

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

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| <b>Level:</b>              | Advanced   |
| <b>Theme:</b>              | Technology and Applications  |
| <b>Prerequisite:</b>       | ENM2030 Oil Sands/Heavy Oil/Coal 1 (Resource Exploration)  |
| <b>Module Description:</b> | 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"> <li>describe techniques used to recover a nonconventional hydrocarbon resource</li> </ul> | <p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>a presentation or report that describes and illustrates:                             <ul style="list-style-type: none"> <li>extraction, processing and transportation infrastructures necessary for the recovery and production of bitumen, heavy oil or coal</li> <li>specific techniques used to extract a nonconventional hydrocarbon, including surface mining, underground mining and/or in situ (“in place”) techniques</li> <li>environmental assessment and management practices conducted by industry throughout recovery and production operations.</li> </ul> </li> </ul> <p><i>Assessment Tool</i><br/> <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i><br/> <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p> | 50                 |

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(continued)

| Module Learner Expectations  | Assessment Criteria and Conditions  | Suggested Emphasis |
|--|---|--------------------|
| <p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>• describe field gathering facilities and distribution systems used in the oil sands, heavy oil or coal industry</li> </ul> | <p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>• 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.</li> </ul> <p><i>Assessment Tool</i><br/><i>Lab Investigations: Advanced Level, ENMLAB-3</i><br/><i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i><br/><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"> <li>• a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction.</li> </ul> <p><i>Assessment Tool</i><br/><i>Energy Sources/Applications/Alternatives (Instructor's Manual)</i></p> <p><i>Standard</i><br/><i>Response indicating 60% mastery</i></p> <ul style="list-style-type: none"> <li>• 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"> <li>– separation, cleaning and/or upgrading facilities</li> <li>– field storage techniques</li> <li>– distribution networks</li> <li>– pipeline systems.</li> </ul> </li> </ul> <p><i>Assessment Tool</i><br/><i>Assessment Criteria: Flow Charts, ENMFLO</i></p> <p><i>Standard</i><br/><i>Complete the flow chart to a standard of 3 on the rating scale</i></p> | <p>10</p>          |

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(continued)

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

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(continued)

| Concept                    | Specific Learner Expectations   | Notes   |
|----------------------------|---|---|
| <p>Recovery Techniques</p> | <p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• describe infrastructures necessary in the recovery and production of a nonconventional hydrocarbon resource:               <ul style="list-style-type: none"> <li>– extraction</li> <li>– processing</li> <li>– transportation</li> </ul> </li> <br/> <li>• research techniques used to extract the hydrocarbon; e.g.:               <ul style="list-style-type: none"> <li>– surface mining</li> <br/> <li>– underground mining</li> <br/> <li>– in situ (“in place”) techniques</li> </ul> </li> <br/> <li>• describe surface and underground equipment used in resource extraction</li> <br/> <li>• research technologies used to process the hydrocarbon:               <ul style="list-style-type: none"> <li>– separating</li> <li>– cleaning</li> <li>– upgrading</li> </ul> </li> <br/> <li>• explain environmental assessment and management practices conducted by industry throughout recovery and production operations</li> </ul> | <p>Discuss safety considerations relevant to the recovery-site; e.g.:</p> <ul style="list-style-type: none"> <li>• first aid</li> <li>• clothing and equipment</li> <li>• government/industry regulations</li> <li>• lifting/hoisting techniques.</li> </ul> <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"> <li>• heavy machinery (including excavators, scrapers, bulldozers and draglines)</li> <li>• blasting, drilling and cutting equipment</li> <li>• augers, conveyor belts and trucks</li> <li>• hand tools and safety equipment.</li> </ul> <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> |

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(continued)

| Concept                         | Specific Learner Expectations   | Notes  |
|---------------------------------|---|--|
| Recovery Techniques (continued) | <p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• describe technological advances used to address environmental concerns throughout recovery and production</li> <br/> <li>• describe basic reclamation activities undertaken by industry.</li> </ul>  | <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"> <li>• tailing ponds</li> <li>• sulphur emission</li> <li>• water drawdown.</li> </ul> <p>Research and discuss:</p> <ul style="list-style-type: none"> <li>• recovery/production area restoration</li> <li>• strip-mine restoration.</li> </ul> |
| Gathering and Distribution      | <ul style="list-style-type: none"> <li>• describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes</li> <li>• describe different types of field storage facilities</li> <br/> <li>• research distribution networks used to move bitumen, heavy oil or coal from recovery-site to market (or refinery).</li> </ul> | <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"> <li>• pipeline systems</li> <li>• tankers and barges</li> <li>• rail and trucking systems.</li> </ul>  |
| Applications of Technology      | <ul style="list-style-type: none"> <li>• explain the economic, social and environmental significance of Alberta's nonconventional hydrocarbon resources</li> <li>• identify factors that affect the recovery potential for heavy oil, oil sands or coal deposits</li> </ul>   | <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"> <li>• nature and depth of the overburden</li> <li>• density and viscosity of oil</li> <li>• porosity and permeability of rock structures</li> <li>• economic viability.</li> </ul>   |

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(continued)

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