

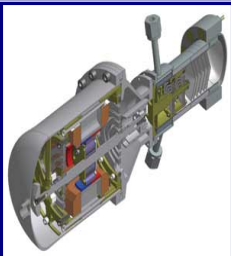


CANADIAN BOILER SOCIETY NEWSLETTER

THE CANADIAN BOILER SOCIETY MEMBER COMPANIES

ABB Inc.
 ANRIC Enterprises Inc.
 Aqua Chem Cleaver Brooks of Canada
 Armour Valve Limited
 Ashland Drew Industrial Div.
 Babcock & Wilcox Canada
 Bigelow-Liptak of Canada
 Boiler Inspection & Insurance Co.
 CH Ljungberg Inc.
 Clayton Sales & Service
 Enbridge Consumers Gas
 Fireye Inc.
 Foster Wheeler Canada
 Fuel Master Burner Div, Pendell Boiler
 Independent Metals & Alloys Inc.

Innovative Steam Technologies
 Johnson Paterson Inc.
 Klenzoid Co. Ltd.
 KMW Systems Inc.
 Lipten Energy Canada Inc.
 McRae Engineering Equipment
 Miura Boiler Co. Ltd.
 Quality Tube Supply Ltd.
 Superior Boiler Works Welding
 Thermogenics Inc.
 Union Gas
 Vapor Power International
 Waterloo Manufacturing Co. Ltd.
 Weishaupt Corporation



*A Stirling
 engine
 generator
 set follow-
 ing this
 design
 passed a
 landmark
 last sum-*

*mer: 87, 600 hours, or 10
 years, of operation without
 maintenance or a decline in
 performance, its
 manufacturer said.*

*For the full ASME article,
 go to page 5*

News from the Chairman - David Duthie

We have had a fairly busy year and we hope a productive year for your association.

The CBS Membership is up slightly which will help to make this society stronger. Foster Wheeler, who were previous members, are one of our newest members this year. Their continued support and input with issues concerning and/or affecting the industry and future boiler market will be an added bonus to the society.

Another added bonus to the society is that both gas utilities are now CBS members. The CBS hopes to work more closely with both utilities to present seminars and/or campaigns which will encourage and educate customers on cleaner and more efficient boiler operation.

During the last year, there were organized meetings with TSSA. These meetings were very significant in resolving regulatory issues and resolving concerns regarding the safety boiler design upgrades. Both meetings were well attended. We hope to continue this movement with regulator bodies. All members are invited to bring forward issues of concern in their market sector.

The CBS website is in full operation. I hope that all members have had the chance to review their own description, and other areas on the site. The site is attracting inquiries which is good marketing for all members. All general inquiries that come in will be forwarded to the appropriate member companies. All concerns or updates should be directed to the CBS office.

The board of directors work hard to organize events during the year to bring members a value in belonging to this boiler association. I would like to take this opportunity to thank all members of the board for their efforts this past year, and look forward to a productive new year.

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News from the President - Richard Barnes

It is a pleasure to welcome you and your associates to the 82nd Annual General Meeting and to present the Annual President's Report.

Introduction

Last year I listed areas of impact or change facing the CBS and its members. These same areas still challenge us today but there has been progress. To keep these areas before you I have listed them again:

1. Changes in approach from the way CBS has operated in the past
2. New Issues for Industry in which CBS can assist its members
3. Change in the President's role
4. Impact of the new website
5. The impact of a Business Office providing meeting facilities and visual presence
6. Changes in the membership and the costs associated with this change
7. Approaches by other organizations to work together more closely in areas of common interest.
8. Development of a closer working relationship with the jurisdictions.

AGM – Technical Meeting

CBS in the past has been very dependent on two or three contributors. This was especially true in the technical area. Lorne Smith has done an excellent job over many years and still continues to contribute in a significant way. With Lorne's retirement, Glen Adgey heads up this area and he is attempting to spread the work around amongst the Board Members and if possible involve the Members themselves. Glen has had some success in this area and if you who are listening wish to participate, please contact Glen. If you have any ideas where CBS involvement will be of value, please mention your ideas to Glen.

Newsletter

CBS now has a regular Newsletter which we are attempting to make interesting and of value to our members. We need your input about the areas you would like to see it cover and the articles and stories that would be of interest. Louise McColeman, who is the CBS Administrative Assistant and Event Coordinator, has done an excellent job developing the newsletter and finding articles of interest. We are at present producing two issues per year. Maybe that is enough but it really needs your feedback.

We want you to contribute and further we would like you to advertise in the newsletter. We would like you to write an article telling us about some of the successes your Company has experienced. The newsletter is sent electronically and that significantly reduces the cost. So let us take advantage of this opportunity and contribute both in feedback and participation. An interesting newsletter is often something that people want to receive.

Jurisdictional Relationship

CBS has continued to strengthen our relationships with the Canadian Provincial Jurisdictions. We participate in the CSA B51 Technical Committee and support the breakfast on the Thursday which is the morning of the B51 Meeting. Glen Adgey participates on the TSSA Advisory Committee with Lorne Smith as an alternate and we experience a reciprocal response from TSSA with Mr. Rick Mile participating in our member events – often contributing with an update on the changes in TSSA.

We had a very good meeting with TSSA on the recent proposals to reduce attendance requirements for fire tube boilers. With all the changes that have taken place at TSSA with the new CEO, the development and resolution of the issues raised at the meeting are still outstanding. However, Rick Mile and I have been discussing the next steps that are required.

Board Chair

The Chair of the Board of Directors David Duthie has been very effective in the continued development of our membership. David in his own quiet way has been maintaining the level of membership and participation. He also provides encouragement and leadership to the other Board of Directors. Thank you David for an excellent job.

Board of Directors – Changes

CBS continues to experience changes in membership from our company members. Lee Lama of Babcock & Wilcox is leaving the Board of Directors and will be replaced by another member from that company. At this time the person replacing Lee has not been absolutely confirmed.

Ryan Tangney from Innovative Steam Technologies is also leaving. He is moving on in his career. CBS is looking forward to the continued excellent participation of Ryan's replacement, Caleb Lawrence.

Both members will be missed by the other Board Directors. They were excellent contributors willing

to work and providing sound guidance and creative suggestions. Ryan's effort in getting the Website established and maintained will be missed.

Financial

The financial situation with CBS is sound but requires watching. Our largest income is our membership fee and that is supported and supplemented by these meetings. Attendance at these meetings often determines whether or not CBS is in the black or the red. So please support our events and please provide feedback on what you would like to see at these events.

Our financial reviews are close to current. The Year 2003-2004 is being completed as we speak. With the large change we experienced in CBS over past 4 years when all of the experience was lost due to retirements, there has been some catching up to do. To the credit of the Board of Directors they have handled this very well.

Other Organizations

We have begun to re-establish our relationship with ABMA. They have invited the CBS President to attend their next meeting at the end of June. We had a reciprocal relationship with ABMA which petered out with the retirement of the previous President of ABMA.

CBS is also participating in an industry with other members of B51 Technical Committee. The other members represent CHEVMA, BPVMA and ABPVMA. The initial meeting created a lot of interest from the Regulators. It was the feeling of the industry members that this had a lot of potential for industry over the long term.

Finally I believe the greatest challenge we have as CBS is to define exactly, as best we can, what we want to achieve through CBS for our society, our industries and our companies. I believe that our perspectives have to broad if we are to achieve anything worthwhile and it certainly follows the heritage that we have been handed by our predecessors.

Respectfully submitted

Richard W. Barnes

Richard W. Barnes
President
Canadian Boiler Society

CBS EDITORIAL, OPINIONS & NEWS

FGM 2005 Toronto, ON

The CBS Fall General Meeting is planned for **October 21, 2005**. The theme of the FGM is **ENERGY MANAGEMENT**.

The FGM will be held at the **Valhalla Inn** located at 1 Valhalla Dr., Etobicoke, Ontario. **Unilever Canada** will host the tour. They are located at 195 Belfield Road, Rexdale, Ontario

To register for the FGM please contact the CBS office 416-253-2760 to obtain a registration form.

Scheduled this in your calendar today! See you there!

BOARD OF DIRECTORS

President	Mr. Richard Barnes
Chairman	Mr. David Duthie Membership Committee
Vice-Chair	Mr. Bryan Heppell
Treasurer	Mr. Kerry Johnson
Member	Mr. Glen Harrison Program Committee
Member	Mr. Glenn Adgey Technical Committee
Member	Mr. Caleb Lawrence Communications Committee
Member	Mr. Frank Morrison

All members are welcome to vote and participate on the Board of Directors! The board of directors encourages you to become actively involved with the issues that concern you. Please feel free to contact the board members at any time!

Annual General Meeting 2005 - Niagara Falls, Ontario



THE EVENT

The Canadian Boiler Society's Annual General Meeting was held on June 5-7, 2005 at the Sheraton Fallsview Hotel and Conference Centre in Niagara Falls, Ontario.

THE GOLF TOURNAMENT

The golfing tournament was held at the Legends Golf Country Club in Niagara Falls, Ontario. The event proved to be yet another great tournament and everyone had a wonderful time!



THE TOUR

The tour was hosted by Trenergy Inc., The CBS would like to thank Ron Grundy, Jeff Bull, and Ken Payette for

organizing a wonderful tour and allowing the AGM participants the opportunity to view their facility.



THE CHAIRMAN'S DINNER

The Chairman's Dinner turned out to be a wonderful evening. The food was delicious and the company was excellent.



Everyone had the opportunity to network and win a great prize. Our congratulations to the winners of the golf tournament. The winning foursome; Glenn Adgey, Ted Kusz, Caleb Lawrence and John Kraemer. The most honest foursome, Lena Johnson, Kerry Johnson, Glen Harrison and Gord Sharp. Ted Kusz was the winner of the prize "closest to the pin" and Mark Ingham was the winner for the "longest drive".



Congratulations to everyone who participated in the CBS golf tournament.

THE BUSINESS MEETING

The Business Meeting was held on Tuesday June 7, 2005. The theme for this Business Meeting was **Boiler Control Systems & Equipment Optimizing Efficiency**. Many issues were brought to light and ideas exchanged.

The three new member companies were welcomed by all the members. Ruth Dekker of Union Gas, Douglas Knox of Foster Wheeler Canada, and Duncan Levesque of Independent Metals & Alloys. The CBS would like to wish all the new members great success through joining CBS and look forward to having them as members!

Plans and suggestions for the upcoming FGM in October were discussed. See page three. The event will be held in Toronto, Ontario. There will be a tour of Unilever Canada. Please mark your calendars and plan to attend. The AGM for next year was also discussed and the Board of Directors reminds members that suggestions and ideas are welcome and should be forwarded to CBS office or to Glen Harrison - Program Committee Chair.

The CBS Chairman, David Duthie, explained how communication and involvement with TSSA is significant to the success of CBS.

Richard Barnes, the President of CBS, spoke about his wishes for a Board of Directors that would be representative of the CBS member companies and more participation in meetings from the members. It was stressed that member involvement is vital for the success of the Society and any participation and feedback is appreciated. To conclude he noted that the CBS has been and will continually evolve. The CBS is and should be a foundation to help the members, the boiler industry and society.

The Canadian Boiler Society would like to thank Glen Harrison of ABB Inc.; Stewart Wood of Utilities Optimized; David Frost of MBB Services Inc. and Bryan Heppell of Thermogenics for enlightening the group with interesting presentations.

The AGM was an great success. The CBS would like to thank the attendees and all those who contributed to the success of this event!

See you at the FGM!

FEATURE ARTICLES

RUN SILENT, RUN LONG

The Stirling Engine is earning a little more respect these days.

by Harry Hutchinson, Executive Editor, ASME ME Power & Energy Magazine

A diesel-powered submarine is a bit of a misnomer. The diesel power supply can run only at the surface, where it has air to breathe. In any event, a diesel would raise too much of a racket to be of use for a sub in hiding. Submerged, the submarine relies on a battery pack with enough charge for about a day's worth of operation.

Nuclear power plants are one way around this limitation, but Swedish submarine builder Kockums AB has found another. It puts Stirling engine power plants into its boats, where they generate electricity for propulsion and for other needs onboard. The company calls its design "air-independent" because, although it is heated by burning diesel fuel, it carries its own oxygen supply. According to Lars Larsson, manager of the Stirling department at Kockums in Malmö, the system allows a boat to stay submerged for weeks.

And, unlike the diesel, the Stirling engine is quiet enough for the submariner's stealthy work.

The Stirling engine is a peculiar thing, probably because we see so few of them. Conceived as a safer alternative to steam, the Stirling engine never quite caught on. Overshadowed these days not by steam but by internal combustion rivals, the Stirling cycle has enjoyed some commercial applications. It drives toys—American Stirling Co. has one that runs on the heat of your hand. Stirling engines are used in cryocoolers and for specialized power generation. But events in the past several months suggest that the Stirling engine may be raising its profile.

Developers of Stirling engines say that their machines make very efficient use of energy and will outlast other types of engines doing the same work. The engine is quiet because, unlike internal combustion, the Stirling cycle needs no explosion of fuel to drive a piston. It needs only steady heat. It makes no difference if that heat comes from a petrochemical fire, a

nuclear reaction, or even sunshine.

When, in 1816, the Rev. Dr. Robert Stirling patented the engine now named for him, he was looking out for the welfare of his hardworking parishioners. He intended it as a safe alternative to the steam boiler which, when poorly constructed, can rupture and kill those standing nearby.

Gas, sealed in a cylinder, is alternately heated and cooled to drive a piston. As with the steam engine, the heat source is outside the cylinder, but interior pressures are nowhere near the level needed to keep a steam engine going.

The coming of Bessemer steel did much to improve the performance and safety of steam boilers, so Stirling's idea languished as steam power surged ahead.

It didn't help that Stirling engines require precise machining to build, nor that compared to a steam engine of similar size, they produce less power. And as the world made the transition from boilers to internal combustion, the long warmup time for the Stirling engine was a decided disadvantage.

Once the engine gets going, however, it can, in theory, run reliably for a long time. To find out just how long, ask the folks at Stirling Technology Co. in Kennewick, Wash.

The company has a number of projects in hand to generate electricity on Earth and in space. One is a generator being prepared for NASA. It combines high efficiency and longevity, properties critical for a deep-space probe. A test unit with a 10 W output last August passed an operating landmark, more than 87,600 hours of continuous service, or 10 years' running with no maintenance or decline in performance.

According to Maury White, Stirling Technology's chief technology officer and a founder of the company, the test system is powered by an electrical heat source, but is designed to be heated by a radioisotope in space. It was the subject of an article published in *Mechanical Engineering* in February 1996 under the headline "Engines That Never Wear Out." Never is a long time, and so is 10 years without a break.

One of the features Stirling Technology stresses about its design is that no moving parts rub together. The piston has about a 25-micrometer clearance in the cylinder. It is supported by flexural bearings, essentially thin metal disks with spiral kerfs cut through them. They are rigid from side to side, to keep the piston centered. They flex with the oscillation of the piston.



An experiment at Sandia aims to get several solar-heated Stirling engines working together, so one day they may be able to cooperate for utility-scale power generation.

Continued on page 6

The piston drives a linear alternator, so there are no linkages to convert linear movement to rotary, White said. The engine and generator are hermetically sealed in a single case. According to White, the hermetic sealing is one reason that helium is the working gas instead of hydrogen. Helium costs "about a point in efficiency," he said, but suits the design better than hydrogen. According to White, "Hydrogen will inevitably permeate through hot metal and be lost to the system so that is not feasible." He added that helium avoids hydrogen embrittlement of the heater head and allays concerns over the safety and handling of hydrogen.

Stirling Technology says it is currently gearing up to produce 10 W and 55 W generator sets and expects to ship a total of 40 systems to customers in the next three years. It has a \$23 million space contract through Lockheed Martin.

Another of the company's current projects involves a federal Small Business Innovative Research Program grant to supply a diesel-fueled mobile generator to the Army. According to Stirling Technology, it will deliver a prototype to the U.S. Army Soldier Systems Center in Natick, Mass. Called a micro-cogeneration system, it will provide hot water, which can be used in a field kitchen, and 1 kW of electricity.

The prototype for the Army is an adaptation of one developed for Stirling Technology's licensee, Enatec Micro-Cogen BV in Lichtenvoorde, the Netherlands. Enatec is a joint venture of three Dutch entities—Eneco Holding, a utility; ATAG Verwarming, a manufacturer

of heating systems, and Energieonderzoek Centrum Nederland, a research institute. The Enatec system is described primarily as a boiler, which uses a portion of the heat energy to generate electricity. Enatec is offering systems for testing by prospective buyers in Europe and has about 10 in field trials at private homes.

A separate company, Stirling Energy Systems in Phoenix, Ariz., is expanding a program with Sandia National Laboratories that uses a dish collector to concentrate sunlight as the heat source to run a Stirling generator set. The expansion will add five solar thermal systems to one already operating at Kirtland Air Force Base near Albuquerque, N.M. The new ones are expected to begin operating soon.

It sounds strange when you hear for the first time that Stirling Energy Systems licensed the basic technology for the solar design from Kockums, the submarine company. But Kockums developed Stirling engines for underwater use, so it isn't such a stretch that the company should adapt the Stirling idea to other extreme environments, such as the desert.

Bob Liden, president of Stirling Energy Systems, said that each Stirling generator set can turn out 25 kW at peak power, from a dish of about 90 square meters—about the area inside an NBA three-point line. A surface of that size would be catching about 90,000 W of sun power on a bright day in New Mexico, for a conversion rate approaching 30 percent.

For comparison, most commercially available photovoltaic panels, which convert sunlight directly into electricity, work at efficiencies of less than 15 percent. Sarah Kurtz, principal scientist at the National Renewable Energy Laboratory in Golden, Colo., said there have been demonstrations of PV systems of 1 kW or so that have used concentrators for sunlight and have topped 25 percent conversion efficiency.

Stirling Energy's dish concen-

trates 90 m² of sunlight to an area about 20 cm in diameter, to heat a four-piston Stirling engine that drives a rotary generator.

According to Sandia, the dish has 82 mirrors from Paneltec of Lafayette, Colo., laminated onto an aluminum honeycomb structure. The honeycomb follows a design invented by Paneltec and two Sandia researchers, Rich Diver and Jim Grossman.

The six generator sets will be able to generate as much as 150 kW, which will be used by the Sandia lab. Chuck Andraka, project leader at Sandia, said the expanded installation will permit "system-level studies and development leading toward large-scale deployment."

Liden said the company is working to bring costs down and to create a final design that will be efficient to manufacture. Prototype systems being installed at Kirtland will cost about \$150,000 each. Liden said the company expects a production model to be closer to \$50,000. At that level, the price comes out to \$2 a watt.

STM Power Inc., a company based in Ann Arbor, Mich., is providing the Stirling-cycle generator sets for a commercial installation to be fueled by waste at a vegetable-oil processing plant in New Jersey.

Northern Power Systems of Waitsfield, Vt., is designing the project at a site owned by Aarhus United USA. STM is providing seven 55 kW generator sets that will supply 65 percent of the electricity needs at the Aarhus plant in Port Newark. The Stirling regenerators, where the working gas is cooled inside the engine, are expected to provide 2.7 million Btu of hot water per hour.

Frank Miller, vice president of operations at Aarhus, said the fuel that will heat the engines is the light oil composed of unattached fatty acids that are stripped off during the deodorizing of edible vegetable oils. The distillate is usually stored in tanks and brings a small price when it is



When a 90m² dish of mirrors concentrates sunlight to an area 20 cm across, the

heat runs a Stirling generator set with a peak power rating of 25 kW. Sandia is testing ways to coordinate six of these systems.

sold.

Aarhus hopes to recoup as much as 30 percent of the \$1.7 million cost of the project under the New Jersey Clean Energy Program, a state fund set up to promote the installation of renewable energy systems in homes and businesses.

The distillate that Aarhus will use as fuel doesn't lend itself to burning in conventional engines because it is highly corrosive. The Aarhus project is practical because combustion products don't touch moving parts of the Stirling engine.

STM recommends preventive maintenance, including lube and fluid check, every 1,000 hours and a longer procedure every 10,000 hours. Mike Alexandrian, an application engineer at STM, said the major maintenance consists of replacing piston rings, rod seal cartridges, and other components in a procedure that takes about 16 hours. It can be done without removing the engine from the package.

Alexandrian said STM has 25 firm orders, which were due to be shipped by the beginning of this month. All of them are designed to run on landfill or biodigester gas.

The Stirling engine is a technology that has neither come into its own in 190 years nor faded away. It is generally considered the province of hobbyists, niche companies, and howstuffworks.com. There are also companies working to create mass-market products for homes and for grid-quality commercial power generation.

The Stirling Engine Society USA has a slogan that speaks to a world in which increasing numbers of people are becoming concerned over pollution and waste. It calls the Stirling engine "extra green, extra quiet, extraordinary."

That leaves out "peculiar," but then, if the Stirling engine can pick up a little more visibility, it won't seem so peculiar anymore.

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Engineering magazine (the American Society of Mechanical Engineers International)." <http://www.memagazine.org/>

Energy Bursts

written by Editor Jeffrey Winters
ASME ME Magazine

More Light from LED

As a light source, light-emitting diodes have a lot going for them: long lives and high efficiencies, to name two advantages. But they tend to be more expensive than standard incandescent bulbs, so researchers have been working to ramp up the amount of light put out by each diode. Now a group at Rensselaer Polytechnic Institute in Troy, N.Y., has found a way to get up to 60 percent more light per watt from a white LED.

Commercially available white LEDs produce many more photons than they emit. More than half the photons produced by the phosphor that sits on top of the light-emitting semiconductor are sent backwards or sideways. Most of this light is absorbed and lost.

The researchers have found a way to avoid that problem by changing the orientation of the phosphor and the semiconductor. They moved the phosphor away from the semiconductor and shaped the lens of the LED to capture more photons. As a result, more light is directed outward.

The new LED can produce as many as 80 lumens per watt, more than five times as many as a typical incandescent bulb. It is hoped that by decreasing the number of LEDs needed to replicate the work of a light bulb, the costs will come down enough to make the energy-saving technology more competitive.

Wind Meter

When people promote a hydrogen economy, more often than not they talk about the potential for wind turbines to power the hydrogen-making process. Wind power is emission-free, while many other sources of electricity that could be used for the job, such as coal plants, typically produce just the

kind of pollution the switch to hydrogen is supposed to banish.

But are wind turbines really up to the job? To find out, in April the University of Minnesota dedicated a 230-foot wind turbine intended to provide data on the feasibility of wind-to-hydrogen projects.

Some of the estimated 5.6 million kilowatt-hours produced annually will power a hydrolysis operation, while the balance will supply electricity to the University of Minnesota's Morris campus.

Poo Power

New York may be the city that doesn't sleep, but its residents are still subject to other bodily functions. That makes it an inviting target for an Arkansas company with patents on a process that can convert sewage into fuel.

ThermoEnergy, a Little Rock-based technology company, signed an agreement in April to use its ammonia-removal process at a New York City wastewater treatment plant. The \$7 million contract with the city's Environmental Protection Agency calls for the company to remove 99.9 percent of the ammonia in the liquid extracted from solid waste at the 150 million gallon-a-day Bowery Bay Water Pollution Control Plant in Queens.

But the company may have its sights set on bigger game. In addition to its ammonia-treatment process, ThermoEnergy has also developed a means of turning sludge into a biosolid with a high-energy content. The process has been tested in a U.S. EPA program, and the company received a patent on the technology in April.

Even if ThermoEnergy can get its fuel technology into New York City



Boosting efficiency of white LEDs should help them compete in applications such as indoor lighting.

Continued on page 8

wastewater plants, don't expect an energy bonanza: Unless a facility is as large as the Newtown Creek station in Queens (shown above), it won't produce enough sludge to cover more than its own energy demand. But recycling the sewage as fuel could cut down on transportation and landfill costs.

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FRANCE RECEIVES NOD FOR FUSION TEST REACTOR

(By Angela Doland, Associated Press - The Star-Ledger Wednesday June 29, 2005)

PARIS - France beat Japan yesterday in the race to host a \$13 billion experimental nuclear fusion reactor that scientists hope will produce a clean, safe and endless energy resource and help phase out polluting fossil fuels.

The United States, The European Union, China, Russia, Japan and South Korea choose Cadarache, in the southern region of Provence, during talks in Moscow. Japan reportedly backed down after agreeing to a bigger role in research and operations.

The project is expected to create 10,000 jobs and take about eight years to build. But fulfilling the long-term vision of the International Thermonuclear Experimental Reactor, as it is called, could take decades.

The six partner consortium is promoting the future of fusion which reproduces the sun's power source and creates no greenhouse gas emissions and only low levels of radioactive waste.

If all goes well with the ITER ex-

perimental reactor, officials hope to set up a demonstration power plant in Cadarache around 2040. Officials project that 10-20 percent of the world's energy could come from fusion by the century's end.

France's Green Party and environmentalists, who generally oppose nuclear power, argued that the project would turn the focus away from concrete efforts to fight global warming now.

The rest of France's political class was united in praise with President Jacques Chirac calling it "a great success for France, for Europe and for all of the partners" in the project.

"The international community will now be able to take on an unprecedented scientific and technological challenge, which opens great hopes for providing humanity with an energy that has no impact on the environment and is practically inexhaustible" he said.

The consortium had been divided over where to put the test reactor, and competition was intense. At stake are billions of dollars in research funding, construction and engineering contracts.

Russia, China and the EU wanted to locate the plant at Cadarache. The EU argued that Cadarache, one of the biggest civil nuclear research centers in Europe, has existing technical support facilities and expertise, thus reducing the risks.

Japan, the United States and South Korea wanted the facility built at Rokkasho in northern Japan.

With the site resolved, participants will now negotiate the construction details and sign a final agreement, hopefully by year's end.

Fusion, which powers the sun and stars, involves colliding atoms at extremely high temperatures and pressure inside a reactor. When the atoms fuse into a plasma, they release energy that can be harnessed to generate electricity.

While fossil fuels are expected to

run short in about 50 years, the reactor would run on an isotope of hydrogen, a virtually boundless source of fuel that can be extracted from water.

The Princeton Plasma Physics lab will oversee the U.S. portion of the ITER project which will come to about \$1.1 billion, according to Rob Goldston, the lab director. The U.S. will contribute a giant superconducting magnet, among other systems.

So far, fusion experiments have yielded only brief pulses of energy while consuming more power than they emit. The ITER reactor will be designed to produce 10 times more energy than it consumes, for 400 seconds. Goldston hopes those goals will be achieved by 2025.

That should lead to another fusion test plant, around 2035 or 2040, that actually generates electricity, Goldston said. If all goes well, commercial plants could follow by 2050.

For now, Goldston simply is relieved that the 18 month tug of war between Japan and France over siting of the ITER is resolved amicably.



Canadian Boiler Society

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PLEASE NOTE: The CBS office has moved from Suite 601 to Suite 202 at 701 Evans Ave, Toronto, ON.

Please feel free to visit anytime.

Editors: Richard Barnes, David Duthie, Glenn Adgey and Louise McColeman