EcoLogo[CM] Program Criteria Review

# Certification Discussion Document

CCD-003: Electricity-Renewable Low-Impact
(H) WATER-POWERED ELECTRICITY

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# 1 Instructions

EcoLogo[CM] is inviting stakeholders to participate in the review of CCD-003: Electricity-Renewable Low-Impact. This standard is being revised to assure that the current requirements continue to define environmental leadership for renewable low-impact electricity.

Currently, both the scope and the criteria statements found in CCD-003 determine what the EcoLogo[CM] Program considers to be environmental leadership amongst all types of electricity production in North America. During this review, the EcoLogo[CM] Program will re-examine both the scope and the criteria statements. As such, leadership will continue to be defined by first determining what types of electricity can be considered as "renewable low-impact" (i.e. scope), and second what requirements should be established to assure that facilities which produce these types of electricity are following best environmental practices according to the market (i.e. criteria statements).

Stakeholder contributions play a pivotal role in the EcoLogo[CM] standards development process.

To begin your participation and register for the review process:

- Send a request to forums@ecologo.org and specify your name (first and last name), indicating your affiliation, and your wish to participate in the CCD-003: Electricity-Renewable Low-Impact.

While the EcoLogo[CM] Standard Development Forum is the main tool for compiling comments, the EcoLogo[CM] program will also accept comments by e-mail and fax. These comments may also be posted to the online forum and will be viewable by all registered forum participants involved in the discussion.

This stakeholder consultation period will be open for 52 days beginning Nov 18, 2008. Comments must be received by January 9, 2009.

Your time and input in helping us to establish the most stringent environmental standards are very much appreciated. We will send you a reminder as our closing date for comments approaches.

Sincerely,

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# 2 Introduction

Water-powered electricity is currently considered in the EcoLogo$^{CM}$ certification criteria document (CCD) for Renewable Low-Impact Electricity and 96 water-powered generating facilities amounting to a total capacity of 1417.80 MW have already been third-party certified by the EcoLogo$^{CM}$ Program. The largest hydro project ever certified by the EcoLogo$^{CM}$ Program which met all of the criteria was of 192MW.

Water-powered electricity products can sometimes offer considerable environmental benefits and meet strict requirements for the conservation of aquatic and riparian ecosystems.

The purpose of this section of the Certification Discussion Document is to provide you with broad market information for water-powered electricity in Canada and the U.S., and to initiate a discussion to help identify which criteria the EcoLogo$^{CM}$ Program should consider revising to ensure that water-powered electricity generating facilities continue to represent environmental leadership as "renewable low-impact electricity" generating facilities.

The EcoLogo$^{CM}$ Program is designed to support a continuing effort to improve and/or maintain environmental quality by reducing energy and materials consumption and by minimizing significant life cycle environmental impacts. Life cycle review is an ongoing process and as such, EcoLogo$^{CM}$ CCDs are regularly updated. Products are also re-audited regularly to ensure certified products continue to offer significant environmental benefits.

# 3 Description

CCD-003 currently defines water-powered electricity as electricity generated from a system or technology that uses a mechanical method to capture and convert the potential energy of water into electricity.

According to Natural Resources Canada (2002), the different types of hydroelectric facilities include:

- Run-of-river facilities
- Partial development
- Developments that use storage
- Hydro thermal systems
- Pumped storage
- Multiple purpose project

# 4 Market Overview

## 4.1 Canadian Market

According to Natural Resources Canada (2006), Canada holds 12% of the world's hydropower production. Moreover, they predict that "hydroelectric energy production will increase by about 14% between 1995 to 2020, or approximately 0.5% per year." They also state that, in 2002, the total hydro production was of 353,000 GWh while the total capacity was of 67,100 MW.

According to the Canadian Hydropower Association (2008), some of the new hydropower projects in the works in Canada include:

- Brilliant Expansion in British Columbia (120 MW)
- Wuskwatim in Manitoba (200 MW)
- Sir Adam Beck 1 in Ontario (60 MW)
- Eastmain-1-A-Sarcelles-Rupert in Quebec (893MW)

And some projects under study include:

- La Romaine & Petit-Mécatina in Quebec (3000 MW)
- Conawapa & Gull (Keeyask) in Manitoba (1870 MW)
- Lower Churchill in Newfoundland & Labrador (2800 MW)
- Lower Mattagami project in Ontario (450 MW)
- Site C in British Columbia (900 MW)
- Slave River in Alberta (1800 MW)
- Many smaller projects in British Columbia, Manitoba,Ontario

## 4.2 American Market

According to NRCan (2006), the U.S holds 11% of the world's hydropower production. Moreover, in 2002, the total hydro production was of 300,000 GWh while the total capacity was of 76,000 MW.

# 5 Other Eco-label Standards

The Green-E (2008) Eco Label specifies that these types of hydro-powered electricity plants are eligible renewables:

> *Hydropower from new generation capacity on a non-impoundment or new (on or after January 1, 1997); generation capacity on an existing impoundment that meets one or more of the following conditions:*
>
> > *a) The hydropower facility is certified by the Low Impact Hydropower Institute;*
> >
> > *b) The facility is a run-of-the-river hydropower facility with a total rated nameplate capacity equal to or less than 5 MW. Multiple turbines will not be counted separately and cannot add up to more than a 5 MW nameplate capacity; or*
> >
> > *c) The hydropower facility consists of a turbine in a pipeline or a turbine in an irrigation canal.*
>
> *The Board will consider on a case-by-case basis new incremental capacity on an existing dam, where the "new" output is equal to or less than 5 megawatts.*
>
> *Green-e will not certify renewables from new impoundments of water.*

The Certification Guidelines from Naturemade (2008), on the other hand, are as follow:

| *Conditions of hydro-electric generation* | |
|---|---|
| *Plant extensions and new plants* | *Power plant extensions and new plants can be certified with naturemade star if they have no further impact on natural or semi-natural habitats, living communities and landscapes. Exceptions are only allowed where there is full reinstatement. What form this might take in an individual case is worked out with the specialist auditor. VUE emphasizes that design must be guided by the ecological state of the art.* |
| *Procedure for newly licensed hydro-electric power plants* | *Newly licensed plants are those licensed since 1.11.92. They are governed, in particular, by Articles 29 – 36 of the Swiss Federal Water Conservancy Act 1991. For such plants, the scope of the procedure to gain the naturemade star quality seal can be reduced. Such plants still have to prove that they comply with all regional and local criteria.* |
| *Interim for old plants* | *Old plants ecologically upgraded to earn VUE naturemade star certification can only be awarded the naturemade basic quality seal until the upgrading is completed. On certain terms, which must be agreed in writing with VUE, operators may advise that they are seeking certification as an 'eco-electric power plant' (e.g. 'XY City Electricity is building an eco-electric power plan here.' ) A credible timescale for the interim is ensured.* |
| *Small plants and cross-flow turbines* | *For small power plants (< 1 MW), electricity from individual machines is certifiable. This allows certification, say, of electricity from cross-flow turbines in larger power plants which do not hold naturemade star certification. Where cross-flow turbines are certified, it must be clearly communicated which electricity from that plant is naturemade star certified, and which is not.* |
| *System limit of certification* | *As a rule, electricity production is certified at the transformer terminal (where the electricity enters the 'public grid'). Certification at producer terminals are possible in the following cases:*<br>• *micro-hydro power plants and*<br>• *plants which affect a reasonably limited area in hydrological terms (e.g. a plant sited in a small valley as one of a chain of plants).* |

The Low Impact Hydropower Institute (LIHI) (2004) also has a certification for low-impact hydro. The criteria of the Institute are as follows:

| | |
|---|---|
| *River Flows* | *For instream flows, a certified facility must comply with recent resource agency recommendations for flows. If there were no qualifying resource agency recommendations, the applicant can meet one of two alternative standards: (1) meet the flow levels required using the Aquatic Base Flow methodology or the "good" habitat flow level under the Montana-Tennant methodology; or (2) present a letter from a resource agency prepared for the application confirming the flows at the facility are adequately protective of fish, wildlife, and water quality.* |

| | |
|---|---|
| | *[Note: "recent resource agency recommendations" are defined as final recommendations made by state, federal, or tribal resource agencies in a proceeding, such as a Federal Energy Regulatory Commission (FERC) licensing proceeding. Qualifying agencies are those whose mission includes protecting fish and wildlife, water quality and/or administering reservations held in the public trust. Agencies such as a state or tribal department of fish and game, or the U.S. Fish and Wildlife Service are considered a "resource agency" but the FERC, with its balancing responsibilities, is not. The agency recommendations must be recent, which means they were issued after 1986 (after enactment of the Electric Consumers Protection Act, which amended the Federal Power Act to increase the profile of recommendations from fish and wildlife agencies in the FERC licensing process). If there are a number of resource agency recommendations, then the most stringent (most environmentally protective) is used. In the case of settlement agreements, the final settlement terms will be considered the agency's "recommendation."]* |
| *Water Quality* | *The water quality criterion has two parts. First, a facility must demonstrate that it is in compliance with state water quality standards, either through producing a recent (after 1986) Clean Water Act Section 401 certification, or demonstrating compliance with state water quality standards (typically by presenting a letter prepared for the application from the state confirming the facility is meeting water quality standards). Second, a facility must demonstrate that it has not contributed to a state finding that the river has impaired water quality under Clean Water Act Section 303(d) (relating to water quality limited streams).* |
| *Fish Passage and Protection* | *For riverine, anadromous, and catadromous fish, a facility must be in compliance with recent (after 1986) mandatory prescriptions regarding fish passage (such as a Fish and Wildlife Service prescription for a fish ladder) as well as any recent resource agency recommendations regarding fish protection (e.g., a tailrace barrier). If anadromous or catadromous fish historically passed through the facility area but are no longer present, the applicant must show that the fish are not extirpated or extinct in the area because of the facility and that the facility has made a legally binding commitment to provide any future fish passage recommended by a resource agency.*<br>*When no recent fish passage prescription exists for anadromous or catadromous fish, and the fish are* |

| | |
|---|---|
| | *still present in the area, the facility must demonstrate either that there was a recent decision that fish passage is not necessary for a valid environmental reason, that existing fish passage survival rates at the facility are greater than 95% over 80% of the run, or provide a letter prepared for the application from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service confirming the existing passage is appropriately protective.* |
| *Watershed Protection* | *A certified facility must be in compliance with resource agency recommendations and FERC license terms regarding watershed protection, mitigation or enhancement. These may cover issues such as shoreline buffer zones, wildlife habitat protection, wetlands protection, erosion control, etc.* |
| *Threatened and Endangered Species Protection* | *For threatened and endangered species present in the facility area, the facility owner/operator must either demonstrate that the facility does not negatively affect the species, or demonstrate compliance with the species recovery plan and any requirements for authority to "take" (damage) the species under federal or state laws.* |
| *Cultural Resource Protection* | *Cultural resources must be protected either through compliance with FERC license provisions, or, if the project is not FERC regulated, through development of a plan approved by the relevant state, federal, or tribal agency.* |
| *Recreation* | *A certified facility must be in compliance with terms of its FERC license or exemption related to recreational access, accommodation and facilities. If not FERC-regulated, a facility must be in compliance with similar requirements as recommended by resource agencies. A certified facility must also provide the public access to water without fee or charge.* |
| *Facilities Recommended for Removal* | *If a resource agency has recommended removal of a dam associated with the facility, certification is not allowed. If a facility meets the requirements under all eight of the criteria, the facility will be certified as a Low Impact Hydropower facility. A facility failing on one or more of the criteria will not be certified.* |

# 6 Life Cycle Research Findings

## 6.1 Life Cycle Definition

The potential life cycle impacts for water-powered electricity most discussed in the literature according to our preliminary research include those from the use stage. At this point, the EcoLogo$^{CM}$ Program leaves the scope and boundaries of the life cycle analysis open for discussion since as stakeholders, you might know of other stressors and impacts not currently addressed in this CDD.

## 6.2 Summary of Major Environmental Impact Categories and Related Stressors

Below you will find some of the major environmental stressors associated to water-powered electricity.

| Stage of the life cycle | Environmental Stressors (numbers in the table refer to specific section in the document) according to various Life Cycle Stages and Impact Categories | | | | | |
|---|---|---|---|---|---|---|
| | Energy | Resources | Emissions to | | | Other |
| | Renewable/ Nonrenewable | Renewable/ Nonrenewable | Water | Air | Soil | |
| Resource Extraction | | | | 6.3.2.1, 6.3.2.2 | | |
| Production | | | | 6.3.2.1, 6.3.2.2 | | |
| Distribution | | | | 6.3.2.1, 6.3.2.2 | | |
| Use | 6.3.2.5 | 6.3.2.5 | 6.3.1.2, 6.3.1.3, 6.3.1.4, 6.3.1.5, 6.3.2.3, 6.3.2.5, 6.3.2.6 | 6.3.2.1, 6.3.2.2, 6.3.2.5 | 6.3.1.3, 6.3.2.4, 6.3.2.5 | 6.3.1.1, 6.3.1.2, 6.3.1.3, 6.3.1.4, 6.3.2.5 |
| Disposal | | | | 6.3.2.1, 6.3.2.2 | 6.3.2.7 | |

## 6.3 Discussion Points on Major Environmental Impact Categories and Related Stressors

This section draws attention to the major environmental impact categories and stressors the EcoLogo$^{CM}$ Program intends to address in its revision of CCD-003. Each section below contains questions pertaining to the environmental impact categories and stressors under investigation.

### 6.3.1 Current Broad Environmental Impact Categories and Related Stressors under Review for Water-Powered Electricity

#### 6.3.1.1 Protection of Fish

CCD-003 already contains many provisions to protect fish. For example, it states that water-powered electricity must be generated in such a manner that the generating facility:

> (a) *operates in compliance with all regulatory licenses, regulatory requirements and/or other authorizations pertaining to fisheries (including, for facilities located in Canada, the Fisheries Act), without regard to waivers or variances that may be granted or authorize.*
>
> (c) *does not operate under any authorization with terms and conditions allowing the harmful alteration, disruption or destruction of fish habitat unless:*
>
> *i) such harmful alteration, disruption or destruction is not affecting the limiting factor controlling productive capacity,*
> *ii) loss of the affected habitat is compensated by the creation of similar habitat, supporting the same stock, at or near the development site within the same ecological unit such that the created habitat replaces lost productive capacity, within an approved safety factor.*

For facilities located in Canada, these conditional authorizations include those issued under Section 35(2) of the *Fisheries Act*, by the Minister of Fisheries and Oceans or under regulations made by Governor in Council under the *Fisheries Act*.

> (j) where a human-made structure is placed across a waterway where no natural barriers exist, provides fish passage when necessary for the purpose of maintaining pre-existing migration patterns for fish communities both upstream and downstream.

Fish protection is also addressed by other provisions in the *Product Specific Requirements* of CCD-003.

**1.Q)** Do you think that the criteria established in CCD-003 still represent environmental leadership for fish protection?

**2.Q)** Should the EcoLogo$^{CM}$ Program include a standard required percentage of fish survivorship in its CCD? If so, how and why? If not, why not?

#### 6.3.1.2 Cumulative Effects of Multiple Projects on a River

The potential cumulative effects of multiple hydro projects in a series on a river are addressed in *The Environmental Impact Statement Guidelines of the Lower Churchill Hydroelectric Generation Project* (Government of Canada and the Government of Newfoundland and Labrador, 2008) as such:

> *In cases where measures exist that are beyond the scope of the Proponent's responsibility that could be effectively applied to mitigate these effects, the Proponent shall identify these effects and the parties that have the authority to act. In such cases, the Proponent shall summarize the discussions that took place with the other parties in order to implement the necessary measures over the long term.*

This gives us an example of what is currently being done to mitigate cumulative effects.

Currently the EcoLogo$^{CM}$ Program mitigates cumulative effects similarly by stating that water-powered electricity must be generated in such a manner that the generating facility:

> *(d)* within practical limits and subject to regulatory direction and approval, ensures that plant operations are coordinated with any other water-control facilities that influence water levels and/or flows operating on the same waterway, in order to mitigate impacts and protect indigenous species and the habitat upon which they depend.

**3.Q)** Do you think that section 9 (d) of the current CCD is sufficient for mitigating negative impacts for series of hydro projects on a single river system? If so, why? If not, why and what would you propose instead?

#### 6.3.1.3 Impacts due to Changes in Water Flow

According to Power Scorecard (2000), hydro projects can change the flow of rivers which may in turn change sediment structure, flood wildlife, cause erosion of vegetation and soil, impact the natural growth and reproduction in many species, degrade shorelines, fisheries, waterfowl and other organisms, and affect the migration of certain fish like salmon.

Moreover, according to them:

> *These impacts can, at times, be mitigated by technological and operational enhancements to the hydro project - e.g., minimum flow turbines, re-regulating weirs, and pulsed operation at peak efficiency. Impoundments can be managed to create new upstream and downstream habitat for fish species and to provide minimum discharges and improved habitat during seasonal or annual drought conditions.*

Currently, CCD-003 mitigates the extent of the problem of changes in water flow by stating that water-powered electricity technologies or systems:

> *(e) as a maximum, causes as much water to flow out of the head pond as is received in any 48-hour period;*
>
> *In cases where this particular criterion cannot be met, the ECP will none-the-less consider certification if the applicant submits evidence that indicates those hydrological and ecological components key to sustainability of the surrounding watershed are maintained. As a minimum, this evidence must include environmental impact assessments and documentation from a formal public consultation process.*
>
> *In cases where neither of the above conditions is met, the applicant can opt to apply to a multi-stakeholder and public Electricity Review Process to demonstrate equal or lower adverse environmental impacts.*

**4.Q)** Do you think that the 48-hour shaping mentioned above is sufficient to mitigate the problems created by the changes in river flow caused by hydro projects? If so, why? If not, why not?

5.Q) Should facilities that meet alternatives methods for setting flows be EcoLogo$^{CM}$ certified? For example, should the *Aquatic Base Flow Methodology or the "good" habitat flow level under the Montana-Tennant Methodology* used by the Low Impact Hydro Institute also be accepted in CCD-003? If so, why? If not, why not?

#### 6.3.1.4 Protection of Indigenous Riparian and Aquatic Ecosystems

According to the Power Scorecard (2000):

> *Construction of a dam can flood riverside lands, destroying riparian and upland habitats. Construction of a dam can also convert river habitat into a lake-like reservoir, threatening native populations of fish and other wildlife. Warm, slow moving reservoirs favor predators of naturally occurring species. Dramatic changes in reservoir water levels…can degrade shorelines and disturb fisheries, waterfowl, and bottom-dwelling organisms.*

Currently several points in CCD-003 including points 9.c), i) and h) address the protection of indigenous and riparian aquatic ecosystems.

6.Q) Do you think that CCD-003 sufficiently addresses the protection of indigenous and riparian aquatic ecosystems? If so, why? If not, why not?

#### 6.3.1.5 Water Quality

According to the Environmental Literacy Council (2008):

> *Hydroelectric plants can also have an impact on water quality by lowering the amount of dissolved oxygen in the water. In the reservoir, sediments and nutrients can be trapped and the lack of water flow can create a situation for undesirable growth and the spread of algae and aquatic weeds.*

Freeman (2007) concurs by stating that lake eutrophication may occur due to hydro projects.

The Low Impact Hydro Institute explicitly states that hydro plants must demonstrate that they do not impair water quality.

CCD-003 addresses water quality by stating that:

> *(f)* operates such that water quality in a head pond, a bypassed reach, reaches downstream of the tailrace and reaches downstream of any diversion dams and/or dykes remains comparable to pre-project quality in unaltered bodies of water or waterways within the local watershed;

7.Q) Do you think that CCD-003 sufficiently addresses the protection of water quality? If so, why? If not, why not?

### 6.3.2 New Broad Environmental Impact Categories and Related Stressors for Water-Powered Electricity

#### 6.3.2.1 Greenhouse Gas Emissions

Generally, there are no atmospheric emissions from the hydroelectric generation itself. However, according to the Ontario Power Authority & SENES Consultants Limited (2005), flooding practices can result in methane emissions due to decomposition of vegetation within the flooded reservoir. Moreover, according to them, "Hydro Quebec estimates 15 kt $CO_2$ eq/TWh (0.015 tonne $CO_2$ eq/MWh) from flooded reservoirs and 2 kg $CO_2$ eq/TWh (0.002 tonne $CO_2$ eq/MWh) from run-of-river hydroelectric."

According to Bratrich et al. (2004), life cycle assessments have shown that "hydro power schemes in temperate regions produce an equivalent of about 3-4 t $CO_2$ per GWh (Frischknecht et al., 1994; Kaltschmitt and Wiese, 1997)." According to them, these are orders of magnitude lower compared to $CO_2$ emissions for oil and coal-fired power plants.

Alternatively, the Pembina Institute conducted a study of a dam project (Wuskwatim) in Manitoba and found, after a life cycle analysis, that greenhouse gas emissions were determined to be 290 less than coal and 130 times less than the most efficient natural gas generation technology (Schneider, 2007).

Moreover, Dey & Lenzen (2006), greenhouse gas emissions generated over the lifetime of hydro plants range between approx. 18 kg of $CO_2$ eq/kWh and 26 kg of $CO_2$/ kWh. They compared this the amounts emitted to conventional sources of energy which range from a minimum of 418 $CO_{2\ eq}$/kWh for fuel cell cogeneration to a maximum of 1033 $CO_{2\ eq}$/kWh for coal.

**8.Q)** Should the EcoLogo$^{CM}$ Program establish criteria for greenhouse gases emissions in CCD-003 for water-powered electricity? If so, how and why? If not, why not?

#### 6.3.2.2 $NO_x$ and $SO_x$ Emissions

According to Bratrich et al. (2004), life cycle assessments have shown that "hydro power schemes in temperate regions produce an equivalent of about 10 kg $SO_x$, and 10kg $NO_x$ per GWh (Frischknecht et al., 1994; Kaltschmitt and Wiese, 1997)."

**9.Q)** Should the EcoLogo$^{CM}$ Program establish criteria for $NO_x$ and $SO_x$ emissions in CCD-003? If so, how and why? If not, why not?

#### 6.3.2.3 Mercury Emissions

According to the Round Table on the Environment and the Economy, "bacteria present in decaying vegetation can also change mercury, present in rocks underlying a reservoir, into a form that is soluble in water. The mercury accumulates in the bodies of fish and poses a health hazard to those who depend on these fish for food (Environment Canada, 2006)."

**10.Q)** Should the EcoLogo$^{CM}$ Program identify environmental leadership for mercury for water-powered generating facilities? If so, how and why? If not, why not?

**11.Q)** Should the EcoLogo$^{CM}$ Program establish criteria for mercury for hydro-powered generating facilities? If so, how and why? If not, why not?

#### 6.3.2.4 Land Use

According to the Ontario Power Authority & SENES Consultants Limited (2005), different types of hydro facilities rank differently in terms of the extent of land use for the facility. They state that pumped storage and diversion generation options do not require land. Impounded generation, however, ranges between 0.082 to 0.19 $km^2$/MW. Compared to other electricity generation sources like biomass, impounded hydro sources rank as one of the worst for the amount of land used.

12.Q) Should the EcoLogo$^{CM}$ Program set a maximum threshold limit for land use in CCD-003? If so, why and how? If not, why not?

#### 6.3.2.5 Alternative Uses and/or Other Energy Options

According to Batrich et al. (2004), "the World Commission of Dams recommends that "an individual assessment is needed to evaluate new construction options and non-dam options should be preferred wherever possible." Also, some Environmental Impact Statement Guidelines do address the consideration of alternative uses (Government of Canada and the Government of Newfoundland and Labrador, 2008).

13.Q) Should CCD-003 also specify that alternative uses and/or other energy options must be evaluated prior to the development of a dam?

#### 6.3.2.6 Restoration

According to Bratrich (2004), "the certification of green hydropower should *not* subsidize new facilities but should be linked to money invested for restoration activities."

14.Q) Do you think that CCD-003 should include Bratrich's proposition regarding investments in restoration projects? If so, how and why? If not, why not?

#### 6.3.2.7 Hazardous Waste

According to Bratrich et al. (2004), no hazardous waste is produced during the decommissioning of a plant.

## 6.4 General Considerations

15.Q) Do you think that all of the significant environmental impact categories and their related stressors related to water-powered electricity have been properly addressed in this CDD? If not, which impact and/or stressor do you think is missing and why?

16.Q) Since the type of electricity covered under the "water-powered" category is generally known as "hydro-powered" electricity in the market and since we may include "tidal and wave-powered electricity" into CCD-003, do you agree that we should change the name "water-powered" to "hydro-powered"?

# 7 Performance Testing

17.Q) Do you know of performance tests the EcoLogo$^{CM}$ Program should be aware of for water-powered electricity?

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