

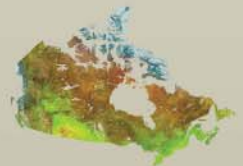
# RETScreen® International

Clean Energy Decision Support Centre  
[www.etscreen.net](http://www.etscreen.net)



Managed by the CANMET Energy Technology Centre - Varennes (CETC-Varennes)

## RETScreen® International: Results and Impacts 1996-2012



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

This report provides a brief overview of the *RETScreen® International Clean Energy Decision Support Centre*, it highlights results-to-date and it summarises an independent study that assesses the present and future impacts of RETScreen International.



# ► Highlights

## *Empowering cleaner energy decisions*

Since 1996, RETScreen International has had a number of notable achievements, including:

- Partnering with key Canadian and international organisations, such as the Renewable Energy Deployment Initiative, the Aboriginal and Northern Community Action Program, UNEP, NASA and the World Bank;
- Developing and disseminating the innovative *RETScreen International Clean Energy Project Analysis Software* to more than 40,908 people in 196 countries;
- Integrating enabling tools into the RETScreen Software, including international product, cost and weather databases; an online user manual; and an e-Marketplace;
- Creating a modular case study based college/university-level training course and an engineering e-Textbook for use by training organisations around the globe or by professionals and students in “self-study” distance learning format;
- Leading government efforts to provide products and services online, via the RETScreen Website;
- Delivering 95 training events across Canada and internationally, including 83 one-day professional training seminars and 12 two-day training-of-trainers workshops;
- Training 2,257 planners, decision-makers and other professionals to better analyse the technical and financial viability of possible projects;
- Building the capacity of 328 university/college professors and clean energy-training experts from industry to be local RETScreen trainers;
- Winning the Canadian Government’s prestigious 2001 – *The Head of the Public Service Award* for excellence in service delivery;
- Saving stakeholders an estimated \$240 million<sup>1</sup> in Canada and \$600 million worldwide through the use of the RETScreen software and related tools;
- Facilitating the implementation of roughly 320 MW of projects in Canada and 1,000 MW worldwide;
- Contributing to the deployment of clean energy technologies worth approximately \$750 million in Canada and \$1.8 billion worldwide; and
- Helping stakeholders take action to reduce greenhouse gas emissions in the order of 630 kT CO<sub>2</sub>/yr to-date and a projected 20 MT CO<sub>2</sub>/yr by 2012.

E Source Distributed Energy Service, Platts, a unit of The McGraw-Hill Companies, Inc.

**“RETScreen is one of the few software tools, and by far the best, available for evaluating the economics of renewable energy installations.”**

*Economic Evaluation Tools for Distributed Generation, Christine Hurley, December 2001.*

Performance Indicators	Present Impact (1998 to 2004)		Future Impact (1998 to 2012)	
	Canada	World	Canada	World
User Savings	\$240 million	\$600 million	\$1.8 billion	\$7.9 billion
Installed Capacity	320 MW	1,000 MW	4.9 GW	24 GW
Installed Value	\$750 million	\$1,800 million	\$10 billion	\$41 billion
GHG Reduction	130 kT CO <sub>2</sub> /yr	630 kT CO <sub>2</sub> /yr	3.6 MT CO <sub>2</sub> /yr	20 MT CO <sub>2</sub> /yr

<sup>1</sup> Currencies presented in this report are in \$CAD; \$1 CAD ≈ \$0.72 US ≈ €0.61 as of May 12, 2004.

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Harry Cleghorn, Cleghorn & Associates Ltd. – External Validation of Impact Assessment.

## Planning and Oversight Team for RETScreen International's Various Activities

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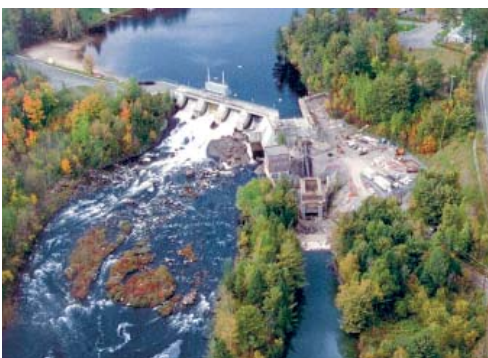
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Central American Bank for Economic Integration (CABEI), Honduras

“RETScreen was very helpful where we used the software tool to validate a new 6.5 MW small hydro project in Costa Rica. The Costa Rica project was already designed and the owners of the project had requested a loan from the bank. CABEI used RETScreen to do a due-diligence review of the loan application and the project was finally approved by CABEI’s Board of Directors.”

Rafael Tercero  
CABEI

## ► Objective & Strategies

*Building the foundation for sustainable development*

The *RETScreen International Clean Energy Decision Support Centre* seeks to build the capacity of planners, decision-makers and industry to implement renewable energy and energy efficiency projects. This objective is achieved by:

- developing decision-making tools that reduce the cost of pre-feasibility studies;
- disseminating knowledge to help people make better decisions; and by
- training people to better analyse the technical and financial viability of possible projects.

Numerous opportunities for implementing commercially viable energy efficient and renewable energy technologies (RETs) across Canada and around the world are currently being missed because various planners and decision-makers still do not routinely consider them at the critically important initial planning stage, even when these technologies have proven to be cost-effective and reliable in similar situations elsewhere. RETScreen International is focused on overcoming this barrier and building the foundation for sustainable development.

*Project Facilitated by RETScreen:*

### Wind Farm in Ireland (7 Turbines x 650 kW)

Solar Air Heating System  
for a School in Canada

**“The RETScreen analysis was critical in getting the renewable portion included with the structural and mechanical work.”**

John McKay, Manager  
Resource Conservation  
Coquitlam, BC

Sustainable Energy Authority  
of Ireland

2003 User Survey Summary:

**RETScreen Software used for 20 wind energy projects built or under construction, totalling 100 MW and an investment of \$210 million.**

Paul Kellett,  
Technical Manager

Photo credit:  
Sustainable Energy Authority  
of Ireland

## ► Partners & Budget

*Maximising impacts while minimising costs*



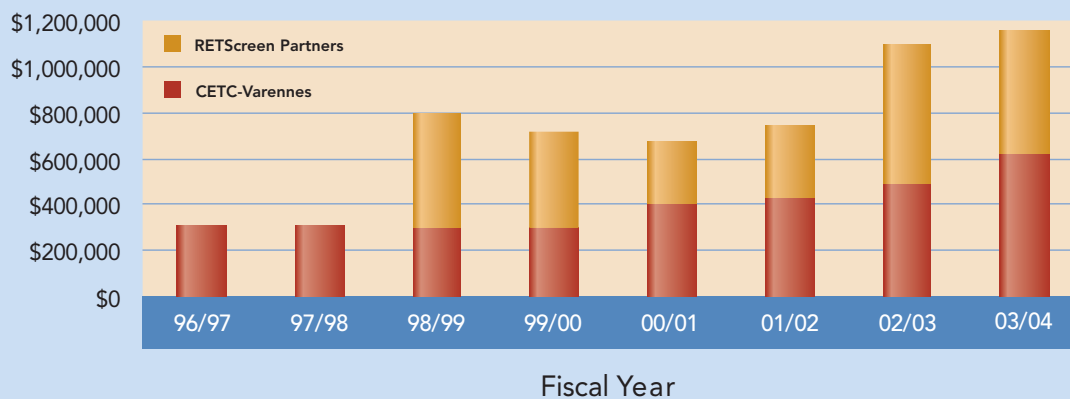
Canada

RETScreen International is managed under the leadership and ongoing financial support of NRCan's CANMET Energy Technology Centre – Varennes (CETC-Varennes) via cost and task shared collaborations with a number of other organisations, and with technical support from a large network of experts from industry, government and academia.

This partnership approach allows RETScreen International to leverage efforts with other government and multi-lateral agencies who share common objectives, and it expands resources and capabilities to develop and disseminate enabling tools that are too expensive and complex for individual firms to develop on their own.

Since 1996, CETC-Varennes (54%) and its' partners (46%) have invested \$5.8 million in RETScreen International and related activities.

### Source of Funds



RETScreen activities commenced in 1996 as the Renewable Energy for Remote Communities (RERC) Program. The mandate was subsequently expanded to cover other markets and the program was renamed the Renewable Energy Capacity Building Program (RECAP). In 2004, the mandate was further expanded to include energy efficiency, to align with NRCan's Clean Energy Strategy and to better meet client needs. To recognise this change, as well as to leverage the well-known RETScreen trademark<sup>3</sup>, the program was renamed the RETScreen International Clean Energy Decision Support Centre (or "RETScreen International" for short).



To-date, direct financial and/or significant task-share contributions have come from:

- **In Canada**, NRCan's Renewable Energy Deployment Initiative (**REDI**); Indian and Northern Affairs Canada (**INAC**)-NRCan Aboriginal and Northern Community Action Program (**ANCAP**); and NRCan's Refrigeration Program and Photovoltaic Program, both located at CETC-Varenes.
- **Internationally**, the United Nations Environment Programme's (**UNEP**) Energy Unit of the Division of Technology, Industry and Economics (**DTIE**) and the UNEP-Global Environment Facility (**GEF**) sponsored Sustainable Alternatives Network (**SANet**); National Aeronautics & Space Administration's (**NASA**) Langley Research Center; and the World Bank's Prototype Carbon Fund (**PCF**).

Other important task-share and/or indirect financial contributions have come from the UNEP Risø Centre on Energy, Climate and Sustainable Development (**URC**) in Denmark; the GEF co-financed, UNEP lead Solar and Wind Energy Resource Assessment (**SWERA**) project; NRCan's **CETC-Ottawa**; NRCan's Federal Buildings Initiative (**FBI**); the Federation of Canadian Municipalities (**FCM**); the Canadian International Development Agency (**CIDA**); the Barbados Ministry of Energy and Public Utilities (**MEPU**); the United States Agency for International Development (**USAID**); and the Korean Institute for Energy Research (**KIER**).

Many other similar organisations around the world are using the RETScreen Software and related tools for their clean energy deployment and capacity building initiatives.



### *Project Facilitated by RETScreen:*

## **Solarwall® on High School in Northern Canada**



Alaittuq High School  
in Rankin Inlet

*"The RETScreen software program was a key decision making tool when the Nunavut government approved the project."*

Brian McCluskey  
Special Projects Officer  
Arctic Energy Alliance,  
Yellowknife, NWT, Canada

Photo credit:  
Arctic Energy Alliance

## ► Core Competencies

*Pioneering the global shift to clean energy*



**“The [RETScreen] team has a proven track record of improving public access to practical information by means of innovative technology. This, combined with a genuine spirit of collaboration, has helped bring energy technology projects to a growing list of clients in high-priority areas”**

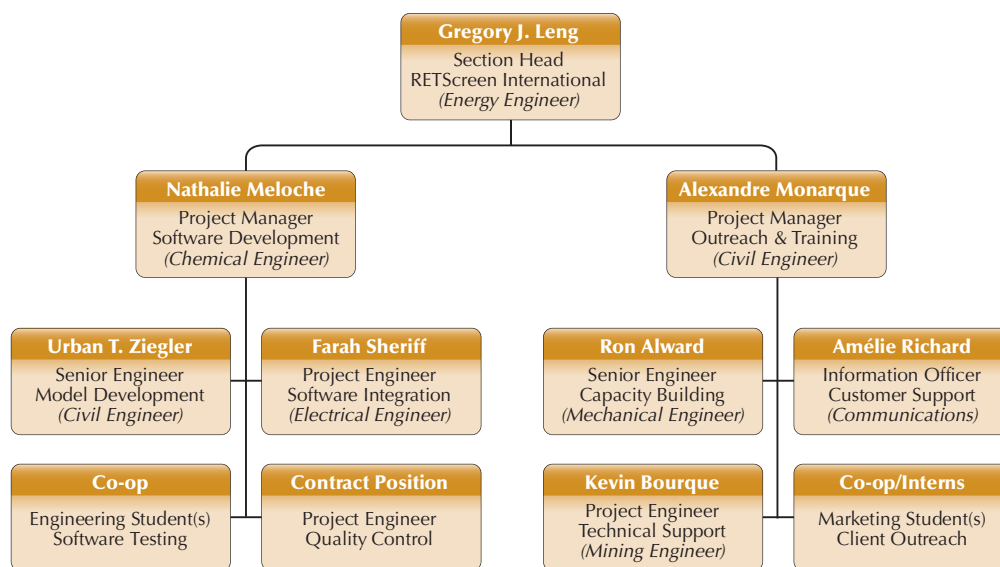
Canadian Government's  
2001- The Head of  
the Public Service Award  
for excellence  
in service delivery

A core team at CETC-Varenes provides the technical knowledge and management of RETScreen International, and a large network of experts from industry, government and academia provide technical support on a contracted or task-shared basis. This approach provides RETScreen International with access to a broad array of expert skills that are needed for specialised tasks.



In addition to this core team at CETC-Varenes, more than 140 additional people have been directly involved in the development and support of RETScreen International, with roughly 20 to 50 people working with the core RETScreen team during the course of the year. They include professional staff from the RETScreen partner organisations such as UNEP, NASA, the World Bank, and other Government of Canada programs; consultants from the firm GPCo; plus experts from a number of other private-sector firms, including Enermodal Engineering, Numerical Logics, TN Conseil, Ottawa Engineering, IT Power India, Umen, Cybercat and Projet Bleu, just to name a few.<sup>4</sup>

### RETScreen International Core Team<sup>5</sup>



<sup>4</sup> See Appendix A for a detailed list of experts involved in RETScreen International.

<sup>5</sup> The Section Head of RETScreen International reports to Dr. Gilles Jean, Director of CETC-Varenes.

The core team and network of experts include energy modelling specialists who help develop the individual technology computer models, cost engineering experts who have considerable hands-on experience with project installations, greenhouse gas modelling and baseline specialists with broad experience in economic and environmental analysis, and financial and risk analysis professionals with considerable experience in evaluating and financing projects.

Other experts include the team developing the ground station and satellite weather databases, as well as the product database. Additional experts validate the work done by the core development team of experts and others provide testing and debugging of the final products, as well as preparing case studies, e-Textbook chapters and training material for the course.

The team also includes numerous people involved in the overall software completion and Website development and a dedicated group involved in customer support and outreach.

Finally, hundreds of other people provide comments and suggestions for improvements to the RETScreen software on an on-going basis, and a growing international network of RETScreen trainers provide local training and technical support to users around the globe.

Canadian-based manufacturer of Solarwall®



**“I am happy to report that the great work being carried out by the RETScreen team is having a direct positive impact on my renewable energy business.”**

**John Hollick, President, Conservall Engineering**

Awards by the RETScreen Core Team	
2003	<b>The 5NR Science Award to Leaders in Sustainable Development</b> For outstanding contributions in federal science for sustainable development as member of the Renewable Energy Technologies Research and Development Team.
2001	<b>The Head of the Public Service Award</b> For excellence in service delivery as member of the Renewable Energy Capacity Building Program (RECAP) Team.
2000	<b>CANMET Energy Technology Branch Merit Award</b> For outstanding initiative in the establishment of the strategic partnership with the United Nations Environment Programme (UNEP).
2000	<b>Circumpolar Housing Forum – Northern Housing Award</b> In recognition of the important role that RETScreen is playing to eliminate barriers and in promoting renewable energies in northern communities.
1998	<b>NRCan Departmental Merit Award</b> For outstanding achievement as member of NRCan’s RETScreen Development Team.
1998	<b>NRCan Energy Sector Merit Award</b> For outstanding achievement as member of NRCan’s RETScreen Development Team.
1997	<b>NRCan Departmental Merit Award</b> For outstanding contribution as member of NRCan’s Renewable Energy Strategy Team.
1997	<b>NRCan Energy Sector Merit Award</b> For outstanding contribution as member of NRCan’s Renewable Energy Strategy Team.

# ▶ RETScreen Software

*Reducing the cost of pre-feasibility studies*

**“Excellent optional help and guidance features—as useful for the novice as for the experienced professional.”**

*Economic Evaluation Tools for Distributed Generation, Christine Hurley, December 2001.*

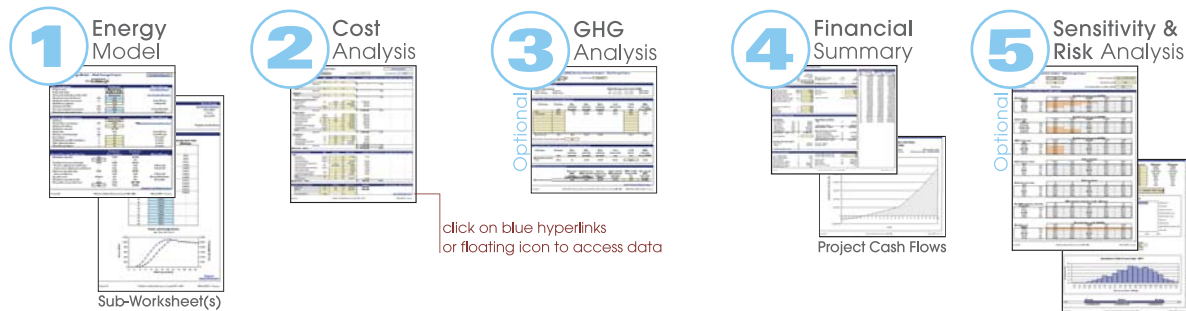
The *RETScreen International Clean Energy Project Analysis Software* can be used worldwide to evaluate the energy production, life-cycle costs and greenhouse gas emission reductions for various types of proposed energy efficient and renewable energy technologies (RETs).

All clean energy technology models in the RETScreen Software (e.g. Wind Energy Project Model, etc.) have a common look and follow a standard approach to facilitate decision-making – with reliable results<sup>6</sup>. Each model also includes integrated product, cost and weather databases and a detailed online user manual, all of which help to dramatically reduce the time and costs associated with preparing pre-feasibility studies.

For example, RETScreen was instrumental in helping CETC-Varenes and a team of eleven consulting firms prepare studies for 56 potential RET projects in Canadian remote communities<sup>7</sup> at a cost of less than \$2,000 each. Similar studies would otherwise have cost in the order of 5 to 10 times this amount! As a result, money saved is now being used to develop a number of these projects, with several projects already built.

## RETScreen Software Model Flow Chart

### Five Step Standard Analysis ➔



➔ Ready to make a decision

### Integrated Features

Weather Data



Product Data



Online Manual



- Training Course
- Engineering Textbook
- Case Studies
- Online Marketplace
- Internet Forums

<sup>6</sup> All RETScreen models have been validated by third-party experts and the results are published within the RETScreen Engineering e-Textbook.

<sup>7</sup> Alward, Ronald, *Remote Community Renewable Energy Technology Project Identification Initiative*. Final Report to CETC-Varenes, August 1999.

The RETScreen Software also facilitates project implementation by providing a common evaluation platform for the various stakeholders involved in a project. For example, numerous people in Canada and around the world report<sup>8</sup> using RETScreen for a variety of purposes, including: feasibility studies; project lender due-diligence; market studies; policy analysis; information dissemination; training; sales of products and/or services; project development & management; and product development/R&D.

To illustrate how this could work, the RETScreen Software files can be shared among the various project stakeholders via email. A consultant may be asked to prepare a RETScreen study for the project owner, such as an independent power producer (IPP). The IPP may then want to change input values as part of a sensitivity analysis of key parameters such as return on investment. The IPP may in turn be asked by the potential lender to submit the file to them so that they can perform the project due-diligence review. In parallel, the utility regulator may want the project file to verify the GHG estimates, and so on. The overall time and cost savings attributable to RETScreen are very important in terms of accelerating clean energy project implementation and market expansion.

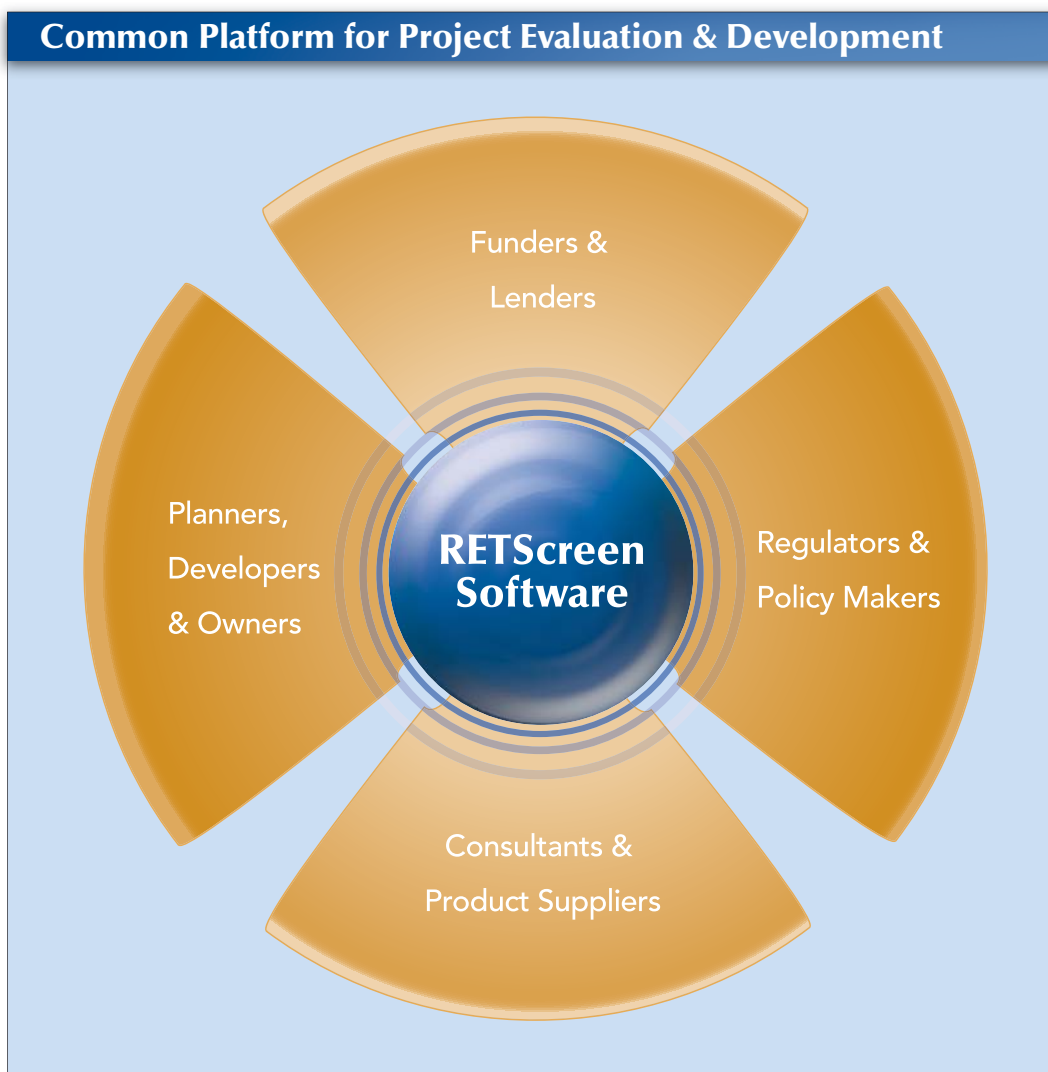
**Eagle Lake Micro Hydro Facility, District of West Vancouver, BC, Canada**



Photo credit:  
**BC Hydro Website**

**“The RETScreen spreadsheet was a very valuable tool, which allowed us to analyse the flow data, compare the different types of installations proposed by the various manufacturers we canvassed and to develop a business model for the proposed development, making very professional presentations to the staff and council of West Vancouver. It was a big part of bringing this project to fruition.”**

**Brian Chatfield,**  
Vice President  
Pacific Cascade Hydro Inc.



# ▶ Clean Energy Technology Models

## *Standardising the decision-making process*

The RETScreen Software can be used to evaluate industrial, commercial, institutional, community, residential and utility applications for the following technologies:

National Renewable Energy Laboratory (NREL), USA

“RETScreen was useful in completing feasibility studies and would use again in the future. It is a valuable tool for the renewable energy community and I applaud your making it freely available to interested users.”

Robi Robichaud,  
Senior Engineer

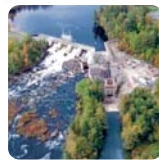
Canadian Association for Renewable Energies

“For those of us who promote renewables but do not actually install systems, RETScreen is a wonderful tool to obtain a ‘quick & dirty’ idea of the cost feasibility and GHG impacts from a wide range of applications.”

Bill Eggertson,  
Executive Director



**Wind Energy Project Model** for central-grid and isolated-grid connected projects, ranging in size from large-scale multi-turbine wind farms to small-scale single-turbine wind-diesel hybrid systems.



**Small Hydro Project Model** for central-grid and isolated-grid connected projects, ranging in size from multi-turbine small and mini hydro installations to single-turbine micro hydro systems.



**Photovoltaic Project Model** for on-grid (central-grid and isolated-grid PV systems); off-grid (stand-alone (PV-battery) and hybrid (PV-battery-genset) systems); and water pumping applications (PV-pump systems).



**Biomass Heating Project Model** for biomass and/or waste heat recovery (WHR) heating projects, from large scale developments for clusters of buildings to individual building applications. The model can be used to evaluate three basic heating systems using: waste heat recovery; biomass; and biomass and waste heat recovery combined.



**Solar Air Heating Project Model** for ventilation air heating and process air heating applications of transpired-plate solar collectors, from small residential to larger commercial/industrial scale ventilation systems, as well in the air-drying processes for various crops.



**Solar Water Heating Project Model** for domestic hot water; industrial process heat and swimming pools (indoor and outdoor), ranging in size from small residential systems to large scale commercial, institutional and industrial systems.



**Passive Solar Heating Project Model** for passive solar designs and/or energy efficient window use in low-rise residential and small commercial building applications, for either retrofit or new construction projects.



**Ground-Source Heat Pump Project Model** for heating and/or cooling of residential, commercial, institutional and industrial buildings, for both retrofit and new construction projects using either ground-coupled (horizontal and vertical closed-loop) or groundwater heat pumps.

RIA, RÅDGIVENDE INGENIØRER OG ARKITEKTER  
(Consulting Engineers & Architects), Denmark

“I’ve personally used RETScreen as an assessment tool. RETScreen makes an outstanding support tool for taking appropriate decisions while in pre-dimensioning and pre-design phases.”

Mauro Lucardi, Architect

Philippine National Oil Company (PNOC) Exploration Corporation, Philippines

“I found the program to be very valuable especially since our core competence is on oil and gas exploration and development. We are now starting to look closely and to develop our renewable energy sources. The program is easy to use and is expert enough to tell me how to correctly proceed.”

Eriberto Garcia, Engineering Manager

Advanced Measurements Inc., Canada

“We are using RETScreen to develop a remote sensor monitoring system with satellite and wireless communication abilities. We used RETScreen to help design the photovoltaic power supply systems. The compiled weather data and calculation abilities in one location was indispensable and significantly reduced development efforts/requirements.”

Gerry Beaudoin, System Integrator

### Project Facilitated by RETScreen:

## Photovoltaic Water Pumping System in Africa



### Upcoming Models:

■ Combined Heat & Power



■ Refrigeration



■ Commercial-Institutional  
Building Energy Audit Tool

■ Industrial Facility  
Energy Audit Tool

(see page 28)

Sasso s.n.c., Italy

“We have used RETScreen to design different solar pumping systems installed in Africa.”

Armando Martinez,  
Renewable Energy Consultant

Photo credit:  
Armando Martinez

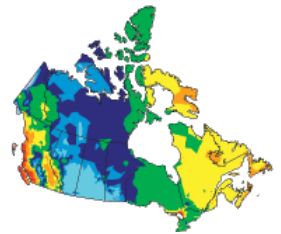




**NASA's Satellite-derived Meteorological Data** for any location on earth is provided for use with the RETScreen Software via the NASA Surface Meteorology and Solar Energy (SSE) Data Set. This data set, developed by NASA in collaboration with RETScreen International, is a useful alternative when ground-based data, or detailed resource maps, are not available for the project location. The NASA data set is formulated from data gathered for the 10-year period from July 1983 to June 1993. The original data are calculated using a 2 to 2.5 degree size grid, and the SSE data is then interpolated to a 1-degree cell. At mid-latitudes (45°), the cell size is therefore approximately 80x110 km<sup>2</sup>.

**Hydrology Data** for more than 500 Canadian river gauges (from Environment Canada) are available within the Small Hydro Project Model, including regional flow-duration curves and specific run-off maps prepared using Water Survey of Canada data. For other project locations, hydrology data from other sources are entered manually into the worksheets.

**Product Data** has also been incorporated directly into the RETScreen Software. This integrated RETScreen International Online Product Database provides users access to contact information for more than 1,000 clean energy technology manufacturers around the globe, including direct Website and email links from within the RETScreen Software. In addition, the database provides access to pertinent product performance and specifications data for a number of these manufacturers. A companion Internet-based **e-Marketplace** provides contact information for clean energy service providers located around the globe.



### *Project Facilitated by RETScreen:*

## **Solar Water Heating at Vancouver International Airport**



**100 Glazed Solar Collectors  
Near the Control Tower**

**“RETScreen helped  
Taylor Munro Energy  
Systems recommend  
the appropriate  
technology for a solar  
water heating system  
at Vancouver  
International Airport.”**

**Morgan McDonald, Taylor  
Munro Energy Systems Inc.**

Photo credit:  
**Larry Goldstein, Vancouver  
International Airport Authority**

# ► Training Material

## *Presentation Slides, e-Textbook & Case Studies*

Course:  
Wind Technology – SYS865  
École de technologie supérieure  
- Université du Québec  
Montreal, QC, Canada

**“The RETScreen Software was used in a Master Degree-level course at ÉTS to teach graduate students how to assess the viability of wind energy projects.”**

Prof. Christian Masson, Ph.D.  
Canada Research Chair  
– Wind Energy Aerodynamics  
in the Northern Environment

McMaster University,  
Hamilton, ON, Canada

**“I am a PhD candidate at McMaster University. I would recommend the program to anyone doing a study of renewable energy sources and I think that it could be used very effectively as a teaching tool for undergraduate students.”**

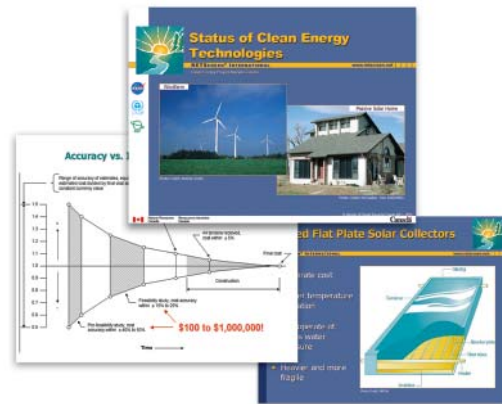
Laura Beaton,  
Ph.D. Candidate

Training material for a modular case study-based *Clean Energy Project Analysis Course* has been created for use by recognised educational centres and training organisations around the globe, as well as for use by professionals and college/university students in “self-study” distance learning format.

Each module can be presented as a separate seminar or workshop for professionals, or as a section of a college/university course. All the modules combined can be presented either as a one to two week long intensive course for professionals or as a one to two semester long course for college/university students.

In addition to the PowerPoint Slides, the training material also includes the electronic textbook *Clean Energy Project Analysis: RETScreen Engineering & Cases*. Written for professionals and university students who are interested in learning how to better analyse the technical and financial viability of possible clean energy projects, the e-Textbook covers each of the technologies in the RETScreen Software, including a background of these technologies and a detailed description of the algorithms found in each of the RETScreen software clean energy technology models.

A collection of **clean energy project case studies** is also provided to complement the training material and to facilitate the use of the RETScreen Software. These case studies include assignments, worked-out solutions and information about how the projects fared in the real world.



Presentation Slides



e-Textbook



Case Studies

# Using RETScreen for Education

## *A Sample of Colleges and Universities*

Country	College/University	Course/Program Information
<b>Argentina</b>	Universidad Nacional de Tucumán	Graduate Projects, Architecture and Urban Planning
<b>Australia</b>	Murdoch University	Energy Online Courses
<b>Bahrain</b>	University of Bahrain	Faculty of Engineering
<b>Canada</b>	Carleton University	Process Analysis, Civil & Environmental Engineering
<b>Canada</b>	École de technologie supérieure Université du Québec	Wind Technology, Mechanical Engineering
<b>Canada</b>	HÉC Montréal	Sustainable Energy Technologies, M.B.A. Energy Sector Management
<b>Canada</b>	McGill University	Environmental Engineering, Civil Engineering & Applied Mechanics
<b>Canada</b>	Mohawk College	Renewable Energy Workshop
<b>Canada</b>	Queen's University	Thermal Systems Design, Mechanical Engineering
<b>Canada</b>	Seven Generations Education Institute/ Lambton College	Renewable Energy Certificate Program
<b>Canada</b>	University of Northern British Columbia (UNBC)	Energy Development, School of Environmental Planning
<b>Canada</b>	University of Ottawa	Energy Conversion, Mechanical Engineering
<b>Canada</b>	Université de Sherbrooke	Climate Change & Energy, Master Degree in Environment
<b>Canada</b>	Willis College of Business & Technology	Renewable Energy Certified Professional
<b>Finland</b>	Helsinki University of Technology (HUT)	Solar Energy Engineering, Advanced Energy Systems
<b>Ghana</b>	Kwame Nkrumah University of Science and Technology (KNUST)	Graduate Projects, Mechanical Engineering
<b>Greece</b>	University of Piraeus	Industrial Management
<b>India</b>	Indian Institute of Technology (IIT) – Roorkee	International Course on Small Hydro Power Planning
<b>Ireland</b>	Tipperary Institute	Certificate in Renewable Energy, Rural Development Department
<b>The Netherlands</b>	University of Twente	Masters in Energy & Environmental Management
<b>Russia</b>	Moscow Power Engineering Institute	Faculty of Water Power Engineering & Renewable Energy
<b>Thailand</b>	Asian Institute of Technology (AIT)	Solar Energy Course, Energy Field of Study
<b>UK &amp; China</b>	University of Ulster & the Hong Kong University of Science and Technology	Postgraduate Diploma and Masters in Renewable Energy
<b>USA</b>	University of California - Berkeley	Renewable Energy, Energy & Resources Group



RETScreen training at the Asian Institute of Technology (AIT) in Thailand.



Prof. S.C. Bhattacharya of AIT presenting RETScreen.



RETScreen training material used by AIT.

Photo credit:  
**Asian Institute of Technology**

# ▶ RETScreen Outreach & Training

*Raising awareness and building capacity*

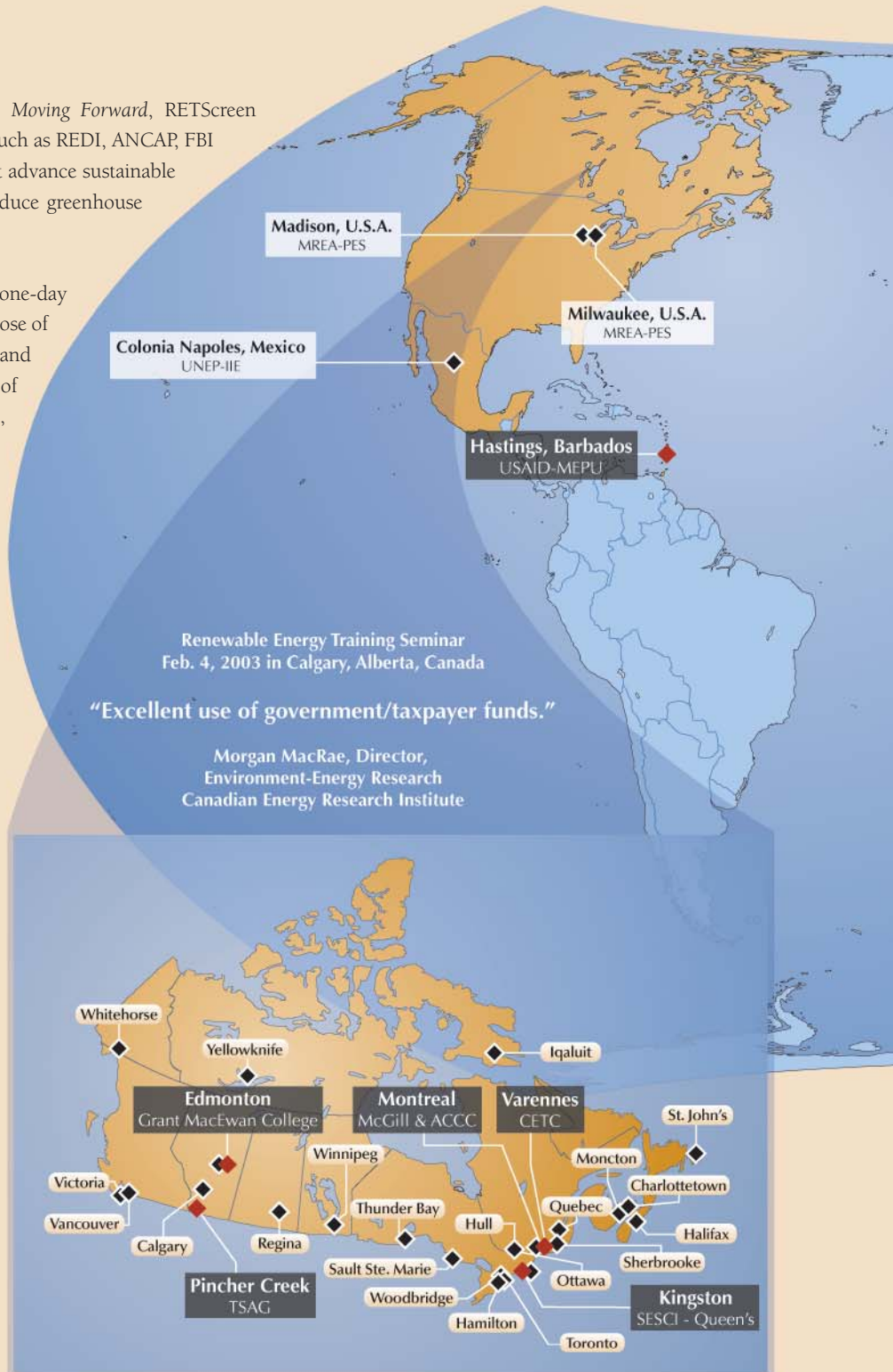
## Activities in Canada

As part of NRCan's *Sustainable Development Strategy: Moving Forward*, RETScreen International co-operates with its' partners in Canada, such as REDI, ANCAP, FBI and FCM, to help Canadians make better decisions that advance sustainable development, while enabling them to take action to reduce greenhouse gas emissions.

More than 1,913 Canadians have been trained at 72 one-day *RETScreen Training Seminars* across Canada. The purpose of these seminars was to increase the awareness of public and private sector stakeholders regarding the availability of cost-effective applications of clean energy technologies, and to strengthen their capacity to perform high quality and low-cost preliminary feasibility studies using the RETScreen software. Post-training technical support was also provided to facilitate project implementation in places such as Aboriginal, northern and remote communities; at federal and municipal government facilities; and in developing countries.

An independent report<sup>9</sup>, as well as surveys completed by participants, have shown a high level of satisfaction and a strong demand to continue this training across Canada.

Location	Participants	Seminars
Calgary, AB	158	5
Charlottetown, PEI	63	2
Edmonton, AB	62	2
Halifax, NS	87	4
Hamilton, ON	48	2
Hull, QC	29	1
Iqaluit, NU	7	1
Kingston, ON	27	1
Moncton, NB	37	2
Montreal, QC	270	10
Ottawa, ON	204	7
Quebec, QC	84	4
Regina, SK	25	2
Sault Ste. Marie, ON	40	2
Sherbrooke, QC	96	3
St. John's, NF	21	2
Thunder Bay, ON	17	1
Toronto, ON	188	6
Vancouver, BC	173	5
Victoria, BC	50	2
Whitehorse, YT	57	2
Winnipeg, MB	112	4
Woodbridge, ON	13	1
Yellowknife, NT	45	1



<sup>9</sup> David, Vincent, Vincent David & Associates Inc., Federal Renewable Training Workshops Survey 2001, Final Report to CETC-Varennes, January 2002.

2,585 people trained at  
95 RETScreen training events

- ◆ RETScreen Trainer Workshop (2-days)
- ◇ RETScreen Training Seminar (1-day)



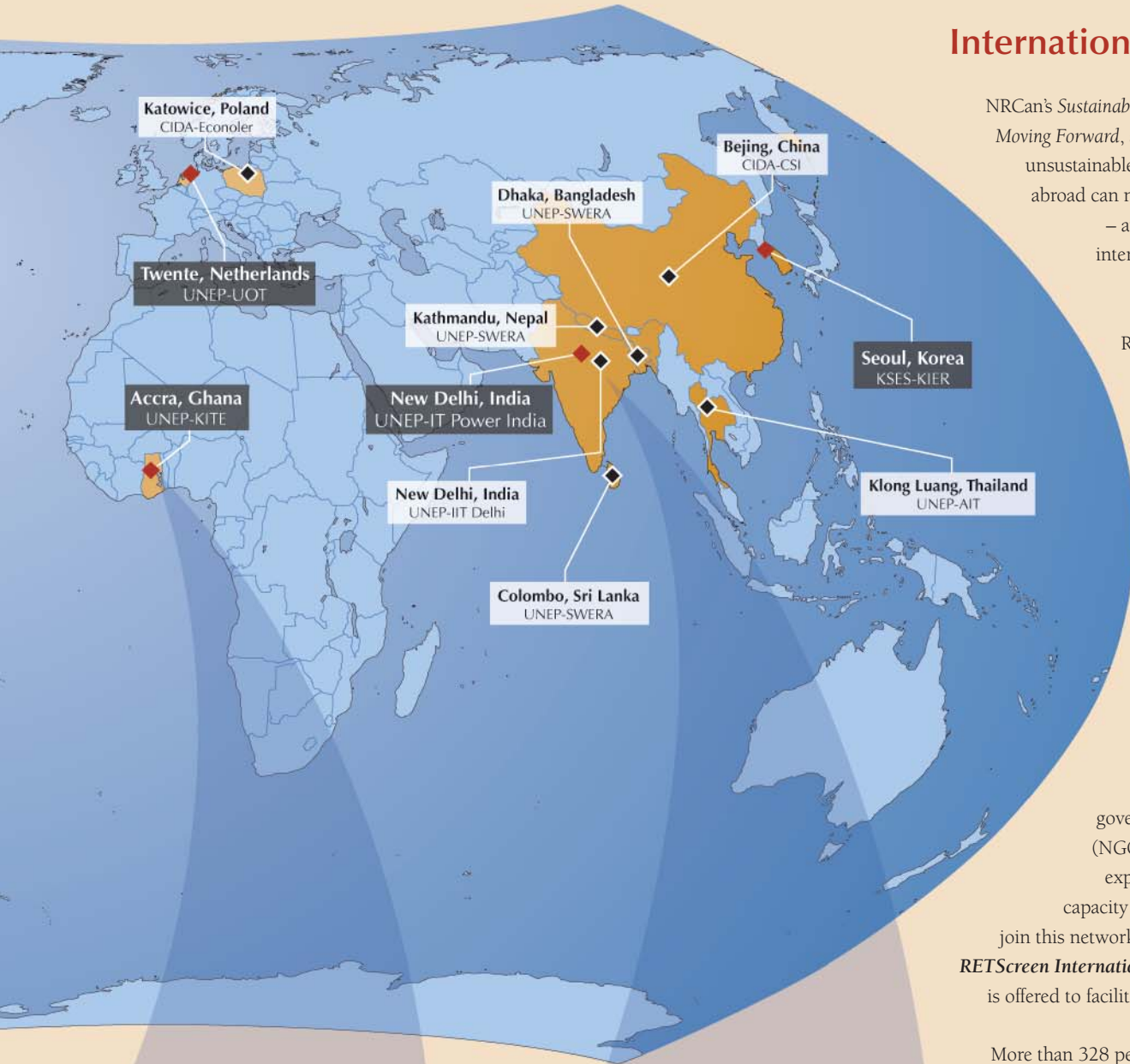
USAID-MEPU - Barbados



UNEP-UOT - Netherlands



CETC-Varenes - Canada



## International Activities

NRCan's *Sustainable Development Strategy: Moving Forward*, addresses the issue that unsustainable resource development abroad can negatively affect Canada – and that it is in Canada's interest to build sustainable development capacity abroad. In this context, RETScreen International is collaborating with UNEP and other international and Canadian partners to build an international network of RETScreen trainers.

University and college professors, as well as professionals from industry, government and non-governmental organisations (NGOs) who have extensive experience in clean energy capacity building, are invited to join this network. An intensive two-day *RETScreen International Trainer Workshop* is offered to facilitate knowledge-transfer.

More than 328 people from 35 countries have attended one of the 12 workshops delivered to-date, including 147 trainers from Canada and 181 from abroad.



UNEP-sponsored training in Africa



UNEP-sponsored training in Asia

## ► Website & User Statistics

*A model of Government On-Line*

“The [RETScreen] site was an early model of the way government should provide information and services on-line, and the project is still several years ahead of the objectives of the Government On-Line initiative.”

Canadian Government’s 2001  
– The Head of the  
Public Service Award  
for excellence  
in service delivery

The *RETScreen International Clean Energy Decision Support Centre Website* is the primary distribution and communication point for RETScreen International, where people can access all products and services available, including the complete suite of decision-making and capacity building tools; register via an Online Calendar for upcoming courses, workshops and seminars delivered by the international network of RETScreen trainers; as well as search or add information to a e-Marketplace and Forum which helps to promote the implementation of clean energy projects by connecting industry, customers and project stakeholders together via the Internet.

The RETScreen Website operates on a high-speed server at CETC-Varenes. It is fully automated and linked to an extensive customer database that allows RETScreen International to service a very large number of stakeholders while simultaneously monitoring the performance of outreach and training efforts.

**RETScreen Website**

Natural Resources Canada / Ressources naturelles Canada

Canada Site / NRCan Site

Français	Contact Us	Help	Search	Canada Site
Home	Download Free	Calendar	Marketplace	NRCan Site

**Centre Overview**

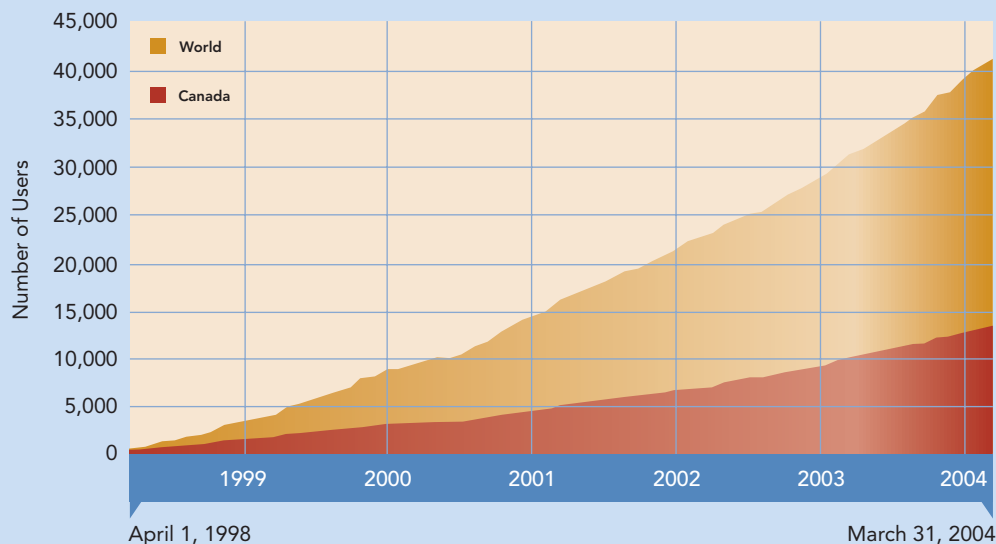
- WIND ENERGY
- SMALL HYDRO
- PHOTOVOLTAICS
- COMBINED HEAT & POWER
- BIOMASS HEATING
- SOLAR AIR HEATING
- SOLAR WATER HEATING
- PASSIVE SOLAR HEATING
- GROUND-SOURCE HEAT PUMPS
- REFRIGERATION

**RETScreen® International**  
**Clean Energy Decision Support Centre**

Managed by the CANMET Energy Technology Centre - Varennes (CETC-Varennes)

NASA UNEP GEF

## RETScreen Software: Cumulative Growth of User Base



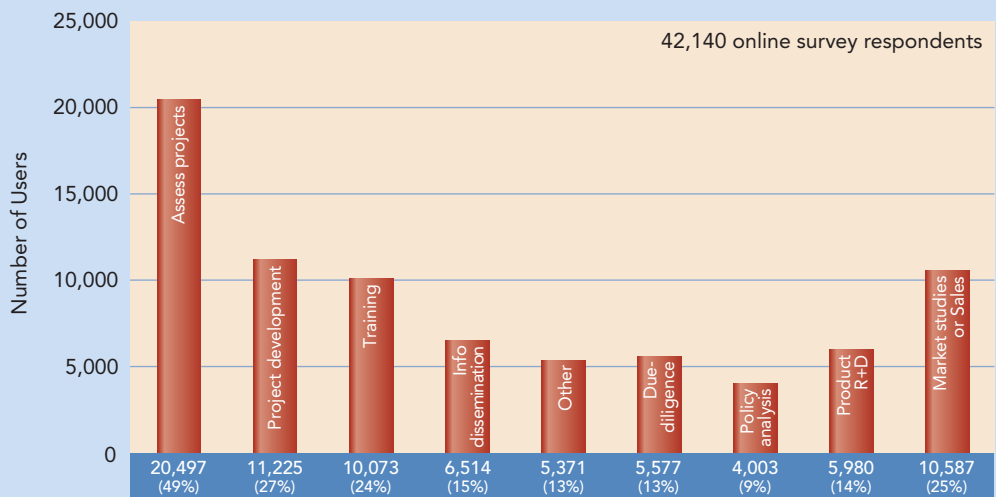
**40,908 users worldwide  
from 196 countries**

Growing at 200 users  
every week

Top Ten Countries		
1	Canada	13,232
2	USA	5,832
3	France	3,557
4	UK	1,653
5	Spain	1,381
6	Australia	995
7	Italy	849
8	Germany	731
9	Belgium	577
10	India	527

As of March 31, 2004

## RETScreen Software: Reported Intended Use



### Profile of Users

#### Type 1 - Implementers (36%)

20% Professional services  
10% Project developer/  
owner  
6% Product suppliers

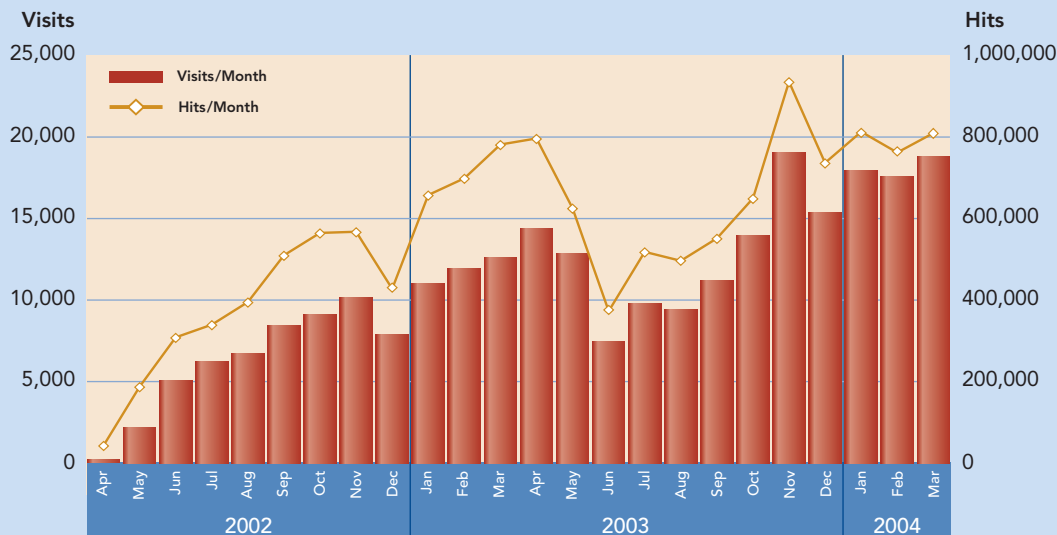
#### Type 2 - Facilitators (28%)

19% Educational institution/  
R&D Centre  
6% Financial/Government/  
Multi-lateral  
3% Association/NGO

#### Type 3 - Individuals (36%)

As of March 31, 2004

## RETScreen Website: Example of Knowledge Transfer



- 13,550,676 total number of hits since April 2001

- 187,062 total number of visits

- 304,523 documents downloaded

- Growing at 8,912 documents downloaded every week

- NASA SSE Website use has increased more than 10 fold due to RETScreen Software users accessing satellite data

As of March 31, 2004

## ▶ RETScreen User Surveys

*1,150 MW of projects built or under construction*

Archemy Consulting Ltd.,  
Canada

“I used RETScreen PV for the calculations for Red River College, Princess St. Campus 12.3 kW BIPV system.

I have also used RETScreen SWH, SAH and PSH extensively for solar design projects in China. These are great calculators. They give quick energy results and helpful cost and GHG figures from an early stage.”

David Rousseau,  
Green Buildings Consultant

Inti Tech Solar, Costa Rica

“The professional format of the reports generated from RETScreen was one of the key factors in obtaining this (PV system) contract. We have also found that the real life output of the solar systems is very consistent with the energy model from RETScreen.”

Jason Borner, Owner

SGA Energy Ltd. was commissioned by Natural Resources Canada to independently assess the impacts of RETScreen International<sup>10</sup>.

Two surveys were performed to support the SGA impact analysis. The first survey was a **telephone survey** conducted by SGA in January 2004 that was designed to gather information on *attributed* user savings. The telephone survey was to 15 prominent RETScreen users representing both implementers and facilitators (described in detail on the next page).

The average reported **annual savings experienced from using RETScreen was \$34,257 per user for project implementers and \$7,872 per user for facilitators**. These data provided SGA a basis for estimating annual user savings amongst implementers and facilitators. To account for uncertainties relating to the sample survey, and to maintain a conservative approach to estimating the impact of RETScreen, the annual savings per user were reduced by 67%, from \$34,257 to \$11,400 for implementers, and \$7,872 to \$2,600 for facilitators. Individual users were ascribed a nominal savings value of \$100 annually. Assumptions by SGA about the portion of RETScreen users by type are based on RETScreen user profile statistics presented on page 23 of this report.

The second survey performed to support the results and impact analysis was an **email survey** conducted in December 2003 by CETC-Varenes, and validated by SGA, that requested amongst other things the capacity of clean energy projects built or under construction that could be *associated* with the use of RETScreen. The survey was distributed to 31,500 RETScreen users and 665 users responded. Quotes from some of the respondents are presented throughout this report.

In order to incorporate this survey into the independent SGA impact assessment report, SGA audited and validated reported installed capacities. Auditing took the form of a brief inspection of the credentials of the organisation or individual to ensure they did work in the clean energy field, and to ensure that double counting of capacity did not occur and those capacity additions were “real.” The focus of the audit was on the larger projects that represent roughly 80% of the survey’s total resulting capacity.

After verification by SGA, 140 respondents reported 616 projects built or under construction where RETScreen was used to help facilitate the project implementation. These projects have a **cumulative installed capacity of 1,150 MW**. Some examples of these projects are presented on pages 26 and 27 of this report.<sup>11</sup>

<sup>10</sup> Graham, Stephen and Steve Higgins, SGA Energy, *An Impact Assessment of RETScreen International 1998-2012*, Final Report to CETC-Varenes, April 2004. Study validated by Dr. Harry Cleghorn of Cleghorn & Associates Ltd.

<sup>11</sup> Note that projects presented in this report are only a sample from organisations that gave permission to publish their individual responses. Survey responses provided information on many other projects that have been built or that are under construction. However, specifics of these projects cannot be presented in this report for reasons of commercial confidentiality.



# SGA Telephone Survey Results & Analysis

## Type 1 - Project Implementers:

Project implementers are those directly involved in the implementation of clean energy projects (engineers, planners, product suppliers, etc.). Project implementers are most likely to benefit from RETScreen as an integrated tool that quickly supports decision-making at the pre-feasibility level of analysis. The ability to quickly evaluate and rule out projects represents large savings for implementers. The portion of RETScreen users that are implementers is 36%.

According to the SGA telephone survey, some of the implementers involved in sales find that RETScreen improves their presentation to the client by providing a financial analysis and offering a semi-independent view of the project making the seller more credible. This standard approach to analysis and results presentation provides benefits by quickly presenting a go/no-go decision.

Other major areas of savings for implementers relate to the software's ability to provide a common platform for project development, including coming to agreement among various parties; project development; training; and the ability to compare several suppliers quickly through the product database. Further areas of 'value' indicated in the telephone survey include: projects becoming feasible due to a lower feasibility study cost; allowing some implementers to begin to participate in clean energy projects; allowing existing implementers to work on lower value projects.

According to the SGA telephone survey, RETScreen users savings at the pre-feasibility and feasibility stages of projects are in the range of \$3,700 to \$132,000/year/implementer. The SGA telephone survey among experienced project implementers indicate for each project implemented approximately 5 projects will have a pre-feasibility assessment completed. The survey found an average annual savings of \$34,257 per implementing user. Because of the non-random nature of the survey and without the capability to verify results more closely SGA chose to reduce this value by 67% to \$11,400 in selecting an average savings per implementing user.

*Portion of RETScreen users that are implementers: 36%*

*Assumed annual savings per implementing user: \$11,400*

## Type 2 - Facilitators:

Facilitators are those users that use RETScreen for purposes other than directly installing technology including uses for education, policy development and so on. Facilitators represent 28% of the total RETScreen users (see "RETScreen Software: Reported Intended Use" statistics on page 23 of this report).

According to the telephone survey results, RETScreen is seen as a valuable education and training tool providing savings in curriculum development for educators and with an excellent ability to quickly build capacity amongst students. Students in training programs are reported to have experienced time savings when performing case studies. A variety of public service employees use RETScreen training sessions and RETScreen software to help them gain an appreciation for the quickly changing landscape of renewables and to prepare policy studies. The SGA survey found an average annual savings of \$7,872 per facilitator. Again, because of the non-random nature of the survey and without the capability to verify results more closely SGA chose to reduce this value by 67% to \$2,600 in selecting an average savings per facilitating user.

*Portion of RETScreen users that are non-implementers: 28%*

*Assumed annual savings per facilitators user: \$2,600*

Further areas of 'value' indicated in response to the telephone survey include: increased trainers that enter the field due to the comprehensive course material; increased trainees that can take courses because of the wide availability of courses and materials.

## Type 3 - Individual Users:

Individuals make up roughly a third of the remaining RETScreen users. SGA assumed that these individuals are non-implementers and primarily benefit from increased awareness that RETScreen brings. To be conservative in the approach to calculating RETScreen impact, a very low benefit has been accorded to these users (\$100/year). The telephone survey did not include this primarily economic value.

*Portion of RETScreen users that are individuals: 36%*

*Assumed annual savings per individual user: \$100*

# Canadian Projects Facilitated by RETScreen

*A Sample of 2003 Survey Results<sup>12</sup>*

	Country	Organisation	Description	Size	Value (\$ Million)
	Canada	Abbotsford, BC – School District 34	Solar air heating	400 m <sup>2</sup>	\$0.1
	Canada	Archemy Consulting Ltd.	Solar/wind electric Solar thermal	21 kW 215 m <sup>2</sup>	\$0.3
	Canada	Arctic Energy Alliance	Solar air heating (4 projects)	408 m <sup>2</sup>	\$0.2
	Canada	Brown, Allen – Building Owner	Solar water heating	500 m <sup>2</sup>	\$0.2
	Canada	Coquitlam, BC – School District 43	Solar air heating (9 projects)	1,050 m <sup>2</sup>	N/A
	Canada	DGV Engineering Services Inc.	Small hydro (3 projects)	35 MW	\$63.0
	Canada	EMCO Corporation	Earth energy (4 projects)	115 kW	\$0.1
	Canada	Enermodal Engineering Ltd.	Solar/wind electric Biomass/earth energy	54 kW 200 kW	N/A
	Canada	Environment Canada – MSC - Atlantic	Wind energy Solar water heating	37 kW 36 m <sup>2</sup>	N/A
	Canada	Generex Hydro Inc.	Small hydro	5 MW	\$6.0
	Canada	Howell-Mayhew Engineering Inc.	Photovoltaics	6 kW	\$0.1
	Canada	Interpac Resources Ltd.	Small hydro	29 MW	\$28.0
	Canada	Ledcor Power Inc.	Small hydro (3 projects)	54 MW	\$120.0
	Canada	Pacific Cascade Hydro Inc.	Small hydro	200 kW	\$0.5
	Canada	Ron Quick & Associates	Biomass power	3 MW	\$4.5
	Canada	Siemens Building Technologies	Solar air heating (3 projects)	2,790 m <sup>2</sup>	\$0.9
	Canada	Solarnetix Inc.	Solar thermal & PV (15 projects)	215 m <sup>2</sup> 4.8 kW	\$0.5
	Canada	TN Conseil	Solar air heating Solar water heating	30 m <sup>2</sup> 1,000 m <sup>2</sup>	\$0.1
	Canada	WindShare	Wind energy	750 kW	\$1.8
	Canada	Current Generation Inc.	Wind energy	10 to 20 MW	N/A
<b>Total</b>				<b>≅ 127 MW 6,704 m<sup>2</sup></b>	<b>\$226.3</b>

Examples from Canadian  
Aboriginal, Northern and  
Remote Communities

<sup>12</sup> This table represents only a sample of the organisations that reported projects built or under construction via the CETC-Varennes December 2003 RETScreen user email survey.

# International Projects Facilitated by RETScreen

*A Sample of 2003 Survey Results<sup>13</sup>*



Country	Organisation	Description	Size	Value (\$ Million)
<b>Australia</b>	Power and Water Corporation	Photovoltaics Wind energy	890 kW 50 kW	\$18.0
<b>Brazil</b>	Negawatt Ltda	Small hydro	4 MW	\$6.0
<b>Costa Rica</b>	Inti Tech solar	Photovoltaics (32 projects)	40 kW	\$0.5
<b>Czech Republic</b>	Hydrohrom	Small hydro (2 projects)	2 MW	\$2.0
<b>Denmark</b>	RIA – Consulting Engineers & Architects	Photovoltaics (10 projects)	250 kW	N/A
<b>Estonia</b>	Generaator E&K LLC	Micro hydro (2 projects)	500 kW	\$ 0.3
<b>France (other)</b>	Electricité de France - Centre d'Ingénierie Hydraulique	Small hydro Wind energy	27 MW 7 MW	\$42.0
<b>Guatemala</b>	Electroriente, S.A.	Small hydro	3.5 MW	\$7.5
<b>Ireland</b>	<b>Sustainable Energy Authority of Ireland</b>	<b>Wind energy (20 projects)</b>	<b>100 MW</b>	<b>\$210.0</b>
<b>Greenland</b>	Tele Greenland A/S	Wind energy Photovoltaics	24 kW 8 kW	\$0.2
<b>India</b>	IT Power India	Photovoltaics Small hydro	89 kW 1 MW	\$4.0
<b>Italy</b>	Seriana Servizi	Biomass power (12 projects)	48 MW	\$108.0
<b>Mauritania</b>	Agence d'Accès Universel aux Services	Photovoltaics Micro hydro	4 kW 5 kW	\$0.1
<b>New Zealand</b>	PCM Solectric Co. Ltd.	Photovoltaics (75 projects)	N/A	\$0.1
<b>Nicaragua</b>	Comisión Nacional de Energía	Mini hydro (8 projects)	12 MW	\$18.0
<b>Russia</b>	SKIF-TECH Ltd.	Earth energy (3 projects)	320 kW	\$0.6
<b>Romania</b>	SPERIN	Wind & solar thrm. (12 projects)	8.4 MW 80 m <sup>2</sup>	\$21.0
<b>Spain</b>	Regional Government	Solar water heating (3 projects)	120 m <sup>2</sup>	\$0.1
<b>Senegal</b>	ASERA	Wind energy Photovoltaics	9 kW 5 kW	\$0.5
<b>United States</b>	Artha Renewable Energy	Solar water heating (10 projects)	560 m <sup>2</sup>	\$0.3
<b>Total</b>			<b>≅ 215.1 MW 760 m<sup>2</sup></b>	<b>\$439.2</b>

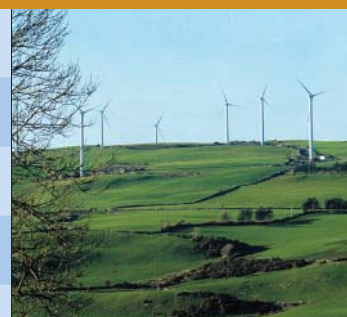


Photo credit:  
**Sustainable Energy Authority of Ireland**

Q1: To date, how many potential projects have you evaluated using RETScreen?

**A1: Over 80 [projects]**

Q2: How many of these potential projects have now been built and/or are currently under construction?

**A2: 12 Built and 8 Under Construction**

Q3: What is the total installed cost (\$US) of the projects built and/or under construction?

**A3: 100 MUSD Built and 40 MUSD Under Construction**

Q4: Per technology, what is the total installed capacity of the projects built and/or under construction?

**A4: Wind energy (MW):  
70 MW Built and  
30 MW Under Construction**

**Paul Kellett, Technical Manager  
Sustainable Energy Authority of Ireland**

<sup>13</sup> This table represents only a sample of the organisations that reported projects built or under construction via the CETC-Varenes December 2003 RETScreen user email survey.

## ► Work Plan for 2004 to 2008

### *New energy efficiency tools & expanded outreach*

RETScreen International has in place a plan to further develop and disseminate the suite of RETScreen tools and services, with a particular emphasis on developing a series of decision-making tools for energy efficiency applications, as well as a plan to significantly increase the use of the tools internationally. Several of these activities are already funded and are well underway, and increased funding will be sought from existing and new partners to support an expansion of these activities.

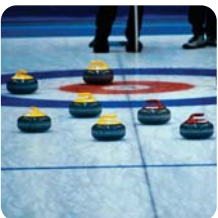
#### Over the next four years, RETScreen International will:

- Develop and disseminate a new advanced version of the RETScreen software and related tools in collaboration with UNEP and PCF. **RETScreen Version 3.0** upgrades include a metric/imperial unit switch; updated product data; an enhanced GHG model to account for the emerging rules for carbon finance; and a new Sensitivity & Risk Analysis worksheet. The Wind Energy and Small Hydro Project Models were released in June 2004, with the other existing models to be upgraded over the next two years.



- Develop and disseminate a new RETScreen **Combined Heat and Power (CHP) Project Model** and related tools in collaboration with UNEP and PCF. The CHP Model, which is well advanced, is highly flexible. It can be used to evaluate any one or combination of the following applications: power; heating; cooling; single buildings or multiple buildings; industrial processes; communities; district heating and district cooling. Further, it permits analysis with a wide range of renewable and non-renewable fuels (which can be used in parallel), including landfill gas; biomass; bagasse; biodiesel; hydrogen; natural gas; oil/diesel; coal; municipal waste, etc. Finally, these fuels can be evaluated using multiple types of power, heating and/or cooling equipment, including reciprocating engines; gas turbines; gas turbine combined cycle; steam turbines; geothermal; fuel cells; micro turbines; boilers, compressors, absorption chillers, etc., all working under various operating conditions (base load, intermediate load and/or peak load). The CHP Model will be released in English in the October 2004 timeframe, with the French version to follow in 2005.

- Develop and disseminate a new RETScreen **Refrigeration Project Model** and related tools in collaboration with the CETC-Varennes Refrigeration Action Program for Buildings (RAPB). The Refrigeration Model, which is in the initial stages of development, will allow the user to evaluate refrigeration systems for commercial and institutional buildings, such as grocery stores, hockey arenas, curling rinks and food storage facilities. For example, it is possible to provide all of the heating needs of these types of buildings, including heat for occupied spaces, ventilation air and feed water, by recovering heat rejected from refrigeration systems. The Refrigeration Model will be released in 2005.



- Develop, translate and disseminate a multi-lingual version of the RETScreen software and related tools (e.g. Spanish, Mandarin, Korean) in collaboration with new funding partners. The development has commenced on a pilot basis in collaboration with the CIDA funded project with Canadian Solar Inc. (CSI) in China, for a new RETScreen **PV Project Model – Mandarin Version**.
- Initiate the development of a new RETScreen **Commercial-Institutional Building Energy Audit Tool** and a new RETScreen **Industrial Facility Energy Audit Tool** in collaboration with new funding partners.
- Continue to work with NASA, UNEP-GEF and the International Energy Agency (IEA) to develop and disseminate **International Meteorology Data Sets & Renewable Energy Resource Maps for RETScreen**. This includes ongoing activities to integrate NASA's global satellite Surface Solar Energy and Meteorology Data Set and the new NASA Prediction Of World Energy Resource (POWER) project results with RETScreen; integrating UNEP-GEF's Solar and Wind Energy Resource Assessment (SWERA) project results for a number of developing countries with RETScreen; and integrating IEA Small-Hydro.com's International Small Hydro Atlas (managed by CETC-Ottawa) with RETScreen.
- Develop and disseminate an **e-Learning** version of the *Clean Energy Project Analysis Course* created in collaboration with UNEP, for use by planners, decision-makers, educators, students and industry personnel in self-study distance learning format.
- Continue to provide ongoing capacity building and project facilitation services to the Aboriginal and Northern Community Action Program (ANCAP) managed by INAC and NRCan, to help encourage the use of renewable energy and energy efficient technologies by **Canadian remote, northern & Aboriginal communities**.
- Establish a new **RETScreen International Outreach and Training Initiative (RIO+)** in collaboration with UNEP and new funding partners in Canada and abroad. This includes a proactive international marketing effort aimed at significantly increasing the dissemination and use of the RETScreen software and related tools. This initiative also includes delivering multiple RETScreen Trainer Workshops around the globe to help build the international network of RETScreen trainers. The target is to have 500 educators worldwide using RETScreen for training by 2008 and 1,000 by 2012.



SWERA Website



Canadian Remote Communities



Graduates of the UNEP-sponsored RETScreen training seminar at the Asian Institute of Technology (AIT) in Klong Luang, Thailand.

# ► Impacts of RETScreen International (1998 - 2012)

Environment Canada  
Atlantic Region

“RETScreen proved very useful to help us determine whether we should look more closely into wind energy. With our hot water solar energy project, we modeled multiple scenarios with RETScreen to help determine how many solar panels were appropriate, based on a reasonable economic return.”

Steve Szabo, Manager,  
Climate Change Division

The impacts of RETScreen International have been assessed by the firm SGA Energy Ltd. for both the present (1998 to 2004) and future (1998 to 2012) and for Canada and the World<sup>14</sup>. Future impacts were considered under two RETScreen funding scenarios; discontinued funding and continued funding at existing levels. For the two time periods, RETScreen impact was evaluated against four performance indicators; the cumulative user savings that can be *attributed* to RETScreen International as a result of people using of the software and related tools; the cumulative installed capacity of clean energy projects built that can be *associated* with RETScreen use<sup>15</sup>; the cumulative installed value of these projects; and finally, the annual greenhouse gas emission reductions of the clean energy projects built that can be associated with RETScreen use. SGA reports that they have chosen to be conservative in their approach to this analysis to maintain report credibility. As such, the study intentionally underestimates the impact of RETScreen International.

## Present Impact (1998 to 2004)

SGA used the RETScreen user surveys (telephone & email), RETScreen user statistics and independent data from industry and government to estimate the performance indicators. To be conservative, emission factors used in estimating the annual GHG reduction are based on gross emissions from all electricity generation and heating sources in Canada including non-emitting sources<sup>16</sup>. This means that annual CO<sub>2</sub> savings, particularly on a World basis, will be underestimated since Canada in its suite of heating and electricity generation technologies uses large components of low or no emitting hydro, nuclear and natural gas. That is Canada's emission factors are low when compared to the world.

Performance Indicators	Present Impact (1998 to 2004)	
	Canada	World
User Savings	\$240 million	\$600 million
Installed Capacity	320 MW	1,000 MW
Installed Value	\$750 million	\$1,800 million
GHG Reduction	130 kT CO <sub>2</sub> /yr	630 kT CO <sub>2</sub> /yr

These estimates are very conservative considering that the RETScreen user email survey showed an associated installed capacity of 1,150 MW for the World, for just 665 people who responded to the survey. The SGA estimate of 1,000 MW does not include possible projects installed by the 40,000+ other RETScreen users who did not complete the email survey. Obviously, the associated installed capacity; installed value; and GHG emission reductions to-date are much larger than reported here. But even using this conservative approach, the estimated impacts are relatively large.

<sup>14</sup> SGA estimates of World impacts are for the entire world, that is they include Canada.

<sup>15</sup> RETScreen International is not considered as being the causal factor in the installation of clean energy technologies or in the reduction of greenhouse gases. Rather RETScreen International is considered as being associated with those indicators since RETScreen software and related tools were involved in the path to technology installation or GHG Reduction.

<sup>16</sup> Environment Canada, GHG Trends Information 1990 to 2001 (heating = 0.03 Tonnes/GJ and electricity = 0.22 Tonnes/MWh).

## Future Impact (1998 to 2012): Discontinued Funding Scenario

Future impacts were considered under a discontinued funding scenario to help SGA calculate the total estimated impacts of the \$5.8 million investment to-date by NRCan's CETC-Varenes and its' partners in RETScreen International.

If funding were discontinued immediately, it is assumed that all current activities in the RETScreen Core Team would cease. All support and promotion activities, updates of existing models and development of new models would end. In this scenario it was assumed that a minimum presence would be maintained on the Website, limited to making software models available. SGA suggests that to maintain software such as RETScreen in the rapidly changing software industry requires constant support, updates and inputs. What is more, SGA concluded that the proactive promotion, training and support of the RETScreen office have been effective in contributing to the exponential increase in users. Without the aforementioned support SGA predicts that it is likely that RETScreen software use would experience a sharp and rapid decline, ending entirely in about 2010.

However, even under this discontinued funding scenario SGA predicts that software momentum would still continue to propel the effectiveness of RETScreen up to 2010 when any likely impact increments would cease. Total cumulative savings would be in the order of \$580 million in Canada and about \$2.1 billion worldwide. RETScreen would have been involved in the development and installation of 1 GW of clean energy projects in Canada and 2.9 GW in the World. Annual CO<sub>2</sub> savings associated with these installations would be 480 kT and 1.9 MT in Canada and the World respectively.

## Future Impact (1998 to 2012): Continued Funding Scenario

SGA reports that if funding was to continue at the current level of approximately \$1.1 million annually and the existing work plan for promotion and model development were put in place, **an exponential rise in impacts of RETScreen International can be expected**, as presented on page 33 of this report. SGA suggests that as with most products in a market economy, RETScreen software penetration can be expected to conform to an "S" curve pattern. In Canada, therefore, penetration of existing models will likely begin to reach saturation in 2008. SGA concludes that planned new models, however, will likely have a very large and immediate impact amongst expanded markets. These will add substantially to user uptake of the RETScreen software. In the World, penetration of existing models will not reach saturation for the foreseeable future and growth potential is substantial. SGA suggests that the addition of new models will only increase the relevance and user base of RETScreen. For the purpose of this analysis SGA assumed that current budgets limit the ability to reach out to potential markets outside of Canada, so it is assumed that the market penetration rate of the RETScreen software abroad will be at a more moderate rate than that has taken place in Canada.

Electric Utility and the  
New RETScreen CHP Model  
Beta Test

**"I believe that use of the CHP Model will speed up delivery of our new Bioenergy Performance Optimization Program, reduce costs for feasibility assessments/studies and hopefully gain customer commitment for CHP. In turn, the cost savings for program delivery can be re-allocated to other aspects of the program, such as incentives towards the CHP's capital cost and/or resources for measurement and verification of the CHP after installation."**

D. R. St. George, M.Sc., P.Eng.  
Biosystems Engineer  
Manitoba Hydro

Under the Continued Funding scenario SGA predicts that it is likely that despite the saturation of existing models in Canada the “effectiveness” of the software will continue to increase. That is, because of improvements to the software, growth of clean energy opportunities and increasing skills of seasoned users, the users of RETScreen will nearly double their effectiveness in implementing clean energy projects by 2012. Increased effectiveness can also be expected for global users. As well the addition of new models will add substantially to the use and impact of the software.

SGA concludes that the continued funding scenario will lead to 3 times the user savings and be associated with at least 7 to 10 times the annual GHG reduction compared to a discontinued funding scenario, as presented in the following table.

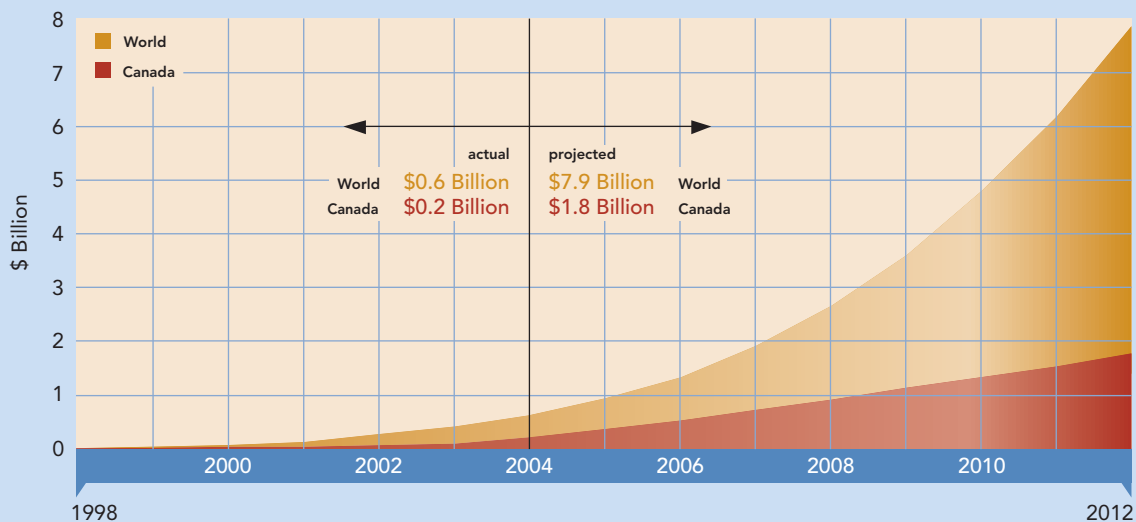
### Future Impacts Under Different Funding Scenarios: 1998-2012

Performance Indicators	Discontinued Funding		Continued Funding	
	Canada	World	Canada	World
User Savings	\$0.6 <sup>17</sup> Billion	\$2.1 Billion	\$1.8 Billion	\$7.9 Billion
Installed Capacity	1.0 GW	2.9 GW	4.9 GW	24 GW
Installed Value	\$2.3 Billion	\$6.6 Billion	\$10 Billion	\$41 Billion
GHG Reduction	0.5 <sup>18</sup> MT CO <sub>2</sub> /yr	1.9 MT CO <sub>2</sub> /yr	3.6 MT CO <sub>2</sub> /yr	20 MT CO <sub>2</sub> /yr

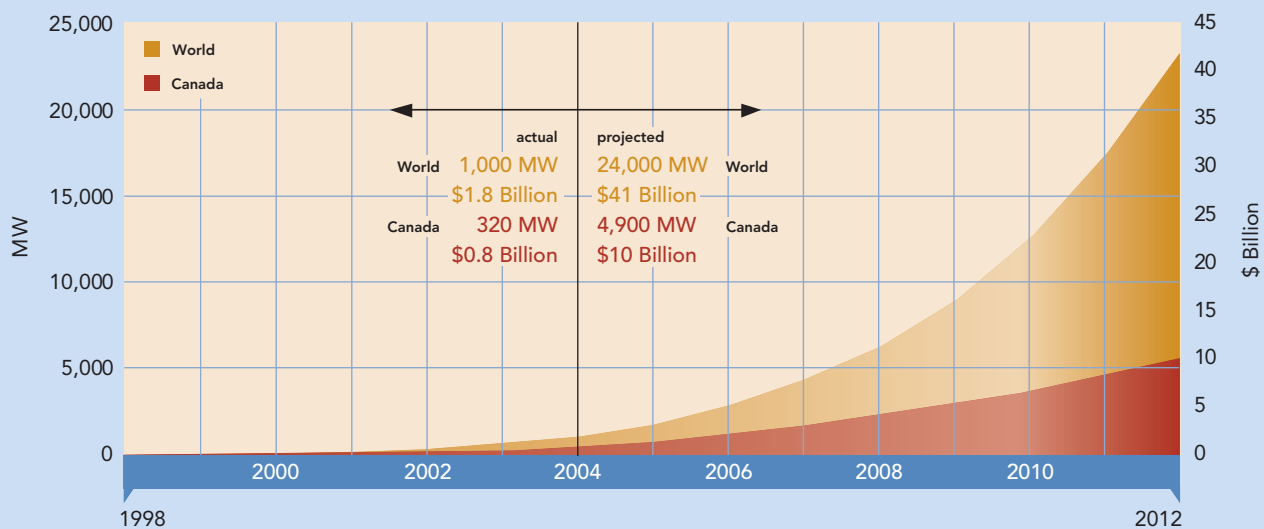
When comparing the continued funding and discontinued funding scenarios, SGA concludes that a further investment of roughly \$10 million through 2012 will help save Canadians a net \$1.2 billion and \$5.8 billion for RETScreen users worldwide. SGA concludes that in Canada, by 2012, RETScreen International impacts will grow exponentially after 2004 where its use can be expected to have provided \$1.8 billion in savings to Canadian users and been conservatively associated with 4.9 GW of new clean energy installations in Canada. The value of these, added to energy efficiency measures associated with RETScreen use, will be in the order of \$10 billion. Annual CO<sub>2</sub> savings in Canada as result of these measures will be at least 3.6 MT. For the World, impacts will be substantially higher. For example, CO<sub>2</sub> savings associated with RETScreen International are conservatively estimated by SGA as 20 MT/yr in 2012.



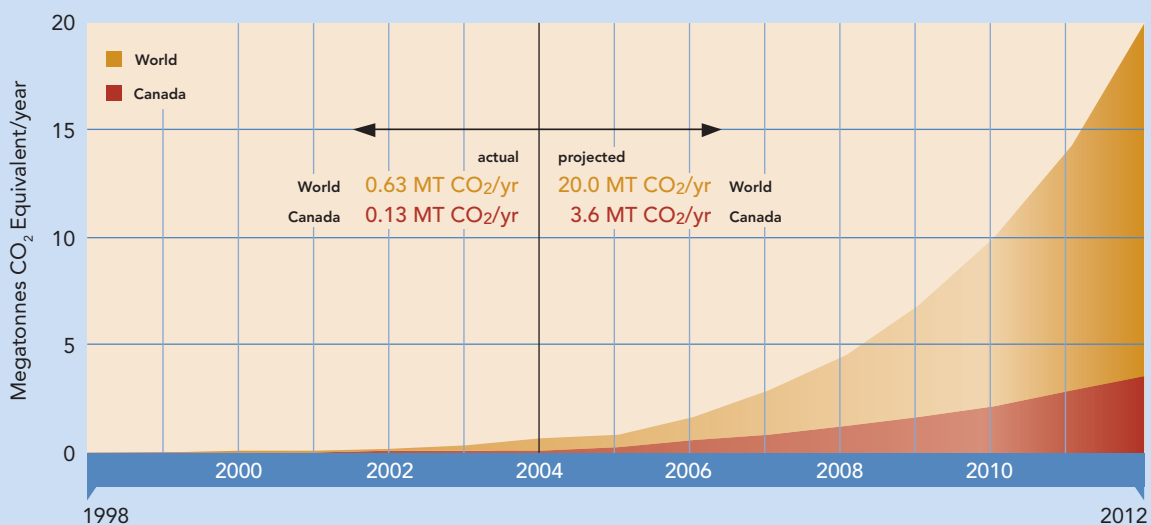
## Cumulative User Savings Attributed to RETScreen



## Cumulative Capacity & Value of Projects Associated with RETScreen



## Annual GHG Emission Reductions Associated with RETScreen





#### RETScreen and the G8 Renewable Energy Task Force

“despite existing effort in the public and private sectors and ambitious plans, the market for renewables remains limited. Efforts in both public and private sector are largely fragmented and dispersed and could be improved with greater co-ordination.”

“...there is sufficient interest among developed and developing country public and private sector for more co-ordination and stronger links through common codes, rules, and procedures, to build global market conditions. RETScreen is a tool to enhance such market coherence (Case Study 27).”

Clini, Corrado and Moody-Stuart, Mark, *Renewable Energy: Development That Lasts*, 2001 G8 Renewable Energy Task Force Chairmen's Report, page 39, 2001.

## ► Conclusions

The use of RETScreen significantly reduces the cost and increases the precision of pre-feasibility studies and contributes to the formulation of more fully informed decisions prior to project implementation. By developing this enabling tool in digital format, and then disseminating it free-of-charge via the Internet and CD-ROM, Natural Resources Canada dramatically accelerates the transfer of technology across Canada and around the globe, maximising impact while minimising costs.

Even with the conservative approach followed in the impact assessment, SGA concludes that RETScreen has had a significant impact on all indicators since the software and related tools have been available. Under a continued funding scenario, SGA estimates that the RETScreen software will have a substantial influence on the global clean energy industry and an exponential rise in the impacts of RETScreen International can be expected.

RETScreen International is making a significant contribution to sustainable development in Canada and throughout the world in line with NRCan's Sustainable Development Strategy, by transferring a Canadian developed technology that is increasing and improving access to clean energy technologies, building awareness & capacity, and helping to identify opportunities that facilitate the implementation of energy projects that save people money, while reducing greenhouse gas emissions.

*RETScreen International  
Empowering cleaner energy decisions*

Photo credits:

1 William Palmer,  
TRI-LEA-EM  
Environmental and Wildlife  
Conservation Visitor Centre

2 Armando Martinez,  
Sasso s.n.c.  
PV Waterpumping in Africa

3 Jeff Deloyde,  
University of Waterloo  
Solar Technology  
Education Project (STEP)

4 David Rousseau,  
Archemy Consulting Ltd.  
Red River College, Princess  
St.Campus BIPV System

5 Armando Martinez,  
Sasso s.n.c.  
Solar Water Heating  
and PV for Alpine Hut

### *Projects Facilitated by RETScreen:*



## ► Appendix A

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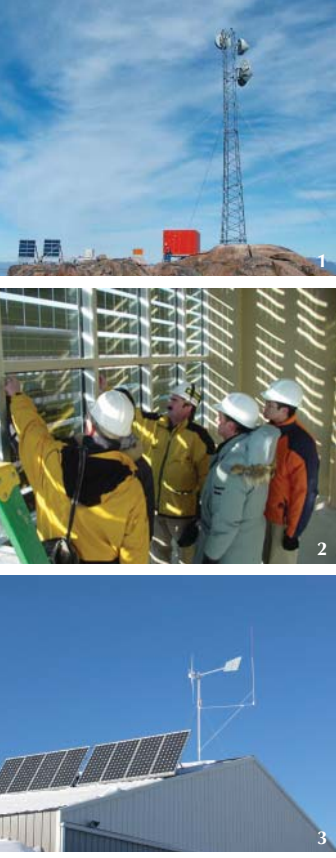
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- 1 Steen Grossman,  
Tele Greenland A/S
- 2 David Rousseau,  
Archemy Consulting Ltd.  
Red River College, Princess  
St.Campus BIPV System
- 3 David Kelly,  
Sedmek Inc.  
Hybrid Wind/PV System
- 4 Steen Grossman,  
Tele Greenland A/S

*Projects Facilitated by RETScreen:*





RETScreen software was used for North America's first urban-based wind turbine (750 kW), installed at the Canadian National Exhibition grounds in Toronto.

Photo credit: Toronto Hydro/WindShare



[www.retscreen.net](http://www.retscreen.net)