



**IEEE Canada**



**Electrical Power and Energy Conference 2009  
La Conférence sur l'Énergie Électrique D'IEEE  
Canada 2009**

**"SUSTAINABLE/ RENEWABLE ENERGY SYSTEMS AND  
TECHNOLOGIES"**

**" LES SYSTÈMES ÉNERGIQUES  
DURABLES/RENOUVELABLES ET LES  
TECHNOLOGIES"**



**October 22 - 23, 2009  
Holiday Inn Select  
99 Viger Av. West  
Montréal, Québec, Canada**

***Organized and Sponsored by IEEE Canada,  
IEEE Montreal Section, and IEEE Ottawa Section***

**[www.ieee.ca/epec09](http://www.ieee.ca/epec09)**



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## **EPEC History**

The Electrical and Power Conference (EPEC) 2009 is focused on Sustainable / Renewable Energy Systems and Technologies which is one of the growth areas in energy worldwide. The conference is sponsored by IEEE Canada and also sponsored and organized by the IEEE Montreal and Ottawa Sections. These were the main sponsors of the 2007 conference.

The Electrical Power Symposia (EPS) started in 2001 addressing issues of deregulation in the electricity industry, which received a lot of attention because of the Ontario Government deregulation initiative at the time. As the EPS grew into an annual event, it focused on other aspects of the Ontario electricity situation, in particular the increasing debt and the widening gap between demand and supply, and, in 2004, on the tough choices facing Ontario, ranging from large-scale nuclear generation to demand management and distributed energy.

In 2005, the focus moved to general issues such as the convergence of power and high technologies. Five major areas of the convergence between the power and high technologies were showcased: communications, real-time applications, wide-area protection, smart metering, and automation in power systems. Due to the presence of the highly developed communication industry that made Ottawa known as the Silicon Valley North, the Symposium drew upon that world class expertise available in Ottawa, but also reached out and had several distinguished speakers from outside of Canada.

That approach of addressing the topics of wider interest and to have both Canadian and international speakers, was followed in 2006 as well. The crucial role of Distributed Generation and Smart Grids is increasingly getting recognition in the economy, energy, and environment, which form a basis for nation's sustainability, security, and development. Since 2006 marked the 150th anniversary of the birth of Nikola Tesla, the inventor of AC power system who also was a member of the IEEE predecessor - American Institute of Electrical Engineers (AIEE) - its Fellow, and Vice-President 1892-1894, the EPS 2006 was organized under the theme "From Tesla's AC Power System to Distributed Generation and Smart Grids".

*Sustainable/ Renewable Energy Systems and Technologies - "LES SYSTÈMES ÉNERGIQUES DURABLES/RENOUVELABLES ET LES TECHNOLOGIES"*

The growing demand of Renewable and Alternative Energy Systems was addressed in 2007 when the symposium was renamed to Electrical Power Conference (EPC).

In the 2008 conference, for the first time the conference left the eastern Canada and was held in Vancouver, BC organized by the IEEE Vancouver Section. The theme was Energy Innovation discussing the extension of the limits of Transmission and distribution, the expansion of Generation and Alternative Energy, Intelligent Grid Technologies and Energy Efficient Technologies.

The list of themes of the conference

2009: Renewable/Sustainable Energy Systems and Technologies

2008: Energy Innovation

2007: Renewable and Alternative Energy Resources

2006: From Tesla's AC Power System to Distributed Generation and Smart Grids

2005: Convergence of Power and High Technologies

2004: Ontario's Tough Electricity Choices

2003: Supply and Demand Challenges

2002: Tricks and Treats in Evolving Electricity Markets

2001: Electricity Deregulation (in Ontario)

The EPEC, former Electrical Power Symposia (EPS) clearly identified a need for a forum in which the information and ideas related to the Power and Energy Systems Engineering can be exchanged among the experts and professionals from the engineering and business communities, and general public. The upcoming Electrical Power conference 2009 will continue addressing this need.

Founders:

Dr. Wahab Almuhtadi

Dr. Branislav Djokic

Dr. Aidan Foss

Mr. Raed Abdullah

## **L'Histoire d'EPEC**

La conférence d'énergie et d'électricité (EPEC) 2009 est axée sur les systèmes d'énergétiques renouvelables/durables et les technologies qui sont un des secteurs en croissance dans le domaine énergétique à travers le monde. La conférence est parrainée par l'IEEE Canada et aussi parrainée et organisée par les sections IEEE de Montréal et d'Ottawa. Tels sont les principaux commanditaires de la conférence 2007.

Les colloques de l'énergie électrique (EPS) ont démarré en 2001, abordant les questions de déréglementation de l'industrie de l'électricité, qui a reçu beaucoup d'attention en raison de l'initiative de déréglementation du gouvernement d'Ontario à l'époque. Des lors l'EPS est devenu un événement annuel, il met l'accent sur d'autres aspects de la situation de l'électricité en Ontario, en particulier l'augmentation de la dette et l'accroissement de l'écart entre l'offre et la demande, et, en 2004, sur les choix difficiles auxquels l'Ontario était confronté, allant de la production nucléaire à grande échelle à la gestion de la demande et la production énergétique.

En 2005, le centre propose des questions d'ordres généraux tels que la convergence de l'énergie et les hautes technologies. Cinq grands domaines de la convergence de l'énergie et les hautes technologies, se sont émergés: les communications, les applications en temps réel, vaste zone de protection, les compteurs intelligents, et de l'automatisation dans les systèmes énergétique. En raison de la présence de l'industrie de la communication très développée qui ont fait d'Ottawa le Silicon Valley du Nord, le Symposium a attiré cette expertise de classe mondiale à Ottawa, mais aussi et a été cherché des invités prestigieux de l'extérieur du Canada.

Cette approche d'aborder les sujets d'intérêt généraux et d'avoir à la fois des invités canadiens et internationaux, a été suivie, en 2006. Le rôle crucial de la production distribuée et de Smart Grids est de plus en plus d'emploi dans l'économie, l'énergie et l'environnement, qui est la base d'un pays en matière de durabilité, de sécurité et de développement. Depuis 2006 a marqué le 150<sup>e</sup> anniversaire de la naissance de Nikola Tesla, l'inventeur du système d'alimentation électrique, qui était aussi membre de l'IEEE prédécesseur - American Institute of Electrical Engineers (AIEE) - son associé, et vice-président

1892-1894, la EPS 2006 a été organisé sous le thème "De la Tesla AC Power System à la production distribuée et le Smart Grids.

La demande croissante des énergies renouvelables et les systèmes d'énergie alternative a été abordée en 2007 lors du symposium qui a été rebaptisé pour Electrical Power Conference (EPC).

À la conférence de 2008, pour la première fois, la conférence a quitté l'est du Canada et a été tenue à Vancouver, en Colombie-Britannique a organisé par l'IEEE Section de Vancouver. Le thème était l'innovation énergétique discutant de l'extension des limites de transmission et de distribution, de l'expansion de la production et d'énergies alternatives, les technologies de Smart Grid et de l'efficacité énergétique.

La liste des thèmes de la conférence

2009: Les systèmes énergiques durables/renouvelables et les technologies

2008: Innovation Énergétique

2007: Ressources énergétique renouvelable et alternative

2006: Du systèmes de puissance Tesla AC á la production et la distribuée et le smart Grids

2005: La convergence énergétique et les hautes technologies

2004: Les choix de l'électricité de l'ontario

2003: Les défis de l'offre et de la demande

2002: Les trucs et les défis dans un marché de l'électricité en évolution

2001: La dérèglementation de l'électricité(en Ontario)

L'EPEC, ancien électriques Symposia (EPS) a clairement identifié la nécessité d'un forum dans lequel les informations et les idées liées à l'énergie électrique et de génie des systèmes énergétique peuvent être échangées entre les experts et les professionnels de l'ingénierie et les entreprises, et le grand public. La prochaine conférence de l'énergie électrique 2009 continuera à répondre à ce besoin.

Fondateurs:

Dr. Wahab Almuhtadi

Dr. Branislav Djokic

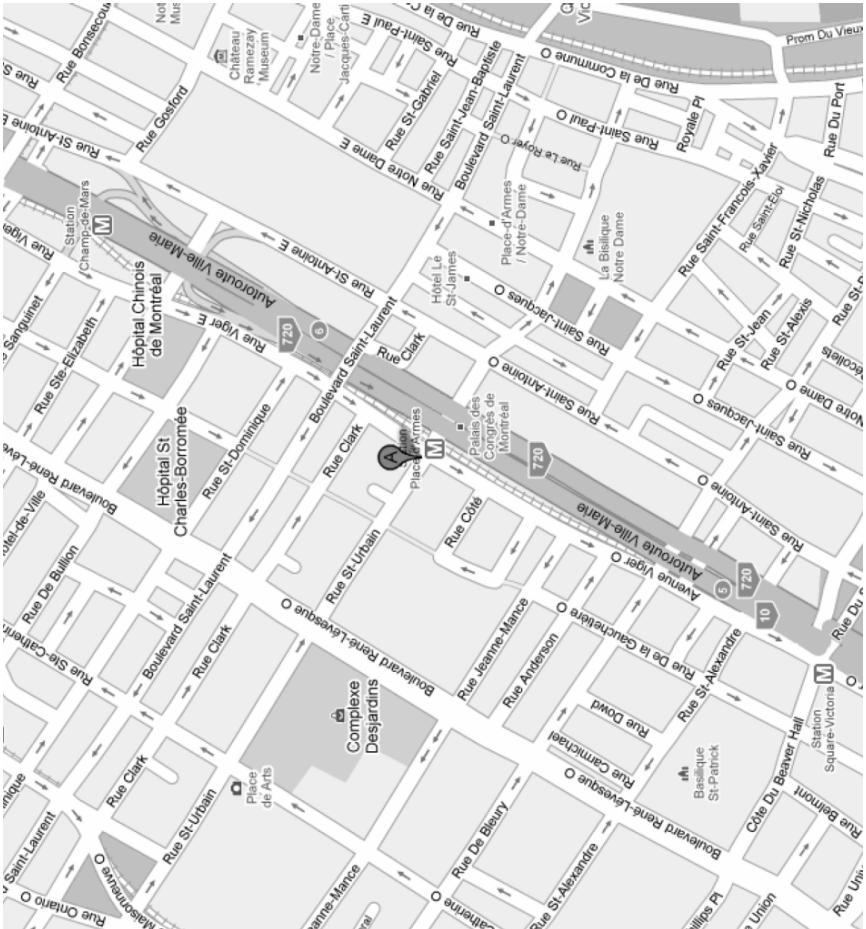
Dr. Aidan Foss

M. Raed Abdullah

## **General Information / Informations générales**

### **Local Map**

The conference will be in: Holiday Inn Select at 99 Viger Av. West Montreal, Quebec, Canada H2Z 1E9, Phone: 514-878-9888





## **Registration Desk**

The Conference Registration Desk will be set up in the lobby of the Conference Center outside the Ballroom for authors and attendees to register and pick up their conference packages.

### **Hours of operation are:**

Wednesday, October 21: 4:00PM to 7:00 PM

Thursday, October 22: 7:00 AM to 6:00 PM

Friday, October 23: 8:00 AM to 10:00 AM

If you require emergency assistance outside these hours, please contact the Conference Office or one of the conference volunteers.

## **Meals and Inclusions**

Each author, attendee, and full partner registration includes the following:

- Wednesday Welcome Reception (Room: Orchidée, 17:50-19:00) Light snacks and drinks will be served; a cash bar will be available.
- Thursday evening Banquet (Room: Ballroom, 19:00).
- Friday Lunch (Room: Ballroom, 12:00-14:00).
- Coffee breaks on Thursday and Friday.

Extra tickets for lunches (\$35) and the banquet (\$60) will be available from the Registration Desk in the main lobby or the Conference Office.

## **Conference Proceedings CD**

Each author and attendee full registration also includes the Conference Proceedings (on Compact Disk), and an attractive commemorative bag.

Additional copies of the Conference Proceedings on Compact Disk are available to fully registered delegates during the conference from the Conference Office at a cost of \$50 each. After the conference, Proceedings will be available from the IEEE Publications.

## **Dietary Needs**

If you indicated special dietary needs when you registered, please indicate these to your server at the meals. Your server will be glad to help with any special requests.

### **Internet Access**

Internet wireless access is available for conference delegates.

### **Authors Screening Room**

A computer is available for authors to verify the software compatibility of their audio/visuals for oral presentations. Authors are strongly encouraged to verify their presentation before their assigned session and be ready to load it onto the session computer in the appropriate room before the start of their session. Consult your Session Chair or Session Volunteer for accessibility times (normally 15 minutes before the session start). Authors are reminded that they must use the computers provided in the Session Rooms, and their presentations must be loaded onto these computers BEFORE the session start time. Laptop and other personal computer cannot be accommodated.

### **Messages and Help**

A Message Board is available by the Conference Office for the use of attendees and for incoming messages.

If you require help, please contact the Conference Office or any of the conference volunteers.

### **Exhibits**

Exhibits will be located at the Hotel from 10:00 AM till 6:00 PM on Thursday-Friday, October 22-23, during the conference.

### **Local Attractions & Events**

Montreal boasts numerous local attractions for your enjoyment. In addition, there are always a variety of interesting events scheduled in the area. Please consult the Conference Office for a complete listing. Our conference volunteers will be happy to assist.

## ***Airlines and Transportation***

### *Airlines:*

- ❖ Montréal–Pierre Elliott Trudeau International Airport - (514) 394-7377  
<http://www.admtl.com/>
- ❖ Air Canada (Reservations) 1-888-247-2262  
Arrivals/Departures 1-888-422-7533
- ❖ WestJet (Reservations) 1-800-538-5696  
Arrivals/Departures 1-877-929-8646
- ❖ Taxi & Limousine Services (514) 990-1979
- ❖ Airport Taxi & Limousine (514) 394-7377

### *Car Rental:*

- ❖ Budget Car & Truck Rental 1-800-268-8900
- ❖ Avis Car Rental 1-800-230-4898 or 514-866-2847
- ❖ National Rent-A-Car 1-877-222-9058 or 514-636-9030
- ❖ Alamo Rent-A-Car 1-877-222-9075
- ❖ Enterprise Rent-A-Car 1-800-261-7331
- ❖ Hertz Rent-A-Car 1-800-654-3131

## **Welcome by the Conference Chair**

On behalf of IEEE Canada, the IEEE Montreal and Ottawa Sections and the organizing committee, I would like to welcome you to the IEEE Electrical Power & Energy Conference 2009, with the theme "Sustainable/Renewable Energy Systems and Technologies". The conference organizing committee has worked hard in the preparation of this conference. We are delighted to announce that the plenary speaker will be Dr Denis Faubert of the Institut de Recherche d'Hydro-Québec. He will speak on ""Energy Sustainability - A Hydro-Quebec Perspective"

In addition there are four distinguished keynote speakers from industry. There is a special session on photovoltaic systems in addition to three other panel sessions focusing on renewable power generation. This is accompanied by several interesting paper sessions and a poster session with presentations by authors from all over the world. The poster session is included just before the banquet on Thursday evening. In the spirit of sustainability, the conference bags were manufactured by a local Non-Governmental Organization, "Petites-Mains (Small Hands)" which works with immigrant women to teach them French, working skills and how to integrate into Québec Society. One of the skills taught is sewing, and you will find a note and a picture of the person who actually manufactured the bag. It is made from 100% natural cotton with no chemicals and was especially designed for this conference to be used as a book-bag with the ability to convert to a more usable shopping bag afterwards.

Montreal is a great city with a charm that is hard to define. There are numerous cultural attractions and fine dining. We hope you have the time to sample some of these during your visit here, a meal or two in Old Montreal (within walking distance of the hotel) should certainly be on the list. Other favourites include many of the fine museums like the Museum of Architecture near Concordia University, the Botanical Gardens as well as the Biosphere and Biodome.

We look forward to meeting you in Montreal and hope you have a rewarding experience.

Dr. Pragasen Pillay, FIEEE, FIET  
Full Professor In Electrical & Computer Engineering  
NSERC/Hydro Québec Senior Chair  
Concordia University, Montreal, Québec, Canada

## **Lettre de Bienvenue du Président**

De la part de l'IEEE Canada, des sections de Montréal et Ottawa de l'IEEE et du comité organisateur, je vous souhaite la bienvenue à la Conférence sur l'énergie électrique IEEE Canada 2009 ayant pour thème "Systèmes et technologies d'énergies durables/renouvelables". Le comité organisateur de la conférence a travaillé fort à sa préparation. Nous sommes ravis d'annoncer que le conférencier lors de l'assemblée plénière sera Dr. Denis Faubert de l'Institut de recherche d'Hydro-Québec. Il parlera de "L'énergie renouvelable – Une perspective Hydro-Québec".

Nous aurons aussi quatre conférenciers principaux provenant de l'industrie. Il y aura une session spéciale sur les systèmes photovoltaïques et trois panels se penchant sur la production d'énergie renouvelable. Le programme comprendra plusieurs sessions de présentations d'articles et une présentation d'affiches par des auteurs du monde entier. Cette dernière aura lieu juste avant le banquet du jeudi soir. Dans l'esprit du développement durable, les sacs de la conférence ont été fabriqués par une ONG locale: "Petites-Mains" œuvre avec des immigrantes pour leur enseigner le français, des compétences de travail, et comment s'intégrer à la société québécoise. Une des compétences enseignées est la couture; vous trouverez dans votre sac une note et la photo de la personne qui l'aura fabriqué. Il sera 100% coton sans produits chimiques et conçu spécialement pour transporter les documents de cette conférence, et pourra ensuite être utilisé comme sac d'épicerie, par exemple.

Montréal est une grande ville au charme ineffable. Elle offre nombre d'activités culturelles et de lieux gastronomiques. Nous espérons que vous aurez le temps d'apprécier certains d'entre eux durant votre séjour: un repas ou deux dans le Vieux Montréal (à distance à pieds de l'hotel) devrait être sur votre liste. D'autres sites favoris comprennent les nombreux musées tels le Musée d'architecture près de l'Université Concordia, le Jardin botanique ainsi que la Biosphère et le Biodôme.

Nous attendons avec impatience votre venue à Montréal et espérons que votre expérience sera enrichissante.

Dr. Pragasen Pillay, FIEEE, FIET  
Professeur de génie électrique et informatique Titulaire  
Chaire senior CRSNG/Hydro-Québec  
Université Concordia, Montréal, Québec, Canada

**Letters of Support / Lettres d'appui**

***A Word from the Deputy Premier,  
Minister of Natural Resources and Wildlife and  
Minister Responsible for Plan Nord***



The development of renewable energy and green technology is a priority for our Government. Québec is a leader in these fields, but would like to go even further and become a veritable point of reference. To achieve this, we will base our efforts on the commitments set out in our 2006-2015 Energy Strategy, which proposes new ambitions for Québec.

Ninety-seven percent of the electricity we produce is derived from clean, renewable sources. Thanks to its hydroelectricity, we are the province with the lowest rate of greenhouse gas emissions in Canada, at roughly half the Canadian per-capita average. Québec has focused on hydroelectricity in the past, and continues to do so now, because it is a reliable form of green energy produced from a plentiful, inexhaustible resource that is under our ownership.

It is for this reason that we will intensify our efforts to develop emerging technologies such as wind energy, photovoltaic solar energy and geothermics. These new sectors will not only create large numbers of jobs, but will also provide opportunities to export energy, technology and know-how, thereby contributing to the wealth of Québec.

Your knowledge and expertise are of primary importance, and will play a key role in allowing us to achieve our shared goals. May your discussions at this annual meeting be productive!

I hope you enjoy the Conference.

A handwritten signature in black ink, appearing to read 'Nathalie Normandeau', written in a cursive style.

Nathalie Normandeau

**Mot de la vice-première ministre,  
ministre des Ressources naturelles  
et de la Faune et ministre responsable du Plan Nord**



Le développement des énergies renouvelables et des technologies vertes est une priorité pour notre gouvernement. Le Québec est un leader de premier plan en ces matières, mais souhaite aller plus loin et devenir une véritable référence. Pour ce faire, nos efforts s'appuieront sur les engagements contenus dans notre Stratégie énergétique 2006-2015 qui constituent de nouvelles ambitions pour le Québec.

L'électricité que nous produisons provient de sources renouvelables et propres à 97 %. Grâce à l'hydroélectricité, nous sommes la province qui a le taux d'émissions de gaz à effet de serre le plus bas au Canada. Nous émettons deux fois moins de GES par habitant que la moyenne canadienne! Si le Québec a misé et continue à miser sur l'hydroélectricité, c'est parce que c'est une énergie verte, fiable et produite à partir d'une ressource abondante et inépuisable qui nous appartient.

C'est pourquoi nous intensifions nos efforts pour développer des énergies émergentes telles que les hydroliennes, l'énergie solaire photovoltaïque et la géothermie. Ces nouveaux secteurs d'activité permettront la création de nombreux emplois en plus d'offrir des possibilités d'exportation d'énergie, de technologies et de savoir-faire qui contribueront à enrichir le Québec.

La mise en commun de vos connaissances et de votre expertise est de première importance et s'avère profitable dans l'atteinte de nos objectifs communs. Je vous souhaite de fructueux échanges à l'occasion de cette rencontre annuelle.

Bon congrès!

A handwritten signature in black ink, which appears to read 'Nathalie Normandeau'.

Nathalie Normandeau

**The Mayor of Montreal**

September 29, 2009



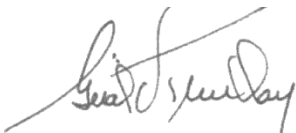
Dear participant,

On behalf of my fellow residents, I would like to welcome delegates to the Electrical Power and Energy Conference (EPEC) 2009. I am very pleased that IEEE Canada has once again selected Québec's leading city for this international event.

The theme of this conference, "Sustainable/Renewable Energy Systems and Technologies," will certainly strike a chord among Montrealers. For decades, our educational and research institutions, and particularly those active in hydroelectricity and applied technology, have made their marks around the world. Montréal has certainly earned its designation as a "city of knowledge and innovation." Sustainable development is, moreover, a topic of great concern within our community. Successive reports on Montréal's First Strategic Plan for Sustainable Development 2007-2009 demonstrate that local stakeholders have joined forces to meet challenges of the 21st century.

I hope you will take the time during your visit to discover or rediscover Montréal, a cosmopolitan metropolis and a city of culture, widely acclaimed for its innovation and for its joie de vivre at every time of year.

I would like to extend my best wishes for success to the organizers of this conference, which, I am certain, will prove highly productive.



Gérald Tremblay  
Mayor of Montréal

Hôtel de ville, 275, rue Notre-Dame Est, Montréal (Québec) H2Y 1C6 CANADA  
Téléphone : 514 872-3101 Télécopieur : 514 872-4059 [mairie@ville.montreal.qc.ca](mailto:mairie@ville.montreal.qc.ca)

**Montréal** 



**Le Maire de Montréal**

Septembre 29, 2009

Chère participante,  
Cher participant,



Au nom de mes concitoyennes et concitoyens montréalais, je souhaite la bienvenue aux congressistes de la Conférence d'énergie et d'électricité (EPEC) 2009. Je suis très heureux que l'IEEE Canada ait à nouveau choisi la métropole québécoise pour cette rencontre d'envergure internationale.

Le thème de cette conférence, Les systèmes d'énergétiques renouvelables/durables et les technologies, trouve assurément un écho à Montréal. Depuis des décennies, nos institutions d'enseignement et de recherche, notamment en hydro-électricité et en technologie appliquée, se distinguent à l'échelle internationale. Montréal peut se prévaloir à juste titre des qualificatifs de ville de savoir et d'innovation. Par ailleurs, le développement durable est une préoccupation majeure au sein de la collectivité montréalaise. Les bilans successifs du Premier plan stratégique de développement durable de la collectivité montréalaise 2007-2009 rendent compte de la mobilisation de différents acteurs locaux face aux défis du XXI<sup>e</sup> siècle.

Je vous invite à profiter de votre séjour pour découvrir ou redécouvrir Montréal, une métropole internationale cosmopolite, une ville de culture, reconnue pour sa créativité et animée en toutes saisons.

Mes meilleurs vœux de succès accompagnent les organisateurs de cette conférence qui sera des plus productives, j'en suis sûr.

A handwritten signature in black ink, which appears to read "Gérald Tremblay". The signature is fluid and cursive.

Gérald Tremblay  
Maire de Montréal

Hôtel de ville, 275, rue Notre-Dame Est, Montréal (Québec) H2Y 1C6 CANADA  
Téléphone : 514 872-3101 Télécopieur : 514 872-4059 [mairie@ville.montreal.qc.ca](mailto:mairie@ville.montreal.qc.ca)

**Montréal** 

*IEEE Canada, 9<sup>th</sup> Annual EPEC [www.ieee.ca/epec09](http://www.ieee.ca/epec09)*

**IEEE Canada President**



Once again Montreal is host of our prestigious Canadian Conference, the “Electrical Power & Energy Conference” 2009 (EPEC 2009). This Conference is a major annual event and is the proud achievement of IEEE Canada, made possible by the efforts of our dedicated and able volunteers. This year’s IEEE Financial sponsors are the Montreal Section, Ottawa Section, IEEE Canada; the Technical Sponsor is the IEEE Power and Energy Society (PES).

As President of IEEE Canada, I am extremely impressed with the dedication and enthusiasm of the Conference Organizing Committee. I congratulate them all for their team effort that is adding to the success of the Conference. The Conference theme is “Sustainable/ Renewable Energy Systems and Technologies” is supported by Technical Committee Members who are top names in the power engineering industry and academia such as Concordia University, ETS, IREQ, McGill University, and the University of Ottawa. I note that the conference is organized along ten tracks, and three panels that include more than 150 papers and posters. Each paper was evaluated technically on the basis of the full submitted manuscript and reviewed by at least two experts in the field. Also, introduction to advanced topics will be made through plenary speeches, presented by world class professionals. To top off the conference peak, we will celebrate IEEE’s 125th Anniversary at the Conference Banquet night.

Despite continuing economic uncertainty, I am happy to recognize those who contributed with their generosity that has helped the conference and reduced registrant fees: Concordia University, Ansoft LLC, Hydro-Quebec, Riverbank Power Corporation and Opal-RT Technologies.

It is our sincere hope that you will have stimulating technical discussions, meet with old friends, and make new friendships at the Conference. Montreal is a beautiful location for the Conference. I hope that you have brought company along and take advantage of the many attractions that the region has to offer during this event.

I look forward to your delight with this event and to it spawning major technical achievements.

Welcome to EPEC 2009 in Montreal!

Dr. Ferial El-Hawary, P. Eng.

FIEEE, FEIC, FMTS

President, IEEE Canada (2008-2009)

"FERIAL" F.El-Hawary@ieee.org, www.ferial.ca

**Présidente de l'IEEE Canada**



Une fois de plus, Montréal est l'hôte de notre prestigieuse Conférence canadienne, «La Conférence sur l'Énergie Électrique " 2009 (EPEC 2009). Cette conférence est un événement annuel majeur qui est la fière réalisation de l'IEEE Canada. Celle-ci est rendue possible grâce aux efforts de nos dévoués bénévoles. Les commanditaires d'IEEE cette année sont : la division de Montréal, la division Ottawa et IEEE Canada; le commanditaire technique est la SPE (société IEEE de la puissance et de l'énergie).

En tant que présidente d'IEEE Canada, je suis extrêmement impressionnée par le dévouement et l'enthousiasme du comité organisateur de la conférence. Je les félicite tous pour leur travail d'équipe qui a contribué à la réussite de la conférence. Le thème de la conférence est "Les Systèmes Énergétiques Durables/ Renouvelables Et Les Technologies ", qui est soutenu par les membres du comité technique qui regroupe les meilleurs noms dans l'industrie de l'ingénierie électrique et des universités telles que l'Université de Concordia, l'ETS, l'IREQ, l'Université de McGill et l'Université d'Ottawa. Je mentionne que la conférence est organisée autour de dix sous-thèmes et trois tables rondes qui comprennent plus de 150 d'articles et affiches. Ces articles ont été évalués sur la base de manuscrits et ont été examinés par au moins deux experts dans le domaine. De plus, l'introduction sur les thèmes avancés se fera à travers des allocutions présentées par des professionnels de renommée mondiale. Pour couronner la conférence, nous célébrerons le 125e anniversaire d'IEEE par un banquet final.

Malgré l'incertitude économique persistante, je voudrais remercier ceux qui ont contribué par leur générosité et qui ont permis la réduction des frais: Université Concordia, Ansoft Corporation, Hydro Québec, Berge, et Opal-RT Technologies.

Nous espérons sincèrement que vous aurez des discussions techniques stimulantes, rencontrerez d'anciens amis, et en ferez de nouveaux à la Conférence. Montréal est une ville magnifique pour tenir cet événement. J'espère que vous amènerai de la compagnie et que vous profiterez des nombreuses attractions qu'offre la région.

Je me réjouis à l'avance de l'événement et des grandes réalisations techniques à venir.

Bienvenue à l'EPEC 2009 à Montréal!

Dr. Ferial El-Hawary, P. Eng.

FIEEE, FEIC, FMTS

President, IEEE Canada (2008-2009)

"FERIAL" F.El-Hawary@ieee.org

[www.ferial.ca](http://www.ferial.ca)

**Welcome Letter from the IEEE Montreal Section Chair**



As Chair of the IEEE Montreal Section, it gives me a great pleasure to welcome you to the 2009 Electrical Power and Energy Conference (EPEC09) to be held right here in downtown Montreal. The Montreal Section is proud to contribute to this conference, jointly with IEEE Canada and the Ottawa Section. We see the EPEC grow every year and this certainly reflects the increasing enthusiasm in the sector of sustainable and renewable energies.

Have a great time in Montreal !

Laurent Lamarre, Ph. D.  
Chair, IEEE Montréal  
Research Engineer (Chercheur)  
IREQ – Hydro-Quebec Research Institute  
Varennes, Qc

**Lettre de bienvenue du président de la section IEEE de Montréal**



En tant que président de la section Montréalaise de la IEEE, il me fait grand plaisir de vous souhaiter la bienvenue à l'édition 2009 de la Conférence sur l'Énergie Électrique, qui se tient ici même au centre ville de Montréal. La Section de Montréal est fière de contribuer à cette conférence et IEEE Canada ainsi que la section d'Ottawa se sont joints à nous. Nous voyons EPEC croître chaque année et ceci reflète certainement l'enthousiasme grandissant dans le secteur des énergies durables et renouvelables.

Amusez-vous bien à Montréal !

Laurent Lamarre, Ph. D.  
Chair, IEEE Montréal  
Research Engineer (Chercheur)  
IREQ – Hydro-Quebec Research Institute  
Varennes, Qc

*IEEE Canada, 9<sup>th</sup> Annual EPEC [www.ieee.ca/epec09](http://www.ieee.ca/epec09)*

### ***Congratulations from the IEEE Ottawa Section Chair***



On behalf of the IEEE Ottawa Section -- founders of EPEC, and co-sponsors of this year's event -- as Ottawa Section Chair, we congratulate each of you for helping advance our knowledge and comfort for what is possible. What a delight to see rekindled interest in the power field with a blending of hi-tech to bring new solutions for harnessing renewable energy sources, improving effectiveness of traditional systems, and integrating renewable energy generation into the grid.

Not long ago when preparing EPS2006 on Smart Grids, there was generally still much reluctance between power and hi-tech academics and practitioners in recognizing how both can work together in advancing the power and energy sector. Integration of renewable generation, implementation of distribution and substation automation, system monitoring and control are not new concepts. What is new is growing expectation from customers, governments, and industry that more be done in these areas to secure electricity supply and delivery, decrease outage duration, improve environmental footprint and spark a new economy.

Based on the interest in events since then culminating with the submitted EPEC 2009 presentations and posters, it seems the reluctance is fading. This is the 9<sup>th</sup> Annual event that will set the bar for EPEC 2010 in Halifax, Nova Scotia. It has been the intention with EPS, EPC and EPEC to project the important catalyst and cataclysmic issues that few may yet see into the horizon that will remould the power and energy field. It is for you to influence the remoulding.

Wishing you all the best.

Raed Abdullah, P.Eng., SMIEEE  
IEEE Ottawa Section Chair

### **Félicitations de président de la section IEEE d'Ottawa**



Au nom de la section IEEE d'Ottawa - fondateurs d'EPEC, et co- sponsors de l'événement cette année - en tant que président de la Section d'Ottawa, nous tenons à féliciter chacun de vous pour leurs efforts de progresser notre connaissance et confort. Quel bonheur de voir raviver l'intérêt dans le domaine de puissance avec une fusion de haute-technologie afin d'apporter des nouvelles solutions pour l'exploitation des sources d'énergie renouvelables, l'amélioration de l'efficacité des systèmes traditionnels et

en intégrant la production d'énergie renouvelable dans le réseau.

Il n'y a pas longtemps, lors de la préparation d'EPS2006 sur les Smart Grids, il y avait une répulsion entre les universitaires -de puissance et haute-technologie- et les praticiens à reconnaître comment les deux peuvent travailler ensemble pour faire progresser le secteur de puissance et de l'énergie. L'intégration de la production d'énergie renouvelable, la mise en œuvre de la distribution et l'automatisation des postes électriques, les systèmes de surveillance et de contrôle ne sont pas des nouveaux concepts. Ce qui est nouveau est l'attente croissante des clients, des gouvernements et de l'industrie que davantage soit fait dans ces domaines afin de garantir l'approvisionnement et la livraison de l'électricité, de diminuer la durée de coupure, d'améliorer l'empreinte écologique et de déclencher une nouvelle économie.

Basant sur l'intérêt des événements depuis le point culminant puis avec la soumission des papiers et des posters de l'EPEC 2009, il semble que la réticence est à la décoloration. C'est le 9e événement annuel qui avancera encor un pas vers EPEC 2010 à Halifax, en Nouvelle-Écosse.

En avait l'intention avec EPS, CPE et CEEP de projeter des questions catalyseurs et cataclysmiques importantes et que peu peuvent encore voir dans l'horizon qui va remanier le domaine de la puissance et de l'énergie. C'est à vous d'influer sur ce remoulage

Je vous souhaite tout le meilleur.

Raed Abdullah, P.Eng., SMIEEE

Président de la section IEEE d'Ottawa



**EPEC 2009 Committee Members**

<b>General Conference Chair:</b>	Dr. Pragasen Pillay <i>Concordia University</i>
<b>Steering Committee Co-Chairs:</b>	Dr. Amir Aghdam, P. Eng. <i>IEEE Eastern Canada Area Chair, IEEE Montreal Section Past Chair, Associate Professor at Concordia University, Montreal</i>
	Dr. Geza Joos <i>McGill University</i>
	Dr. Anader Benyamin, P. Eng. <i>IEEE Montreal Section Chair, Adjunct Associate Professor at Concordia University, Director of R&amp;D at ART Advanced Research Technologies Inc., Montreal</i>
	Dr. Wahab Almuhtadi, P. Eng. <i>IEEE Ottawa Section Past-Chair, IEEE Ottawa-Power and Energy Society Chair, IEEE Ottawa-Communications Society Chair Professor Algonquin College, Ottawa, Ontario, Canada</i>
<b>Technical Program Co-Chairs:</b>	Dr. Sheldon Williamson <i>IEEE Montreal Section; Assistant Professor at Concordia University, Montreal</i>
	Dr. Laurent Lamarre <i>IREQ</i>
	Dr. Voicu Groza <i>University of Ottawa</i>

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<b>Technical Program Committee:</b>	Dr. Arezki Merkhouf <i>IREQ</i>
	Dr. Branislav Djokic, P. Eng. <i>IEEE Canada Other Societies Chair, IEEE Ottawa Section Past Chair; Senior Researcher at National Research Council Canada, IEEE INMS Distinguished Lecturer</i>
	Dr. Kamal Al-Haddad <i>ETS</i>
	Dr. Vijay Sood University of Ontario Institute of Technology
	Dr. Wilsun Xu <i>University of Alberta</i>
	Dr. Praveen Jain <i>Queen's University</i>
	Dr. Mo El-Hawary Dalhousie University <i>IEEE Press Board Chair, IEEE Canada Past President</i>
	Dr. Ambrish Chandra <i>ETS</i>
<b>Joint Secretary:</b>	Mr. Reinaldo Tonkoski <i>Concordia University</i>
	Mr. Chirag Desai <i>Concordia University</i>
<b>Project Management Chair:</b>	Dr. Anader Benyamin-Seeyar <i>IEEE Montreal Section</i>
	Nazih Khaddaj Mallat, Ph.D. Candidate <i>IEEE Montreal Section</i>
<b>Registration / Publication:</b>	Mrs. Preeti Raman
	Mr. Eric Germain <i>ETS</i>

<b>Local Arrangement:</b>	Dr. Amir Aghdam, P. Eng. <i>IEEE Eastern Canada Area Chair, IEEE Montreal Section Past Chair; Associate Professor at Concordia University, Montreal</i>
	Mr. Jean-Claude Latortue <i>Chair of Graduates Of the Last Decade (GOLD) Affinity Group, IEEE Montreal Section; Montreal</i>
<b>Publicity Chairs:</b>	Mr. Raed Abdullah, P.Eng., SMIEEE <i>IEEE Ottawa Section Chair</i>
	Mr. Eric Germain <i>ETS</i>
<b>Panel/ Invited/ Special Session Chairs:</b>	Dr. Luiz Lopes <i>Concordia University</i>
	<i>Photovoltaic (PV) Systems Integration Issues</i> Dr. Lisa Dignard <i>CanmetENERGY - NRCan</i>
	<i>Hydro Power &amp; Storage Technology</i> Dr. Stan Pejovic <i>University of Toronto</i>
	<i>Plug-in Hybrid EV</i> Dr. Sheldon Williamson <i>Concordia University</i>
	<i>Marine Energy</i> Dr. Mo El-Hawary <i>Dalhousie University</i>
<b>Sponsorship and Exhibition Co-Chairs:</b>	John Grefford, P.Eng. <i>IEEE Canada Public Relations Chair, IEEE Ottawa Section Past Past Chair; Principal Engineer, CRO Engineering Ltd., Carp, DCC-CDC</i>
	Dr. Ambrish Chandra <i>ETS</i>
	Dr. Arezki Merkhouf <i>IREQ</i>

<b>Student Activities:</b>	Dr. Pouya Valizadeh <i>Concordia University</i>
<b>Treasurer:</b>	Mr. Shauheen Zahirazami <i>Concordia University</i>
<b>Webmaster:</b>	Mr. Seyed Kian Jalaeddini
<b>IEEE Canada President:</b>	Dr. Ferial El-Hawary <i>IEEE Region 7 Director</i>
<b>IEEE PES President:</b>	Mrs. Wanda K. Reder

## Plenary Presentations



**Dr. Denis Faubert, Director IREQ, Institut de Recherche d'Hydro-Québec**

As General Manager of Hydro-Québec's research institute since January 2007, Dr. Denis Faubert is very familiar with the challenges related to managing R&D and technological innovation activities. Throughout his career, Dr. Faubert has

worked in the scientific community, first as a researcher and later in R&D management. Prior to joining Hydro-Québec's research institute, he was Director General of R&D Programs for Defence Canada, reporting directly to the Assistant Deputy Minister of Science & Technology within the Department of National Defence. He holds a doctorate in laser physics and has been recognized for his leadership and managerial skills. A well-known figure in R&D and technological innovation circles, Dr. Faubert shares his extensive expertise by sitting on many international boards and committees, including the Board of the International Electric Research Exchange, the Natural Sciences and Engineering Research Council of Canada's Committee on Research Partnerships, and other bodies.

**"Energy Sustainability - A Hydro-Quebec Perspective"**



**Dr. Zoltan Cendes - Chief Technology Officer and General Manager of Ansoft, LLC**

Dr. Zoltan Cendes is the Chief Technology Officer and General Manager of Ansoft, LLC, a subsidiary of ANSYS, Inc. In addition, he serves on the Board of Directors of ANSYS, Inc. From 1996 to 2008, Dr. Cendes served as Chairman of the Board and Chief Technology Officer at Ansoft Corporation, which he founded in 1984. He has made significant contributions in the area of finite element modeling of electromagnetic devices. In particular, he solved the problem of spurious modes that prior to his work had made the application of finite element methods in electrical engineering impractical. He, along with his coworkers, developed new types of finite elements called edge elements that eliminate the problem of spurious modes. He also introduced the Delaunay mesh generation algorithm and adaptive mesh refinement procedures to finite element analysis and the transfinite element method and model order reduction procedures to high frequency electromagnetics. In 1980, he was appointed associate professor of electrical engineering at McGill University, Montreal, Canada. In 1982, he joined the faculty of electrical and computer engineering at Carnegie Mellon University, Pittsburgh, PA, where he was a professor until 1996. Cendes received his MS and doctoral degrees in electrical engineering from McGill University. A fellow of the Institute of Electrical and Electronics Engineers (IEEE), Dr. Cendes received the IEEE Antennas and Propagation Society (IEEE AP-S) Distinguished Achievement Award in 2008. In addition, he has served on the editorial board of IEEE Spectrum, on the International Steering Committee of the COMPUMAG Conference, and as an IEEE AP-S Distinguished Lecturer.

**“Technology Innovation for Sustainable/Renewal Energy – A Simulation Driven Approach”**

The drive towards sustainable/renewable energy is built on innovation – solar power, wind power, fuel cells, energy storage systems, higher efficiency electric generators, electric vehicles and a host of other power and energy alternatives gain greater acceptance as reliability and efficiency are improved and costs are reduced. For these reasons, new ideas and recent advances in existing designs fuel an expanding industry. We are experiencing changes in power generation,

delivery and use unprecedented since the time of Tesla, Westinghouse and Steinmetz 100 years ago.

Fortunately, the last 100 years have witnessed the transition from paper and pencil design and cut and try engineering methods to computer simulations and virtual prototyping. We are now able to design and build new energy systems in the computer, simulate them, optimize them, and make sure they work before expensive hardware is fabricated. Just as important, computer simulations provide understanding – how does the efficiency of a wind turbine-generator increase with variable step power conversion, how can an electric car get higher performance by optimizing the start-up stroke angle, how does wind flow affect resonances that can decrease the life of power systems – these and many other questions are answered easily in the computer but are very difficult to obtain experimentally.

This talk presents a range of simulation examples from the new, innovative power and energy industry. We present the optimization of a wind power generation system, from simulating the kinetic energy derived from the wind to the electrical energy produced by the generator, from the heat generated from losses in the generator laminations to the heat produced due to harmonics in DC-AC power conversion, and from the effects of wind gusts on reliability of wind turbine blades to the effects of power surges on grid reliability. For traditional electric generators, we present how advances in simulation techniques are used to gain a greater understanding of the total losses experienced by the electric machine and how these losses correspond to a rise in temperature and corresponding thermal stress as well as direct mechanical stress. For hybrid electric vehicles, we show how multiphysics simulations can increase reliability and performance and model the energy stored in a battery during a drive cycle. Obtaining a fundamental understanding the underlying physics-based issues is critical in obtaining the optimal design.



**Mr. John G Caron - Vice President for ABB Service in Canada**

Mr. John G Caron is Vice President for ABB Service in Canada. John has a Master's degree in Project Management from the University of Quebec and an undergraduate degree in Mechanical Engineering from University of Sherbrooke.

John has worked in the manufacturing and process industry for 22 years. For the past 14 years, he has built Service operations with solving customer issues in mind. He joined ABB in 2000 and works closely for ABB's five Divisions. His stewardship has rapidly made the Canadian team a top business performer within ABB global service network. During his tenure, ABB Service in Canada has grown over 400% with no stop insight.

John Caron's current challenges include working with utility and process industry customers to increase asset reliability to realize energy conservation gains as well as reducing the total cost of ownership.

**"ABB's Innovative Solutions to Increase Industrial Productivity"**

During his presentation, Mr. Caron will talk about how ABB's innovative solutions are helping customers to use electrical power effectively and to increase industrial productivity in a sustainable way. He will focus on several breakthroughs, including HVDC Light technology, technologies for ultrahigh-voltage transmission at 800 kV DC and 1,000 kV AC, FACTS and Smart Grid. He will also describe ABB's renewable energy solutions including wind, hydrogen, hydro and solar power technologies.



**Mr. Jean Bélanger - Co-Founder, CEO and CTO of OPAL-RT Technologies**

Mr. Jean Bélanger is the co-founder, CEO and CTO of OPAL-RT Technologies. Founded in 1997, OPAL-RT Technologies develops and commercializes digital real-time simulators for the design of systems and the testing of electronic controllers. Jean Bélanger received his Electrical Engineering degree in 1971 in Laval University, in Quebec City, and his Master degree from the École Polytechnique de Montreal.

Under his direction and technological leadership, OPAL-RT became a well known developer of state-of-the-art real-time simulators capable to simulate all sorts of mechanical and electrical systems, including the fastest power electronic converters used in a wide range of industries - from hybrid vehicles to entirely electrical-driven aircrafts, and from micro-grids to very large AC/DC power systems.

Jean Bélanger began his career at Hydro-Quebec's System Planning Division and in IREQ. His contribution allows the insulation and co-ordination of equipments and the installation of lines on the 765-kV James Bay transmission system, as well as the installation of static var compensators and series capacitor. He also contributed to the design and construction of Hydro-Quebec real-time simulators.

Today, Jean Bélanger foresees that high-end real-time simulators will soon be available to all engineers, scientists and students by taking full advantage of off-the-self PCs. This is the main challenge that Jean Bélanger and the OPAL-RT team took as their primary goal.

**“The Use of Model-Based Design Method and Real-Time Simulation for Power Electronic System Design and Test: Renewable Energy Applications”**

Mr. Belanger will discuss how power system simulators evolve to follow the evolution of power systems, which are taking full advantage of power electronic systems using conventional thyristors and very fast IGBT switches.

He will explain how standard PCs can now be used to replace multi-million dollar analog simulators to test the most advanced and fast power electronic systems proposed by innovative manufacturers for renewable energy systems, hybrid vehicles, electrical aircrafts and all-electric ships. He will also present examples of real-time simulation of large wind farms, multi-terminal HVDC systems and STATCOM with hundreds of IGBT switches.

He will conclude by challenging University faculties in enhancing the teaching of modern power systems.





**Mr. John Douglas, Founder, President and CEO,  
Riverbank Power Corporation**

Mr. Douglas is the founder, President and CEO of Riverbank Power Corp. Mr. Douglas is also the founder and a Director of Transmission Developers Inc. Until recently, Mr. Douglas served as the President and CEO of Ventus Energy Inc. a company which he co-founded in 2004 to develop wind farms in Canada. In 2007, Ventus was acquired by Suez Energy for \$140 million. Previously Mr. Douglas was Senior Vice President and Director in the Investment Banking group at Sprott Securities Inc. (now Cormark Securities Inc.), Canada's leading small-to-mid capitalization investment bank. Mr. Douglas joined Sprott in 1996 and participated in the employee buy-out of the majority ownership position from its founder Eric Sprott in 2000. Mr. Douglas is a Chartered Accountant and Chartered Business Valuator.

**"A New Concept in Pump Storage: Introduction to Aquabank"**

Riverbank Power Corporation is an alternative energy development company whose mission is to become the leading independent power producer of underground pumped storage facilities in the world. The Company is developing a portfolio of new underground pumped storage facilities in North America. Each facility represents 1,000 MW of pumped storage hydro power generation. This new alternative energy storage solution, known as Aquabank™, has tremendous potential worldwide while creating significant new employment opportunities. Aquabank™ converts surplus "off-peak" energy created from wind, tidal, and biomass into a substantially more valuable, reliable, and needed capacity product for delivery in the "on-peak" market. Aquabank™'s new storage medium effectively acts as a "battery" to enable the proliferation of other renewable energy sources such as wind, tidal, and biomass. Aquabank™ will also significantly strengthen the transmission grid and improve its reliability. The ancillary benefits derived from Aquabank™'s functionality are essential to the achievement of Renewable Portfolio Standards around the world.

Riverbank's Aquabank™ is an underground alternative power generation facility that produces electricity from turbines located underground near a suitable water source with a combined installed capacity of 1,000 MW.

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The Aquabank™ system temporarily diverts water from the source using the force of gravity down 600 metre shafts to an underground powerhouse, where it travels through four massive turbines, thereby creating emission-free electric power. This newly generated power is then harnessed by a transformer and sent to the power grid to help accommodate peak consumption periods in urban communities.

Once through the turbines, the water is then temporarily stored in enormous reservoirs at approximately the same depth as the powerhouse before being pumped back to its original source using lower cost power from traditional and renewable power sources.

## EPEC09 Program at a Glance

Day	Hours	Hibiscus A	Ball room	Hibiscus B	Orchidée A	Spa	Ball Room Lobby
<b>THURSDAY</b>	8:30		Opening- Plenary-Keynote				Coffee Break and Exhibition
	10:15						
	10:30	<b>T2.1</b> Electric/Hybrid Electric Vehicles	<b>Panel#1</b> Recent Developments and Trends in Large Hydroelectric Generators	<b>T2.3</b> Microgrids			
	12:30		Lunch and Exhibition				
	14:00	<b>T3.1</b> Power Electronics & Drives	<b>T3.2</b> Special Session Photovoltaic (PV) Systems Integration Issues	<b>T3.3</b> Power Systems I			
	16:00					<b>Coffee Break and Exhibition</b>	
	16:15- 17:15 17:30- 18:30 18:30			<b>BANQUET</b>		<b>Poster Session 1</b> <b>Poster Session 2</b>	
<b>FRIDAY</b>	8:00		<b>Keynote</b>				Coffee Break and Exhibition
	9:30						
	10:00	<b>F2.1</b> Biomass and Heat Recovery	<b>F2.2</b> Power Systems II	<b>Panel#2</b> Marine Energy	<b>F2.4</b> Wind Power I		
	12:00		LUNCH and Keynote				
	14:00	<b>F3.1</b> Special Session Plug In Hybrid EV	<b>Panel#3</b> Hydro Power and Storage Technology	<b>F3.3</b> Wind Power II	<b>F3.4</b> Energy Efficiency		
	16:00						Coffee Break
	16:15	<b>F4.1</b> Solar Power	<b>F4.2</b> Generation	<b>F4.3</b> Alternative Systems	<b>F4.4</b> Energy Storage		

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**Registration and Welcoming Reception**

<b>Wednesday, October 21, 2009</b>	
16:00–19:00	<b>Registration</b> <b>Location: Holiday Inn Select Lobby Next to the Hotel Registration 2<sup>nd</sup> Floor</b>
17:30-19:00	<b>Welcome Reception</b> <span style="float: right;"><b>Location: Orchidée A, Holiday Inn</b></span>

**Technical Program Overview**

<b>Thursday, October 22, 2009</b>			
7:00–8:30	<b>Registration</b> <b>Location: Holiday Inn Select Lobby Next to the Hotel Registration 2<sup>nd</sup> Floor</b>		
8:30-8:40	<b>Official Opening Address</b> Dr. Pragasen Pillay, Concordia University, Conference Chair		<b>Room: Ballroom</b>
8:45-9:30	<b>Plenary Session</b> <span style="float: right;"><b>Room: Ballroom</b></span> <b>Chair: Dr. Pragasen Pillay, Concordia University, Conference Chair</b>		
	8:45-9:30	<b>"Energy Sustainability - A Hydro-Quebec Perspective"</b> By Dr. Denis Faubert, Director, IREQ, Institut de Recherche d'Hydro-Québec	
	<b>Keynote speaker</b> <span style="float: right;"><b>Room: Ballroom</b></span>		
	9:30-10:15	<b>"Technology Innovation for Sustainable/Renewal Energy – A Simulation Driven Approach"</b> By Dr. Zoltan Cendes, Chief Technology Officer and General Manager of Ansoft, LLC.	
	10:15-10:30	<b>Coffee Break and Exhibition</b> <span style="float: right;"><b>Room: Ballroom Lobby</b></span>	
10:30-12:30	<b>Oral Sessions</b>		
	Session T2.1 Electric/Hybrid Electric Vehicles Chair: Dr. Narayan Kar, University of Windsor	Session T2.2 <b>PANEL #1</b> Recent Developments and Trends in Large Hydroelectric Generators	Session T2.3 Microgrids Chair: Dr. Luiz Lopes, Concordia University

*Sustainable/ Renewable Energy Systems and Technologies - "LES SYSTÈMES ÉNERGIQUES DURABLES/RENOUVELABLES ET LES TECHNOLOGIES"*

	<b>Room: Hibiscus A</b>	Chair: Dr. Arezki Merkhouf, Hydro Québec <b>Room: Ballroom</b>	<b>Room: Hibiscus B</b>
12:30-14:00	<b>Lunch and Exhibition</b> <b>Location: Exhibition in the Ballroom Lobby, lunch on your own</b>		
	<b>Oral Sessions</b>		
14:00-16:00	Session T3.1 Power Electronics & Drives Chair: Dr. Kamal Al-Haddad, ETS  <b>Room: Hibiscus A</b>	Session T3.2 Special Session Photovoltaic (PV) Systems Integration Issues Chair: Dr. Lisa Dignard, NRCan  <b>Room: Ballroom</b>	Session T3.3 Power Systems I Chair: Dr. Geza Joos, McGill University  <b>Room: Hibiscus B</b>
16:00-16:15	<b>Coffee Break and Exhibition</b> <b>Room: Ballroom Lobby and Spa</b>		
16:15-17:15	<b>Poster Session 1</b> , Co-Chairs Dr. Kamal Al-Haddad, Dr. Amir Aghdam, Dr. Anader Benyamin-Seeyar <b>(the first 32 papers in the poster session will be in poster session 1)</b> <b>Room: Spa</b>		
17:30-18:30	<b>Poster Session 2</b> . Co-Chairs Dr Kamal Al-Haddad, Dr. Amir Aghdam, Dr. Anader Benyamin-Seeyar <b>(posters 33-64 will be in the second poster session 2)</b> <b>Room: Spa</b>		
19:00	<b>BANQUET and Awards</b> <b>Room: Ballroom</b>		

<b>Friday, October 23, 2009</b>			
8:00-8:05	<b>Welcome:</b> Dr. Pragasen Pillay, Concordia University, Conference Chair		
	<b>Keynote speakers</b> <b>Chair:</b> Dr. Geza Joos, McGill University <b>Room: Ballroom</b>		
8:05-8:45	<b>"ABB's Innovative Solutions to Increase Industrial Productivity"</b>  By Mr. John G Caron, Vice President for ABB Services in Canada		
8:05-10:00	8:50-9:30	<b>"The Use of Model-Based Design Method and Real-Time Simulation for Power Electronic System Design and Test: Renewable Energy Applications"</b>  By Mr. Jean Bélanger, Co-Founder, CEO and CTO of OPAL-RT Technologies.	
	9:30-10:00	<b>Coffee Break and Exhibition</b> <b>Room: Ballroom Lobby</b>	

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	<b>Oral Sessions</b>			
10:00-12:00	Session F2.1 Biomass and Heat Recovery Chair: Dr. Daniel Rousse, ETS  <b>Room: Hibiscus A</b>	Session F2.2 Power Systems II Chair: Dr. Ambrish Chandra, ETS  <b>Room: Ballroom</b>	Session F2.3 <b>PANEL #2</b> Marine Energy Chair: Dr. Mo El- Hawary, Dalhousie University  <b>Room: Hibiscus B</b>	Session F2.4 Wind Power I Chair: Dr. Voicu Groza, University of Ottawa  <b>Room: Orchidée A</b>
12:00-14:00	<b>Lunch</b> <b>“A New Concept in Pump Storage: Introduction to Aquabank”</b> Keynote by Mr. John Douglas: Founder, President and CEO of Riverbank Power Corp Chair: Dr. Kamal Al-Haddad, ETS			<b>Room: Ballroom</b>
	<b>Oral Sessions</b>			
14:00-16:00	Session F3.1 Special Session Plug In Hybrid EV Chair: Dr. Sheldon Williamson, Concordia University  <b>Room: Hibiscus A</b>	Session F3.2 <b>PANEL #3</b> Hydro Power and Storage Technology Chair: Dr. S Pejovic, University of Toronto  <b>Room: Ballroom</b>	Session F3.3 Wind Power II Co-Chairs: Dr. Azeem Khan and Dr. Paul Barendse, University of Cape Town, SA  <b>Room: Hibiscus B</b>	Session F3.4 Energy Efficiency: Chair: Dr. Joseph Ojo, Tennessee Tech.  <b>Room: Orchidée A</b>
16:00-16:15	<b>Coffee Break</b>			<b>Room: Ballroom Lobby</b>
	<b>Oral Sessions</b>			
16:15-18:15	Session F4.1 Solar Power: Dr. Wahab Almuhtadi  <b>Room: Hibiscus A</b>	Session F4.2 Generation Chair: Dr. Laurent Lamarre, Hydro Quebec  <b>Room: Ballroom</b>	Session F4.3 Alternative Systems Dr. Mamadou Lamine Doumbia, University of Quebec at Trois Rivieres  <b>Room: Hibiscus B</b>	Session F4.4 Energy Storage Dr. Branislav Djokic, National Research Council, Ottawa  <b>Room: Orchidée A</b>

## Technical Program Detail

<b>Thursday, October 22, 2009 8:30AM – 10:30AM</b>	
8.:30	<b>Opening Ceremony</b> <span style="float: right;"><b>Room: Ballroom</b></span>
<b>Plenary Session</b> <span style="float: right;"><b>Room: Ballroom</b></span> <b>Chair:</b> Dr. Pragasen Pillay, Concordia University, Conference Chair	
8:45	<i>"Energy Sustainability - A Hydro-Quebec Perspective".</i> Dr. Denis Faubert, Director and General Manager, IREQ
9:30	<i>"Technology Innovation for Sustainable/Renewal Energy – A Simulation Driven Approach"</i> Dr. Zoltan Cendes, Chief Technology Officer and General Manager of Ansoft, LLC.
<b>10:15 AM – 10:30 AM Coffee Break and Exhibition</b> <span style="float: right;"><b>Room: Ballroom Lobby</b></span>	
<b>Thursday, October 22, 2009 10:30AM – 12:30AM</b>	
10.:30	<b>Oral Sessions</b>
<b>Session T2.1: Electric and Hybrid Vehicles</b> <span style="float: right;"><b>Room: Hibiscus A</b></span> <b>Chair:</b> Dr. Narayan Kar, University of Windsor	
10:30	<b>Comparative Study of HEV Control Strategies for Improved Drivetrain Efficiency Analysis</b> <i>Chirag Desai -Concordia University, Sheldon Williamson -Concordia University</i>
10:50	<b>Neural Network Based Torque Control of Switched Reluctance Motor for Hybrid Electric Vehicle Propulsion at High Speeds</b> <i>Dongyun Lu -University of Windsor, Narayan C. Kar -University of Windsor</i>
11:10	<b>Voltage Mode and Current Mode Control for a 30 kW High-Performance Z-Source Inverter</b> <i>Joeri Van Mierlo -Vrije Universiteit Brussel, Omar Ellabban -Vrije Universiteit Brussel</i>

11:30	<p><b>A Novel FPGA Based Off-Line Control Strategy for SRM Integrated Vehicle Propulsion System</b>  <i>Peng Zhang -Concordia University, Sheldon Williamson -Concordia University</i></p>
11:50	<p><b>Hydrogen Safety Monitoring on Challenge X Vehicle</b>  <i>Jerry Hines –NI, Miki VanCleave –NI, Stephen Barrett -NI</i></p>
12:10	<p><b>Hyper-Cycling Series Hybrid Drivetrain Implementation</b>  <i>Chris Matthieu -University of Windsor, Marco Danti -University of Windsor, Mustafa Sheikh -University of Windsor, Narayan Kar -University of Windsor, Shuhaib Saleem -University of Windsor</i></p>

**Session T2.2: Panel session #1: Recent Developments and trends in Large Hydroelectric Generators**

**Chair:** Dr. Arezki Merkhouf, IREQ

**Room:** Ballroom

**1. Title: Wind and Pumped Storage**

**Speaker:** Rick Miller, HDR|DTA

**Abstract:** Wind power has become an important contributor in the U.S. renewable energy portfolio, with over 18,000 MW currently installed and sustainable wind energy playing an increasingly important role in our long-term energy strategy. The U.S. Department of Energy examined the technical feasibility of having wind energy supply 20% of the nation's energy by the year 2030, and concluded that regions with large hydroelectric resources will have much lower costs integrating this technology. There are many advantages of wind as a clean, renewable energy source, but its variability is still a major challenge. Implementing this significant increase in wind power into the broader electric supply system will require multiple balancing strategies and storage options to maintain capacity reserves and system reliability.

This paper will examine hydroelectric pumped storage as an enabling technology for increased wind power incorporation into the U.S. energy supply system. Many scientific studies show that wind is predominant at night; the electricity generated from this weather trend can provide an excellent source of pumping power for a pumped storage system. The stored energy can then be utilized to "steady" the variability of wind when it is needed most. Pumped storage has historically been used to balance load on a system and allow large, thermal generating sources to operate at optimum conditions. Pumped storage has also been proven as an excellent grid enhancer by providing much needed ancillary services, such as synchronous condensing operation, kVAR and frequency control, and quick response to load changes. Wind generation now provides pumped storage with yet another opportunity to play a critical role in our nation's energy future.

**Speaker's Bio:** Richard R. Miller is a civil engineer with over 30 years of experience in



water resources and hydroelectric/pumped storage plant operations/engineering. His expertise includes project management, hydropower/pumped storage operations, civil engineering, resource planning, and training/managing staff. As the immediate Past President of the National Hydropower Association, Mr. Miller has been actively involved in drafting and reviewing federal legislative language for proposed Renewable Electricity Standards, carbon cap and trade proposals, as well as energy storage and hydropower grid stability standards. He has also been an advisor to the Department of Energy regarding wind/pumped storage integration and energy storage market requirements. Mr. Miller is Senior Vice President of Renewable Energy Services with HDR|DTA.

## **2. Title: Electromagnetic Modeling of Large Hydro electrical Generators**

**Speakers:** E. Guillot<sup>2</sup>, A. Merkhof<sup>1</sup>, C. Hudon<sup>1</sup> and Y. Le Menach<sup>3</sup>,

<sup>1</sup>IREQ Research Institute of Hydro Québec, Varennes, Québec

<sup>2</sup>Electricité de France, direction Recherche et Développement

<sup>3</sup>L2EP University of Lille Cité scientifique 59655 Villeneuve d'Ascq

**Abstract-** In order to evaluate the performances and the limits of large hydro electrical generators, modeling tools such as numerical and analytical methods can be very useful for the power plant utility. This present paper deals with the electromagnetic modeling of a hydroelectric generator by using different approaches including numerical and analytical methods.

Numerical and analytical simulations were carried out on large existing hydro electrical large pump storage. The different obtained results with different approach such as magnetic field distribution and magnetic losses at different operation mode will be discussed and compared with the test results in this paper.

**Speakers Bio:** Eilin Guillot received the Diploma degrees in electrical engineering from the Ecole Spéciale des Travaux Publics, Paris, France. In 1999 she joined the Research and Development division of EDF. Her research interests include condition monitoring, diagnostic tools and numerical modeling of electrical machines.

## **3. Title: Influence of Hydro-generator Rotor Pole Geometry as Obtained with 3D Scan on the Electromagnetic parameter**

**Speakers:** N. Amyot, G. Gauthier, A. Merkhof, C. Hudon, J. Picard, S. Beauregard, B. Navarrette Hydro-Québec (IREQ)

**Abstract:** The geometry of the pole face shapes in large hydroelectric generators affects many aspects of the electromagnetic design such as voltage waveform, voltage distortion and telephone influence factor, reactance, air gap stiffness, magnetic noise, vibration, and electromagnetic losses. In many existing industrial design practices of the rotor pole shape, the single pole face radius ( $R_1$ ) is used to obtain a ratio of the maximum to the minimum air gap varying from 1.5 to 2.0. More recently, some other

design practices are characterized by using a second radius ( $R_2$ ) pole tip. It is claimed that the use of this new geometry results in an overall generator design with lower total losses.

The aim of this study was to capture the exact geometries of an existing rotor with 3D scanning systems in order to compare, in the near future, the electromagnetic losses and other electrical parameters for the actual geometry and extreme geometries. 3D scan methods were performed to determine the exact actual rotor pole shape geometry of an existing rotor of large hydro electrical generator. The obtained results are discussed and compared to the design data.

**Speakers Bio:**

Normand Amyot received the B.Eng. and M.Sc.A. degrees in physics engineering from École Polytechnique de Montréal in 1987 and 1990 respectively. He joined the Research Institute of Hydro-Québec (IREQ) scientific staff in 1991, where he is now a senior research scientist. His field of expertise includes electrical insulation aging and characterization, diagnostic techniques and condition based maintenance.

Geneviève Gauthier is a mechanical engineering graduate from Ecole Polytechnique de Montréal. She's a researcher at IREQ, the research institute of Hydro-Québec, and her main area of interest is reverse engineering on large complex geometries, like hydraulic turbine runners.

**4. Title: Hydroelectric Generator Power Increase Challenges**

**Speaker:** A. Merkhof and C. Hudon

Hydro Québec, IREQ

**Abstract:** The hydroelectric generation industry faces two related challenges: increasing the output and reliability of these aging facilities. Increased output may be achieved with or without mechanical modifications to the generator. Many aspect of hydroelectric generator should be considered during the upgrade study. Magnetic losses of the stator core and poles may change significantly with the load increase. The open and short circuit losses are major components in the efficiency and temperature rise calculations. Advanced numerical methods are used to determine different magnetic losses in the considered hydroelectric generator, many results and aspects will be discussed in this paper.

**Speaker Bio: Dr. Arezki Merkhof** is Senior Member IEEE, B.Sc. Eng.'90, University of Algeria; M.Sc.'92 University of Pierre and Marie Curie, France; Ph.D.'1999 University of Sherbrooke (Quebec), in electrical engineering. In June 2000, he joined GE Energy (Hydro), where he is a member of R&D team until 2008. And then he moved to the research Institute of Hydro Quebec (IREQ). His research activities include analytical and numerical simulation of large rotating electrical machines, numerical and analytical

computation of electromagnetic fields, variable frequency transformers, power electronic and drives.	
<b>Session T2.3: Microgrids/Grid Interfacing</b> <span style="float: right;"><b>Room: Hibiscus B</b></span>	
<b>Chair:</b> Dr. Luiz Lopes, Concordia University	
10:30	<b>Adaptive Neuro-Fuzzy Control of Renewable Interfacing Inverter to Maintain Smooth Power Flow and Non-Linear Unbalanced Load Compensation Simultaneously</b> <i>Amrisha Chandra -École de Technologie Supérieure, Mukhtiar Singh -École de Technologie Supérieure</i>
10:50	<b>Frequency Regulation and Advanced Power Sharing in Microgrids Including Modified Droop Coefficients and Virtual Resistances</b> <i>Luiz A.C. Lopes -Concordia University, Mohammad Ali Aghasafari - Concordia University, Sheldon S. Williamson -Concordia University</i>
11:10	<b>Optimal Design and Operation of a Grid-Connected Microgrid</b> <i>Amirnaser Yazdani -The University of Western Ontario, Shervin Mizani -The University of Western Ontario</i>
11:30	<b>Virtual Frequency-Voltage Frame Control of Inverter Based Low Voltage Microgrid</b> <i>Yan Li -University of Alberta, Yun Wei Li - University of Alberta</i>
11:50	<b>Design and Implementation of an Anti-Islanding Protection Strategy for Distributed Generation involving Multiple Passive Protections</b> <i>Aidan Foss -ANF Energy Solutions, Kalle Leppik -ANF Energy Solutions</i>
12:10	<b>A Dynamic Voltage Regulator Compensation Scheme for a Grid Connected Village Electricity Hybrid Wind/Tidal Energy Conversion Scheme</b> <i>Adel Sharaf -University of New Brunswick, Tarek About-Seoud - University of New Brunswick</i>
12:30 – 14:00 <b>Lunch and Exhibition</b> <b>Location: Exhibition in the Ballroom Lobby, Lunch on your own</b>	

**Thursday, October 22, 2009 14:00 – 16:00**

**Session T3.1: Power Electronics & Drives**

**Room: Hibiscus A**

**Chair:** Dr. Kamal Al-Haddad, *École de Technologie Supérieure*

14:00	<p><b>A PMSM Drive Design with Inverter-Stage Soft-Switching Hysteresis Current Control and Space Vector Modulation for Two-Level Operation of a Very Sparse Matrix Converter</b> <i>Ed Nowicki -University of Calgary, Mohamed Aner -University of Calgary, Nacer Benaifa -University of Calgary</i></p>
14:20	<p><b>The Effect of States on Time Calculations and States Sequence in Low Order Harmonics of Space Vector Modulated Current Source Converter</b> <i>Luiz Lopes -Concordia University, Maged Naguib -Concordia University</i></p>
14:40	<p><b>An Optimal Control Strategy for the IPM Motor Drives</b> <i>Hasan Abniki -UT, Mehdi karbalaye zadeh – UT, Mohammad taghi nabavi razavi -UT</i></p>
15:00	<p><b>ANN-Based Optimal Energy Control of Induction Motor in Pumping Applications</b> <i>Ali Elgendy -Ministry of Irrigation and Water Resources Egypt, Mohamed Badr -Ain Shams University Egypt, Osama Bayoumy, Queen's University Canada, Praveen Jain -Queen's University Canada</i></p>
15:20	<p><b>Neural Network Based Speed Observer for Interior Permanent Magnet Synchronous Motor Drives</b> <i>Hicham Chaoui -University of Ottawa , Mustapha C.E. Yagoub - University of Ottawa, Wail Gueaieb -University of Ottawa</i></p>
15:40	<p><b>PEM Fuel Cell Dynamic Model for Electronic Circuits Simulator</b> <i>Ernane A. A. Coelho -Federal University of Uberlândia, Henrique José, Avelar - Federal University of Uberlândia, João B. Vieira Júnior, Federal University of Uberlândia , José R. Camacho -Federal University of Uberlândia, Luis C. Freitas -Federal University of Uberlândia, Marcel Wu -Fe</i></p>

<b>Session T3.2: SPECIAL SESSION: Photovoltaic (PV) Systems Integration Issues</b> <b>Chair:</b> Dr. Lisa Dignard, NRCan <span style="float: right;"><b>Room:</b> Ballroom</span>	
14:00	<b>Simulation Tools for Photovoltaic Systems Grid Integration Studies</b> <i>Athula Rajapakse -University of Manitoba, Dharshana Muthumuni -Manitoba HVDC Research Centre</i>
14:20	<b>State Feedback Linearization Control of a Grid Connected Photovoltaic Interface with MPPT</b> <i>Ambrish Chandra -École de Technologie Supérieure, Aslain Ovono Zue - École de Technologie Supérieure</i>
14:40	<b>Clustered PV Inverters in LV Networks: An Overview of Impacts and Comparison of Voltage Control Strategies</b> <i>Dezso Sera -Aalborg University Institute of Energy Technology, Erhan Demirok -Aalborg University Institute of Energy Technology, Pedro Rodriguez -Technical University of Catalonia Department of Electrical Engineering, Remus Teodores- 5. Aalborg University, Institute of Energy Technology, Pontoppidanstræde 101, Aalborg, Denmark</i>
15:00	<b>Grid Voltage Regulation Utilizing Storage Batteries in PV Solar – Wind Plant based Distributed Generation System</b> <i>Rajiv Varma - University of Western Ontario, Ravi Seethapathy -Hydro One Networks Inc., Vinod Khadkikar -University of Western Ontario</i>
15:20	<b>Fault Contribution of Grid-Connected Inverters</b> <i>Dave Turcotte -Natural Resources Canada, Farid Katiraei -Quanta Technology</i>
15:40	<b>Active Power Curtailment of PV Inverters in Diesel Hybrid Mini-grids</b> <i>Reinaldo Tonkoski -Concordia University, Luiz Lopes -Concordia University, Dave Turcotte -Natural Resources Canada</i>

<b>Session T3.3: Power Systems I</b>		<b>Room: Hibiscus B</b>
<b>Chair:</b> Dr. Geza Joos, McGill University		
14:00	<p><b>Modified Artificial Bee Colony Algorithm for Optimal Distributed Generation Sizing and Allocation in Distribution Systems</b> <i>Fahad Abu-Mouti -Dalhousie University, Mohamed El-Hawary - Dalhousie University</i></p>	
14:20	<p><b>Modified Bacterial Foraging Algorithm for Optimum Economic Dispatch</b> <i>Ibrahim Farhat -Dalhousie University , Mohamed El-Hawary - Dalhousie University</i></p>	
14:40	<p><b>Strategic Maintenance Scheduling of Distributed Generations in Oligopolistic Electricity Markets</b> <i>Mohammad Ali Fotouhi Ghazvini -K. N. Toosi University of Technology , Seyyed Masoud Moghaddas Tafreshi -K. N. Toosi University of Technology</i></p>	
15:00	<p><b>A New Solution for Maintenance Scheduling Using Maintenance Market Simulation Based on Game Theory</b> <i>Amirhosein Parsaeifard - Islamic Azad University, Tehran, Iran, Mahmoud Reza Haghifam - Tarbiat Modares University, Tehran, Iran, Moein Manbachi - Islamic Azad University, Tehran, Iran</i></p>	
15:20	<p><b>Short-Term Hydro-Thermal Scheduling Using an Improved Bacterial Foraging Algorithm</b> <i>Ibrahim Farhat -Dalhousie University, Mohamed El-Hawary - Dalhousie University</i></p>	
15:40	<p><b>Performance Improved Distributed System Based Integrated Controlled STATCOM</b> <i>Abdualah Aljankaway -UNB</i></p>	
16:00PM – 16:15PM <b>Coffee Break</b>		<b>Room: Ballroom Lobby and Spa</b>

**Thursday, October 22, 2009 16:15PM – 18:00PM**

16:15-17:15 **POSTER Sessions: 1**

**Room: Spa**

**Co-Chairs:** Dr. Kamal Al-Haddad, Dr. Amir Aghdam and Dr. Anader Benyamin-Seeayar

**Poster Session: Biomass Power**

P1 **GUI Energy and Economic Analysis of Closed-loop Plasma Waste-to-Power Generation Model and in Comparison with Incineration and Micro-turbine Models**  
*Frank Yeboah -NC A&T State University, Harmohindar Singh -NC A&T State University, Ransford Baidoo -NC A&T State University*

P2 **Exergy and Energy Analysis of Plasma Waste-to-Power Generation Model**  
*Ransford Baidoo -NC A&T State University, Frank Yeboah -NC A&T State University, Frederick Ferguson -NC A&T State University*

**Poster Session: Conservation and Energy Efficient Technologies**

P3 **A New Method of Control for Multilevel Converter Implemented on FPGA**  
*Kamal Al-Haddad -École de Technologie Supérieure, Luc-André Grégoire -École de Technologie Supérieure, Youssef Ounejjar -École de Technologie Supérieure*

P4 **Energy Security in the Residential Sector: An Examination of Rapid Responses to Home Heating Emergencies**  
*Dave Ron -Dalhousie University, Larry Hughes -Dalhousie University*

**Poster Session: Expanding Generation and Alternative Energy**

P5 **Experimental Investigation of a grid-Connected Photovoltaic/Wind Energy System**  
*Mamadou Lamine Doumbia- Université du Québec à Trois-Rivières, Kodjo Agbossou - Université du Québec à Trois-Rivières*

P6	<p><b>Developing a Communications Architecture for the Smart Grid</b>  <i>Vijay K. Sood-University of Ontario Institute of Technology , Daniel Fischer – University of Ontario Institute of Technology, Mikael Eklund - University of Ontario Institute of Technology, Tim Brown - WireE Canada Inc.</i></p>
P7	<p><b>Field Test Results of Power-Line Signaling Based Anti-Islanding Scheme</b>  <i>Chris Lerohl -University of Alberta , Corey Senkow -Manitoba Hydro,, Wilsun Xu -University of Alberta , Xun Long -University of Alberta, Yunwei Li -University of Alberta</i></p>
P8	<p><b>Utilization of the Modulated Power Filter Compensator Scheme for Grid Connected Tidal Energy Utilization Systems</b>  <i>Adel Sharaf -University of New Brunswick , Tarek Aboul-Seoud - University of New Brunswick</i></p>
P9	<p><b>A Review of Ocean Wave Energy Conversion Systems</b> <i>Mehrdad Moallem -Simon Fraser University , Reza Sabzehgar -Simon Fraser University</i></p>
P10	<p><b>Robust Gain Scheduled Control of a Hydrokinetic Turbine Part 1: Design</b>  <i>Jeff Pieper -University of Calgary, Vincent Ginter -New Energy Corp. Inc.</i></p>
P11	<p><b>Robust Gain Scheduled Control of a Hydrokinetic Turbine Part 2: Testing</b>  <i>Jeff Pieper -University of Calgary, Vincent Ginter -New Energy Corp. Inc.</i></p>
P12	<p><b>A Case Study of BIPV Installation for an Urban Building in Downtown Montreal</b>  <i>Arbi Gharakhani Siraki -Concordia University, Pragasen Pillay - Concordia University ,Sheldon Williamson -Concordia University</i></p>



<b>Poster Session: Electric/ Hybrid Electric Vehicles</b>	
P13	<b>A Full Hybrid Electric Scooter</b> <i>KU Chan –University of Macau, TW Ching - University of Macau</i>
P14	<b>Analysis of the Battery Performance in Hybrid Electric Vehicle for Different Traction Motors</b> <i>Chitradeep Sen -University of Windsor, Narayan Kar -University of Windsor</i>
P15	<b>Review of Alternate Energy Storage Systems for Hybrid Electric Vehicles</b> <i>Sheldon Williamson -Concordia University, Zahra Amjadi - Concordia University</i>
<b>Poster Session: Fuel Cells</b>	
P16	<b>A Novel Stabilization Dynamic filter Scheme for Fuel Cell Utilization System</b> <i>Adel Sharaf -University of TT, Mohamed El-Sayed -University of TT</i>
P17	<b>Current-Tracking in Fuel Cell/Battery Hybrid System Using Fuzzy Controller</b> <i>Abolfazl Ranjbar -Babol Noshirvani Institute of Technology, Ali Nabavi Niaki -Toronto Canada, Reza Ghaderi -Babol Noshirvani Institute of Technology, Seyed Mehdi Rakhtala Rostami -Babol Noshirvani Institute of Technolog</i>
P18	<b>A Novel Isolated DC/DC Converter For Fuel Cell Powered Load</b> <i>Amir Hosein Fathi -Sharif University, Ramin Roshandel -Sharif University , Sajad Hoseinnia -Shahed University</i>
P19	<b>Air Cathodes for Metal-Air Batteries and Fuel Cells</b> <i>Haijiang Wang -NRC-IFCI, Jonathan Martin - NRC-IFCI, Vladimir Neburchilov -NRC-IFCI, Wei Qu -NRC-IFCI</i>

<b>Poster Session: Intelligent Grid Technologies</b>	
P20	<p><b>Transformation of Energy Systems: The Control Room of the Future</b>  <i>Adrian Clarke -Energy Australia, Christopher Pavlovski –IBM, Jeff Fry -Energy Australia</i></p>
<b>Poster Session: Novel Power Generation</b>	
P21	<p><b>Energy Generation and Storage using Evaporated Brines</b>  <i>R.I. MacDonald -Halodyne Inc.</i></p>
P22	<p><b>Simulation of a Distributed Generation System Using Microturbine in STELLA</b>  <i>Ana Aguiar –BatLab, Cristiane Merigui –BatLab, João Pinto -BatLab Marcio Kimpapa -BatLab</i></p>
<b>Poster Session: Power Systems</b>	
P23	<p><b>Novel Three Phase Seven Level PWM Converter</b>  <i>Kamal Al-Haddad -École de Technologie Supérieure, Luc-Andre Gregoire -École de Technologie Supérieure, Youssef Ounejjar -École de Technologie Supérieure</i></p>
P24	<p><b>Multi-Objective Optimization of a Water-Tube Heat Recovery Steam Generator System</b>  <i>Behzad Najafi -K. N. Toosi University of Technology , Hamidreza Najafi -K. N. Toosi University of Technology</i></p>
P25	<p><b>Application of Dynamic programming for Distributed generation Allocation</b>  <i>Mahmoud Reza Haghifam - Tarbiat Modares University, Tehran, Iran, Navid Khalesi -Azad University</i></p>
P26	<p><b>Controller Design to Regulate the DC Voltage of a VSC Converter</b>  <i>Carlos Hidalgo -Distrital University, Gilberto Ordonez -Distrital University, Nelson Diaz -Distrital University</i></p>

<b>Poster Session: Solar Power</b>	
P27	<b>Residential Solar Systems: Technology, Net-Metering, and Financial Payback</b> <i>Kourosh Sedghisigarchi -West Virginia Institute of Technology</i>
P28	<b>Design of a Solar Powered Battery Charger</b> <i>John Makaran -Fanshawe College, Ke Liu -Fanshawe College</i>
<b>Special Session: Photovoltaic (PV) Systems Integration Issues</b>	
P29	<b>A Systematic Approach for Energy Design of Advanced Solar Houses</b> <i>Andreas Athienitis -Concordia University, José Candanedo - Concordia University</i>
<b>Poster Session: Plug-in Hybrid EV</b>	
P30	<b>PHEV Impacts on Microgrid Systems</b> <i>Brian Hacker – FSU, Chris Edrington – FSU, Sardis Azongha –FSU</i>
<b>Poster Session: Technology Trends</b>	
P31	<b>DSP-Based Sinusoidal PWM Signal Generation Algorithm for Three Phase Inverters</b> <i>Abdelrahman Yousif -Université du Québec à Trois-Rivières, Eshag Lesan-Université du Québec à Trois-Rivières, Mamadou Lamine Doumbia-Université du Québec à Trois-Rivières, Pierre Sicard- Université du Québec à Trois-Rivières</i>
P32	<b>Power Peak Shaving for a Subway – An Opportunity Study</b> <i>Francois Ruelland –Société de transport de Montréal, Kamal Al-Haddad –Ecole de Technologies Supérieur</i>

17:30-18:30 <b>POSTER Sessions: 2</b>		<b>Room: Spa</b>
<b>Co-Chairs:</b> Dr. Kamal Al-Haddad, Dr. Amir Aghdam and Dr. Anader Benyamin-Seeyar		
<b>Poster Sessions: Analysis</b>		
P33	<b>Parametric Analysis of Pump-Turbine Sites.</b> <i>James L. Gordon, James L. Gordon inc.</i>	
P34	<b>Evolutionary Analysis of Electricity Markets Based on Gradual Cournot Adjustment</b> <i>Yigang You -Huazhong University of Science and Technology</i>	
P35	<b>New Technology and Power Definitions Make Accurate Revenue Metering Possible in the Presence of Harmonic Distortion</b> <i>Andrew Berrisford -BC Hydro</i>	
P36	<b>Multi-Objective Optimization of a Fire-Tube Heat Recovery Steam Generator System</b> <i>Behzad Najafi -K. N. Toosi university of Tech, Hamidreza Najafi -K. N. Toosi university of Tech</i>	
P37	<b>Implementation of Preisach-Type Model for Studying of B-H Curve Influence on the Behavior of Flux-Coupling Type SFCL</b> <i>Faramarz Faghihi -Islamic Azad University South Tehran Branch Young Researchers Club, Homa Arab -Islamic Azad University South Tehran Branch Young Researchers Club</i>	
P38	<b>Icephobic PTFE Coatings for Wind Turbines operating in Cold Climate Conditions</b> <i>G. Guy Ross -INRS Énergie Matériaux et Télécommunications, Gilles Abel -INRS Énergie Matériaux et Télécommunications, Rachid Karmouch -INRS Énergie Matériaux et Télécommunications</i>	
P39	<b>An Investigation on the Relationship Between Impedance Matching and Maximum Power Transfer Problems</b> <i>Tongwen Chen -University of Alberta , Wilsun Xu -University of Alberta</i>	

P40	<p><b>Imulation and Hardware Verification of A PD Fuzzy Speed Controller for a Three Phase Induction Motor</b>  <i>Harold Chamorro- Universidad Distrital, Cesar Trujillo, Cesar Trujillo-Universidad Distrital, Guillermo Guarnizo, Guillermo Guarnizo-Universidad Distrital</i></p>
<p><b>Poster Session: Design</b></p>	
P41	<p><b>Fault Ride-Through Capability of Grid Connected Variable Speed Permanent Magnet Synchronous Generator for Wind Energy Conversion System</b>  <i>Dinesh Kumar Jain -Guru Premsukh Menorial College of Engineering Budhpur Delhi India, K.S. Sandhu -NIT Kurukshetra Haryana India, Rajveer Mittal -Maharaja Agrasen Institute of Technology, Rohini, Delhi, India</i></p>
P42	<p><b>Robust Continuous Generalized Predictive Control of a Permanent Magnet Synchronous Motor Drive</b>  <i>Mohand Ouhrouche -University of Quebec at Chicoutimi, Rachid Errouissi -University of Quebec at Chicoutimi</i></p>
P43	<p><b>Online Impedance Matrix Estimation of Interconnected Power Systems</b>  <i>Jing Yang -Central South University, University of Alberta, Min Wu - Central South University, Tongwen Chen -University of Alberta, Wilsun Xu -University of Alberta</i></p>
P44	<p><b>Power Quality Related Consumers Rights in Indian Electricity Market</b>  <i>Dinesh Kumar Jain -Guru Premsukh Memorial College of Engineering Budhpur Delhi India, Lokendra Pal Singh -Maharaja Agrasen Institute of Technology, Rohini, Delhi, India, S.P. Jain -NIT Kurukshetra Haryana India</i></p>
P45	<p><b>Hydro Review Boards - An Important Component for a Successful Development.</b>  <i>James L. Gordon-James L. Gordon inc.</i></p>

<b>Poster Session: Wave and Tidal Power</b>	
P46	<p><b>Optimal Self Regulating Stand-Alone Wave Energy Conversion Scheme</b>  <i>Adel Elgammal -University of Trinidad and Tobago, Adel Sharaf - University of Trinidad and Tobago</i></p>
P47	<p><b>State of the Art of Wave Energy in Spain</b>  <i>Hans Christian Soerensen - SPOK ApS Denmark, Julia Fernandez Chozas - SPOK ApS Denmark</i></p>
P48	<p><b>A Review of Methods for Determining Average Available Power from Tidal Currents</b>  <i>Gregory Trowse -Dalhousie University, Mohamed El-Hawary - Dalhousie University</i></p>
<b>Poster Session: Wind Power</b>	
P49	<p><b>Optimal Energy Utilization for a Stand-Alone Wind Energy Scheme WES</b>  <i>Adel Elgammal -University of Trinidad and Tobago, Adel Sharaf - University of Trinidad and Tobago</i></p>
P50	<p><b>Effects of Seasonality and Locality on the Operating Capacity Benefit of Wind Power</b>  <i>Bipul Karki -University of Saskatchewan, Roy Billinton -University of Saskatchewan</i></p>
P51	<p><b>Converter Protection Scheme for Permanent Magnet Synchronous Generator During DC Wind Farm Inner Fault Condition</b>  <i>Jin Yang -The University of Glasgow, John O'Reilly -The University of Glasgow, John E. Fletcher -The University of Strathclyde</i></p>
P52	<p><b>A Statistical Analysis of Wind Speed Data in West Central Part of Karnataka Based on Weibull Distribution Function</b>  <i>Jangamshetti H -Basaveshwara Engineering College, Keshavan Belur - PES Institute of Technology, Kumaraswamy BG -JM Institute of Technology</i></p>

P53	<p><b>A VAR Control Strategy of Wind Farm Based on Layered Principle</b>  <i>Songyan Wang -2. Harbin Institute of Technology, Xia TANG - Southeast Univeristy, Xia Zhou -1. State Grid Electric Power Research Institute</i></p>
P54	<p><b>3-Phase Resonant DC-DC Converter for Medium Power Applications</b>  <i>Dragan Jovicic -University of Aberdeen, Geza Joos -McGill University, Jonathan Robinson -McGill University</i></p>
P55	<p><b>Detailed Modeling of Wind Power Plants Incorporating Variable-Speed Synchronous Generator</b>  <i>Ali Shirvani -Chemnitz University of Thechnology, Kaveh Malekian - Chemnitz University of Thechnology, Uwe Schmidt -Chemnitz University of Thechnology , Wolfgang Schufft -Chemnitz University of Thechnology</i></p>
P56	<p><b>Reduced Order Doubly Fed Induction Generator Models for Controller Design</b>  <i>Katherine Elkington, Royal Institute of Technology, Mehrdad Ghandhari, Royal Institute of Technology</i></p>
P57	<p><b>A Novel Maximum Peak Power Tracking Controller for Wind Energy Systems Powered by Induction Generators</b>  <i>Abdellatif Miraoui –UTBM, Dimitri Torregrossa –UTBM, Francois Peyraut –UTBM, Marcelo Simoes -Colorado School of Mines, Morgan Kiani -University Of Texas at Arlington</i></p>
P58	<p><b>Laminar Flow and Turbulence Modeling to Trace Wake Pattern Around Building Clusters for Domestic Scale Wind Turbine Sitting</b>  <i>Govindarajan A. Chittaranjan , Concordia University</i></p>
P59	<p><b>A Comparative Study of Maximum Power Extraction Strategies in PMSG Wind Turbine System</b>  <i>Meisam Shirazi-K.N.Tossi University of Technology, Iran, Abbas Hooshmand Viki-K.N.Tossi University of Technology, Iran, Omid Babayi -K.N.Tossi University of Technology, Iran</i></p>

<b>Poster Session: Extending the Limits of Transmission and Distribution</b>	
P60	<p><b>Failure Rate Modeling: A Data Mining Approach, Using MV Network Field Data</b>  <i>Alireza Fereidonian –PWTU, Elham Akhavan -Islamic Azad University, Tehran South Branch, Mahmoudreza Haghifam -Tarbiat Modares University, Tehran, Iran</i></p>
P61	<p><b>Design of a Digital Control System for a PWM-Based STATCOM</b>  <i>Edmundo Barrera Cardiel - Universidad Michoacana de San Nicolas de Hidalgo, Luis Eduardo Ugalde Caballero -Universidad Michoacana de San Nicolas de Hidalgo, Osvaldo Ramos Banderas - Universidad Michoacana de San Nicolas de Hidalgo</i></p>
<b>Poster Session: Energy Storage</b>	
P62	<p><b>An Overview of Phase Change Materials and Their Implication on Power Demand</b>  <i>Daniel R. Rousse-École de Technologie Supérieure, Nizar Ben Salam-École supérieur des sciences et techniques de Tunis Tunisie, Stéphane Lassue-Faculté des sciences appliquées université d'Artois France</i></p>
P63	<p><b>Voltage Stability Margin Improvement Using Shunt Capacitors and Active and Reactive Power Management</b>  <i>Amir Parastar , Babak Mozafari, Hossein Omidi, Mohammad Ali Khaburi - Department of Electrical Engineering, Science and Research Branch, Islamic Azad University, TEHRAN</i></p>
P64	<p><b>Mathematical Modeling, ANN, Batteries and DSM Techniques Applied to a Medium Scale Milk Industry</b>  <i>Ravi Babu Pallikonda -ACE Engineering College, Sreedivya Vadlapudi - Sreenidhi Institute of Science &amp; Technology, Sreedivya Vadlapudi -Sreenidhi Institute of Science and Technology</i></p>
<p><b>BANQUET: Room: Ballroom Thursday, October 22, 2009 19:00</b></p>	



<b>Friday, October 23, 2009 08:00AM – 10:00AM</b>	
8:00	<b>Welcome:</b> Dr. Pragasen Pillay, Concordia University
<b>Keynote speakers</b> <span style="float: right;"><b>Room: Ballroom</b></span> <b>Chair:</b> Dr. Geza Joos, McGill University	
8:05	<b>"ABB's Innovative Solutions to Increase Industrial Productivity"</b> <i>By Mr. John G Caron, Vice President for ABB Service in Canada</i>
8:45	<b>"The Use of Model-Based Design Method and Real-Time Simulation for Power Electronic System Design and Test: Renewable Energy Applications"</b> <i>By Mr. Jean Bélanger, Co-Founder, CEO and CTO of OPAL-RT Technologies.</i>
<b>9:30 AM – 10:00 AM Coffee Break and Exhibition</b> <span style="float: right;"><b>Room: Ballroom Lobby</b></span>	
<b>Friday, October 23, 2009 10:00 – 12:00</b>	
<b>Session F2.1 Biomass and Heat Recovery</b> <span style="float: right;"><b>Room: Hibiscus A</b></span> <b>Chair:</b> Dr. Daniel Rousse, ETS	
10:00	<b>How Small can Micro-Scale Generation be? Size Analysis of a Novel Biomass Power Plant</b> <i>Mathias Loeser -University of Bath, Miles Alexander Redfern -University of Bath</i>
10:20	<b>The Sugarcane Ethanol Power Industry in Brazil: Obstacles, Success and Perspectives</b> <i>Francisco Galiana -McGill University, Jorge Marques De Azevedo -McGill University</i>
10:40	<b>Converting Food Waste to Usable Energy in the Urban Environment Through Anaerobic Digestion</b> <i>Nathan Curry - Concordia University, Pragasen Pillay – Concordia University</i>
11:00	<b>Controller Design For a Waste Heat Energy Conversion Generator</b> <i>David Mercy -University of Ontario Institute of Technology UOIT, J. Mikael Eklund - University of Ontario Institute of Technology UOIT, Jinfu Zheng - University of Ontario Institute of Technology UOIT, Neil Yhap - University of Ontario Institute of Technology UOIT, Ryan Naughton -University of Ontario Institute of Technology UOIT</i>

11:20	<p><b>Data Collection, Simulation and Design of a Waste Heat Energy Conversion System</b>  <i>Charles Elliot -University of Ontario Institute of Technology UOIT, Ian Marnoch -University of Ontario Institute of Technology UOIT, Ian Spencer - University of Ontario Institute of Technology UOIT , J. Mikael Eklund - University of Ontario Institute of Technology UOIT, Jinfu Zheng - University of Ontario Institute of Technology UOIT</i></p>
11:40	<p><b>Determination of ZIP Parameters with Least Squares Optimization Method</b>  <i>Ghasem Abdollahi Sarvi -Khaje Nasiredin Toosi University(Kntu), Mahmood Sadeghi -Iran University of Science and Technology</i></p>
<p><b>Session F2.2: Power Systems II</b> <span style="float: right;"><b>Room: Ballroom</b></span>  <b>Chair:</b> Dr. Ambrish Chandra, ETS</p>	
10:00	<p><b>Mitigations of Voltage Instability in Power Systems (Paper Review)</b>  <i>Komla Folly -University of Cape Town, Leonard Azimoh -University of Cape Town, SP Chowdhury -University of Cape Town</i></p>
10:20	<p><b>Transient Stability Assessment Algorithm based on Post-Fault Recovery Voltage Measurements</b>  <i>Athula Rajapakse -University of Manitoba, Francisco Gomez -University of Manitoba, Udaya Annakkage -University of Manitoba</i></p>
10:40	<p><b>Transient Stability with Grid Connection and Wind Turbine Drive-Train Effects</b>  <i>Aurelio Medina -Universidad Michoacana of San Nicolas of Hidalgo, Florin Iov -Institute of Energy Technology Aalborg University, Luis A. Fajardo-R - Universidad Michoacana of San Nicolas of Hidalgo</i></p>
11:00	<p><b>A New Combination of Shunt Hybrid Power Filter and Thyristor Controlled Reactor for Harmonics and Reactive Power Compensation</b>  <i>Abdelhamid Hamadi -École de Technologie Supérieure, Kamal Al-Haddad - École de Technologie Supérieure, Salem Rahmani -École de Technologie Supérieure</i></p>

**Session F2.3: Panel session#2: Marine Energy**

**Room: Hibiscus B**

**Chair:** Dr. Mo El-Hawary, Dalhousie University

**1. Title: Evaluation of electrical technology solutions in marine energy**

**Speaker:** Dr. Ghanashyam Ranjitkar, Natural Resources Canada

This paper will present the findings of the study to evaluate the electrical technology solutions

in marine energy converters. It will identify the technology gaps related to the electrical technology, and will provide a set of technical recommendations that would advance the development of the subsystems for use in of the marine energy sector.

In recent years, considerable advances have been made in developing a technology to generate energy from waves and tides. However, many wave and tidal energy technologies are still in the concept and prototype development stages. Canada, with a tremendous potential for marine energy, has an opportunity to maximize the advantages of these technologies to displace fossil fuel generated power with renewable energy, and potentially reduce the greenhouse gas (GHG) effects substantially. Canada has number of device developers that have invested significantly in this field and are in need of support to advance their devices to commercial stage. Natural Resources Canada commissioned a report in Sept 2008 "Review of Marine Energy

Technologies and Canada's R&D Capacity" that identified a number of specific technology areas that could benefit from targeted R&D activities that would assist in advancement of the marine energy sector. Among the identified areas, were the following specific to electrical technology areas:

- – Riser cable for electricity transfer to seabed
- – Electrical quick connect/disconnect system
- – Subsea circuit breaker to isolate individual devices from the collector system
- – Direct drive generator for tidal machines
- The study tries to further clarify and to assess these areas in more technical depth, in order to identify the needs specific to the electrical technology area. It addresses the electrical technologies associated with electrical power delivery to shore, safety and protection of devices as well and reliability of these devices in consultation with the device developers. It focused in terms of technical availability, challenges, barriers and need for further investigation, and finally to provide technical recommendations and R&D activities that would assist the development of marine energy sector

**2. Title: Marine In-Stream Energy Conversion**

**Speaker:** Dr. Eric Bibeau, NSERC/Manitoba Hydro Alternative Energy Industrial Chair, Mechanical Engineering Department, University of Manitoba

**3. Title: Power tracking control of hydrokinetic energy conversion systems**

**Speaker:** Jahangir Khan, PowerTech Labs

**Abstract:** Efficient operation of a hydrokinetic energy conversion system depends greatly on the method of power tracking being deployed. This, in turns, implies optimally regulating the rotor speed against various internal (e.g. Load variations) and external (e.g. water velocity) variations. In this work, this area of research is explored. Various elements of the flow-field and their possible effects on the overall system performance are discussed. A comparative look at several control concepts (tips speed ratio, power feedback, or hill-climbing) for implementation in hydrokinetic systems is provided. To elaborate further, a vertical axis device with permanent magnet generator (interfaced to the grid through power electronic stages) is considered. This work relies on a set of mathematical models, which are validated through experiments and are used in the simulation environment.

**Speaker's Bio:** Mr. Jahangir Khan received his B.Sc. (Elect. Eng.) Degree from Bangladesh University of Engineering & Technology (BUET), Dhaka, Bangladesh in 2001, and M.Eng. degree from Memorial University of Newfoundland, St. John's, Canada, in 2004, respectively. During 2001 / 2002, he taught undergraduate courses at Ahsanullah University of Science & Technology in Dhaka, Bangladesh. Since August 2007, he has been working as a power systems engineer at Powertech Labs Inc., BC, while continuing his Ph.D. research through Memorial University of Newfoundland. His work mostly involves system level modeling/simulation and hardware development with emphasis on control synthesis, power conditioning, and technology integration. During his Masters level graduate studies, he carried out resource estimation, hybrid system sizing, and dynamic simulation of alternative energy technologies. As part of his doctoral research he is currently working on hydrokinetic turbine system modeling, development, and control synthesis. At Powertech Labs Inc. his work encompasses power system studies and grid integration of alternative energy technologies, especially hydrokinetic and wave devices.

**4. Title: Environmental issues related to Marine Energy Resources**

**Speaker:** Dr. Rod Doane, Department of Fisheries and Oceans

**Session F2.4: Wind Power I**

**Room:** Orchidée A

**Chair:** Dr. Voicu Groza, University of Ottawa

10:00

**Frequency Control Support and Participation Methods Provided by Wind Generation**

*Emmanouil Loukarakis –NTUA, Ioannis Margaris –NTUA, Manolis Loukarakis –NTUA, Panayiotis Moutis -NTUA*

10:20	<p><b>A Single-Switch Three-Phase Boost Rectifier to Reduce the Generator Losses in Wind Energy Conversion Systems</b>  <i>Fernando Dos Reis –PUCRS, Luiz Lopes -Concordia University, Reinaldo Tonkoski -Concordia University</i></p>
10:40	<p><b>Development of an Interactive Reliability Model for Wind and Hydro Power Systems</b>  <i>Po Hu - University of Saskatchewan, Rajesh Karki -University of Saskatchewan, Roy Billinton -University of Saskatchewan</i></p>
11:00	<p><b>Power Quality Assessment with a State Space Model of a Wind Park in dq0 Coordinates.</b>  <i>Aurelio Medina -Universidad Michoacana de San Nicolás de Hidalgo, Rafael Cisneros -Universidad Michoacana de San Nicolás de Hidalgo, Rafael Cisneros -Universidad Michoacana de San Nicolás de Hidalgo</i></p>
11:20	<p><b>Control of Wind-Diesel Isolated System With Power Quality Improvement</b>  <i>Amrish Chandra -École de Technologie Supérieure, Miloud rezkalah -École de Technologie Supérieure</i></p>
11:40	<p><b>Power Electronic Solutions for Vertical Axis Urban Wind Turbines</b>  <i>Tamas Bertenyi -Quiet Revolution Ltd.</i></p>
<p><b>12:00 – 14:00 Lunch and Keynote Presentation</b> <span style="float: right;"><b>Room: Ballroom</b></span>  <b>“A New Concept in Pump Storage: Introduction to Aquabank”</b>                  Keynote by Mr. John Douglas: Founder, President and CEO of Riverbank Power Corp                  Chair: Dr. Kamal Al-Hadad, ETS</p>	
<p><b>Friday, October 23, 2009 14:00 – 16:00</b></p>	
<p><b>Session F3.1: Special Session: Plug In Hybrid EV</b>  <b>Room: Hibiscus A</b>  <b>Chair:</b> Dr. Sheldon Williamson, Concordia University</p>	
14:00	<p><b>Probabilistic Modelling of the Impacts of Plug-in Electric Vehicles on Distribution Networks in British Columbia</b>  <i>Andrew Rowe -University of Victoria, Liam Kelly -University of Victoria, Peter Wild -University of Victoria</i></p>

14:20	<p><b>Suitability Analysis of In-Wheel Motor Direct Drives for Electric and Hybrid Electric Vehicles</b>  <i>Manu Jain -Concordia University, Sheldon Williamson -Concordia University</i></p>
14:40	<p><b>Impact of Large-scale Electric Vehicle Application on the Power Supply</b>  <i>Albert Moser -RWTH Aachen University, Hans-Jürgen Haubrich -RWTH Aachen University, Lin Zhao -RWTH Aachen University, Michael Hübner - RWTH Aachen University, Tobias Mirbach -RWTH Aachen University</i></p>
15:00	<p><b>Efficient Power Management Through Optimized Speed and Torque Operation of Drivetrain Components</b>  <i>Ashim Das -University of Windsor, Narayan Kar -University of Windsor</i></p>
15:20	<p><b>Advantages and Applications of Vehicle to Grid Mode of Operation</b>  <i>Carlos Martinez -McGill University, Geza Joos -McGill University, Mohamed El Chehaly -McGill University</i></p>
15:40	<p><b>Energy Based Graphical User Interface Modeling for PHEV Energy Management System</b>  <i>Narayan C. Kar - University of Windsor, Saeedeh Hamidifar -University of Windsor</i></p>
<p><b>Session F3.2 Panel Session #3: Hydro Power and Storage Technology</b>  <b>Chair:</b> Dr. S Pejovic, UoFT; <span style="float: right;"><b>Room:</b> Ballroom</span>  <b>Co-Chairs:</b> J. Douglas, Riverbank Power; T. Maricic, OPG; Dr. B. Karney, UoFT;          J.L. Gordon, consultant</p>	
<p><b>The panel session is to tackle the following topics:</b></p> <ul style="list-style-type: none"> <li>• Storage and pumped-storage plants, a solution to stability, reserve and peak power generation,</li> <li>• Hydro, small and big, as a renewable energy resource,</li> <li>• Multidisciplinary transfer of experience and knowledge,</li> <li>• Hydroelectric plants design, then and now,</li> </ul> <p><b>and to entail the following presentations:</b></p> <ul style="list-style-type: none"> <li>• Ontario Underground Pumped-Storage Plant Aquabank™ by John Douglas, Riverbank Power,</li> <li>• Parametric Analysis of Pump-Turbine Sites, by James L. Gordon,</li> <li>• Asia-Pacific Hydro Market Analysis and Forecast for Next Five Years, by Bikram</li> </ul>	

<p>Lamba,</p> <ul style="list-style-type: none"> <li>• On-Line Management, Control and Optimization of Electricity Generation by Dr. S. Pejovic,</li> <li>• Transfer of knowledge and New Courses at the University of Toronto by Dr. Bryan Karney,</li> <li>• Hydro Review Boards - an Essential Component for a Successful Development, by J. L. Gordon.</li> </ul>	
<p><b>Session F3.3: Wind Power II</b> <span style="float: right;"><b>Room: Hibiscus B</b></span>  <b>Co-chairs:</b> Dr. Azeem Khan and Dr. Paul Barendse, University of Cape Town</p>	
14:00	<p><b>Direct Power Control of a DFIG-based WECS with Active Filter Capabilities</b>  <i>Amrbrish Chandra -École de Technologie Supérieure, Etienne Tremblay -Shell Albian Sands, Sergio Atayde -École de Technologie Supérieure</i></p>
14:20	<p><b>State Control with Narrowband Disturbance Rejection for Wind Driven DFIG under Grid Voltage Unbalance</b>  <i>Osama Bayoumy -Queen's university, Praveen Jain -Queen's university</i></p>
14:40	<p><b>Virtual Synchronous Generator Control in Autonomous Wind-Diesel Power Systems</b>  <i>Luiz A. C. Lopes -Concordia University, Miguel Torres -Concordia University</i></p>
15:00	<p><b>Design of an H8 Controller for Energy Storage in a Wind-Diesel System</b>  <i>Chad Michael Abbey -McGill University, Vahid Raissi Dehkordi -McGill University</i></p>
15:20	<p><b>Modeling, Control Design and Simulation of a Grid Connection Control Mode for a Small Variable-Speed Wind Turbine System</b>  <i>Iosif Szeidert -Politehnica University of Timisoara, Lucian Mihet-Popa - Politehnica University of Timisoara, Octavian Prostean -Politehnica University of Timisoara, Voicu Groza -University of Ottawa</i></p>
15:40	<p><b>Quality Monitoring of Electrical Power Distribution Network Using a Low-power Microcontroller</b>  <i>Adrian Vartosu -"Politehnica" University of Timisoara, Ciprian Dughir - "Politehnica" University of Timisoara, Gabriela Prostean -"Politehnica" University of Timisoara, Voicu Groza -University of Ottawa</i></p>

<b>Session F3.4: Energy Efficiency</b>		<b>Room: Orchidée A</b>
<b>Chair:</b> Dr. Joseph Ojo, Tennessee Technological University		
14:00	<p><b>Energy Savings Opportunities in Ventilation Processes with Fans Performing at Variable Load</b> <i>Constantin Pitis -BC Hydro – Power Smart Burnaby BC, Valentin Giurgiu - CDC – BC Vancouver BC, Voicu Groza -University of Ottawa</i></p>	
14:20	<p><b>Practical Modeling Of Losses At Pattern Distribution Network And Its Accuracy Evaluation</b> <i>Salahedin Zandi Pouryan -Hadaf University of Sari</i></p>	
14:40	<p><b>Precipitation-based Conductor Cooling Model for Dynamic Thermal Rating Systems</b> <i>Edward Lozowski -University of Alberta, Pawel Pytlak -University of Alberta, Petr Musilek -University of Alberta</i></p>	
15:00	<p><b>Smart Grids Better with Integrated Energy System</b> <i>Bryan Karney -University of Toronto, Stan Pejovic - University of Toronto, Tihomir Maricic -Ontario Power Generation</i></p>	
15:20	<p><b>Magnetic Core Losses Measurement Instrumentations and a dynamic Hysteresis Loss Model</b> <i>M-Cheng Cheng -Clarkson University, Natheer Alatawneh -Concordia University, Pragasen Pillay -Concordia University, Yu Zhang -Clarkson University</i></p>	
15:40	<p><b>Test Program of Copper and Aluminum Electrical Connectors under Severe Ageing Conditions Commonly Found in Renewable Energy Systems</b> <i>Chris Morton -Powertech Labs Inc., Ron Frank -Canadian Copper &amp; Brass Development Association, Vern Buchholz -Canadian Copper and Brass Development Association</i></p>	
<b>16:00PM – 16:15PM Coffee Break</b>		<b>Room: Ballroom Lobby</b>



**Friday, October 23, 2009 16:15PM – 18:15PM**

**Session F4.1: Solar Power**

**Room: Hibiscus A**

**Chair:** Dr. Wahab Almuhtadi, Algonquin College, Ottawa

16:15	<p><b>Analog Signal Processing for Photovoltaic Panels Grid-Tied by Zeta Converter</b>  <i>Fernando Dos Reis –PUCRS, Henrique Gomes –PUCRS, Henrique Lopez - PUCRS, Reinaldo Tonkoski -Concordia University, Renan Viero -PUCRS</i></p>
16:35	<p><b>Low Power Solar System Grid-Tied With MPPT Based on Temperature Compensation</b>  <i>Cesar Zollmann –PUCRS, Fernando Dos Reis –PUCRS, Henrique Lopez - PUCRS, Reinaldo Tonkoski -Concordia University, Renan Viero -PUCRS</i></p>
16:55	<p><b>Design-Dimensioning Model For Grid-Connected Photo Voltaic systems</b>  <i>Gerardo Gordillo -University of Nacional, Johann Hernandez -University of Nacional, Nelson Diaz -University of Nacional</i></p>
17:15	<p><b>Effectiveness Evaluation of Photovoltaic Powered Water Pumping units in Sahelian area</b>  <i>Brayima Dakyo -GREAH/Le Havre University, Innocent Compaore -GREAH/Le Havre University, Innocent N. Compaore -Université du Havre, Jacque Raharijaona -GREAH/Le Havre University, Yezouma COULIBALY -ZiE</i></p>
17:35	<p><b>Optimization and Control of Photovoltaic Powered Water Pumping System</b>  <i>Ali Chikh -École de Technologie Supérieure, Ambrish Chandra -École de Technologie Supérieure</i></p>
17:55	<p><b>Energy Saving by Using Newly Designed Automated Solar Powered Evaporative Air Cooler (ASPEAC)</b>  <i>Abdul Al-Azzawi -Algonquin College, Wahab Almuhtadi -Algonquin College</i></p>

**Session F4.2: Generation**

**Room: Ballroom**

**Chair:** Dr. Laurent Lamarre, Hydro Québec

16:15	<p><b>Essential Role of Technical Review in Hydro-Designs</b>  <i>Bryan Karney -University of Toronto, Stan Pejovic - University of Toronto, Tihomir Maricic -Ontario Power Generation</i></p>
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16:35	<p><b>Niagara Pump Generating Station Proven Functionality Unique in Canada</b>  <i>Don Haber -Ontario Power Generation, Stan Pejovic - University of Toronto, Tihomir Maricic -Ontario Power Generation</i></p>
16:55	<p><b>Modern Design of Pump-turbines</b>  <i>Manfred Sallaberger -Andritz Hydro, Peter Bachmann -Andritz Hydro, Peter Nowicki -Andritz Hydro</i></p>
17:15	<p><b>Generators for Rural Electrification from Renewable Energy</b>  <i>Olivare Dzune Mipoung -Concordia University, Pragasen Pillay -Concordia University</i></p>
17:35	<p><b>A New Fuel Cost Model of Thermal Unit Considering Output Ramp Rate And its Application to ELD</b>  <i>Teruhisa Kumano -Meiji University, Yohei Shiokawa -Meiji University</i></p>
17:55	<p><b>Operation of Auxiliary Electrical System of Power Plant in Emergency Conditions of Power System</b>  <i>Janusz Buchta -Technical University of Lodz, Janusz Buchta -Technical University of Lodz, Maciej Pawlik -Technical University of Lodz, Rafal Szubert -Technical University of Lodz</i></p>
<p><b>Session F4.3: Alternative Systems</b> <span style="float: right;"><b>Room: Hibiscus B</b></span>  <b>Chair:</b> Dr. Mamadou Lamine Doumbia, University of Trois Rivieres</p>	
16:15	<p><b>PEM Fuel Cell Stack Hardware-In-the-Loop Emulation using DC/DC Converter Design</b>  <i>Abdellah El-Moudni -University of Technology of Belfort-Montbeliard, Abdellatif Miraoui -University of Technology of Belfort-Montbeliard, Benjamin Blunier -University of Technology of Belfort-Montbeliard, Fei Gao - University of Technology of Belfort-Montbeliard</i></p>
16:35	<p><b>Design and Performance Analysis of a Thin Film Double Junction Photovoltaic Cell by Software Simulation.</b>  <i>A. R. M. Foisal -International Islamic University Chittagong, Mohammad Amin -International Islamic University Chittagong, N. K. Das -Chittagong University of Engineering &amp; Technology</i></p>
16:55	<p><b>PEM Fuel Cell Voltage-Tracking using Artificial Neural Network</b>  <i>Abolfazl Ranjbar -Babol Noshirvani Institute of Technology, Ali Nabavi Niaki - Toronto Canada, Reza Ghaderi -Babol Noshirvani Institute of Technology,</i></p>

	<i>Seyed Mehdi Rakhtala Rostami -Babol Noshirvani Institute of Technolog</i>
17:15	<b>Configuration Study of High Altitude Solar Collectors</b> <i>Adrian R. Tatnall - University of Southampton, Guglielmo S. Aglietti -University of Southampton, Stefano Redi -University of Southampton, Thomas Markvart - University of Southampton</i>
17:35	<b>Modeling and Active Damping of Harmonic Propagation on Electric Distribution Systems</b> <i>Kamal Al-Haddad -École de Technologie Supérieure, Luiz Eduardo Borges da Silva -Universidade Federal de Itajubá, Wilson Sant'Ana -École de Technologie Supérieure</i>
17:55	<b>Data Segmentation Algorithms for a Time-Domain Harmonic Source Modeling Method</b> <i>Hooman Mazin -University of Alberta , Ming Dong -University of Alberta, Wilsun Xu -University of Alberta</i>
<b>Session F4.4: Energy Storage</b> <span style="float:right"><b>Room: Orchidée A</b></span> <b>Chair:</b> Dr. Brainslav Djokic, National Research Council, Ottawa	
16:15	<b>Ride-through Capability of Adjustable-Speed Drive during Various Power Quality Events Using Super Capacitor</b> <i>Dinesh Kumar Jain -Guru Premsukh Memorial College of Engineering, Ratna Dahiya -NIT Kurukshetra Haryana India , Sativir Deswal -Maharaja Agrasen Institute of Technology, Rohini, Delhi, India</i>
16:35	<b>Improved Performance of Diesel Driven Permanent Magnet Synchronous Generator Using Battery Energy Storage System</b> <i>Dinesh Kumar Jain -Guru Premsukh Memorial College of Engineering, Jashvir Singh -CRR Institute of Technology, Rajveer Mittal -Maharaja Agrasen Institute of Technology Sec-22 Rohini Delhi India</i>
16:55	<b>Energy Storage for Renewable Energy Combined Heat, Power and Hydrogen Fuel (CHPH2) Infrastructure</b> <i>Henry Reiser -Lambton College for Applied Science, Khaled Nigim -Lambton College for Applied Science</i>
17:15	<b>Study of The Ambient Temperature Effect on The Characteristics and the Lifetime of Nickel-Metal Hydride Secondary Battery</b> <i>Dariga Meekhun -LAAS-CNRS, Jean-Marie Dilhac -LAAS-CNRS, Vincent Boitier -LAAS-CNRS</i>

17:35	<b>Considerations to Electromechanical Design to Enhance Rural Energisation in Sub-Saharan Africa</b> <i>Mohamed Azeem Khan -University of Cape Town, Paul Stanley Barendse - University of Cape Town, Pragasen Pillay -Concordia University, Richard Okou okou -University of Cape Town</i>
17:55	<b>Thermal Model of Electromechanical Flywheel with Brushless DC Machine</b> <i>Mohamed Azeem Khan -University of Cape Town, Paul Stanley Barendse - University of Cape Town, Pragasen Pillay -Concordia University, Richard Okou -University of Cape Town</i>

## Hotel Floor Layout

### Legend

#### Level S1:

- 1- Dahlia
- 2- Orchidée A**
- 3- Orchidée B
- 5- Administration room for staffs
- 6- Administration room for staffs
- 7- Administration room for staffs
- 8- Administration room for staffs
- 9- Muguet
- 10- Jacinthe

#### **S - Spa**

#### Level 2:

- 11- Hibiscus A**
- 12- Hibiscus B**
- 13- Camélia
- 14- Jasmin
- 15- Pivoine

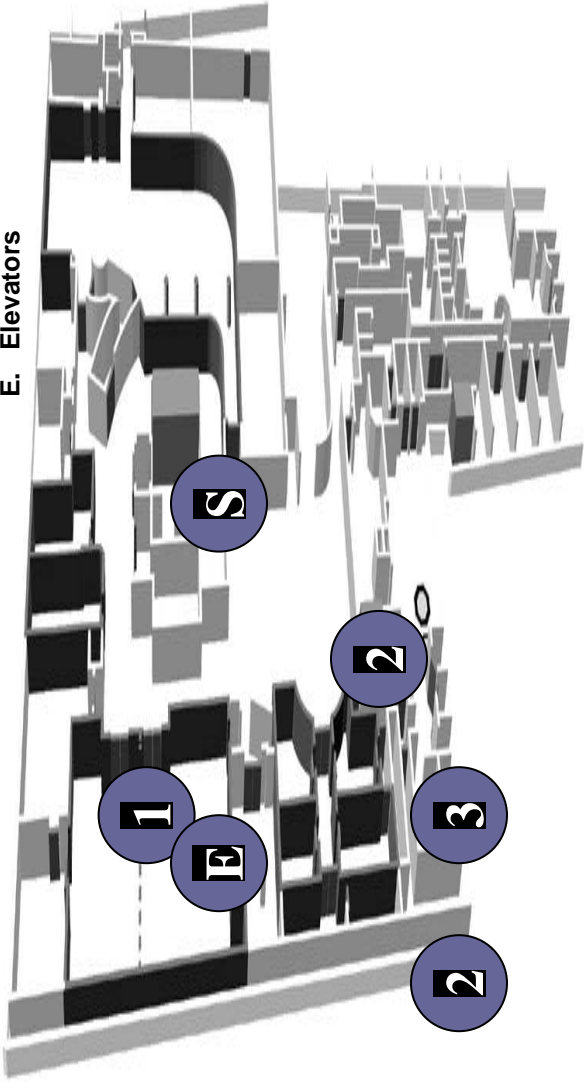
#### Level 3:

- 4- Salle de Bal/Ballroom**



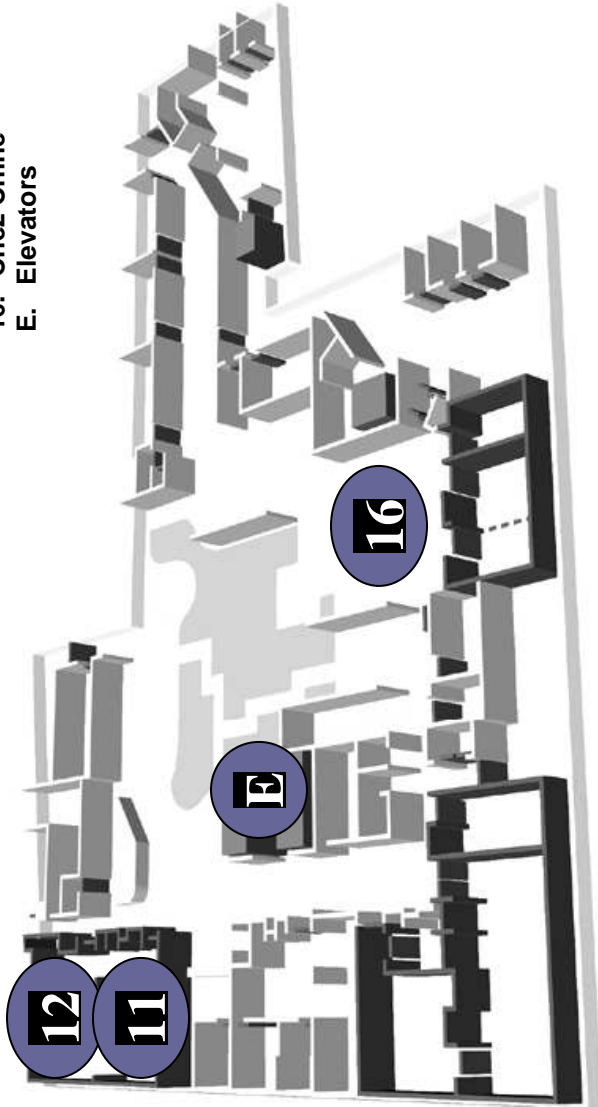
Level S1

- 1. Dalhia
- 2. Orchidée A
- 3. Orchidée B
- S. Spa Sinomonde
- E. Elevators



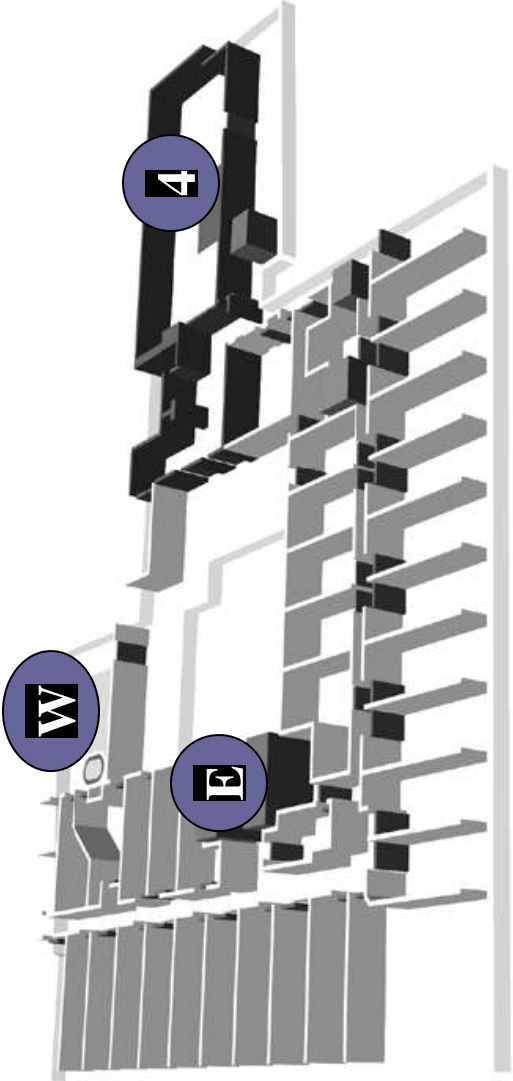
**Level 2**

- 11. Hibiscus A
- 12. Hibiscus B
- 16. Chez Chine
- E. Elevators



**Level 3**

- 4. Ballroom**
- E. Elevators**
- W. Swimming Pool**



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