



## School of Renewable Resources Certificate in Renewable Energy

**RNW 120**  
**Renewable Resource Measurements: Earth, Water, Wind & Fire**

Course Outline  
Fall, 2009

### Instructors

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### Instructors' Office Hours

posted on instructor's office door

### Hours / Week

Lecture	1 hour / week	
lab	4 hours / week	TBA
Credit		3

### Course Description:

RNW 120 Renewable Resource Measurements: Earth, Water, Wind & Fire introduces measurement techniques applicable to a range of renewable resource technologies. Students will work in the field and lab to learn basic measurement skills including chain and compass surveying; use of a clinometer; use of a portable GPS unit; measuring tree height, volume, annual growth, and biomass potential from plants and algae; soil properties, including soil thermal conductivity used for ground source heating and cooling, hydrology skills to assess small hydro potential; and weather measurements like heat, precipitation, humidity, wind speed, and solar insolation. Students will complete a simple heat loss calculation and a GSHP sizing exercise. Graduates will be able to demonstrate field knowledge or skills at a level consistent with expectations for entry-level renewable energy technicians.

### Prerequisites:

English 12 or equivalent, Principles of Math 11 with a C+ or Math Applications 11 with a B are required for program admission, and successful completion of all courses in the first semester or permission of the Chair of the School of Renewable Resources.

### **Transfer Credit:**

Selkirk College has negotiated articulation agreements with several universities whereby graduates from the School of Renewable Resources are able to receive credit towards the completion of other post-secondary programs. Please contact a Selkirk College counsellor or the Chair of the School of Renewable Resources for more information regarding transfer credit. Past transfer credit is no assurance of credit that may currently be obtained. For students wishing to obtain transfer credit, retain this course outline, completed and graded assignments and academic transcripts. Use these documents to support requests for transfer credit.

### **Course Outcomes:**

This course is an integral part of the Certificate in Renewable Energy program: a post-secondary, college-level program. Renewable Energy Certificate program graduates who complete this course will be able to demonstrate knowledge or skills listed at a level consistent with expectations for entry-level renewable energy technicians.

### **Educational Outcomes:**

- Demonstrate safe field and lab work practices
- complete basic renewable resource field and lab measurements including:
  - chain and compass surveying skills,
  - use of a clinometer,
  - measure tree height, tree volume, forest density, and annual growth increment,
  - estimate biomass potential per unit area
  - determine the texture of soil and apply this to thermal properties of soils,
  - perform a simple heat loss calculation,
  - perform a simple ground source heat pump sizing exercise,
  - measure stream flow and head and estimate hydro electric power potential,
  - collect weather data including wind speed and solar insolation
- Compete lab exercises including:
  - grow algae, separate algal oil, convert oil to biodiesel and comment on process,
  - use of a calorimeter,
  - use a simple light meter,
  - build and operate a simple hydro generator,
  - build and operate a simple wind turbine,

### **Textbooks / Supplemental Materials:**

**Required Texts:** *RNW 120 Renewable Resource Measurements: Earth Water Wind & Fire Lecture and Lab Notes, Fall 2009* edition by Frank Fowler and Robert M. Macrae

**Required Equipment and Supplies:** Each Student is responsible for providing the following items:

scientific calculator (Sharp EL-531W or equivalent)	Pens and pencils
field clothing	Protractor
sturdy walking boots	Note book
rain gear	

Students should keep this equipment available for use in all labs. Any additional equipment and supplies needed for lab exercises will be supplied by instructor.

## Topic Outline

1. Introduction
  - a. safety
  - b. measurements, accuracy, precision, units
  - c. record keeping
  - d. review residential building heat loss calculation assignment
  - e. review GSHP sizing assignment
2. Land Surveying
  - a. basic concepts and applications
  - b. slope and horizontal distance
  - c. area measurement
  - d. line transect, line intercept samples,
  - e. map basics
  - f. GPS (global positioning system) basics
3. Biomass Measurements
  - a. tree height
  - b. tree volume
  - c. tree density
  - d. standing tree volume
  - e. annual increment
  - f. biomass energy potential
  - g. biodiesel from algae experiment
4. Soil Properties
  - a. soil texturing
  - b. thermal properties of soil
  - c. size a ground source heat pump (GSHP)
5. Hydrology
  - a. stream flow
  - b. head
  - c. gross and net small hydro potential energy
  - d. build and experiment with a simple hydro turbine and electric generator
6. Climate & Weather
  - a. measure heat, humidity, precipitation, wind speed, air pressure, and solar insolation
  - b. review weather and climate resources
  - c. use solar pathfinder and solar charts
  - d. calculate wind energy resources

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**Evaluation:**

Lab reports (post lab assignments) (10 @ 5%)	50%
Midterm examination	20%
Heat loss calculation assignment	10%
Size GSHP assignment	10%
Professionalism (punctual, regular attendance, prepared, equipped and contributing to personal and team success)	10%
Total	<u>100%</u>

**Grading:**

A+	95% to 100%	= 4.00	B+	80% to 84%	= 3.33	C+	65% to 69%	= 2.33
A	90% to 94%	= 4.00	B	75% to 79%	= 3.00	C	60% to 64%	= 2.00
A-	85% to 89%	= 3.67	B-	70% to 74%	= 2.67	C-	55% to 59%	= 1.67
						P	50% to 54%	= 1.00
						F	Less than 50%	= 0.00
						DNW	Did not withdraw	= 0.00

**Evaluation Methods:**

Professionalism will be evaluated on the basis of punctuality, regular attendance, preparation, completion of assignments as scheduled, courtesy during classes and other educational activities, helping classmates to learn course material, respect for college property, public and private property visited while on field trips. These are qualities that employers seek in renewable energy technicians and technologists and are therefore behaviors that are encouraged and entitled to recognition. These qualities are not easily measured and require discretion in their evaluation on the part of the instructor.

## Additional Relevant Information/Course Expectations:

### Attendance and Late Assignments:

Students are expected to make every reasonable effort not to miss examinations and to submit assignments on time. Compassionate excuses will be considered only if documented. Students must advise the instructor *before* assignment deadlines or examinations if they are unable to meet the schedule. Otherwise *late assignments will not be accepted for grading nor will examinations be rescheduled.*

The academic policies of the School of Renewable Resources and Selkirk College will be observed. For more information on these policies refer to the School of Renewable Resources Academic Policies and the Selkirk College Calendar at <http://ecampus.selkirk.ca/> or visit the Advanced Certificate in Renewable Energy program web site at <http://selkirk.ca/programs/rr/academicprograms/renewableenergy/>

### Course Schedule:<sup>1</sup>

week	date (week ending)	topic or activity	deadlines
1	11-Sep	RNW program orientation	none
2	18-Sep	introduction lab 1 start algae culture lab review heat loss calculation assignment & sizing GSHP assignment	none
3	25-Sep	lab 2	lab 1 post lab
4	02-Oct	lab 3	lab 2 post lab
5	09-Oct	lab 4	lab 3 post lab
6	16-Oct	no classes - Thanksgiving	heat loss assignment due
7	23-Oct	mid term and lab 5	lab 4 post lab
8	30-Oct	lab 6	lab 5 post lab
9	06-Nov	lab 7	lab 6 post lab
10	13-Nov	lab 8	lab 7 post lab
11	20-Nov	lab 9	lab 8 post lab
12	27-Nov	lab 10	lab 9 post lab
13	04-Dec	biodiesel lab	sizing GSHP assignment due
14	11-Dec	wrap up	lab 10 post lab

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<sup>1</sup> Course schedule is subject to change without notice.