

# 2010 isee User Conference

## MAKING CONNECTIONS

### Poster Presentations

#### 1. **Systems Thinking: When the process is more valuable than the results**

*by Isaac Wagner, Memorial Sloan-Kettering Cancer Center*

Memorial Sloan-Kettering Cancer Center exclusively treats cancer patients. Therefore, our relationship with our patients is more long-term than most healthcare organizations. Due to our obligations to existing patients, if resources are constrained, we must limit access to new patients. We will soon hit maximum capacity on our Inpatient beds (which state regulations make extremely costly and difficult to build). This situation will prevent us from treating new patients. New patients tend to use a set of resources representative of all services that we offer; existing patients tend to only use Inpatient services. Therefore, if we cut off new patients, other resources, such as surgery and radiation would be underutilized.

System dynamics modeling was chosen to evaluate three strategies to mitigate our Inpatient resource constraint. Not only was this technique successful in its stated goal, but it provided an unexpected insight which challenged conventional thinking about a fundamental aspect of our hospital.

#### 2. **Pricing Strategies: Pricing in innovation diffusion among competitors**

*by Javier Pulido Cejudo, Instituto Tecnológico y de Estudios Superiores (ITESM)*

Pricing is analyzed with a system dynamics approach in the context of a dynamic competition among two competitors. One of the competitors offers a product that appears first in the market (leader), intended to be an innovation, the other (follower), offers a similar product but enters into the market with a certain lag. Price sensitivity, brand equity, lag's length, quality of the products and consumers' response are considered. The leader's strategy stands on price and revenue performance whereas the follower's is on market share. Simulation based experiments are used to compute dynamic price elasticity, and the hypothesis that the absolute value of price elasticity increases with time is confirmed. The hypothesis that price reduction increases market share and profitability is also analyzed, finding scenarios where it is confirmed and refuted according to price sensitivity of the market.

#### 3. **Developing Systems Citizens in K-12 Education**

*by Lees Stuntz, Creative Learning Exchange*

The Creative Learning Exchange (CLE) is dedicated to developing Systems Citizens in K-12 education who use systems thinking and system dynamics to meet the interconnected challenges that face them at personal, community, and global levels. We support our mission by facilitating communication and sharing of materials among K-12 schools and teachers to help create a network of schools using Systems education.

#### **4. Coupling STELLA Simulation Models with Linear Program Optimization Models to Better Manage Reservoirs in the Connecticut River Watershed**

*by Brian Pitta, University of Massachusetts Amherst*

This poster describes a decision support system for managing the reservoirs in the Connecticut River Watershed to improve our ability to maintain flows that support and enhance ecological functions. The research upon which this poster focuses is jointly funded by The Nature Conservancy and the U.S. Army Corps of Engineers and includes researchers from the University of Massachusetts Amherst, the Hydrologic Engineering Center, and the United States Geological Survey, as well as the sponsoring agencies. The models developed for this research examine reservoir releases and storages at a daily time step. STELLA simulation models, coupled with LINGO linear programming optimization models, are at the core of the decision support system. The modeling process begins with a STELLA simulation model of the current reservoir operations. This model is calibrated to historic data and assures the model can accurately replicate the system. A linear program optimization model, built using LINGO, incorporates some of the current operating rules and the physical constraints of the system as well as introducing new ecological flow targets. The optimization model produces alternative operating policies based on the objective function and the prioritization of the objectives. The new targets produced from the optimization model are entered into the STELLA simulation model to analyze the system response to the new targets. This process is repeated using climate-impacted streamflow to analyze how the operating policies should change to account for possible shifts in the climate.

#### **5. Modeling Large Watershed Systems in STELLA**

*by Kelcy Takahashi Adamec, University of Massachusetts Amherst*

The Connecticut River Basin extends from the Connecticut Lake in New Hampshire to the Long Island Sound. The Connecticut River is more than 410 miles long and its flows are regulated by more than 60 large dams. The research upon which this poster focuses is jointly funded by The Nature Conservancy and the U.S. Army Corps of Engineers and includes researchers from the University of Massachusetts, Amherst, the Hydrologic Engineering Center and the United States Geological Survey, as well as the sponsoring agencies. A simulation model has been developed to represent current dam operations for the Connecticut River Basin. Initial model development uses historical streamflow collected from USGS gage sites to approximate streamflow input at each desired location. The model is assessed by comparing streamflow and dam storage in the simulation model with historical dam storages and downstream records of historical streamflow at dams and gages. Since streamflow input is approximated, streamflow output will not be an exact match, but should still replicate or closely mimic historic values. If streamflow output is inaccurate, the research team is able to refine the model with more accurate operations. Once the model is considered generally accurate, dam operations can be changed to examine the system response to historic streamflows under alternate operational policy. As it is developed, streamflow input will be exchanged with a more complex streamflow approximation to achieve better accuracy. Further analysis will include exchanging historical streamflow approximations with climate impacted streamflow. The resulting model response will demonstrate how current reservoir operations will react to a possible future.

## **6. A Framework for Independently Using Systems Thinking Simulations**

*by Richard Langheim, Ramapo College*

This presentation focuses upon the use of simulations outside of the classroom and in limited classroom experiences. A great deal of work on extending systems thinking in the K-12 environment has focused upon the professional development of teachers and the thoughtful creation of models and simulations. Today, systems thinking has become ubiquitous and it is therefore important to frame the extracurricular use of models and simulations in order to maintain the integrity of the discipline. This presentation describes a framework for the use of models and simulations in activities, such as Boy Scout merit badge work, and in limited classroom experiences that can be used by teachers as an entry to systems thinking.

## **7. Alberta Oil Sands Projects: Using STELLA to Build Model(s)**

*by Coim Janaki Raman, CSJ Training & Consulting*

Alberta's policy to reduce carbon dioxide emissions poses some interesting challenges. New ways of undertaking activities to reduce emissions, while maintaining standard of living, is the desired end goal. Canada has vast reserves of oil in its tar sands deposits in northern Alberta. These are world scale deposits relative to known conventional oil reserves and will play an important role in the world's economy in years to come. Substantial energy is required to extract the oil and upgrade it into usable products. This energy is currently derived from fossil fuels and releases of carbon dioxide are a consequence. This paper examines conventional mining and the other extraction and processing concept (Steam Assisted Gravity Drainage, SAGD), which can use steam generated by electricity or gas as input. These products, in turn, can be used to increase energy production while reducing carbon dioxide emissions. The paper focuses on the magnitude of carbon dioxide emission avoidance, which is anticipated, based on data from current and projected projects.

This paper reviews the current status of development of the oil sands industry projects and the carbon dioxide emissions expected if current extraction and upgrading techniques were continued. Using STELLA to build a system dynamics model, the scope of a project to produce bitumen for upgrading to Synthetic Crude Oil (SCO) is outlined.

## **8. Energy and Logistics Models**

*by David Hoffman, University of Alaska Anchorage*

This poster shows two recent energy industry models and their results and two supply chain models. One energy model separates heavy oil by heating with the mixture separated into oil, water and sand. The objective is to schedule removal of the components while keeping the heating element in the tank always immersed in the oil. The second models represent the supply and demand on natural gas in Anchorage. One supply chain model evaluates truck fuel deliveries to the North Slope on a weekly schedule. The last model is the loading and unloading of a container ship in Anchorage.

## **9. Models of Drug Response that Incorporate Time Dependent Effects**

*by Sara Rosenbaum, University of Rhode Island*

The mathematical relationship between a drug dose and the time course of the intensity of drug response can be broken down into two parts: the relationship between the dose and the drug concentrations achieved in the body over time (pharmacokinetic); and the relationship between the drug concentration at the site of action and response (pharmacodynamic). Drug pharmacokinetics can usually be modeled using relative simple linear models, in which drug concentrations are proportional to dose. In contrast, the characteristics of the relationship between drug response and concentration are more complicated. Firstly, the direct action of the drug is usually a capacity limited process that approaches a maximum value as concentrations increase. Secondly, the time course of drug response may be complicated by delays, irreversible drug effects that persist long after the drug has been eliminated, and homeostatic processes that may produce tolerance. Several mechanistic models have been developed to describe many of these effects. Interactive versions of these models have been created in STELLA to allow students of pharmacology to observe the varied nature of drug response, the characteristics of the models, and the importance and significance of the various parameter values. Models for simple drug response, drug tolerance and the hematological toxicity effects of anticancer drugs are presented.

## **10. System Dynamics Educational Programs**

*by Diane Poirier, Worcester Polytechnic Institute*

Worcester Polytechnic Institute offers online courses, graduate certificates, and a Master of Science degree in System Dynamics. Stop by to find out more about the courses offered and WPI's distinguished faculty, including conference participants Khalid Saeed, Oleg Pavlov and "virtual" conference presenter John Morecroft.

## **11. Forio Simulate Answers**

*by Paul Smith, Forio Business Simulations*

Have you ever used iSee NetSim to publish an *iThink* or STELLA model to Forio Simulate web hosting service? Stop by our table to find out more about Forio Simulate's features, such as social networking, user account management, saving and comparing runs, multi-player and advanced user interface controls.

## **12. iSee Lab**

*by iSee Development Team, iSee systems*

Staffed by members of the iSee development team, the lab will be open at various times during the conference for demonstrations of the latest software development and to ask specific questions about software features and operations. Stop by our table at the poster session to ask questions or to schedule an appointment.