Water Management Decision-Support Software

The Challenge of Knowledgeable and Valued Decisions

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Speaker Biographies / Abstracts

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Michael Kane,
Riverside Technology Inc.

Michael Kane is the manager of the Water Resources Group at Riverside Technology, inc. (RTi). As a senior water resources engineer, he specializes in the development and implementation of river forecasting systems and water resources decision support systems. He has applied his skills in these areas to projects that include streamflow forecasting, water rights modeling, multi-reservoir system operations, and snow and runoff modeling. He has been involved in decision support system projects throughout the United States (including Bonneville Power, Idaho Power, and the Tennessee Valley Authority) and the world (including Panama, El Salvador, South Africa, Uzbekistan, and India). Mr. Kane has a Bachelor's and Master's degree in water resources engineering from the University of Maryland and is currently a PhD. candidate at Colorado State University.

Jim Cooper,
Earth Satellite Corporation (MDA Federal)

Jim Cooper is the Director of Business Development for Earth Satellite Corporation, a leading provider of geospatial information products and services to the defense, intelligence, resource management, weather and mapping markets.

Decision Support Systems for Improved Water Resources Management and Operations

Each day managers at hydroelectric generation facilities face a myriad of decisions with both short- and long-term financial impact. Technology advances such as increased communications bandwidth, computer power, and visualization tools have moved Decision Support Systems (DSS) from their previous role of aiding off-line planning and design decisions to a much more valuable position of supporting critical facility and resource management information in real time. Riverside Technology inc. (RTi) has implemented over 30 versions of these modern DSSs in the United States and internationally. The common components of these systems are the integration of data sources, a consistent methodology, real time data inputs, and Geographic Information System (GIS) based outputs. The DSSs typically include simulation models for a variety of applications such as hydrologic forecasting, reservoir operations, hydropower generation, irrigation management and/or water allocation. In particular, recent advances in hydrometeorological forecasting combined with reservoir operations models in a DSS framework provide powerful information for resource management decision makers.

These characteristics can best be demonstrated by describing some of the implemented systems. Systems developed for Tennessee Valley Authority (TVA), Denver Water, and the State of Colorado are among those to be highlighted. The purpose of the TVA project was to establish the base case conditions for current reservoir operations and investigate the impacts of alternative operations. Using RiverWareTM modeling software, TVA has revised its operating polices to produce lower transportation costs, increase power reliability, increase recreational activities, enhance wildlife habitat and improve water quality without increasing the risk of floods. The Colorado Decision Support System (CDSS) was developed to assist the State of Colorado with their management decisions for the rivers within the state. The CDSS includes a variety of modeling applications for water resources planning, consumptive use estimation, and water rights administration. By combining these elements in a unique information-sharing environment, the State is able to make informed decisions regarding major water issues and policies by having a better means for organizing and accessing a wide range of water resources information, and for evaluating alternative management strategies in response to increases in population and demand, droughts, endangered species issues, and interstate compacts.

Doug Smith,
BC Hydro

Doug Smith originally hails from Winnipeg, Manitoba and attended the University of Saskatchewan where he received his Bachelor of Science in Engineering Physics in 1974. In 1980 he earned a Masters of Applied Science in Environmental Engineering at the University of Toronto. The majority of his professional career as been spent in water resources systems analysis as a consulting engineer and has worked on a wide variety of decision support systems for hydrologic forecasting, hydro power and water supply operations across North America . In 2000, he joined BC Hydro and currently heads up the Resource Optimization group in Generation at BC Hydro. This group does all the near term operational planning for BC Hydro including coordination with U. S. counterparties under the Columbia River Treaty.

BC Hydro's Integration of Commodity Risk Management and Operations Planning

BC Hydro generation system is predominantly hydro power with significant storage capacity. BC Hydro's current system loads exceeds its supply so that it is a net importer of energy on an annual basis. Its system storage provides a great deal of flexibility as to when it can schedule its energy purchases. BC Hydro has an operational planning decision support modelling system that optimizes system operation including system import and exports. These models optimizes the expected future value of net income and explicitly considers the uncertainty of system inflows and market prices. This system is currently being upgraded to incorporate decision support for hedging of energy purchases with goal of reducing the risk exposure to commodity markets. This paper provides an overview of BC Hydro optimization modelling system and how it is being upgraded for commodity price risk management.

Peter Kowalski,
Ontario Power Generation - Niagara River Control Centre

Peter has been employed by Ontario Power Generation for 27 years – 8 years as Senior Shift Operator at various large-scale hydroelectric generating stations and 19 years as a River Control Supervisor. Present responsibilities include regulating water flow over Niagara Falls and controlling the elevation of Grass Island Pool, determining flows in Niagara River, scheduling water diversion for OPG and NYPA within identified constraints, ice management on the upper and lower Niagara River and short term flow forecasting. He has been involved in the development and enhancement of software applications that are used at River Control and has also been involved in identifying areas for improvement and initiating enhancement of various operating aids (cameras, communications systems and operating protocols) used in the discharge of our duties.

Experiences in Ice Management on the Niagara River

This presentation will provide an overview combining past experiences and present operating strategies as they relate to ice management on the Niagara River. In consideration of the normal climate and load profile for the area, efficient and effective ice management represents a critical component of the wintertime operating strategy.

The primary focus will be the impact of ice on the overall operation of the hydroelectric generating facilities of the New York Power Authority and Ontario Power Generation in the upper Niagara River and the respective control actions that are in place to mitigate those impacts. Since both advance and real time water dispatch schedules can be adversely affected by ice conditions, normal decision-making processes must include considering the influx of ice and the associated negative impacts.

The presentation will also discuss available tools and software presently utilized by the Niagara River Control Centre in exercising the responsibility to forecast ice generation, monitor its transport and discharge and to remove ice stoppages from sensitive areas in the upper Niagara River.

Bruce Hinton,
Manitoba Hydro

Bruce Hinton completed his Bachelor and Masters degrees in civil engineering at the University of Waterloo. Upon graduation, he worked in the continued development and application of the Acres Reservoir Simulation Program with Acres International in Niagara Falls. In 1992, he moved to the Resource Planning department of Manitoba Hydro and became part of the development team for the SPLASH model. He has extensive experience in the development and application of water resources models to hydro-electric systems.

Long-Term Planning using the SPLASH DSS

The SPLASH model has been used extensively to assist in the long-term planning functions at Manitoba Hydro. This primarily consists of economic analyses related to various proposals of generation expansion scenarios. During the public hearings for the Wuskwatim Generating station, the SPLASH model was used to determine changes to the overall system water regime resulting from the plant addition. The system effects related to the altered water regime becomes an important set of input data to the Environmental Impact Statement. The presentation will focus on the changed role of the SPLASH model to represent system effects.

Jason Westmacott,
Manitoba Hydro

Jason graduated from the University of Manitoba with a Bachelors of Science in Civil Engineering in 1994, and a Master of Science, specializing in water resources, in 1996. Since graduation, Jason has worked as a consulting engineer in Vancouver and Calgary with AGRA Earth and Environmental, and has worked for the past 5 years at Manitoba Hydro in the areas of resource planning, and operations planning. Currently, Jason is responsible for reservoir and energy scheduling and ongoing development of the forecasting and energy management models used for short to medium term planning horizons.

Using a DSS to Analyze the Medium-Term Planning and Operations of the Manitoba Hydro System

Manitoba Hydro uses the HERMES (Hydro Electric Reservoir Management Evaluation System) medium-term decision support system as an operations and resource management tool. The task of the DSS is to maximize revenues by optimizing generation, reservoir and maintenance scheduling on a weekly basis. In order to achieve this the DSS must have forecasts of inflows, load demands, market and hydraulic conditions.

We will highlight the functionality of the HERMES DSS in assisting water management decisions for various hydrologic conditions. We will analyse the application of the DSS on the examples of budgetary projections, economic analysis of resource allocation, and operation planning during drought and flood conditions.

Session 1: Experiences

Bill Girling,
Manitoba Hydro

Bill Girling is a Professional Engineer and has been with Manitoba Hydro for the past 21 years. Bill started his career working for local consulting firms and then went on to work for Manitoba Hydro as the Hydrologic Studies Engineer and more recently as the System Capability Engineer. Most of his career has been spent working on projects related to planning of future hydroelectric generating facilities and increasing the output of existing hydro plants.

Some of Bill's main areas of expertise are in:

- Climate change impacts; specifically major drought impacts
- Hydropower system planning with emphasis on:
  - Supply-side efficiency improvements (rerunnering, existing plant upgrades, etc.) – modelling & economic analysis
  - Climate change impact assessment
  - Long-term Water supply & hydrologic issues
  - Modelling short-term operational issues in future planning

Recently Bill has been working closely with Synexus Global (an Acres company) on the short-term modeling of the integration of wind power into Manitoba Hydro's system.

Diana Hurdowar-Castro,
Synexus Global Inc.

Diana has an advanced degree in Water Resource Engineering and has worked for Synexus Global and Acres International for almost 15 years on various water resource projects, including physical hydraulic modeling, power systems planning, and hydroelectric water quality and environmental issues.

Stuart Bridgeman,
Synexus Global Inc.

Mr. Bridgeman is Director of Water & Power Resource Optimization at Synexus Global Inc. with responsibility for the Vista Decision Support System. He has a Bachelor of Science and Masters of Science in Civil Engineering from Queen's University; and 30 years of experience in water resources and hydropower studies and operations.

Using a DSS to Analyze the Short-Term Impacts of Integrating Wind Power into Hydro Operations

Manitoba Hydro employs both a long-term generation system simulation model (SPLASH - 40-year planning horizon) and a near-term operational forecasting tool (HERMES -1 to 2 year horizon) in simulating the operation of their integrated system. Manitoba Hydro also utilizes the Vista DSS to assist in hourly operations dispatch and are currently evaluating the Vista DSS to examine the short term operability of the system on an hourly or daily time step, to augment their long-term planning studies.

The Vista DSS is an operations and management tool that simulates and optimizes unit (plant), reservoir, river reach and transmission operations on an hourly basis to maximize revenue given market opportunity and load requirements. The Vista Decision Support System can be used in two modes:

- In operations mode, Vista maximizes the net benefits (benefits minus costs) of operations over a specified period and, within that period, it guides the hourly dispatch of generating and pumping units in the most efficient manner.
- In planning mode, Vista enables planners to evaluate the operational effects and cost implications of potential physical or operational changes to the hydraulic system. Such analyses includes, relicensing, upgrades, and new generation capability such as wind power.

Manitoba Hydro recently retained Synexus Global to evaluate the short-term impacts of integrating wind power into their hydro-based operation using the Vista Decision Support System. As part of the comprehensive Manitoba Hydro wind integration study, the Vista DSS was used in planning mode to determine the financial impacts of hydro operational changes to accommodate wind generation. These costs arise from re-regulation of flows to reduce spill with varying quantities of wind energy supply, the impacts of transmission limits, the costs of providing additional reserve for wind energy.

As part of the CEATI workshop it is proposed to highlight the functionality of the Vista DSS software package in assisting water management decisions, using the wind study as a practical example of the model's capabilities.

Steven McArdle,
4DM Inc.

Mr. McArdle is the President of 4DM, an innovative consulting company that combines science and engineering principles with Geospatial Information Technology. His efforts have been primarily directed towards the water resources, environmental, and business intelligences sector. His accumulated experiences have been acquired through strategic consulting, spatial analytics and application development projects. Mr. McArdle insight comes from building on his university studies in Earth, Atmospheric, and Space Science with over 12 years of consulting experience.

Chris Tonkin,
Ontario Power Generation

Mr. Tonkin has worked for Ontario Power Generation and its predecessor company Ontario Hydro for the past 33 years. His work experience began as an electrical operator on the Wanapitie River near Sudbury Ontario. From there Chris has moved through various positions in the company that included;

- Regional Operating Supervisor in North eastern Ontario
- Hydroelectric Operating Practices Supervisor in Ontario Hydro's Head Office
- Water Resource Division – Manager of scheduling and forecasting
- Current position of Operating Manager for the Ottawa and Madawaska Rivers.

Mr. Tonkin has represented Ontario Power Generation Hydroelectric's division on many Provincial committees both in water management issues and electrical power system issues.

The Experiences from Implementing Decision Support Technology To Address Water Management Plans In An Operational Environment

In Ontario, Water Management Plans have become a regulatory requirement for all waterpower producers to maintain water levels and flows in the regions they operate. Changes to the electricity market, increase usage for recreational purposes, growth of residential and cottages property near water bodies, along with concerns related to the environment, were instrumental in government policy changes. Waterpower producers have had to respond rapidly to ensure they are compliant with the regulations.

To address compliance, operators, managers, and engineers need situation awareness information to keep informed to balance operational decisions. In the past year, Ontario Power Generation (OPG) has dedicated resource to implement an online Adaptive Water Management System (AWMS) as a decision support tool to provide the access to information needed to address rapidly the requirements of Water Management Plans. A technology solution was created in response to supporting operational demands. The tool provides users with situation awareness of water levels and flows, the ability to implement, modify, and manage daily instructions at the facilities, track conditions in the watershed, provide a status of compliance including reporting, and flagging stakeholder and operational issues along the river system. The AWMS application was conceptualized and developed by 4DM Inc. in collaboration with Ottawa St. Lawrence Plant Group for the Madawaska River Watershed. The Madawaska River Water Management Review was innovative in its establishment of a partnership between operator, regulator and Public Advisory Committee to develop a water management plan, which has been used as a model for similar plans across Ontario. OPG has been recipient of the "Outstanding Stewardship of America's Rivers Award" for work on the Madawaska River, by the National Hydropower Association for five consecutive years.

The presentation will focus on the path experienced to implementing a decision support tool to enable water management plans for Ontario Power Generation in a technology solution. In particular, the process that was used to identify and collate the information needs required by the water managers and engineers. Discussions will then identify the technology concept and the model used to meet the user requirements. The presenters will also share experiences identifying the commitment required, strengths and weakness and the evolving path shaping decision support tools.

Tung Van Do,
Powel-MiniMax Inc.

Tung Van Do, P.Eng. obtained his M.A.Sc., Civil Engineering (Water Resources) from the University of British Columbia in 1987, and his B. Sc., Civil Engineering, from the University of Hue (Vietnam) in 1973. He currently serves as Vice-President, Hydro Engineering Powel MiniMax, Inc., Victoria, B.C., Canada. He has practiced as a consulting engineer in the USA and Canada since 1982, after working for a national power company in Vietnam for eight years. He specializes in water resources system analysis, mathematical and computer modeling, software development and operations research.

Integration of Real-Time Unit Dispatching Optimization with SCADA and AGC

Hydro units are especially suitable for providing ancillary services in the regulation of frequency and tie-line flow. Automatic Generation Control (AGC) is used to control hydro units for this purpose. Unfortunately, AGC does not usually optimize unit dispatching and as a result, hydro units running under AGC are operating at less than optimal efficiency.

This paper describes an optimization model that was developed to provide optimal set points to AGC using real-time data from a SCADA system. Several technical issues are resolved to ensure that the optimal solution is also a practical one. Other issues relate to monitoring operating constraints and providing warnings and suggestions to avoid violations of operational restrictions. In addition to running in fully automatic and closed-loop mode driven by AGC with real-time data fed from a SCADA system, the model also provides manual mode where operators can experiment with different dispatching schemes to either maximize power output at a given discharge level or minimize water usage to meet a required generation. Being consistent with a given hourly schedule for the day is also an important factor for this model to consider. By monitoring actual generation, the model can issue a warning when accumulated generation for the current hour deviates beyond a pre-set threshold.

In addition to operating constraints, an environmental constraint considered in this model is dissolved oxygen (DO) downstream of hydroelectric plants. Field data is assembled to determine the relationship between vent openings and DO improvement, and between vent openings and turbine efficiencies. An optimization algorithm will be developed to automatically meet the DO constraint at maximum turbine efficiency.

Hong Gao,
Powel-MiniMax Inc.

Mr. Hong Gao draws upon more than 20 years of experience, specializing in advanced programming techniques and optimization methodologies. Mr. Gao has a BS in mathematics and statistics, and a M.Sc. in operational research and algorithms. He is responsible for for optimization and model design for Powel-MiniMax's HYDROPS Decision Support Software (DSS).

Implementing Soft Constraints in Hydroelectric Decision Support Systems (DSS)

Soft constraints have many uses in optimization models, and some pitfalls. Soft constraints are useful in providing hydro operations targets to guide the solution but to allow occasional unavoidable violations of the targets, just like in real life. Another purpose for soft constraints is to provide some practical computational flexibility. Without soft constraints a tightly formulated optimization model of a hydroelectric decision-support system (DSS) may become infeasible (no solution is possible) because of errors in the input data or because input parameters were incorrect – in this situation when infeasibility occurs, the results will be meaningless or the model may produce no useful output. Soft constraints make it more likely that useful output will always be produced to serve as a guide in reformulating the model.

In the paper, we will discuss the implementation of soft constraints using penalty methods in optimization modeling. We will discuss the different types of soft constraints, as well as the penalty parameters in the objective function.

Soft constraints can be a useful tool for guiding the solution from an optimization model towards practical results. But if a model has several types of soft constraints the coefficients, or penalties, must be selected with care to avoid weighting the solution towards misleading results especially for coefficients with different measurement units. The paper will discuss how soft constraints are used to model ramping and minimum instream flow constraints. Practical examples drawn from actual hydroelectric DSS implementations will be used to illustrate the challenges of applying soft constraints and the results that were achieved. Soft constraints technology developed specifically for the HYDROPS DSS software system has been successfully implemented in utility companies across North America and in China.

Michel Tremblay,
SNC-Lavalin

Michel Tremblay is with SNC-Lavalin since 1989. He holds a Ph.D. in civil engineering, specialized in water resources, from École Polytechnique de Montréal. He has an extensive experience in the operation of water resource systems, hydrologic studies and design of hydraulic structures. He developed a complete software package named PROSPER for the operation of hydroelectric networks. This software package includes a long-term and short-term optimization model and a simulation model.

Vincent Balvet,
SNC-Lavalin Energy Control Systems Inc.

Vincent Balvet holds both a DEA in Computer Science from Université Bordeaux 1, France, and a Software Engineer's Diploma from that university's École Nationale Supérieure d'Électronique et de Radioélectricité (ENSERB). In 1994, he joined the Energy Control Systems division of CAE Electronics, which became SNC-Lavalin Energy Control Systems Inc in 2000. Since then, he has participated in the design, development and deployment of a large number of Energy Management Systems throughout the world. As the engineering Group Leader for Generation Management, Operations Scheduling and Dispatcher Training Simulator applications, he is the technical lead for SNC-Lavalin ECS' hydro-generation optimization tools.

Hydro Modeling and Optimization Tools for Power System Operation and Flood Management

There is increasing need for sophisticated decision support tools in the field of hydro management. This is due to the complexities of the systems to manage and the multiple constraints and objectives to fulfill within changing hydrology, energy demand and energy price conditions.

SNC-Lavalin has developed a suite of integrated hydro modeling and optimization tools for decision support ranging from long term planning to automated real time operation of reservoirs, power plants and power systems.

Optimization of the operation of a power system having a hydroelectric component must take into account the analysis of the hydrology, the variability of the mentioned changing conditions while respecting numerous operational constraints. PROSPER is a user-friendly long to short term analysis package which optimizes the storage and releases from hydro reservoirs within an electrical system, while quantifying the implications of deviating from optimal operation.

Floods are one of the most severe natural disasters. AWARE-FMS can forecast the inundation extent for the coming days and disseminate the information via Internet. This system includes a real-time data acquisition module combined with rainfall/runoff and hydrodynamic flood propagation and inundation models to schedule and optimize the operation of regulating reservoirs.

These modeling and optimization tools are modular and can be integrated to fulfill specific user needs. They can be combined with the "hydro platform" of the GEN4™ SCADA and Energy Management System (EMS) of SNC-Lavalin Energy Control Systems. The latter system is used by numerous power utilities around the world to operate hydro plants, cascades of hydro plants, or complete power grids.

Such combined capability has become essential because of the regional nature of some of the constraints a hydro control system is managing (for instance silting, flood conditions, icing…). This capability has been extended to integrating utility proprietary optimization packages, such as Hydro-Québec's "SuperChop" economic dispatch application.

Further developments are planned to both enhance the optimal coordination of hydro and thermal resources, and to more completely integrate transmission security constraints within the unit commitment and loading problems.

Nils Olav Tangvik,
Powel ASA

Nils Olav Tangvik brings to bear more than 20 years of experience, specializing in the energy and utility industries. His expertise is in energy demand forecasting, inflow forecasting, short-term hydropower planning, and generation optimization tools. Nils is also involved with account management, the assembly of account plans and teams, and the development of account relationships, particularly with large international utilities. Nils received his M.Sc. degree in cybernetics from the Norwegian University of Technology in 1981.

Hydro-Electric Generation Decision Support Systems (DSS) in Deregulated Markets

The paper describes typical generation planning workflows at hydro-electric companies in Scandinavia. The companies must manage complex watercourses with different characteristics and varying hydrological conditions. Equally important, each company uses its own methodology in organizing the planning process, influenced by market systems that vary from country to country. The Powel ICC decision support system has been designed to address this complex variation of unique requirements.

The hydro-electric planning cycle starts with long-term planning that produce directives for a short-term planning horizon of 1-4 weeks. Short-term planners use these mandates together with market and hydrological information to establish and place robust day-ahead spot bids to the NordPool Power Exchange1. At this stage the purpose is to secure spot contracts that maximize the next day's revenue, within the scope of current mandates. When the NordPool bids are settled, detailed schedules for next day's generation must be made in order to fulfill the generation obligations in a cost-efficient way. Most companies are responsible for multiple watercourses with different hydrological conditions and water values. Optimization of operations is crucial to the decision process

In parallel, the remaining reserves in the generation system should be used to gain maximum profit from bids in regulated power markets. This requires a complete overview of available capacity and marginal costs in the total hydropower system.

During the day, frequent replanning is usually required in order to take advantage of the possibilities in regulated power and intra-day markets. The time available for running decision support software is often very limited and timeliness is critical. Consequences of intra-day trades must be incorporated into current plans within minutes, and there might not be time available for running a new optimization. Often a manual change of plans followed by watercourse simulations - to all consequences of the change - is the best approach. Generation disturbance due to an unplanned outage may require immediate manual changes of plans purely based on operator's experience. Once the new plans are activated, the decision support system is used to analyze upcoming hydrological consequences and follow-up the manual change.

Michael D. Eilts,
Weather Decision Technologies

Michael Eilts, President and CEO of Weather Decision Technologies, Inc. (WDT) received his B.S. and M.S. degrees in Meteorology and an MBA from the University of Oklahoma. He is also a Harvard Senior Executive Fellow. Before founding WDT in April, 2000, Mike worked at the National Severe Storms Laboratory (NSSL) for 18 years, the last 7 as the Assistant Director. While at NSSL, Mike managed a Division that grew from 20 people to 100 people when he left in 2000. Mike has written over 75 papers in meteorological journals and conference proceedings and is internationally recognized for his knowledge of Doppler radar and its application to precipitation estimation and hydrology, severe weather warning and aviation hazard detection and prediction.

The HydroMet Decision Support System (HDSS): New Applications in Operational Hydrology

Weather Decision Technologies (WDT) in has developed a turn-key, and highly customizable, hydro-meteorological management system package termed the HydroMet Decision Support System (HDSS). This system integrates data from radar, rain gauges, satellites, surface networks, and numerical models to provide high resolution Quantitative Precipitation Estimates and Forecasts (QPE/QPF). This presentation will address the following HDSS components:

1. Radar Quality Control: including clutter removal, bright-band identification, identifying hybrid scans, and scan filling for each individual radar.
2. Mosaicking of all available radars onto a high resolution three-dimensional grid.
3. Application of a Vertical Profile of Reflectivity (VPR) algorithm to correct the lowest level of the gridded radar data for which QPE/QPF will be performed.
4. Integration of radar, satellite, rain gauges, differential Z-R and Z-S relationships, and numerical model data into a QPE package called the Quantitative Precipitation Estimation and Segregation Using Multiple Sensors (QPE-SUMS).
5. Multi-Day Precipitation Forecasts: QPE-SUMS provides estimates of precipitation based on all available data out to 72 hours or longer. It also uses vertical temperature data to discriminate between rain and snow.
6. 1-4 Hour Precipitation Nowcasts: The McGill Algorithm for Precipitation Nowcasting Using Semi-Lagrangian Extrapolation (MAPLE). MAPLE provides forecasts of reflectivity out to 4 hours in advance. Differential Z-R and Z-S relationships are applied to these radar forecasts to provide flash flood prediction and hydrological models with radar based QPF.
7. Flood Warning: The Flash Flood Prediction Algorithm (FFPA). FFPA uses MAPLE based QPF, delineated watershed basin information, and user defined Flash Flood Guidance (FFG) values to automatically monitor total basin rainfall and alert operational users to those basins that are approaching or exceeding FFG with as much lead time as possible.
8. Customizable HDSS Displays: Users interface with the HDSS thru a 3-D graphics workstation, and thru Web-browser based display of HDSS data and products.

Franco Petrucci,
Environment Canada, Meteorological Service of Canada

Mr. Petrucci is a meteorologist from the Meteorological Service of Canada (Services, Clients and Partners Directorate). He has been with the Service for over 15 years, first as an operational meteorologist in Halifax and for the past 12 years performing applied research in automated forecast systems and statistical techniques at the Canadian Meteorological Centre in Montréal. After a brief stint at a wind energy consulting firm, he returned to the CMC and is now assigned to the development of services for the MSC's clients and partners in the natural resources sector; and in particular for the energy sector. Mr. Petrucci holds a Master's Degree in Physics from Laval University and a MBA from HEC Montréal.

Anticipated Future Developments in DSS

The science of meteorology is evolving very quickly from traditional, deterministic forecasts to probabilistic forecasts. Today, new forecast products are available using the results from many different numerical weather prediction systems. Ensemble prediction systems are produced by changing initial conditions, by changing parameterizations and through the use of different modeling systems. For example, instead of a precipitation amount, the probability of exceedence of different thresholds can be provided. Examples of probabilistic precipitation forecasts will be displayed and described along with anticipated future developments. It is expected that these types of forecasts will be used for economic decision-making as well as natural disaster mitigation.

Richard St-Jean,
Brascan Power Corporation

Having graduated from McGill University in 1986, Richard St-Jean started to work in the hydroelectric sector in 1989 as a project manager. In 1995, he accepted an opportunity to join the operations team and during these years lead many hydrological studies, was the co-author of 2 papers presented to the Canadian Dam Safety Association and managed implementation of three different generations of Decision-Support Systems.

With the market changes that hit the industry in the late 1990, he was the originator of the first electricity sale from a Québec privately owned generator to an outside market using the TransÉnergie transmission grid in 1998. Using this success, an innovative business strategy was presented to the Board of Director to grow the business using the emerging open markets opportunities. From operations manager of a 230 MW hydroelectric system, Richard is now Director of Hydro Assets Management, leading a group of professionals to plan generation and manage ancillary services of more than 100 hydroelectric stations located on 35 different watersheds spread in Canada and US.

Dale Peters,
Brascan Power Corporation

Dale Peters is a Short-Term Generation Planner with Brascan Power Corporation in Gatineau, Quebec and has been a member of the Ontario Region Marketing Team since August, 2004. His responsibilities include short term planning and scheduling of Brascan's hydroelectric assets in Ontario and Quebec, which deliver energy and capacity to the Ontario Energy Market. He earned a technical diploma in Civil and Water Resources (1973) from St. Lawrence College, Cornwall, Ontario.

Prior to joining Brascan he served as a Water Resource Specialist in the Hydro Division of Acres International Limited in Niagara Falls, Canada. Dale joined Acres in 1973 and participated in large number of engineering studies and projects. He has worked on both international and domestic generation system master plans and hydroelectric facility development from conceptual through final design and commissioning. In recent years Dale has participated in a number of river system Water Management Planning studies, performing power and energy studies to assess impacts for generator stakeholders.

Brascan Power Experience with DSS Applications

Brascan Power Corporation, through its North American assets, has been involved in the acquisition, implementation and utilization of a wide range of DSS applications over the past 20 years. A large amount of experience has been gained through the use of a variety of DSS packages. The overall capabilities and sophistication of these applications has continued to evolve, driven by the dynamics of changing energy markets and the increasing need for greater optimization of asset operation and management. Actual DSS applications are now required to provide close to real-time optimization solutions that consider both electricity price volatility and uncertainty in inflows.

The evolution of DSS applications has been impacted to a great extent by scientific advances in computational hardware, yielding significant increases in processing speed and memory size. High powered optimization algorithms are now employed along with increased data acquisition and management capabilities. This has also created some negative benefits, the most significant one being validation and quality assurance of ever increasing amounts of archived data. Considering that this data becomes the primary input for optimized solutions, the importance of this cannot be understated.

The objective of acquiring any DSS application is to have made a cost effective investment for a product that provides reliable, logical and practical solutions over a reasonable lifespan.

An overview of Brascan's DSS experience will present some of the successes, limitations, pitfalls and disappointments, followed by a wish-list to consider for future development.