

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION F: ADVANCED LEVEL

The following pages define the curriculum and assessment standards for the advanced level of Energy and Mines.

Advanced level modules demand a higher level of expertise and help prepare students for entry into the workplace or a related post-secondary program.

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MODULE ENM3010: ENERGY & THE ENVIRONMENT

Level: Advanced

Theme: Social and Cultural Perspectives

Prerequisite: None

Module Description: Students assess the social, economic and environmental benefits and costs of resource development, and demonstrate personal and shared actions that foster energy conservation and environmental stewardship.

Module Parameters: Access to relevant government, industry and community resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe the social, economic and environmental significance of energy development • plan and implement a strategy for personal action that fosters an environmentally sensitive lifestyle 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or report describing the social, economic and environmental significance of an energy development. Presentation/report to address: <ul style="list-style-type: none"> – social, economic and environmental factors affecting the development – actions taken by industry and government to address social, economic and/or environmental concerns – public consultation procedures established to respond to concerns regarding the development. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for presentations/reports</i></p> <ul style="list-style-type: none"> • conducting an audit of personal energy use within the home and community. <p><i>Assessment Tool</i> <i>Task Checklist: Conducting an Energy Use Audit, ENM3010-1</i></p> <p><i>Standard</i> <i>Complete all tasks on the checklist to a standard of 3 on the rating scale</i></p>	<p>30</p> <p>30</p>

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> plan and implement a group; e.g., class, school, community, action campaign that fosters environmental awareness, energy conservation and energy efficiency 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> maintaining a journal of lifestyle practices that affect an energy resource, inferences regarding the potential impact of each practice on the resource, and ideas for environmental citizenship. <p><i>Assessment Tool</i> <i>Reflection Guide for Environmental Responsibility/Citizenship, ENMREF</i> <i>Guide to Inferences: Personal Impact on Resources, ENM3010–2</i></p> <p><i>Standard</i> <i>Complete 10 journal entries; address criteria for reflection to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> developing, implementing and assessing a personal action strategy for promoting energy conservation and an environmentally sensitive lifestyle. <p><i>Assessment Tool</i> <i>Assessment Criteria: Proposal for Environmental Action, ENMPRO</i></p> <p><i>Standard</i> <i>Develop, implement and assess the strategy to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> conducting a cost-benefit analysis of an energy saving technology. <p><i>Assessment Tool</i> <i>Task Checklist: Conducting a Cost-Benefit Analysis, ENM3010–3</i></p> <p><i>Standard</i> <i>Complete all tasks on the checklist to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> given a current community issue regarding energy conservation, energy efficiency and/or lifestyle choices, negotiating and debating the issue while assuming the role of one or more stakeholder groups. <p><i>Assessment Tool</i> <i>Negotiation and Debate: Advanced Level, ENMNEG–3</i></p> <p><i>Standard</i> <i>Address criteria in negotiation/debate to a standard of 3 on the rating scale</i></p>	<p>30</p>

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain career opportunities relevant to environmental management • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • developing, implementing and assessing a classroom, school or community action campaign that fosters environmental awareness and energy conservation. <p><i>Assessment Tool</i> <i>Assessment Criteria: Proposal for Environmental Action, ENMPRO</i></p> <p><i>Standard</i> <i>Develop, implement and assess the strategy to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • completing a research project on one or more career opportunities in environmental management. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR-3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>10</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Environmental Significance</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the social, economic and environmental significance of an energy development; e.g.: <ul style="list-style-type: none"> – a hydro dam – an oil sands/coal development project • analyze relationships between an energy development and the environment 	<p>Investigate local developments; e.g.:</p> <ul style="list-style-type: none"> • Keephills • Brazeau/Bighorn Dams • Fort McMurray oil sands. <p>Research environmental issues resulting from:</p> <ul style="list-style-type: none"> • greenhouse gases • acid deposition • habitat destruction • resource depletion.

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Concept	Specific Learner Expectations	Notes
<p>Environmental Significance (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe actions taken by industry to reduce or eliminate environmental impacts of an energy development • identify government policy and regulation at provincial and national levels intended to respond to social, economic and environmental concerns regarding an energy development • describe public consultation procedures and trade-offs that respond to social, economic and environmental concerns. 	<p>How effective are current:</p> <ul style="list-style-type: none"> • development practices? • reclamation technologies? • environmental monitoring procedures? <p>Policies/programs intended to foster a sustainable energy future usually focus on:</p> <ul style="list-style-type: none"> • using less • finding alternative sources.
<p>Strategy for Personal Action</p>	<ul style="list-style-type: none"> • conduct an energy audit by maintaining a log of personal energy use for a period of several days • distinguish among needs and wants as reflected through the energy audit • evaluate the impact of personal energy use and lifestyle factors on the environment • describe and implement a strategy to ensure an environmentally sensitive lifestyle • evaluate the social, economic and environmental consequences of implementing the strategy • revise the strategy according to environmental, social and economic outcomes. 	<p>Plan for student-directed projects. Encourage students to express personal views and values.</p> <p>Plan for:</p> <ul style="list-style-type: none"> • student debates • negotiation • consensus building. <p>Identify 10 or more personal actions and their consequences for the environment.</p> <p>Brainstorm proposals for decreasing personal energy use.</p> <p>Evaluate proposals on the basis of effectiveness and practicality.</p> <p>Establish and implement priority actions.</p> <p>Debate the benefits and costs of outcomes.</p> <p>Review and adjust the action plan.</p>

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Concept	Specific Learner Expectations	Notes
<p>Group Action Campaign</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and assess opportunities for reducing environmental impacts of energy use within the classroom, school and/or community • identify obstacles to group action to reduce environmental impacts • plan and implement a classroom, school and/or community campaign that fosters environmental awareness and energy conservation • identify constructive ways in which individuals can influence group decisions that affect energy consumption and the environment • design a social, economic and/or environmental impact assessment and consultation process for a proposed energy project. 	<p>Conduct a cost-benefit analysis of an energy-saving technology; e.g.:</p> <ul style="list-style-type: none"> • microwave ovens • fluorescent bulbs. <p>Develop a marketing campaign to increase public awareness.</p> <p>Establish goals and plan the campaign. As time permits, conduct the campaign and assess results.</p> <p>For example:</p> <ul style="list-style-type: none"> • voting • lobbying • seeking office • supporting compatible interest groups. <p>Use a team approach. Encourage students to assume the role of owner, intervenor, lobbyist, etc. Discuss the importance of <u>planning</u> for a new project or the expansion of an existing project.</p>
<p>Career Opportunities</p>	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities in environmental management; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – general consulting • evaluate current employment opportunities based on employment statistics 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p>

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities (continued)	<i>The student should:</i> <ul style="list-style-type: none">• research trends in environmental management, and future career opportunities.	Arrange/facilitate: <ul style="list-style-type: none">• information interviews• work study/experience• job shadowing.

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2020 Conventional Oil/Gas 1 (Resource Exploration)

Module Description: Students examine specific recovery and production techniques within the context of a conventional oil and/or gas industry, and they explain related career opportunities.

Module Parameters: Access to conventional oil/gas recovery and production industry.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none">describe techniques used to complete and service a conventional oil or gas well	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none">a presentation or report that describes and illustrates steps taken to prepare a successful oil or gas well for production. Report to address:<ul style="list-style-type: none">– installation of production casing and tubing– cementing– installation of wellhead– well perforation– well stimulation treatments. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p>	40

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • through laboratory and/or field-based investigations: <ul style="list-style-type: none"> – identifying applications of principles of science and technology in well production operations – comparing the principles and processes involved in naturally flowing wells with those depending on recovery by artificial lift. <p><i>Assessment Tool</i> <i>Lab Investigations: Advanced Level, ENMLAB-3</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Conduct lab investigations to a standard of 3 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field-based investigations</i></p> <ul style="list-style-type: none"> • a summary of environmental assessment and management practices conducted by industry throughout recovery and production operations. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • a concept test in which the student demonstrates knowledge of well-site production equipment and surface facilities, and their function in recovery, production and environmental/workplace safety. <p><i>Assessment Tool</i> <i>Energy Sources/Applications/Alternatives (Instructor's Manual)</i></p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p>	

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain applications of enhanced oil recovery technology in maximizing recovery rates for conventional oil or gas • describe field gathering facilities and distribution systems used in the conventional oil or gas industry • explain career opportunities relevant to the recovery and production sector of the conventional oil and gas industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on secondary and tertiary methods of enhanced oil recovery. Research to address: <ul style="list-style-type: none"> – water and gas injection – pumping technology – miscible flooding – steam injection – fireflooding – horizontal drilling. <p><i>Assessment Tool</i> <i>Research Process: Enhanced Oil Recovery, ENM3020–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • a flow chart that traces the movement of a conventional oil or gas commodity from well-site to market (or refinery). Flow chart to illustrate (as appropriate): <ul style="list-style-type: none"> – separation facilities – field storage techniques – distribution networks – pipeline systems – pump/compressor stations. <p><i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i></p> <p><i>Standard</i> <i>Complete the flow chart to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • completing a research project on technical, professional and/or labour-based careers in the recovery and production sector of conventional oil and gas industry. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR–3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p>	<p>20</p> <p>20</p> <p>20</p>

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
Well Completion and Servicing	<p><i>The student should:</i></p> <ul style="list-style-type: none"> outline steps that are taken to prepare a successful oil or gas well for production: <ul style="list-style-type: none"> installation of production casing and tubing cementing installation of wellhead well perforation describe well-site production equipment and surface facilities and their function in production, maintenance and safety; e.g.: <ul style="list-style-type: none"> service rig flare line accumulators distinguish between natural flowing wells and wells that depend upon artificial lift explain well stimulation treatments used to ensure underground movement of hydrocarbons to the well bore describe methods used to control well production explain environmental assessment and management practices conducted by industry throughout recovery and production operations 	<p>Discuss safety considerations relevant to the well-site; e.g.:</p> <ul style="list-style-type: none"> first aid clothing and equipment government/industry regulation lifting/hoisting techniques. <p>Identify general parts of a service rig and accompanying equipment; e.g.:</p> <ul style="list-style-type: none"> blowout preventers rig tank tongs wellhead. <p>Encourage students to make links with concepts studied in the core science program.</p> <p>For example,</p> <ul style="list-style-type: none"> acidizing fracturing. <p>Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.</p>

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Well Completion and Servicing (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe technological advances used to address environmental concerns throughout recovery and production • research well completion practices and production equipment used in frontier operations. 	<p>Gather information regarding practices followed to maintain environmental standards; e.g.:</p> <ul style="list-style-type: none"> • directional wells • land reclamation • control of sulphur emissions. <p>For example:</p> <ul style="list-style-type: none"> • arctic • off-shore.
Enhanced Oil Recovery	<ul style="list-style-type: none"> • identify factors that determine the portion of oil in a reservoir that can be produced naturally through primary recovery methods; e.g.: <ul style="list-style-type: none"> – density and viscosity of the oil – porosity and permeability of the rock – pressure in the reservoir • explain applications of infill drilling to improve oil or gas recovery rates • explain secondary methods of enhanced oil recovery • explain tertiary methods of enhanced oil recovery • identify factors that influence the life of an oil and/or gas well • describe techniques used to estimate recoverable oil and gas reserves • describe future sources of oil and gas supplies; e.g.: <ul style="list-style-type: none"> – unrecovered oil in existing reservoirs – frontier production – oil sands. 	<p>Cite reasons for making production as efficient as possible.</p> <p>Average recovery in light oilfields is about 30% of the original oil. The remaining 70% cannot be recovered economically with existing technology.</p> <p>Research the use of directional wells for infill drilling.</p> <p>For example:</p> <ul style="list-style-type: none"> • water and gas injection • pumping technology. <p>For example:</p> <ul style="list-style-type: none"> • miscible flooding • steam injection • fireflooding • horizontal drilling. <p>Compare and contrast the concepts of “proved reserve,” “probable reserve” and “established reserve.”</p> <p>Discuss factors that determine estimates of recoverability and producibility; e.g.:</p> <ul style="list-style-type: none"> • reservoir characteristics • economic considerations • regulatory limitations.

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Gathering and Distribution	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe well-site and satellite facilities used for dehydration, separation, heating and measurement processes • describe different types of field storage facilities • research distribution networks used to move conventional oil or gas from well-site to market (or refinery) • describe the layout of a pipeline system used for transporting conventional oil or gas • explain the function of pump and compressor stations in moving oil or gas along transmission lines. 	<p>For example:</p> <ul style="list-style-type: none"> • surface • underground. <p>For example:</p> <ul style="list-style-type: none"> • pipeline systems • tankers and barges. <p>For example:</p> <ul style="list-style-type: none"> • rail systems • trucking systems. <p>For example:</p> <ul style="list-style-type: none"> • gathering lines • trunk lines • gas transmission systems. <p>Research electronic inspection devices used to detect potential problems such as faulty welds, dents, cracks or corrosion.</p>
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the recovery and production sector of a mineral industry; e.g.: <ul style="list-style-type: none"> – earth science – engineering – technical and support services – apprenticeship trades – environmental management • evaluate current employment opportunities based on employment statistics • research recovery and production trends and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)

Level:	Advanced
Theme:	Technology and Applications
Prerequisite:	ENM2030 Oil Sands/Heavy Oil/Coal 1 (Resource Exploration)
Module Description:	Students examine specific recovery and production techniques within the context of Alberta’s oil sands, heavy oil or coal deposits; and they explain related career opportunities.

Module Parameters: Access to industry involved in the recovery and production of nonconventional hydrocarbon resources.
 Access to a science laboratory.
 This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.
 See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning
 Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe techniques used to recover a nonconventional hydrocarbon resource 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a presentation or report that describes and illustrates: <ul style="list-style-type: none"> extraction, processing and transportation infrastructures necessary for the recovery and production of bitumen, heavy oil or coal specific techniques used to extract a nonconventional hydrocarbon, including surface mining, underground mining and/or in situ (“in place”) techniques environmental assessment and management practices conducted by industry throughout recovery and production operations. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p>	50

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe field gathering facilities and distribution systems used in the oil sands, heavy oil or coal industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> through laboratory and/or field-based investigations, identifying applications of principles of science and technology involved in separating, cleaning and/or upgrading a nonconventional hydrocarbon. <p><i>Assessment Tool</i> <i>Lab Investigations: Advanced Level, ENMLAB-3</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Conduct lab investigations to a standard of 3 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field-based investigations</i></p> <ul style="list-style-type: none"> a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction. <p><i>Assessment Tool</i> <i>Energy Sources/Applications/Alternatives (Instructor's Manual)</i></p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p> <ul style="list-style-type: none"> a flow chart that traces the movement of nonconventional hydrocarbon from recovery site to market (or refinery). Flow chart to illustrate (as appropriate): <ul style="list-style-type: none"> separation, cleaning and/or upgrading facilities field storage techniques distribution networks pipeline systems. <p><i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i></p> <p><i>Standard</i> <i>Complete the flow chart to a standard of 3 on the rating scale</i></p>	<p>10</p>

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain current and emerging applications of technology in maximizing recovery of heavy oil, bitumen or coal in Alberta • explain career opportunities relevant to the recovery and production sector of a nonconventional hydrocarbon industry • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on techniques used to maximize resource recovery. Research to address: <ul style="list-style-type: none"> – factors that affect recovery potential for an oil sand, heavy oil or coal deposit – applications of enhanced recovery technology, including horizontal drilling and innovations in extraction and/or separation – techniques used to estimate recoverable deposits of bitumen, heavy oil or coal. <p><i>Assessment Tool</i> <i>Research Process: Enhanced Recovery of Nonconventional Hydrocarbons, ENM3030–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • completing a research project on technical, professional and/or labour-based careers within the recovery and production sector of a nonconventional hydrocarbon industry. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR–3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>20</p> <p>20</p> <p>Integrated throughout</p>

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Recovery Techniques	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe infrastructures necessary in the recovery and production of a nonconventional hydrocarbon resource: <ul style="list-style-type: none"> – extraction – processing – transportation • research techniques used to extract the hydrocarbon; e.g.: <ul style="list-style-type: none"> – surface mining – underground mining – in situ (“in place”) techniques • describe surface and underground equipment used in resource extraction • research technologies used to process the hydrocarbon: <ul style="list-style-type: none"> – separating – cleaning – upgrading • explain environmental assessment and management practices conducted by industry throughout recovery and production operations 	<p>Discuss safety considerations relevant to the recovery-site; e.g.:</p> <ul style="list-style-type: none"> • first aid • clothing and equipment • government/industry regulations • lifting/hoisting techniques. <p>For example, strip, open-pit.</p> <p>For example, shaft, slope.</p> <p>For example, steam injection, solvent injection, firefloods.</p> <p>Research the use of:</p> <ul style="list-style-type: none"> • heavy machinery (including excavators, scrapers, bulldozers and draglines) • blasting, drilling and cutting equipment • augers, conveyor belts and trucks • hand tools and safety equipment. <p>Encourage student to make links with concepts studied in the core science courses.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.</p>

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Recovery Techniques (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe technological advances used to address environmental concerns throughout recovery and production • describe basic reclamation activities undertaken by industry. 	<p>Identify specific environmental problems related to recovery/production. Research potential solutions to the problems identified; e.g.:</p> <ul style="list-style-type: none"> • tailing ponds • sulphur emission • water drawdown. <p>Research and discuss:</p> <ul style="list-style-type: none"> • recovery/production area restoration • strip-mine restoration.
Gathering and Distribution	<ul style="list-style-type: none"> • describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes • describe different types of field storage facilities • research distribution networks used to move bitumen, heavy oil or coal from recovery-site to market (or refinery). 	<p>Identify challenges associated with the gathering and transmission of bitumen and heavy oil, and technologies developed to assist in these processes.</p> <p>For example,</p> <ul style="list-style-type: none"> • pipeline systems • tankers and barges • rail and trucking systems.
Applications of Technology	<ul style="list-style-type: none"> • explain the economic, social and environmental significance of Alberta's nonconventional hydrocarbon resources • identify factors that affect the recovery potential for heavy oil, oil sands or coal deposits 	<p>Subscribe to <i>Rock Chips</i> (a newsletter published by the Alberta Geological Survey).</p> <p>Explain how recovery potential may be affected by:</p> <ul style="list-style-type: none"> • nature and depth of the overburden • density and viscosity of oil • porosity and permeability of rock structures • economic viability.

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Applications of Technology (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain technologies used to maximize resource recovery; e.g.: <ul style="list-style-type: none"> – horizontal drilling – extraction and separation processes • describe special drilling techniques, core description and geophysical logging for oil sands deposits • research public and private agencies responsible for developing new technology to assist in the recovery of nonconventional hydrocarbon resources • describe techniques used to estimate Alberta’s recoverable heavy oil, bitumen and coal. 	<p>Discuss reasons for making production as efficient as possible.</p> <p>For example,</p> <ul style="list-style-type: none"> • Alberta Research Council • Alberta Oil Sands Technology and Research Authority • Office of Coal Research and Technology. <p>Compare and contrast the concepts of “proved reserve,” “probable reserve” and “established reserve.”</p>
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the recovery and production sector of a nonconventional hydrocarbon industry; e.g.: <ul style="list-style-type: none"> – earth science – engineering – technical and support services – apprenticeship trades – environmental management • evaluate current employment opportunities based on employment statistics • research recovery and production trends and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2040 Metals/Nonmetals 1 (Resource Exploration)

Module Description: Students examine specific recovery and production techniques within the context of a metallic and/or nonmetallic mineral deposit, and they explain related career opportunities.

Note: Industry often refers to a third category of minerals called “structural materials”; i.e., minerals used primarily in construction, including sand and gravel, decorative and building stone, cement, clay and limestone. Modules ENM2040 and ENM3040 include structural materials within the broader category of nonmetallic minerals.

Module Parameters: Access to industry involved in the recovery and production of metallic and/or non-metallic minerals.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe techniques used to recover metallic and nonmetallic commodities from mineral deposits 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a presentation or report that describes and illustrates: <ul style="list-style-type: none"> extraction, processing and transportation infrastructures necessary for the recovery of a commodity from a rock or mineral deposit specific mining techniques used to extract a metallic or nonmetallic mineral, including placer mining, surface mining, underground mining and/or drilling/borehole mining environmental assessment and management practices conducted by industry throughout recovery and production operations. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> through laboratory and/or field-based investigations, identifying applications of principles of science and technology involved in separating, cleaning and/or upgrading a metallic or nonmetallic mineral. <p><i>Assessment Tool</i> <i>Lab Investigations: Advanced Level, ENMLAB-3</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Conduct lab investigations to a standard of 3 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field-based investigations</i></p> <ul style="list-style-type: none"> a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction. <p><i>Assessment Tool</i> <i>Exploring Manufacturing (Instructor’s Manual)</i></p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p>	<p>50</p>

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe field gathering facilities and distribution systems used in the mineral industry • explain current and emerging applications of technology in enhancing recovery methods for mineral deposits • explain career opportunities relevant to the recovery and production sector of a mineral industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a flow chart that traces the movement of a mineral commodity from recovery-site to market (or refinery). Flow chart to illustrate (as appropriate): <ul style="list-style-type: none"> – separation, cleaning and/or upgrading facilities – field storage techniques – distribution networks. <p><i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i></p> <p><i>Standard</i> <i>Complete the flow chart to a standard of 3 on the rating scale</i></p>	<p>10</p>
	<ul style="list-style-type: none"> • completing a research project on techniques used to maximize resource recovery. Research to address: <ul style="list-style-type: none"> – factors that affect the recovery potential for a mineral deposit – applications of enhanced recovery technology, including drilling and blasting techniques, rock bolting and screening machines, video technology and remote control, and innovations in separation technology – techniques used to estimate recoverable mineral deposits in Alberta. <p><i>Assessment Tool</i> <i>Research Process: Enhanced Mineral Recovery, ENM3040-1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 3 on the rating scale</i></p>	<p>20</p>
	<ul style="list-style-type: none"> • conducting research on technical, professional and labour-based careers within the recovery and production sector of a mineral industry. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR-3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p>	<p>20</p>

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Recovery Techniques</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> describe infrastructures necessary in the recovery of commodities from rock and mineral deposits <ul style="list-style-type: none"> extraction processing transportation research basic techniques used to extract metallic and nonmetallic mineral deposits; e.g.: <ul style="list-style-type: none"> placer mining surface mining underground mining other extraction methods describe surface and/or underground equipment used in resource extraction research technologies used to process a metallic, nonmetallic or structural mineral: <ul style="list-style-type: none"> crushing/screening separating/dressing cleaning/roasting upgrading/smelting 	<p>Discuss safety considerations relevant to the recovery-site; e.g.:</p> <ul style="list-style-type: none"> first aid clothing and equipment government/industry regulation lifting/hoisting techniques. <p>Obtain a copy of <i>Edmonton Beneath Our Feet</i> from the Alberta Geological Survey.</p> <p>For example:</p> <ul style="list-style-type: none"> drilling borehole mining. <p>Research the use of:</p> <ul style="list-style-type: none"> heavy machinery (e.g., excavators, scrapers, bulldozers and draglines) blasting, drilling and cutting equipment augers, conveyor belts and trucks hand tools and safety equipment. <p>Encourage student to make links with concepts studied in the core science courses.</p>

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
<p>Recovery Techniques (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain environmental assessment and management practices conducted by industry throughout recovery and production operations • describe technological advances used to address environmental concerns throughout recovery and production • describe basic reclamation activities undertaken by industry. 	<p>Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.</p> <p>Identify specific environmental problems related to recovery/production. Encourage students to propose solutions.</p> <p>Research and discuss:</p> <ul style="list-style-type: none"> • recovery/production area restoration • strip-mine restoration.
<p>Gathering and Distribution</p>	<ul style="list-style-type: none"> • describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes • describe different types of field storage facilities • research distribution networks used to move metallic or industrial minerals from recovery-site to market (or refinery). 	<p>Obtain the brochures <i>Aggregates</i> and <i>Aggregates and Our Environment</i> from the Alberta Sand and Gravel Association.</p> <p>For example:</p> <ul style="list-style-type: none"> • rail systems • trucking systems • tankers and barges.
<p>Applications of Technology</p>	<ul style="list-style-type: none"> • explain the current and potential significance of Alberta's mineral resources • identify factors that affect the recovery potential for a mineral deposit 	<p>Discuss the current and future economic, social and environmental significance.</p> <p>Explain how recovery potential may be affected by:</p> <ul style="list-style-type: none"> • depth of overburden • size and nature of the deposit • economic viability • environmental impact.

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
Applications of Technology (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain applications of technology in enhanced recovery methods; e.g.: <ul style="list-style-type: none"> – drilling and blasting techniques – rock bolting and screening machines – video technology and remote control – innovations in separation technology • identify methods used for the exploration of “hidden” or “blind” deposits • research public and private agencies responsible for developing new technology to assist in the recovery of Alberta’s mineral resources • describe techniques used to estimate recoverable mineral deposits in Alberta. 	<p>Discuss reasons for making production as efficient as possible.</p> <p>Subscribe to <i>Rock Chips</i> (a newsletter published by the Alberta Geological Survey).</p> <p>Discuss methods used both in existing mines and for new developments.</p> <p>For example:</p> <ul style="list-style-type: none"> • Alberta Research Council • National Research Council. <p>Consider applications of:</p> <ul style="list-style-type: none"> • computing techniques • assays • mathematical modelling.
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the recovery and production sector of a mineral industry; e.g.: <ul style="list-style-type: none"> – earth science – engineering – technical and support services – apprenticeship trades – environmental management • evaluate current employment opportunities based on employment statistics • research recovery and production trends and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2050 Renewable Energy Technology

Module Description: Students examine opportunities for planning renewable energy development and conserving conventional energy for its ideal use.

Module Parameters: Access to relevant government, industry and community resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> identify alternatives and consequences associated with current issues involving energy supply and demand 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> analyzing two or more current issues regarding energy supply and demand at local and global levels. Analysis to address social, economic, environmental and technological perspectives. <p><i>Assessment Tool</i> <i>Issue Analysis: Energy Supply and Demand, ENM3050-1</i></p> <p><i>Standard</i> <i>Analyze each issue to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> completing a research project on applications of renewable and nonrenewable energy technology in sustainable energy development. Research to address: <ul style="list-style-type: none"> benefits and obstacles related to the use of renewables and nonrenewables the role of alternative energy options, energy efficiency and conservation lifestyles in achieving sustainable energy development. <p><i>Assessment Tool</i> <i>Research Process: Sustainable Energy Development, ENM3050-2</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 3 on the rating scale</i></p>	<p>20</p>

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe the benefits and obstacles associated with demand-side energy management • present a plan for sustainable energy development • explain career opportunities relevant to energy planning and development 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • developing and implementing a demand-side energy management awareness and information campaign within the school and/or community. Campaign to include: <ul style="list-style-type: none"> – an outline of conservation and efficiency measures that can be implemented – promotional materials, including posters, handbills, videotaped commercials and/or information programs – a plan for action. <p><i>Assessment Tool</i> <i>Assessment Criteria: Energy Management Campaign, ENM3050–3</i></p> <p><i>Standard</i> <i>Develop and implement the campaign to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • developing and presenting a plan for sustainable energy development within one sector of society. Plan may be developed as a paper, display or video presentation, and should include: <ul style="list-style-type: none"> – goals, objectives and benefits of the development – development details, including site and technological requirements, processes and supply/distribution networks – a strategy for monitoring development outcomes and resolving potential conflicts/issues. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE–3</i></p> <p><i>Standard</i> <i>Develop and present the plan to a standard of 3 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • completing a research project on one or more career opportunities in energy planning and development. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR–3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p>	<p>30</p> <p>30</p> <p>20</p>

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Energy Supply and Demand</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> examine social, economic and environmental perspectives regarding conventional energy supply describe recent applications of technology in conventional energy development research forecasts regarding future energy supply and demand, and options for ensuring a sustainable energy future describe applications of renewable energy in supplementing conventional energy sources. 	<p>Discuss issues relevant to the development of conventional energy supplies; e.g.:</p> <ul style="list-style-type: none"> How much? How fast? <p>Consider trends regarding energy conservation, efficiency and “conservation lifestyles.”</p> <p>Research technologies designed to:</p> <ul style="list-style-type: none"> improve recovery rates lessen environmental impacts. <p>Discuss/assess options such as:</p> <ul style="list-style-type: none"> using less finding alternative sources. <p>Discuss current and/or emerging applications of renewable energy; e.g.:</p> <ul style="list-style-type: none"> domestic/industrial heating transportation.

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Concept	Specific Learner Expectations	Notes
<p>Demand-side Energy Management</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe basic principles of demand-side energy management • evaluate benefits and obstacles associated with demand-side energy management • suggest advantages of demand-side energy management over supply-side energy management in planning future energy development • describe ways in which society can support and/or adapt to demand-side energy management; e.g.: <ul style="list-style-type: none"> – change people’s habits to save energy and reduce waste – use design and technology to increase energy efficiency. 	<p>Demand-side management focuses attention on how energy is used; e.g.:</p> <ul style="list-style-type: none"> • controlling need • levelling consumption • developing energy alternatives • saving conventional sources for their ideal use. <p>Consider factors such as:</p> <ul style="list-style-type: none"> • energy efficiency and conservation • environmental quality • energy costs. <p>Discuss common barriers to demand-side management; e.g.:</p> <ul style="list-style-type: none"> • lack of awareness of long-term benefits • low energy prices • lack of energy standards for buildings, vehicles, etc.
<p>Sustainable Energy Development</p>	<ul style="list-style-type: none"> • provide a definition and examples of sustainable energy development • suggest a rationale for sustainable energy development that addresses social, economic and environmental perspectives • compare the roles of renewable and nonrenewable technology in sustainable energy development • cite examples of sustainable energy path development that involve least-cost combinations and efficient use of both conventional and nonconventional energy sources • propose changes in current social values and political structures that may facilitate sustainable energy development 	<p>Contact the Pincher Creek Development and Information Centre (formerly the Southwest Alberta Renewable Energy Initiative) for current information on sustainable energy development in Alberta.</p> <p>Sustainable energy path development involves matching the “quality” of the energy <u>provided</u> to the “quality” of the energy <u>required</u>.</p> <p>Consider changes required in:</p> <ul style="list-style-type: none"> • consumer practices • government policy • technology.

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Concept	Specific Learner Expectations	Notes
Sustainable Energy Development (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • develop and present a plan for sustainable energy path development that includes: <ul style="list-style-type: none"> – supply-side management solutions – demand-side management solutions • evaluate the plan on the basis of predicted social, economic and environmental consequences. 	<p>The plan might involve:</p> <ul style="list-style-type: none"> • wind farms • photovoltaic development • geothermal development • hydrogen development • hydro development.
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities that involve energy planning and development e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – environmental management • evaluate current employment opportunities based on employment statistics • research trends in energy planning and development, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3060: PETROCHEMICALS

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2060 Refining Hydrocarbons

Module Description: Students investigate the conversion of hydrocarbons into consumer products within a petrochemical industry, and they explain related career opportunities.

Module Parameters: Access to a petrochemical industry.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

MODULE ENM3060: PETROCHEMICALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Petrochemical Products</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> describe the social, economic and environmental significance of Canada's petrochemical industries identify and describe important petroleum feedstocks used in the petrochemical industry identify the primary groups of petrochemicals obtained from petroleum feedstocks and subsequently processed into intermediate and finished products identify and describe intermediate and finished products that are derived from petrochemicals 	<p>Prepare a poster/display of consumer and industrial products (or services) derived from the petrochemical industry.</p> <p>Research the use of:</p> <ul style="list-style-type: none"> crude oil natural gas ethane, propane and butane naphtha gas oil. <p>For example:</p> <ul style="list-style-type: none"> methanol benzene, toluene and xylene butadiene and butylene propylene ethylene. <p>For example:</p> <ul style="list-style-type: none"> plastics synthetic clothing fibres medicines paints detergents fertilizers and pesticides.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Petrochemical Products (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and describe major consuming industries for Canada's petrochemical products. 	<p>Research the use of petrochemicals in:</p> <ul style="list-style-type: none"> • forest products • transportation • textiles • electronics • cosmetics and pharmaceuticals • agriculture.
<p>Changing Petroleum Molecules</p>	<ul style="list-style-type: none"> • describe petroleum molecules as strings and rings of carbon and hydrogen atoms • construct models of simple and more complex hydrocarbon molecules • research basic fractionating processes used to sort petroleum molecules • explain how petroleum molecules are broken apart, reassembled and blended through the processes of cracking, polymerization and isomerization • research the role of temperature, pressure and catalysts in sorting and rearranging petroleum molecules. 	<p>For example:</p> <ul style="list-style-type: none"> • methane • paraffin. <p>Assemble and use a simple fractionating column to separate and sort molecules through the process of fractional distillation.</p> <p>Conduct laboratory investigations. Encourage students to relate experimental outcomes to studies in the core science program.</p>
<p>Refining and Manufacturing Processes</p>	<ul style="list-style-type: none"> • research the conversion of a hydrocarbon into a petrochemical product within one of Canada's petrochemical industries; e.g.: <ul style="list-style-type: none"> – plastic – polyethylene – detergent – fertilizer • identify specific hydrocarbon feedstocks used in the manufacturing process • describe techniques employed to sort, break apart, reassemble and/or blend petroleum molecules 	<p>Distinguish between the refining of crude oil (ENM2060) and the manufacture of petrochemicals (ENM3060).</p> <p>For example,</p> <ul style="list-style-type: none"> • fractionating • cracking • polymerization • isomerization.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Refining and Manufacturing Processes (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • construct a flow chart outlining the path of a hydrocarbon from recovery-site to finished product • explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations • describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs • explain environmental assessment and management practices conducted by industry throughout manufacturing operations • describe industry initiatives that respond to environmental concerns • describe industry initiatives that address occupational health and safety requirements • describe industry initiatives in re-refining and reprocessing to ensure a life-cycle approach to chemicals management. 	<p>Draw/construct a simplified model of a petrochemical facility.</p> <p>Construct flow charts that illustrate storage and distribution systems.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout manufacturing operations.</p> <p>For example:</p> <ul style="list-style-type: none"> • waste treatment • emission control. <p>For example:</p> <ul style="list-style-type: none"> • odour scrubbers • noise suppressants • water purification. <p>Research the development of recycled materials for specific environments and applications.</p>

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the petrochemical industry; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within a petrochemical industry • evaluate current employment opportunities based on employment statistics • research trends in the refining and manufacturing of petroleum-based products, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2070 Refining Rocks & Minerals

Module Description: Students investigate technologies used to convert petroleum and mineral resources into industrial (stock) materials used in secondary manufacturing processes, and they explain related career opportunities.

Module Parameters: Access to a primary manufacturing industry.

Access to a science, construction or fabrication laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing and/or manufacturing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe industrial (stock) materials produced through primary manufacturing processes • describe relationships between the molecular structure, properties and applications of an industrial (stock) material 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on industrial (stock) materials produced through primary manufacturing. Research to address: <ul style="list-style-type: none"> – major categories of raw materials used in primary manufacturing – basic types of industrial (stock) materials produced through primary manufacturing, including metallic, structural, polymeric, ceramic and composite – standard forms for each type of industrial (stock) material. <p><i>Assessment Tool</i> <i>Research Process: Industrial (Stock) Materials, ENM3070–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • conducting laboratory and/or field-based investigations that involve: <ul style="list-style-type: none"> – identifying the mechanical, chemical, thermal, electrical/magnetic and optical properties of an industrial (stock) material – constructing models/diagrams that illustrate the molecular structure of an industrial (stock) material – relating the physical/chemical properties and molecular structure of an industrial (stock) material to its applications in secondary manufacturing. <p><i>Assessment Tool</i> <i>Lab Investigations: Advanced Level, ENMLAB–3</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Conduct lab investigations to a standard of 3 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field-based investigations</i></p>	<p>10</p> <p>40</p>

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> explain technologies used to manufacture a metallic, polymeric, ceramic or composite material explain career opportunities relevant to a primary manufacturing industry demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a flow chart that outlines raw materials, processes and technologies involved in the manufacture of a metallic, polymeric, ceramic or composite material. <i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i> <i>Standard</i> <i>Complete the flow chart to a standard of 3 on the rating scale</i> a summary of environmental assessment and management practices conducted by industry throughout manufacturing operations. <i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i> <i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i> conducting research on technical, professional and labour-based careers within the primary manufacturing industry. <i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR-3</i> <i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i> observations of individual effort and interpersonal interaction during the learning process. <i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i> 	<p>30</p> <p>20</p> <p>Integrated throughout</p>

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Concept	Specific Learner Expectations	Notes
Industrial (Stock) Materials	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • compare primary and secondary manufacturing processes • describe major categories of nonrenewable resources (raw materials) used in primary manufacturing • identify and describe major types of industrial (stock) materials produced through primary manufacturing processes: <ul style="list-style-type: none"> – metallic – structural – polymeric – ceramic – composite • describe standard forms for each type of industrial (stock) material: <ul style="list-style-type: none"> – plate, bar and rod – sheet, roll and film – pellet and powder • describe major consuming industries for stock materials produced in Canada. 	<p>Obtain a copy of <i>Edmonton Beneath Our Feet</i> from the Alberta Geological Survey.</p> <p>Research applications of:</p> <ul style="list-style-type: none"> • petroleum • natural gas • metallic ores • nonmetallic ores. <p>For example, ferrous, non-ferrous.</p> <p>For example, sand, gravel, crushed stone.</p> <p>For example, thermoplastic, thermoset.</p> <p>For example, clay-based, refractory, glass, abrasive.</p> <p>For example, layered, fibre-reinforced, particle.</p> <p>Provide examples and assemble a display of each type of industrial (stock) material.</p> <p>Research applications of stock materials in:</p> <ul style="list-style-type: none"> • secondary manufacturing • construction • consumer/domestic use.
Properties and Applications	<ul style="list-style-type: none"> • describe and compare the molecular structure of a metallic, polymeric, ceramic and composite material 	<p>For example:</p> <ul style="list-style-type: none"> • atoms and molecules • molecular arrangement • attractions and connections.

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Properties and Applications (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • construct models that illustrate the molecular structure of metallic, polymeric, ceramic and/or composite materials • conduct experiments to determine the properties of an industrial (stock) material: <ul style="list-style-type: none"> – mechanical – chemical – thermal – electrical and magnetic – optical • relate the properties of an industrial (stock) material to its molecular structure • explain how the properties of an industrial (stock) material determine its applications in product design and secondary manufacturing processes. 	<p>For example, strength, elasticity and plasticity, malleability and ductility, hardness.</p> <p>For example, conductivity, melting/freezing point, combustibility, rate of expansion.</p> <p>For example, conductivity, resistivity, permeability.</p> <p>For example, opacity, reflectivity, colour.</p> <p>Research the development of new materials for specific environments and applications.</p>
<p>Primary Manufacturing Technologies</p>	<ul style="list-style-type: none"> • research the conversion of a nonrenewable resource into an industrial (stock) material within one of Canada’s primary manufacturing industries • identify specific mineral ores and/or petroleum feedstocks used in the manufacturing process • describe techniques employed to manufacture the stock material • construct a flow chart outlining major stages in the manufacturing process 	<p>Distinguish between the refining of rocks and minerals (ENM2070) and the manufacture of stock materials used in secondary manufacturing (ENM3070).</p> <p>For example:</p> <ul style="list-style-type: none"> • thermal • chemical • mechanical • electrical. <p>Illustrate inputs, processes, outputs and feedback systems.</p>

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Primary Manufacturing Technologies (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations • describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs • explain environmental assessment and management practices conducted by industry throughout manufacturing operations • describe industry initiatives that respond to environmental concerns • describe industry initiatives that address occupational health and safety requirements • describe industry initiatives in reprocessing and recycling to ensure a life-cycle approach to chemicals management. 	<p>Draw/construct a simplified model of a primary manufacturing facility.</p> <p>Construct flow charts that depict facilities/steps in storage and distribution.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout manufacturing operations.</p> <p>For example:</p> <ul style="list-style-type: none"> • waste treatment • emission control. <p>For example:</p> <ul style="list-style-type: none"> • odour scrubbers • noise suppressants • water purification. <p>Note links with ENM1090 (Fundamentals of Recycling).</p>

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)
(continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research careers and the range of occupational opportunities within primary manufacturing industries; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within a primary manufacturing industry • evaluate current employment opportunities based on employment statistics • research trends in the manufacture of industrial (stock) materials, and future career opportunities; e.g.: <ul style="list-style-type: none"> – developing new materials – recycling and resource conservation – waste management. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3080: MARKET BASICS & TRENDS

Level: Advanced

Theme: Technology and Applications

Prerequisite: None

Module Description: Students explain the basic principles involved in marketing an energy or mineral resource, and analyze trends in the development and marketing of energy or mineral products.

Module Parameter: Access to energy or mineral industry.

Supporting Module: ENM2080 Supply & Distribution

<p><i>The student will:</i></p> <ul style="list-style-type: none"> • identify basic marketing principles and their application in an energy or mineral industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • identify basic components of a marketing strategy used to transport and market an energy or mineral resource. Marketing components to address: <ul style="list-style-type: none"> – commodity supply – marketing structures – transportation – pricing – advertising and promotion – sales and distribution. <p><i>Assessment Tool</i> <i>Assessment Criteria: Components of a Marketing Strategy, ENM3080-1</i></p> <p><i>Standard</i> <i>Identify basic components of the marketing strategy to a standard of 3 on the rating scale</i></p>	<p>20</p>
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MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe market demands for an energy or mineral product, and describe the impact of government policies on marketing practices 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or report that describes current demands and markets for an energy or mineral commodity, product or service, and the impact of government policies on marketing practices. Report to include: <ul style="list-style-type: none"> – an analysis of social, political, economic and environmental factors affecting market demands – the identification of local, national and/or international markets – reflection on the importance of the energy or mineral resource to the Province of Alberta and the Government of Canada – the identification of three or more relevant government policies (e.g., local, provincial and/or national) – based on information gathered from government and industry contacts, a case history of the impacts of one policy on marketing practices. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p>	<p>30</p>
<ul style="list-style-type: none"> • identify market trends and development opportunities in domestic and international markets 	<ul style="list-style-type: none"> • developing and presenting a plan for altering an energy or mineral-related policy, product or service, or developing a new policy, product or service. Plan to address: <ul style="list-style-type: none"> – consumer preferences and market opportunities – relevant social/economic/environmental factors – identification of a target market – a strategy for developing the product or service – local and global marketing strategies – supporting trade structures, policies and/or agreements. <p><i>Assessment Tool</i> <i>Assessment Criteria: Developing a Marketing Plan, ENM3080-2</i></p> <p><i>Standard</i> <i>Develop the plan to a standard of 3 on the rating scale</i></p>	<p>40</p>

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Concept	Specific Learner Expectations	Notes
Market Principles (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify factors that influence pricing of the product or service; e.g.: <ul style="list-style-type: none"> – market analysis – supply and demand – cost factors • explain how products are moved to market, including the function of intermediate stops such as terminals and bulk plants • describe the effectiveness of different methods of transportation; e.g.: <ul style="list-style-type: none"> – marine, road and rail systems – pipeline systems • evaluate the role of advertising and promotion in retailing practices, and their impact on consumer demands. 	<p>Loan “The Gasoline Game” (a computer simulation that examines factors determining the price of gasoline) from the Petroleum Communication Foundation.</p> <p>Explain the function of different types of pipelines:</p> <ul style="list-style-type: none"> • gathering lines • crude oil trunk lines • product trunk lines. <p>Examine trends in promotional and marketing strategies.</p> <p>Design/evaluate an approach to marketing.</p>
Market Practices	<ul style="list-style-type: none"> • identify social, political, economic and environmental factors that affect market demand for an energy or mineral resource • research and prepare a case history on market demands for one energy or mineral commodity • identify major export partners for oil, oil products and natural gas, coal and coal-generated energy, or mineral resources 	<p>Explain how market demand may be influenced by:</p> <ul style="list-style-type: none"> • consumer trends • trade liberalization • inflation and dollar value • environmental concerns. <p>Obtain the <i>Canadian Minerals Yearbook</i> from Natural Resources Canada.</p> <p>Gather information and statistics from a variety of current sources; e.g.:</p> <ul style="list-style-type: none"> • by talking to specialists • by contacting government agencies • by searching the Internet. <p>Locate major export partners on a map of the world.</p>

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Concept	Specific Learner Expectations	Notes
<p>Market Practices (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • compare the nature and extent of Canada’s market share in North America, the Pacific Rim, Europe and other locations • identify national and provincial government policies that influence the development and marketing of an energy or mineral resource • research and prepare a case history regarding the impact of one government policy on the development and marketing of an energy or mineral resource in Canada • evaluate the impact of national and provincial environmental protection policies on the development and marketing of a commodity or product • evaluate the impact of national and provincial transportation policies on the development and marketing of a commodity or product • evaluate the impact of provincial, national and international trade agreements on the development and marketing of an energy or mineral resource. 	<p>Consider the competitive advantages and disadvantages of different nations.</p> <p>Research impacts of:</p> <ul style="list-style-type: none"> • National Energy Program • Western Economic Diversification • Oil and Gas Royalty Reduction. <p>Contact government and industry resource persons.</p> <p>For example:</p> <ul style="list-style-type: none"> • cost of production • market demand for “green” products. <p>For example:</p> <ul style="list-style-type: none"> • product price • extent of market. <p>For example:</p> <ul style="list-style-type: none"> • Western/Atlantic Accord • North American Free Trade Agreement • European Economic Community.
<p>Market Development</p>	<ul style="list-style-type: none"> • consider factors that influence market trends and resulting trade opportunities • evaluate the impact of developing technologies on one of Canada’s energy or mineral products • identify market opportunities that arise from product diversification and specialization, international trade and participation in a global economy 	<p>For example:</p> <ul style="list-style-type: none"> • demographic • environmental • economic. <p>For example:</p> <ul style="list-style-type: none"> • production efficiency • resource utilization • development of value-added commodities. <p>Research new and emerging products and/or services derived from an energy or mineral resource.</p>

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Concept	Specific Learner Expectations	Notes
Market Development (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • outline market conditions leading to, and steps in altering, a product or service, or developing a related product or service • explain the role of market research and product development in adapting a commodity, product or service to meet present and anticipated needs • evaluate opportunities for the global marketing of a commodity, product or service • compare approaches used to market a commodity, product or service in Canada with approaches used in other nations. 	<p>Research steps taken to patent a product or process.</p> <p>Design and conduct a survey regarding consumer preferences for a product or service.</p> <p>Consider market opportunities in:</p> <ul style="list-style-type: none"> • the United States and Mexico • nations of the Pacific Rim • other developing nations.
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities related to marketing an energy or mineral resource; e.g.: <ul style="list-style-type: none"> – market survey – advertising and sales – transportation and distribution – product development – support services <ul style="list-style-type: none"> • legal • consulting • environmental • infer career opportunities and trends from employment statistics • research trends in the marketing sector of an energy or mineral industry, and resulting career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)**Level:** Advanced**Theme:** Management and Conservation**Prerequisite:** ENM2090 Energy Designs/Systems 1 (Basic Principles)**Module Description:** Students analyze energy-saving technologies and systems and design a residential/commercial structure or transportation technology that demonstrates the principles of energy conservation and efficiency.**Module Parameters:** Access to a construction, fabrication, mechanics or science laboratory.**Curriculum and Assessment Standards**

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none">describe energy use within a residential/commercial environment or transportation sector	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none">conducting an energy audit within a residential/commercial environment or transportation sector. Audit to include:<ul style="list-style-type: none">an inventory/review of past and present energy usethe establishment of acceptable goals for energy efficiency and consumptionproposed strategies for achieving energy-use goals. <p><i>Assessment Tool</i> <i>Task Checklist: Energy Audit, ENM3090-1</i></p> <p><i>Standard</i> <i>Complete the energy audit to a standard of 3 on the rating scale</i></p>	40

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)

(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • design a residential/commercial structure or transportation technology that uses energy conservation and efficiency • explain career opportunities relevant to energy design and technology • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • given a problem in energy design, constructing a drawing/model of a residential/commercial structure or transportation technology that addresses the problem. The drawing/model must illustrate: <ul style="list-style-type: none"> – a clear response to the design problem – component parts and processes – efficient use of energy and other resources – regard for human and environmental safety. <p><i>Assessment Tool</i> <i>Project Assessment: Technology Design, ENMTEC</i> <i>Assessment Criteria: Diagrams and Technical Drawings, ENMDRA</i></p> <p><i>Standard</i> <i>Complete the design <u>and</u> drawing/model to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • completing a research project on one or more career opportunities in energy design. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR-3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>50</p> <p>10</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
Energy Analysis	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • conduct an inventory of energy use within a residential/commercial environment or transportation sector 	Ask local utility companies about energy analysis in residential/commercial environments.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)
(continued)

Concept	Specific Learner Expectations	Notes
Energy Analysis (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • analyze energy efficiency within the residential/commercial environment or transportation sector • establish a target level of energy efficiency and determine potential savings that may result from achieving this target • research technologies and/or strategies that can be used to achieve the target level of energy efficiency. 	<p>If analyzing energy use in the transportation sector, refer to <i>Wise Use of Petroleum Resources: The Car in Our Daily Lives</i> (see Section I: Learning Resource Guide).</p> <p>Plan for:</p> <ul style="list-style-type: none"> • discussion and debate • personal action plans. <p>Contact resource persons from the residential, commercial or transportation sector.</p>
Low Energy Designs and Systems	<ul style="list-style-type: none"> • identify an energy design problem relevant to a residential/commercial structure or transportation technology • research design technologies available to respond to the situation • identify limitations present in the design problem • examine similar structures or technologies that incorporate energy efficient design suitable for the context • generate alternatives regarding the design, select the most appropriate alternative, and plan a sequence of tasks to create the structure or technology • make/model a structure or technology by following plans that have been established 	<p>Consider design problems and solutions that address:</p> <ul style="list-style-type: none"> • size and/or weight • topographic and/or climatic factors • energy transfer and/or conversion • comfort and practical use • cost limitations. <p>Approach problems from a historical perspective (e.g., 1980s energy crisis and the development of the fuel injector).</p> <p>Talk to others to clarify ideas. Consider similar problems and how they were solved. Make reasoned judgements regarding design potential.</p> <p>Plan for:</p> <ul style="list-style-type: none"> • drawing/designing • constructing models.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Low Energy Designs and Systems (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • evaluate the strengths and limitations of the energy design, and consider alternatives that may improve the process and/or outcomes. 	<p>Assess the design in relation to:</p> <ul style="list-style-type: none"> • original needs and intentions • efficient use of resources • human and environmental safety.
<p>Career Opportunities</p>	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities in low energy design and technology; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – environmental management • infer career opportunities and trends from employment statistics • research trends in low energy designs and systems, and resulting career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS)

Level: Advanced

Theme: Management and Conservation

Prerequisite: None

Module Description: Students develop and present an integrated plan for sustainable resource development that incorporates supply side and demand side resource management.

Module Parameters: Access to government, industry and community organizations responsible for sustainable energy management and environmental stewardship.

Note: This is a summative module that requires prior knowledge of the principles of sustainable development. It should be the last module studied in a series of Energy and Mines modules.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none">describe basic principles of resource management	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none">a presentation or report that provides definitions and Alberta examples of:<ul style="list-style-type: none">renewable and nonrenewable resourcesconservationsustainable developmentsupply-side managementdemand-side managementintegrated resource use. <p><i>Assessment Tool</i> <i>Presentations/Reports: Advanced level, ENMPRE-3</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p>	20

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> present a plan for the sustainable development and integrated use of an energy or mineral resource 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> developing and presenting a plan for the sustainable development and integrated use of an energy or mineral resource. Plan to address: <ul style="list-style-type: none"> short- and long-term goals and objectives the views of relevant stakeholder groups a process for public involvement proposed management standards and guidelines a schedule of development activities a map/flow chart that identifies existing and proposed developments, processes and technologies, and supply/distribution networks permits, licences and/or other legal agreements that may affect the plan a strategy for monitoring use and resolving potential conflicts. <p><i>Assessment Tool</i> <i>Assessment Criteria: Developing a Resource Management Plan, ENM3100-1</i></p> <p><i>Standard</i> <i>Achieve a minimum performance rating of:</i></p> <ul style="list-style-type: none"> 2 in management outcomes 3 in planning processes 	<p>70</p>
<ul style="list-style-type: none"> explain career opportunities relevant to resource management 	<ul style="list-style-type: none"> completing a research project on one or more career clusters in resource management. <p><i>Assessment Tool</i> <i>Career Search: Advanced Level, ENMCAR-3</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 3 on the rating scale</i></p>	<p>10</p>
<ul style="list-style-type: none"> demonstrate basic competencies. 	<ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Management Principles</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain sustainable development, conservation and environmental citizenship within the context of Alberta’s energy or mineral resources • describe principles of supply-side resource management and demand-side resource management by citing examples of each within Alberta • research local opportunities for consultation and public involvement in resource management decisions. 	<p>This is a summative module requiring background knowledge of development principles. <u>It should be the last module studied in a sequence of Energy and Mines modules.</u></p> <p>For example:</p> <ul style="list-style-type: none"> • community associations • industry • local government • provincial departments/agencies.
<p>Planning Process</p>	<ul style="list-style-type: none"> • describe short- and long-term goals for the sustainable development and integrated use of an energy or mineral resource • identify major factors to be addressed in a resource management plan: <ul style="list-style-type: none"> – the objectives of different stakeholders – relevant government legislation/regulations – an inventory of existing resources – appropriate development and production techniques – market characteristics and trends – applications of research and technology • identify alternatives regarding supply-side and demand-side management, and select the preferred alternatives 	<p>For example:</p> <ul style="list-style-type: none"> • social • economic • environmental. <p>Invite resource managers from local energy/mineral industry to explain management processes and techniques.</p> <p>Survey the views of different stakeholder groups and resolve conflicts that may arise.</p> <p>For example:</p> <ul style="list-style-type: none"> • recreational • environmental • industrial • agricultural. <p>Incorporate consultation with other resource users and public involvement into the planning process.</p> <p>Interview local landowners regarding their views on resource management.</p>

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Planning Process (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe on permits, licences or other legal agreements that may be required • identify a set of actions and present the management plan; e.g.: <ul style="list-style-type: none"> – a general description of the resource and proposed developments – long- and short-term management objectives – proposed management standards and guidelines – a schedule of short-term development activities • prepare a map/flow chart to accompany and elaborate upon the management plan • describe techniques for monitoring resource use, management outcomes and resolving potential conflicts. 	<p>Specific management plans will vary, but need to address some common actions.</p> <p>Maps/flow charts might illustrate:</p> <ul style="list-style-type: none"> • location of resources • proposed development activities • supply and distribution networks • interactions with other sectors.
<p>Career Opportunities</p>	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities in resource management; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – environmental management • evaluate current employment opportunities based on employment statistics • research trends in resource management, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.