduction

With the (more or less) imminent opening of the retail electricity market in Ontario, the Low Impact Stakeholders' Alliance (LISA) is seeking a credible and practical approach to inform consumers of the environmental characteristics of the power they will be offered by a variety of marketers, and thereby to allow them to "vote with their pocketbooks" to favour environmentally preferable power. Retail access for the first time allows individual consumers to choose power suppliers based on their environmental performance, should they choose to do so, but only if reliable, credible, coherent and comprehensible information is available to them. At the same time, it is hoped that the willingness of environmentally conscious consumers to pay premium prices for "green" power will provide a much-needed boost to those generation technologies which are not yet competitive with conventional generation. Given the disappearance of utility support for new low-impact generating technologies, the green power market may determine whether or not new technologies eventually achieve technological and commercial maturity, or not.

While this may sound like a simple goal, it is a project fraught with difficulties. While it is easy to make broad generalizations, the fine distinctions that are necessary in any rating or certifying system require careful analysis and difficult policy choices.

In section 1, we will briefly describe the EcoLogo and Green Leaf programs, contrasting them with each other and with the American Green-e program.

In section 2, we will look at the approach of Scientific Certification Systems (SCS) of Oakland, California which, as we shall see, is qualitatively different from those described in section 1.

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Finally, in section 3, we will briefly describe the Power Score Card, an initiative of the Pace Energy Project that provides a environmental quality ratings for both generators and power products.

## 1. Ecologo, Green Leaf and Green-e

One of the key choices facing LISA is whether to promote a system that certifies generators or power products. A system that certifies retail power products without examining individual generators will inevitably rely on blanket characterization of different resource types, without looking at the precise characteristics of individual generators. On the other hand, since the real choice facing consumers is between retail power products and not between generators, a system that is limited to certifying generators may in the end give consumers a confusing jumble of information, if marketers rely on a large and diverse group of generators.

Another distinct choice is whether to adopt an "all-or-nothing" certification approach, or one with multiple gradations. It has been suggested that a graduated system would be more useful to consumers facing a large number of choices in the marketplace than an "all-or-nothing" award approach that provides no information to distinguish between those resources that fail to qualify for the "premium" label.

The various certification models LISA has looked at thus far can be described according to these parameters as follows:

| | **generators** | **power products** |
|---|---|---|
| **"all or nothing"** | EcoLogo | Green-e |
| **gradated** | Green Leaf | |

Thus, EcoLogo and Green Leaf both focus on the environmental performance of individual generators. In the case of EcoLogo, precise guidelines determine the qualification criteria for each eligible generating technology. Some of these criteria are generic, applying to all types of generation (e.g. proper handling of waste products, appropriate consultation with stakeholders, no adverse impacts for endangered or threatened species), while others are specific to the particular generating technology.

Similarly, the Green Leaf program (like EcoLogo, administered by TerraChoice Environmental Services Inc.) would also assess the environmental performance of individual generators, but on a scale of 1 to 5. Unlike EcoLogo, which is a governmental program requiring Cabinet approval for product guidelines, Green Leaf is a commercial program. It should also be noted that, while TerraChoice currently administers the Ecologo for electricity and Green Leaf programs for a variety of different products, the Green Leaf program for electricity has to the best of our knowledge not yet been designed. While on the one hand this means that LISA could have considerable input into its design, if it were to choose the Green Leaf approach, the downside is that LISA and TerraChoice would have to start almost from scratch to build the program.

The Green-e program, which has achieved considerable support in the United States, is, unlike both Ecologo and Green Leaf, based on the certification of power products, which are almost inevitably composed of a mix of power from a variety of sources, rather than individual generators. Green-e certifies power products in which:

- at least 50% of the electricity comes from "renewable" sources, defined to include wind, solar, geothermal, certain hydro facilities (see below) and biomass (including landfill gas),

- the emissions from the fossil portion (if any) are lower than an equivalent amount of system power,

- the product does not contain any nuclear power, other than that contained in the system power portion,

- a certain percentage (5% in the first year after market opening, increasing by 5% a year to a limit of 25%) of the product consists of "new renewable" electricity, from facilities commissioned after 1997 (in New England, 1998).

Hydroelectric facilities under 30 MW are currently eligible to meet the renewables requirement, but this criterion is being phased out, to be replaced by certification by the Low Impact Hydropower Institute. Hydro facilities are not eligible for meeting any part of the "new renewables" requirement.

Marketing materials for certified power products prominently display the Green-e logo.[1] Due to its different nature, the EcoLogo is not used in the same way. While marketers offering electricity products to the general public are of course expected to mention the Ecologo certification generators whose product they are marketing, it is not the "package" *per se* that is certified, but its component parts. Thus, for example, a power product composed of 52% Ecologo-certified wind power could be sold in the U.S. as a Green-e certified package (assuming that it meets the other Green-e requirements), Canadian marketers would be limited to specifying that 52% of it was of Ecologo-certified sources. Similarly, a product composed of 48% Ecologo-certified power could not be sold under the Green-e logo, though in Canada it could be marketed as "48% Ecologo-certified."[2]

Green-e certification is in many ways less demanding of individual generators than is EcoLogo certification. For example, while Green-e requires that at least 50% of a power product be

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[1] See for example http://www.greenmountain.com/electricity/products/compare_ca.asp.

[2] The labelling problem would be even greater for a power product which consists, for instance, of 12% EcoLogo certified renewable power, 15% EcoLogo certified non-renewable power, and 73% high-sulfur coal power. While such a product would not be eligible for Green-e certification, it could still display its two EcoLogos in its marketing materials (indicating the respective percentages), while making no mention of the coal-fired source of the rest of the power.

derived from renewable sources, few additional constraints are prescribed. Thus, *all* wind power qualifies for the renewable portion of a Green-e product, whereas EcoLogo imposes additional criteria concerning siting, stakeholder consultation, impacts on birds, etc. However, because it is essentially a marketer certification rather than a generator certification, Green-e makes a considerable effort to audit marketers to ensure that they their purchases from qualified suppliers are sufficient to meet their sales volumes.[3] Since neither EcoLogo nor Green Leaf will be directly certifying marketers, it is not clear that they would maintain the same level of oversight.

## 2. Scientific Certification Systems

Scientific Certification Systems (SCS) of Oakland, California describes itself as "a neutral, third-party testing and certification organization evaluating a wide variety of food safety and environmental claims."[4] It operates certification programs for forestry, organic foods and marine fisheries, in which it has been authorized by non-profit organizations such as the Marine Stewardship Council and the Forest Stewardship Council to certify companies as being in compliance with criteria established by the Councils. It also certifies products as "environmentally preferable," using its own protocols based on life-cycle assessment.

According to its web site, SCS offers two types of electricity certification: Environmentally Preferable Electricity *Portfolios* and Environmentally Preferable Electricity *Sources*. Portfolio certification seeks to determine the most environmentally preferable combination of cost-effective options, including upgrades to existing generation assets, improvements to transmission and distribution infrastructures, new alternative power generation sources, distributed generation technologies and demand-side conservation initiatives. It does so by comparing environmental performance and improvements against the average environmental performance of the regional power pool, and in theory makes it possible to evaluate the environmental consequences of any proposed action, from building a wind farm to installing high-efficiency industrial boilers to installing scrubbers on a coal plant, based on the net effect on the total impacts from electric generation in the region.

SCS Environmentally Preferable Electricity *Source* certification, on the other hand, certifies the environmental performance of specific energy sources, based on a comparison with the regional power pool. It quantifies a project's impacts based on twenty indicators grouped into five categories: energy resource depletion, renewable resource depletion, ecosystem disruption and direct physical disturbance, emission loadings and residual hazardous wastes. For each one, the project is then compared to the system power average (scaled to the equivalent energy production) for the regional grid where the generator is located. Individual generators which

[3] While grid operators generally have an obligation to ensure that generators don't sell more power than they produce, their tracking and settlement systems are not necessarily adequate to ensure that a marketer's green power sales do not exceed its supplies from generators meeting criteria defined by a non-official entity such as Green-e.

[4] http://www.scs1.com/

"beat" the system power average on all indicators are deemed to be "environmentally preferable."

This "source" certification is thus in some ways analogous to the Ecologo described above, in that it results in certification of certain generators as "environmentally preferable." However, unlike Ecologo, no technology-specific criteria are specified. Instead, a generatoris certified if, according to SCS' analysis, it beats the system average (by whatever degree) in each of the impact categories used.

Both the methodologies used by SCS for source certification and portfolio certification rely on the company's modelling of the entire system in which the generator is located. SCS claims to have established "a program based on internationally standardized life-cycle impact assessment protocols to evaluate and certify the relative environmental merits and tradeoffs of various energy generation systems using a comprehensive, internationally standardized assessment methodology."[5]

In promising to "scientifically" integrate the full range of environmental costs and benefits for all types of generation, SCS distinguishes itself from the other approaches described above. In each of these systems, the criteria on which certification decisions are based reflect policy choices (e.g. wind power is preferable to coal power), which in turn are based on the designers' best assessment of the relative environmental performance of the different alternatives. However, they make no attempt to derive their evaluation criteria from quantitative analyses.

In seeking to establish a strictly objective evaluation system, where "the numbers" speak for themselves without human mediation and where no subjective or policy-oriented choices need be made, SCS sets itself a formidable task. The success of this ambitious project depends both on the accuracy and completeness with which the system is characterized and on the sensitivity of the methodologies used to properly represent the actual environmental impacts of each generating option. Given that all resources are in effect compared to each other, any systematic error in the assessment of any aspect of the regional generating system will affect the reliability of the entire system.

The indicators used by SCS to evaluate energy systems are as follows:

**Energy Resource Depletion**
Coal depletion (tons of oil equivalent, or toe)
Biomass depletion (toe)
Oil depletion (toe)
Natural gas depletion (toe)
Uranium depletion (toe)
**Renewable Resource Depletion**
Water resource depletion (equiv. cubic metres)
**Mineral Resource Depletion**
Mineral Resource Depletion (equiv. tons)
**Ecosystem Disruption**
Terrestrial and aquatic habitats (equiv. acres)
Key species (if applicable) (% increased mortality)
**Emission Loadings**

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[5] *Ibid.*

Greenhouse gas loadings (equiv. tons $CO_2$)
Acidification loading (equiv. tons $SO_2$)
Ground level ozone loading (equiv. tons ozone)
Statospheric ozone depletion loading (equiv. tons CFC-11)
PM-10 (equiv. tons PM-10)
Other hazardous chemical (air) loading (equiv. kg)
Eutrophication loading (equiv. tons P)
Total oxidizing chemical (TOC) loading (equiv. tons C)
Total suspended solids (equiv. tons C)
Hazardous aquatic loading (equiv. kg)
Thermal loading (degrees over ambient)
**Residual Hazardous Wastes**
Ash wastes (equiv. tons)
Radioactive waste (equiv. tons)

The methodologies SCS applies to the characterization of the impacts of thermal power seem quite adequate. A broad range of quantitative indicators are used, which lend themselves well to life-cycle assessment. A more careful review is required to determine whether or not the same is true of nuclear power, i.e. whether or not the indicators and methodologies used are adequate to capture the full range of environmental impacts of nuclear power.

Of the indicators used by SCS, however, only three show significant values for hydropower: the two Ecosystem Disruption indicators, "terrestrial and aquatic habitats" and "key species," and the air emission indicator "greenhouse gas loadings." Hydro projects display non-zero values on other indicators, due for the most part to the fossil fuels used in their construction, but these are generally insignificant.[6] A brief analysis of the way each of these three indicators is applied is provided in Appendix I.

Based on our review of the documents provided by SCS and on several long interviews with SCS president Stan Rhodes, we must conclude that the SCS approach fails to adequately represent the environmental characteristics of hydropower. Reducing the varied impacts of hydropower into simple quantitative indicators is a formidable challenge, and the SCS approach, both in the choice of indicators and in the way they are assessed, fails to represent the complex and varied impacts related to hydro projects.

SCS limits its assessment of ecosystem impacts to impacts on terrestrial and aquatic habitats, and impacts on "key species." Habitat impacts are in turn reduced to a simple acres/GWh metric that implicitly attributes an equal value to every square metre of the earth's surface, without distinction as to ecological richness or complexity. Thus, the loss of 1 $km^2$ of "habitat" from the total dewatering of a 200m stretch of a 5m-wide river is deemed equivalent to the loss of 1 $km^2$ of grassland to an industrial development or to a power line corridor.[7] The profound effects that such dewatering may have on the riverine ecosystems are unmeasured and unreported, except insofar as effects are noted on "key species" (direct population impacts on a few species of greatest economic interest, such as commercial and sport fisheries). Flow-related impacts are also for the most part rendered invisible. The conundrum of how to systematically and

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[6] Projects which require substantial road construction, air transport, etc. such as those in Northern Quebec may be exceptions to this generalization.

[7] To the extent that SCS consider the habitat "created" by floods (aquatic habitat) or by dewatering (e.g. mudflats) to be of ecological value, the lost habitat can be compensated by a "credit" of up to 85%.

quantitatively represent the complex impacts of hydropower on the intricate webs of life that inhabit riverine ecosystems is definitively resolved by simply ignoring them. As for direct or indirect social impacts, whether on Native or non-Native communities, they are excluded from the SCS methodology altogether.[8]

The conceptual attractions of life-cycle analysis are undeniable. However, much additional work is required before it can be considered operational insofar as hydropower is concerned. SCS acknowledges this weakness:

> Ideally, ecosystem disruption would be measured in terms of the depletion of the affected ecosystems. However, such assessment is not yet supported by current ecological field assessment techniques.[9]

Faced with its inability to measure ecosystem depletion, SCS measures this disruption "in terms of the physical alteration of habitats and, as warranted, identified key species."[10] However, such an approach inevitably fails to fully account for hydropower's ecosystem impacts. Thus, life-cycle analysis as implemented by SCS underestimates the impacts of hydropower and hence overestimates its benefits relative to other energy resources. Insofar as the SCS system compares each resource to the entire system, this flaw falsifies the entire program, not only its certification decisions for hydro projects.

It is thus not surprising that SCS claims that its approach will highlight the "inherent environmental advantages of hydro power" and justify its value-added pricing.[11] A methodology that systematically understates hydro's ecological impacts and greenhouse gas impacts and fails to take any note of its social impacts will inevitably make it look good when compared to generating technologies for which all impacts are fully accounted for. A "scientific" approach is only as good as the data and methodologies used. A transparent, consensus-based process is superior to a technocratic mechanism based on inappropriate and inadequate indicators.

It should also be noted, in this regard, that it is virtually impossible for coal, biomass, oil, natural gas or nuclear power resources to be identified as "environmentally preferable" under the SCS methodology, due to the choice of "energy resource depletion" indicators. Since a natural gas plant will inevitably have a greater effect on natural gas depletion than the average of a system which includes non-gas generators, such a plant will never be able to meet the criterion of beating the system average for *all* indicators. The same is true for oil, coal and nuclear power, but not for hydropower, since no equivalent "freeflowing river depletion" indicator is used. If there were, all hydro projects would inevitably exceed the system average for this indicator, and thus fail the test for "environmentally preferable" resources.

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[8] Stan Rhodes, pers. comm.

[9] SCS, Lake Chelan Project LCSEA Study Report (draft), March 3, 2000, p. 10.

[10] *Ibid.*

[11] Stanley Rhodes and Linda Brown, "Certified: green power," in *International Water Power and Dam Construction,* 51:28-29 (Jan. 1999)

A central aspect of the SCS methodology is the comparison between a particular project and the regional baseline. However, attempting to characterize the average ecosystem impact or the average impact on key species for a diverse set of power plants over a vast region poses enormous methodological problems — especially when hydropower makes up a significant part of that region's power supply. While the use of generic baseline values may be acceptable in predominately thermal grids, the same exercise would have to be carried out on every hydro project in the region simply in order to determine the baseline.

In order to meet the challenge of accounting properly for the varied environmental and social impacts related to electricity generation, all impacts must be addressed, even those impacts that do not easily lend themselves to the selected analytical framework. If some types of impacts are assessed less thoroughly than others, life-cycle analysis will simply become an excuse for arbitrarily preferring one type of generation over another.

## 3. Power Score Card

The *Power Scorecard* was developed by the Pace Energy Project (part of the Pace University School of Law Center for Environmental Legal Studies), and has obtained the support of a number of important environmental organizations.[12] The Power Scorecard provides a straightforward methodology for comparing environmental impacts of all generating technologies, based on both proprietary and publicly available information.

As noted earlier, the Power Scorecard serves both to characterize generators and power products. Power Scorecard intends to establish ratings for each power product offered in each U.S. state in which retail access is allowed,[13] based in turn on ratings for each generator that contributes power to that product.[14]

The Power Scorecard rates generators on the basis of eight criteria,[15] using a scale from 0 to 10. (Scores can also be extended beyond the upper limit in the event of adverse environmental impacts significantly greater than the norm, or beyond the lower limit in the event that mitigation measures result in a positive environmental benefit.)

For quantitative impacts such as $CO_2$ or $SO_x$ emissions, the Power Score is based on an explicit schedule. For example, SOx emissions are rated on a scale ranging from 0 for the emissions of a

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[12] The National Resources Defence Council, Environmental Defense, the Union of Concerned Scientists, the Northwest Energy Coalition and the Izaak Walton League.

[13] The Power Scorecard web site (http://www.powerscorecard.org) currently provided data for all power products offered in California and Pennsylvania.

[14] For power products making environmental claims, the rating is generally based on the scores of the individual generators, based on data provided on a confidential basis to Power Scorecard. For marketers that refuse to provide such information, scores are based on the best available information, or on default values for the relevant technology.

[15] The criteria are $CO_2$, $SO_x$, $NO_x$, mercury, water use, water quality, on-site land use, and off-site land use.

high efficiency natural gas plant (near 0) to 10 for those of a high sulfur coal plant without flue gas desulfurization equipment (46.5 lbs SOx per MWh). Default values for all eight categories are provided for 30 distinct generating technologies.

For hydropower, Power Scorecard assigns a value of zero for each of the four air quality criteria. For water and air impacts, however, it assigns values based on whether the facility has been certified by LIHI (4), whether it has been reviewed by FERC since the 1986 legislative modifications (8), or not (10). Additionally, if a facility has been recommended for removal because of severe ecological or dam safety issues, it is given values of 20.

Once the generators are rated, the rating for a power product is simply a weighted average of its suppliers. Power Scorecard also indicates for each power product the percent of its supplies that come from new, environmentally preferable renewable sources. These include solar, wind, geothermal and biomass, but exclude hydropower.[16] New environmentally preferable capacity is characterized as "new" for the first 10 years after commissioning.

Power Scorecard has the advantage of being simultaneously a mechanism for characterizing generators (like EcoLogo and Green Leaf) and power products (like Green-e). Like SCS, it requires characterizing all generators in the system, but it does so based on an easily applied, transparent scoring system.

It goes without saying that these criteria would have to be modified for use in Canadian power markets. However, the great strength of the Power Scorecard methodology is precisely its great transparency and the ease with which it could be modified to reflect Canadian concerns — if those responsible for its development allow the scorecard to be adapted for the Canadian market.

This adaptation would need to take two forms. For non-hydro resources, it would simply be a matter of a Canadian stakeholder group reviewing the rating criteria and the weightings used to ensure that reflect Canadian sensibilities and concerns, altering them as appropriate.

For hydro resources, however, the problem is (as usual) more complicated, as the distinctions currently used by Power Scorecard (LIHI certification, post-1986 FERC authorization) cannot be applied to Canadian hydro projects. In order to reflect the very large variability in the impacts of different hydro projects, a new made-in-Canada rating scheme would have to be developed. Depending on the amount of time, energy and resources one wishes to devote to this challenge, the solution could range from a simple a size-based criterion, to a complex indicator taking into account storage, flooding and flows, to an elaborate certification process analogous to the one designed by LIHI in the U.S. Whatever the scope, the design of the hydro criteria should probably be entrusted to a separate working group able and willing to address the complexities that will inevitably arise.

[16] Landfill gas may qualify under certain conditions.

## 4. Options

Having reviewed these five certification systems, LISA's options can be summarized as follows:

I. Certification of generation facilities:

- A. Choose between pass/fail and rating approach:
  - 1) If pass/fail:
    - a) decide whether or not to recognize Ecologo certification as the sole standard for the green power Ontario market. If not:
      - i) use draft Ecologo guideline for non-hydro renewables, and
      - ii) convene a stakeholder group to draft additional guideline for non-renewables, and
      - iii) convene a hydro working group to:
        - determine how to apply draft Ecologo guideline, or
        - develop easier-to-apply criteria,
  - 2) If rating, choose between Power Scorecard approach and Green Leaf approaches:
    - a) if Power Scorecard approach:
      - i) begin discussions with Power Scorecard Steering Committee,
      - ii) convene a stakeholder group to review criteria for Ontario context;
    - b) if Green Leaf approach:
      - i) convene a stakeholder group to develop rating criteria
    - c) in either case:
      - i) convene a hydro working group to develop criteria for rating Canadian hydropower facilities;

II. Certification of retail electricity products

- A. Choose between pass/fail and rating approach:
  - 1) if pass/fail approach selected:
    - a) convene stakeholder group to explore possible adaptation of Green-e to Ontario context,
  - 2) if rating approach selected:
    - a) convene a stakeholder group to explore possible adaptation of Power Scorecard, SCS or Green Leaf approach to Ontario context and to explore interface with MEST tracking system.

III. Program management

- A. Unless Ecologo is recognized as the sole certifying agent for the Ontario market, determine whether program management (assessing applications and granting certification) is to be handled directly by LISA or out-sourced.

For each of the above options it seems clear that certification of eligible hydro facilities will remain a serious challenge. None of the U.S. programs (LIHI, Green-e, Power Scorecard) are directly adaptible to Canada, given the degree to which they rely on the U.S. regulatory framework. In-house or out-sourced use of the Ecologo guideline is also problematic, in that, due to the way the criteria are framed, assessing applications thoroughly and objectively would require considerable resources and expertise. A working group on hydro issues is thus essential under almost all scenarios.

## Appendix I — SCS approach to hydropower certification

SCS provided us with its studies of two hydro projects for review: the 50 MW Lake Chelan project in the State of Washington[17] and the 417.5 MW Safe Harbor Project in Pennsylvania.[18] SCS has also carried out a study of the Harspranget Power Station in Norway, owned by Vattenfall which, unlike both Safe Harbor and Lake Chelan, is a large storage hydro facility. While SCS maintains that its would treat projects with substantial reservoir storage very differently than it does these essentially "run-of-the-river" projects, no documentary support for this assertion was provided.[19] The following analysis of the SCS methodology is thus based entirely on the Safe Harbor and Lake Chelan reports.

### *4.1. Terrestrial and aquatic habitats*

For this as for all the other indicators, SCS compares environmental performance of an individual generator against the average performance of the regional power pool, scaled to correspond to the annual electricity production of the station under study.

SCS measures ecosystem disruption in acres of lost habitat, net of habitat "gains." This reliance on area lost or gained as a measure of impact on terrestrial and aquatic habitats is one of the more controversial aspects of the SCS methodology. In the words of one peer reviewer, this methodology "probably underestimates the effects of operation of the plant [as i]t does not include all of the effects of project operation on the biota of the lake and in the receiving waters."[20]

To account for the obvious differences in ecological importance of different areas, SCS distinguishes habitats into two groups: "Degradation or Conversion of General Habitats on a Non-Equivalent Basis" and "Conversion of General Habitats on an Equivalent Basis."[21] The first category consists of habitats that are significantly degraded (e.g. a dewatered river bed, flooded mudflats or wetlands, terrestrial habitat lost to roads and buildings). Each acre of such degraded habitat is "charged" against the facility. For the second category, SCS credits the acres of created habitat (discounted to reflect uncertainties), thereby counterbalancing the habitat lost. Thus, for example, the flooding of Lake Chelan resulted in the loss of 1,255 acres of forest, cliff and grassland habitat, which is counterbalanced by the creation of the same number of acres of

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[17] This report was provided on a confidential basis, as the Chelan County Public Utility District No. 1 has not yet released it to the public.

[18] Scientific Certification Systems, *A Study of Safe Harbor Hydroelectric Power Generation Based on Life-Cycle Stressor-Effects Assessment: Final Report,* September 1999. According to Stan Rhodes of SCS, this report is public, though other interested parties have apparently attempted to obtain it without success.

[19] Stan Rhodes of SCS promised to seek permission from Vattenfall to provide us with a copy for review but, despite repeated requests, he has yet to respond.

[20] Whitney, *op. cit.,* p. 3.

[21] SCS, Safe Harbor, p. 29; Lake Chelan*.,* p. 30.

"lake" habitat. However, this created habitat is "discounted" by 15%, resulting in a net loss of habitat of just 188.2 acres.

This value is added to other habitat losses (e.g. terrestrial habitat lost to roads, powerhouses, transmission corridors, etc.) and the resulting net habitat depletion value is compared to the estimated average habitat depletion for the regional grid. The net habitat depletion for the Lake Chelan project (422.2 acres for average annual generation of 375 GWh) is compared to that of the Western Systems Coordinating Council (WSCC), an enormous region covering 1.8 million square miles stretching from New Mexico to Alberta. SCS estimates average habitat depletion for the WSCC region at 400 to 1,200 acres per 375 GWh of generation.[22] Since the value for Lake Chelan is less than the median value (800 acres) of WSCC, SCS declares the Lake Chelan project to be "environmentally preferable."

It should also be noted that the SCS habitat disruption index takes no direct notice of the fluctations of reservoir water levels or of downstream flows. For example, while Safe Harbor is operated continuously as a run-of-the-river plant during high-flow periods, during periods of low flow it is operated so as to concentrate energy and capacity into on-peak hours. During periods of extremely low flow, weekend inflows are retained for use during the weekday on-peak hours.[23] No mention is made in the study of the required level of conservation flows during these periods, or of the ecological impacts that may result from these flow variations.

### *4.2. Key species*

In addition to habitat loss, SCS evaluates harm to "key species" as part of its evaluation of ecosystem disruption. For the Lake Chelan project, SCS identified no key species,[24] but fish biologist Richard R. Whitney,[25] one of the two peer reviewers selected to review the Lake Chelan analysis, pointed out that four species (burbot, cutthroat tytout, pygmy whitefish and bull trout) "are no longer abundant and merit special attention with respect to their maintenance,"[26] noting that the bull trout was listed as "threatened" under the Endangered Species Act. In response, SCS stated that:

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[22] No source or methodology is described for this estimate. According to Stanley Rhodes (pers. comm.), this benchmark is based largely on the habitat impacts of coal mining. While a substantial proportion of the WSCC is hydro, Mr. Rhodes made clear that this benchmark is not based on any project-by-project assessment of habitat loss for hydropower in the Western region.

[23] SCS, Safe Harbor, p. 14.

[24] SCS, Lake Chelan, p. 10.

[25] Richard R. Whitney, *Review of "A Study of the Lake Chelan Hydroelectric Project Based on Life-Cycle Stressor-Effects Assessment" Scientific Certification Systems Report for Peer Review Dated September 21, 1999,* November 16, 1999 (Appendix 3a to SCS, *op. cit.*), p. 4.

[26] Richard R. Whitney, *Review of "A Study of the Lake Chelan Hydroelectric Project Based on Life-Cycle Stressor-Effects Assessment" Scientific Certification Systems Report for Peer Review Dated September 21, 1999,* November 16, 1999 (Appendix 3a to SCS, *op. cit.*), p. 4.

> Based on the data available to the authors *at the time of this study,* there was no evidence to indicate that the Project operations have negatively impacted resident fish species.[27] (italics in original)

SCS thus appears to reverse the traditional "burden of proof," whereby it is up to a developer to demonstrate that project impacts are minor or manageable. Given the lack of public involvement in the SCS process, such a "presumption of innocence" is quite problematic, especially in the vast wilderness areas of northern Canada where the utilities are virtually the only source of data.

### *4.3. Greenhouse gases*

The SCS determination of greenhouse gas loadings is meant to include both emissions from fossil fuels (life cycle analysis) and from the flooded biomass in the reservoir. This latter figure is based on "[a]n estimate of the biomass in the flooded area behind the power station, based on surrounding vegetation and historic maps."[28] No methodology, data or detail is provided regarding this calculation, other than the results. For $CO_2$, the Lake Chelan project is deemed responsible for 493 tons/year from the construction phase[29] and 104 tons/year from operations; as well, there are estimated to be 0.11 tons/year of methane emissions from construction.

SCS considers reservoir emissions to have been released all at once at the time of construction, rather than continuously over the life of the reservoir. Based on this faulty assumption, it reduces their values according to the number of years that have passed since the reservoir was built, using decay curves based on the estimated atmospheric lifetime of these gases. Thus, for the Lake Chelan project, which was built 76 years ago, the gross $CO_2$ loadings are reduced by 64%; for methane emissions, gross loadings of 1 ton/yr are reduced by 99.95%!

This methodology reflects the underlying assumption that all $CO_2$ and methane emissions related to flooding took place at the moment the reservoir was filled. This ignores the scientific consensus that emissions continue over the life of the project,[30] and even the earlier (and now discredited) view that emissions were the result of flooded biomass and diminished gradually over a period of several decades.

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[27] SCS, "SCS Response to Peer Reviewer Comments," Appendix 4 to SCS, *op. cit.,* p. 3.

[28] SCS, *Safe Harbor Study,* p. 34.

[29] This is the annual share, based on amortizing the emissions attributed to construction over 100 years. The estimated total emissions are not provided, nor are the amortization assumptions.

[30] This consensus is based on the understanding that emissions result not only from flooded biomass but from suspended and dissolved organic compounds swept downriver from the catchment area. World Commission on Dams, *Dam Reservoirs and Greenhouse Gases: Report on the Workshop Held on February 24-25, 2000, Hydro-Québec, Montreal (Final Minutes),* p. 4.