New Technologies to Increase the Renewable Energy Ratio

Dr. Eric Bibeau

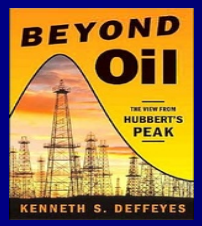
Mechanical & Manufacturing Engineering Dept

Manitoba Hydro/NSERC Alternative Energy Chair

Clean Technology

System-wide Technology Transfer Forum
University of California
Hyatt Regency San Francisco, April 3

What is “Clean Technology”?

- **Different perspectives**
- **Address <u>all</u> aspects**
  - peak oil 

  - air emissions 
  - GHG and global warming 
  - sustainability 

Many ways to be baffled

- **Clean air versus GHG reductions**
  - focus on local **versus** global emission reductions
- **GHG reduction versus Sustainability**
  - sacrifice opportunities
- **Where is "Strategic Intelligence"**
  - tangible goals on a year to year basis
- **Hard to compare options**
  - limited resources, time, money and talent
    - what is best value for society

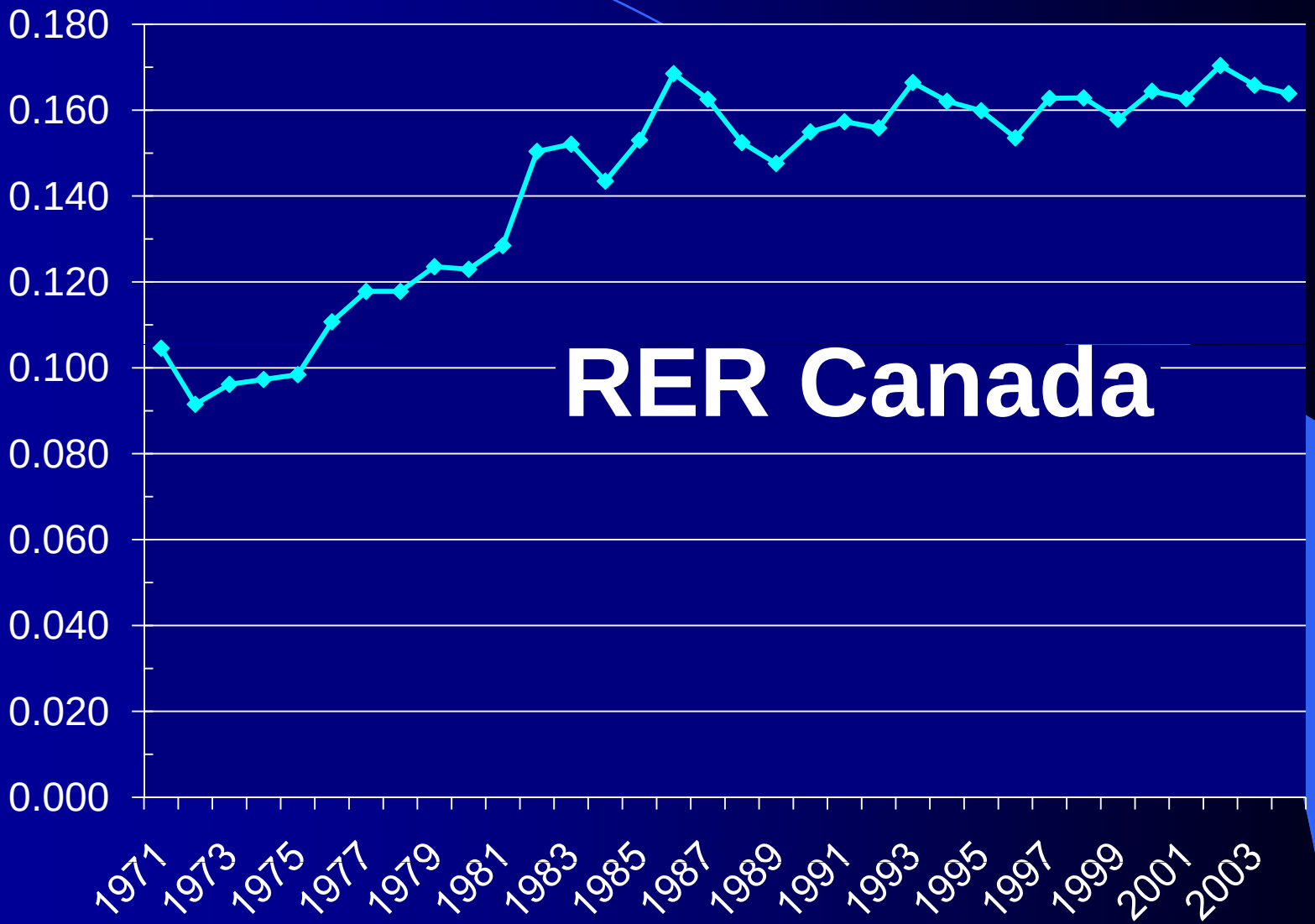
Simplification of Course of Action

- **Focus on increasing the renewable energy ratio (primary energy)**

$$RE = \frac{RE}{PE}$$

- **3 ways to increase the RER**
  - R: Add more Renewables
  - E: Increase Overall Efficiency
  - D: Reduce energy Demand

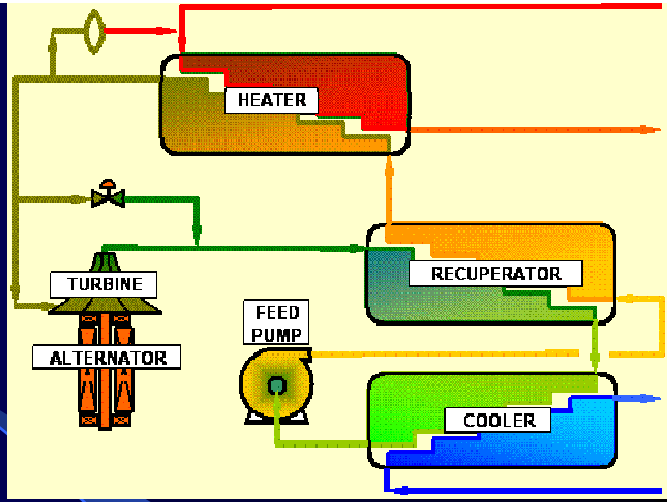
Canada's Performance



"Clean" Technologies to Increase RER (IP Disclosures)

- **Entropic Cycle (R)**
  - distributed low-cost bioenergy CHP
- **PET™ Technology (R and E)**
  - renewables & displacing fossil fuels for mobility
- **Kinetic Turbines (R)**
  - low cost and simple operation
- **Electronic Seal (D)**
  - reduce demand for confidential containers

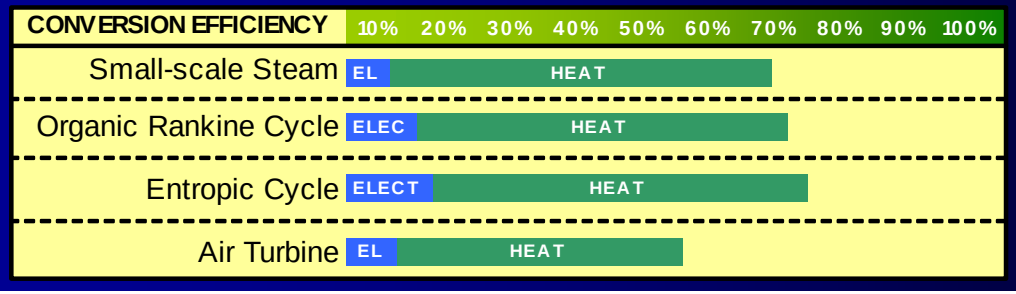
1. Entropic Cycle (R)



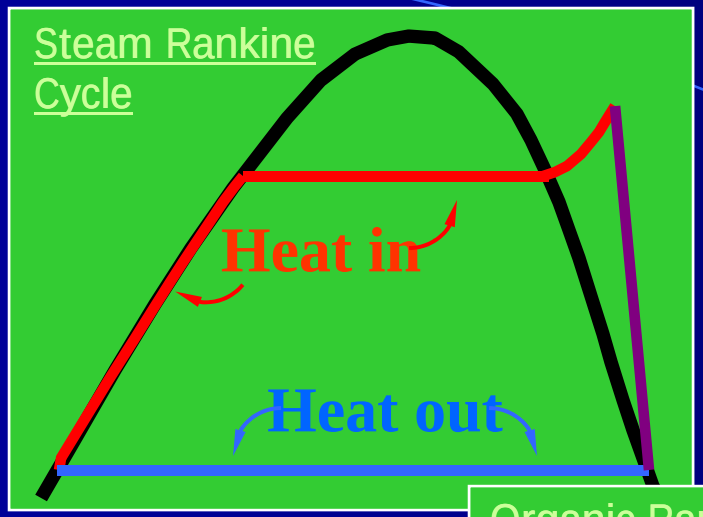
- **Small scale (50 to 5,000 kWe)**
  - thermal energy conversion
  - renewable fuels and waste heat
- **Combined heat and power (CHP)**
  - electricity and 90ºC hot water
- **Closed, single-loop, fluid mixture**
  - temperature change during boiling
  - internal recuperation of latent heat
- **Steam operators not required**
- **Developed for low cost distributed power**

Entropic Cycle and RER

- **Derive 70% of the LHV of the biomass residues**
- **Limits transportation fuel as used locally**
- **Replaces**
  - fossil fuel used for heat with renewable energy
  - fossil base electricity with renewable energy
- **Can be best strategy for communities to cost effectively increases there RER**
- **No steam operators and added safety**

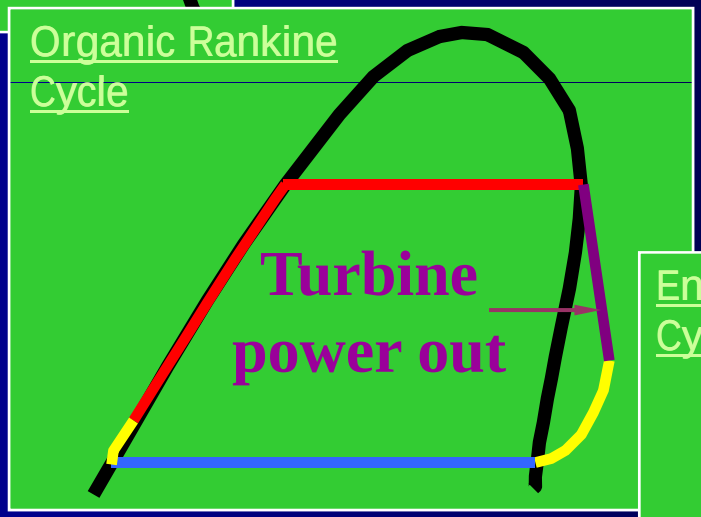


Cycle Comparison



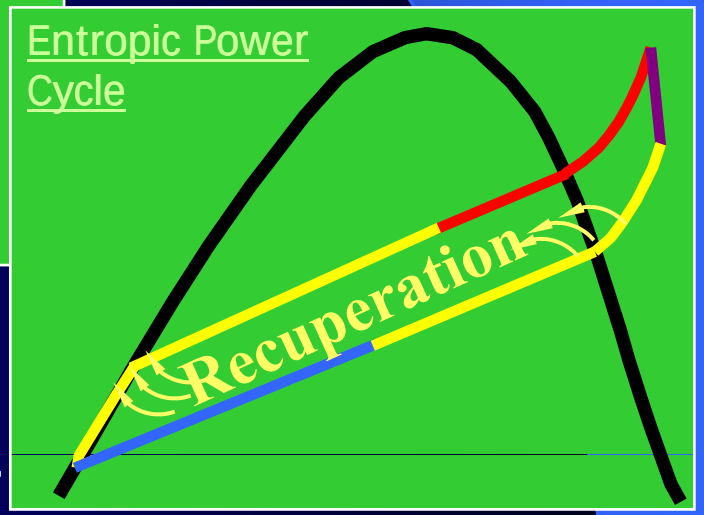
Steam

- no inherent recuperation



ORC

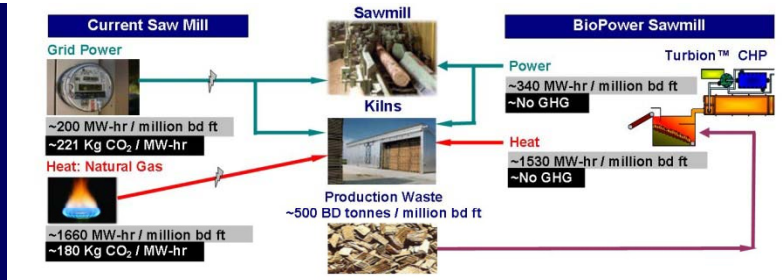
- no superheat
- Sensible heat recuperation



Entropic

- Latent heat recuperation
- Pre-vaporized fluid to heater
- High temperature coolant

Applications



200 Million bd ft per year sawmill		Current Sawmill		BioPower Sawmill
Power	40,000 MW-hr	8,840	tonne CO_2	0 tonne CO_2
Heat	332,000 MW-hr	59,760	tonne CO_2	0 tonne CO_2
Total		68,600	tonne CO_2 **	0 tonne CO_2 **

- **Heat recovery**
  - gas turbines, diesel compressors, flare
- **Capture industrial waste process heat**
  - aluminum, glass, steel plants
- **Sawmills can become energy integrated**
  - remanufacturing plants & construction
- **District CHP displaces**
  - diesel generation; natural gas; propane
  - agricultural and remote communities

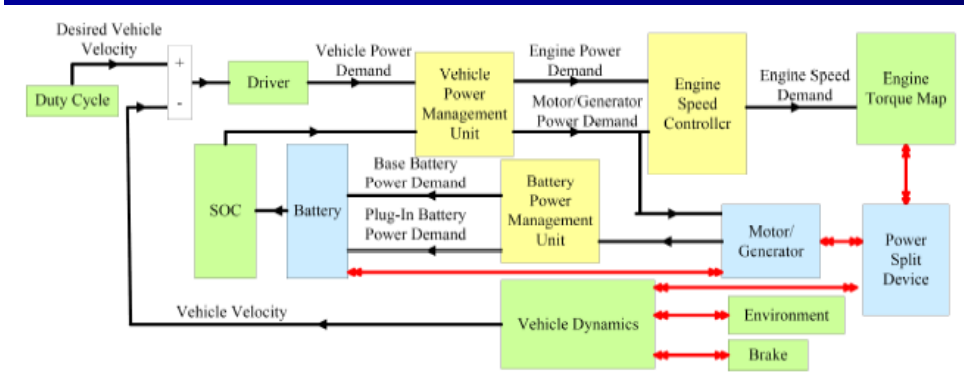
2. PET™

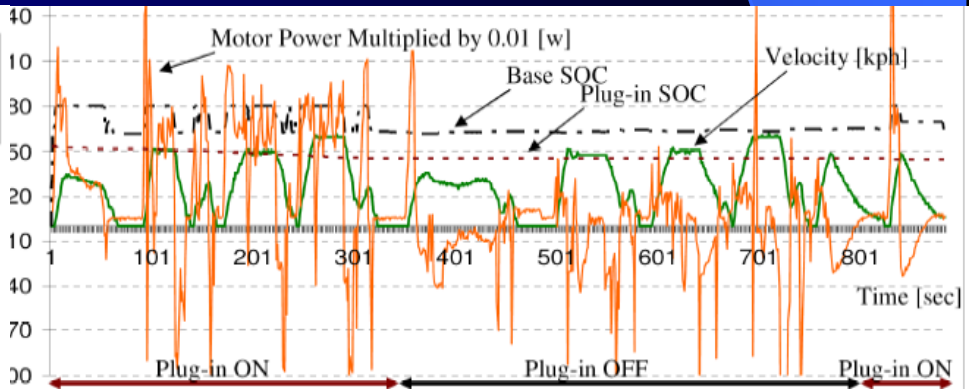
Plug-in Electric Transporter (R, E)

- **PHEV strong value proposition for mobility**
  - favors the development of renewables
  - high interest from utilities
  - allow most effective use of electricity for mobility
  - manages vehicle weight for extended range
- **PET**
  - Platform technology to allow 650 million vehicles and the 600 projected additional vehicles
    - access benefits of hybridization
    - access benefits of grid electricity for mobility

Plug-in Electric Transporter Design

- **Provides opportunity for users**
  - buy smaller vehicles to tow occasional loads
- **Key aspects of PET**
  - limited changes to the vehicle
- **After market product simple to install**





PHEV and the RER

- **Green power**
  - export or new generation
  - North American grid system
  - potential to displace GHG
  - PHEV: best value for Manitobans

Power Export GHG Displacements	Assumed MH Export Profile (%)	Current Emission Factor (kg CO_2/kWhr)
North Dakota	10	1.02
Minnesota	80	0.69
Saskatchewan	5	0.83
Ontario	5	0.24
	Total	0.71

Plug-in Highway NETWORK

PHEV2007 Conference

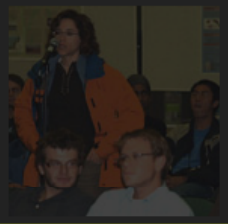
WHERE THE GRID MEETS THE ROAD

Winnipeg, Manitoba November 1 & 2, 2007

DOWNLOAD BROCHURE

Manitoba Hydro PLATINUM SUPPORTERS Natural Resources Canada Ressources naturelles Canada

PHEV2007 Photo Gallery (100 photos)



Gold Supporters.

Transport Canada Transports Canada

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Silver Supporters

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NSERC CRSNG PRAIRIES

University of Manitoba

The Centre for Sustainable Transportation Le Centre pour un transport durable

AT THE UNIVERSITY OF WINNIPEG

PHEV2009 Conference in Montreal

Contact Peter Radziszewski McGill University for information

PHEV2007 Conference: "Where the Grid Meets the Road"

The Plug-in Highway Network invites you to PHEV2007 conference to be held on November 1 to 2, in Winnipeg, Manitoba.

The conference will focus on the range of opportunities and challenges that Plug-in Hybrid Electrical Vehicle (PHEV) present for sustainable transportation. It will provide a forum for collaboration amongst industry, academia, utilities, governments and institutions to understand how PHEV technologies integrate into current and future transportation systems and the electrical power grid.

The conference will focus in part on:

- establishing a Canadian network of researchers focused on PHEV related issues,
- focus on the simulation of advanced vehicles to optimize the effective use of renewable resources,
- reviewing on-going demonstrations PHEV project across North America, and
- discussion of the possible role of Canadian government in supporting PHEV development.

Conference highlights include:

- workshop to create a network of Canadian researchers focused on PHEV and PEV,
- review of on-going PHEV and PEV demonstrations in North America,
- tour of New Flyer hybrid bus manufacturing plant (attendance limited),
- courses on simulation of vehicles by leading experts,
- public PHEV forum to help educate the public at large (Download Brochure),
- development of a PHEV bus demonstration project using B100 as part of the Plugin Highway program, and
- display of PHEV vehicles and batteries.

If you have a keen interest in PHEV and sustainable transportation, we hope that you will join us.

Quick Download

Proceedings...

PHEV2007 Program

Delegates

Headlines

PHEV on UTube continue...

Toronto mayor unveils hybrid-conversion project continue...

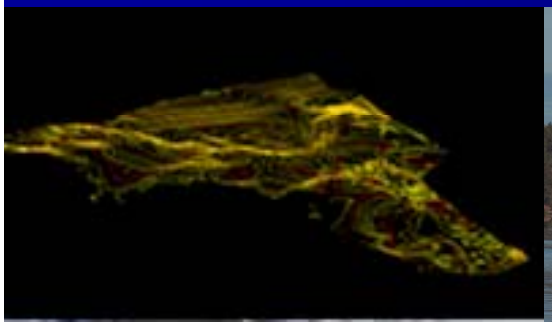
2005 Alternative Energy Conference proceedings available here...

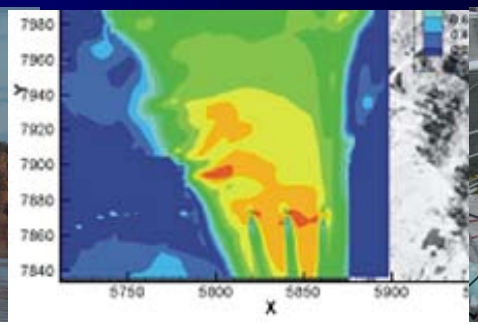
Speakers

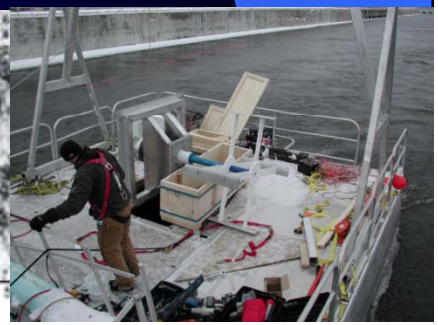
Chelsea Sexton; Jasna Tomic; Felix Kramer; Dr. Andy Frank; Dr. Ali Emadi; Dan Eberle; Phil Sharer; Ewan Pritchard; Mark Duvall; Keith Parks

3. Kinetic Turbines (R)

- Important undeveloped hydro resources
- Limited civil structures
- Fast deployment
- Lack of available performance data
- Remote sites to displace diesel
- Multiple units to increase capaicty

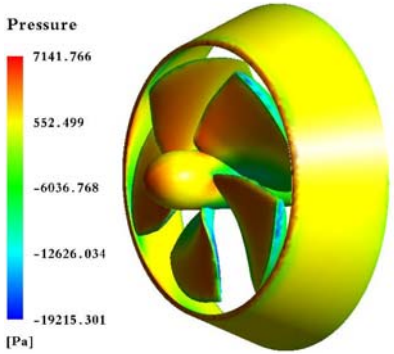


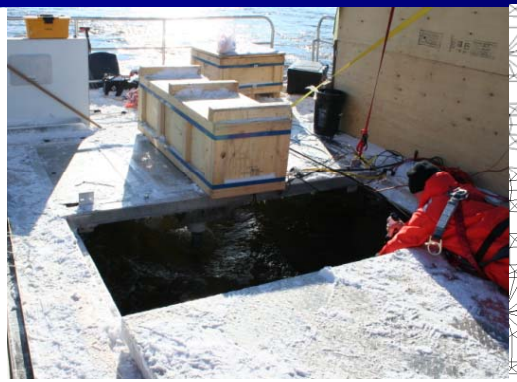


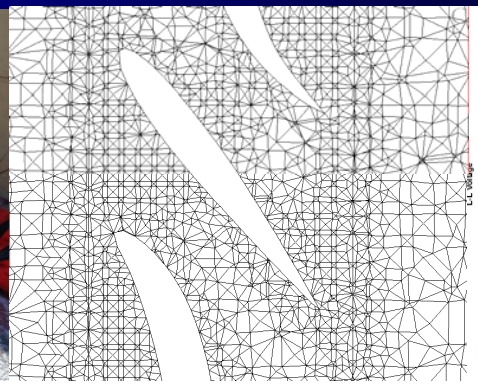


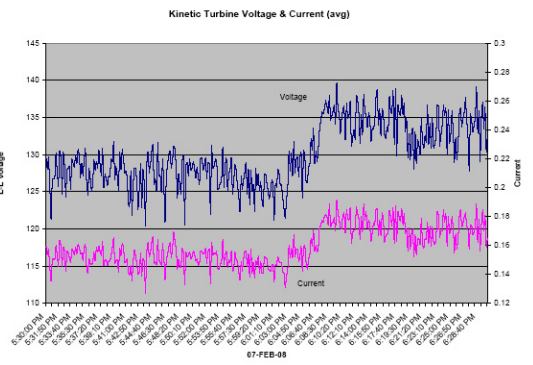
In-Situ River Testing

- **Quantify costs**
  - deployment
  - operational
  - maintenance
- **Study effect of ice and cold weather**
- **Test if suitable for river applications**



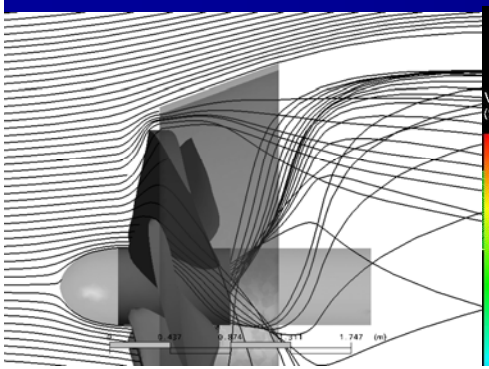


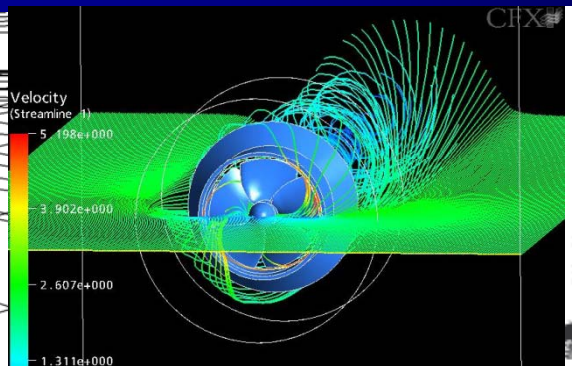


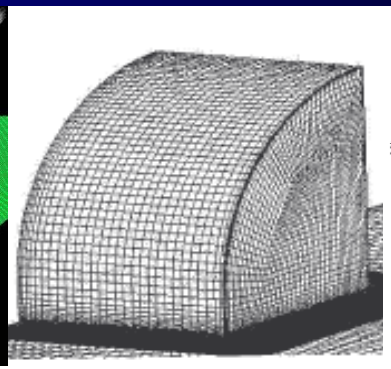


Design Needs

- **Low cost anchor**
- **Simple to deploy/retrieve**
- **Address environmental factors**
  - ice break up and active/passive frazzle ice
  - logs and debris
  - cold temperatures (safety and loads)







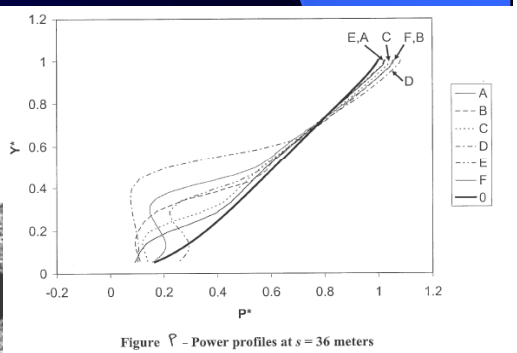


Figure P – Power profiles at $s = 36$ meters

4. Electronic Seal (D)

- **Institutions use reusable envelopes**
  - reduced use for delivering proprietary information
    - pay stubs, account information…
  - often use one-time-use sealed envelopes
- **Reusable-sealed containers**
  - provides confidentiality
  - track time and date when opened
  - database of destinations
  - used for delivery and storage

Acknowledgement

- NSERC/Manitoba Hydro Chair in Alternative Energy
- Government of Manitoba
- University of Manitoba, Technology Transfer Office

Presentations on alternative energy

- http://www.umanitoba.ca/engineering/mech_and_ind/prof/bibeau/