

# Energy

## Required Components for the SHSM–Energy

1. A bundle of nine Grade 11 and Grade 12 credits that comprises:
  - four energy major credits
  - three other required credits from the Ontario curriculum, in English, mathematics, and a choice of business studies, science or Canadian and world studies (geography)
  - two cooperative education credits tied to the sector
2. Seven sector-recognized certifications and/or training courses/programs (four compulsory and a choice of three electives)
3. Experiential learning and career exploration activities within the sector
4. Reach ahead experiences connected with the student’s postsecondary pathway
5. Development of Essential Skills and work habits required in the sector, and documentation of them using the OSP

## Profile of the Energy Sector

Energy is an emerging and expanding sector that encompasses all aspects of energy generation, distribution, and consumption, including research and development, design, construction, installation, and maintenance. Core industries in this sector include:

- renewable and alternative energy such as wind, solar, and biomass
- power generation and distribution
- fossil fuels
- energy efficiency.

Energy conservation at all stages of power generation, distribution, and consumption is a major concern for all stakeholders in the energy sector, including energy producers, governments, and consumers. Urban energy consumption in Canada grew by 20 per cent from 1990 to 2005 and will continue to rise as Canada’s population increases and its economy expands.<sup>1</sup> World demand for energy is projected to increase by 44 per cent from 2006 to 2030.<sup>2</sup> Canada plays an active role in producing and exporting energy: 26 per cent of

### INSIGHT

The requirements of this SHSM are unique and are geared to the energy sector. However, the design of all SHSM programs follows a consistent model, described in **Section A: Policy**.

<sup>1</sup> Quality Urban Energy Systems of Tomorrow, *Integrated Energy Systems in Canadian Communities: A Consensus for Urgent Action*, [www.questcanada.org/pdf/Quest\\_White\\_Paper\\_English\\_-\\_Final.pdf](http://www.questcanada.org/pdf/Quest_White_Paper_English_-_Final.pdf)

<sup>2</sup> U.S. Energy Information Administration, Independent Statistics and Analysis, *International Energy Outlook 2009*, [www.eia.doe.gov/oiaf/ieo/world.html](http://www.eia.doe.gov/oiaf/ieo/world.html)

Canada's total exports are energy related.<sup>3</sup> In response to economic and environmental concerns, there has been much discussion in Canada of ways in which energy systems can be transformed, and this has raised the profile of the energy sector in the public's consciousness.

Career opportunities in this sector are abundant because of the aging energy workforce and increasing public demand for greener power sources. In 2005, there were approximately 250,000 jobs in the energy sector. Industry Canada predicts that 13,000 jobs will be created in the renewable energy sector by 2012, including projected job growth of over 100 per cent in solar industries.<sup>4</sup>

Students enrolled in the SHSM–Energy will be involved in today's rapid and exciting changes in green energy technologies. They will have the opportunity to solve some of the most pressing issues facing modern societies while having good prospects for a varied career in a dynamic sector. Depending on local circumstances, the SHSM–Energy may be designed to have a particular focus – for example, on power generation and distribution, renewable and alternative energy, or energy efficiency. Where a choice of focus areas is offered, students may select one.

## Occupations in the Energy Sector

The following table provides examples of occupations in the energy sector, with corresponding NOCs, sorted according to the type of postsecondary education or training the occupations would normally require. Many of the careers listed below can be obtained by following several different pathways. For example, "Technical Sales Specialist" appears under the college pathway but may also be achieved by following the university or workplace pathway.

### FIND IT!

See **Section A1.6** for more on occupations and NOCs.

Apprenticeship Training	College
<ul style="list-style-type: none"> <li>• Arborist 2225</li> <li>• Construction Millwright and Industrial Mechanic 7311</li> <li>• Contractor and Supervisor, Electrical Trades and Telecommunications Occupations 7212</li> <li>• Contractor and Supervisor, Mechanical Trades 7216</li> <li>• Electrical Mechanic 7333</li> <li>• Electrical Power Line and Cable Worker 7244</li> </ul>	<ul style="list-style-type: none"> <li>• Biological Technologist and Technician 2221</li> <li>• Civil Engineering Technologist and Technician 2231</li> <li>• Construction Electrician 7241</li> <li>• Energuide and Quality Control Manager 2264</li> <li>• Geological and Mineral Technologist and Technician 2212</li> <li>• Geothermal Installer 7251</li> <li>• Geothermal System Designer 7213</li> </ul>

<sup>3</sup> Canadian Centre for Energy Information, *Energy Drives Canada*, "Canada by the numbers", November 2009, [www.centreforenergy.com/documents/aboutenergy/ByTheNumbers/CAN-bythenumbers.pdf](http://www.centreforenergy.com/documents/aboutenergy/ByTheNumbers/CAN-bythenumbers.pdf).

<sup>4</sup> "Canadian solar industry expects 100 per cent growth by 2012", *Journal of Commerce* (April 29, 2009), [www.joconl.com/article/id33588](http://www.joconl.com/article/id33588).

<p><b>Apprenticeship Training</b> <i>(continued)</i></p> <ul style="list-style-type: none"> <li>• Gas Fitter 7253</li> <li>• Glazier 7292</li> <li>• Industrial Instrument Technician and Mechanic 2243</li> <li>• Industrial Electrician 7242</li> <li>• Insulator (heat and frost) 7293</li> <li>• Machinist, Machining, and Tooling Inspector 7231</li> <li>• Petroleum, Gas, and Chemical Process Operator 9232</li> <li>• Power System Electrician 7243</li> <li>• Power Systems and Power Station Operator 7352</li> <li>• Refrigeration and Air Conditioning Mechanic 7313</li> <li>• Stationary Engineer and Auxiliary Equipment Operator 7351</li> <li>• Steamfitter, Pipefitter, and Sprinkler System Installer 7252b</li> </ul>	<p><b>College</b> <i>(continued)</i></p> <ul style="list-style-type: none"> <li>• Industrial Engineering Technician 2233</li> <li>• Land Surveyor 2154</li> <li>• Mapping and Related Technologist and Technician 2255</li> <li>• Mechanical Engineer and Technologist 2232</li> <li>• Natural and Applied Science Policy Researcher, Consultant, and Program Officer 4161</li> <li>• Petroleum, Gas, and Chemical Process Operator 9232</li> <li>• Supervisor, Petroleum, Gas, and Chemical Processing and Utilities 9212</li> <li>• Technical Sales Specialist – Wholesale Trade 6221</li> <li>• Utilities Manager 0912</li> </ul>
<p><b>University</b></p>	<p><b>Workplace</b></p>
<ul style="list-style-type: none"> <li>• Architects 2151</li> <li>• Chemical Engineer 2134</li> <li>• Climatologist 2114</li> <li>• Economist and Economic Policy Researcher and Analyst 4162</li> <li>• Electrical and Electronics Engineer 2133</li> <li>• Engineering Manager 0211</li> <li>• Environmental Assessor 4161</li> <li>• Geological Engineer 2144</li> <li>• Mechanical Engineer 2132</li> <li>• Petroleum Engineer 2145</li> <li>• Physicist 2111</li> </ul>	<ul style="list-style-type: none"> <li>• Assembler, Fabricator, Inspector and Tester: Motors, Transformers and Electrical Appliances 9484</li> <li>• Electronic Service Technicians 2242</li> <li>• Gas Maintenance Workers 7442</li> <li>• Home Energy Evaluator 2264</li> <li>• Oil and Gas Well Drilling Worker and Services Operator 8412</li> <li>• Petroleum, Gas, and Chemical Process Operator 9232</li> <li>• Renewable Energy Products Salesperson 6421</li> <li>• Residential and Commercial Installer and Servicer 7441</li> <li>• Solar Panel Chemical Process Technician 2211</li> <li>• Wind Turbine Material Controller 1471</li> </ul>

Note: Some of the names of occupations in this table may differ slightly from the names given in the National Occupation Classification system. The names listed here reflect common usage by institutions and organizations in this sector in Ontario.

## Postsecondary Programs and Training in the Energy Sector

The following are examples of programs and training related to careers in the energy sector and the accreditations associated with each.

### *Apprenticeship Training*

Electrician – Construction and Maintenance	Certificate of apprenticeship/ certificate of qualification
Fitter Welder	Certificate of qualification
Industrial Electrician	Certificate of qualification
Industrial Instrument Mechanic	Certificate of qualification
Industrial Mechanic Millwright	Certificate of qualification
Powerline Technician	Certificate of qualification
Process Operator	Certificate of qualification
Refrigeration and Air Conditioning Mechanic	Certificate of apprenticeship/ certificate of qualification
Steamfitter	Certificate of qualification

### *College*

Architectural Technician/Technologist	Diploma
Building Renovation Technician	Diploma
Chemical Engineering Technician – Environmental	Diploma
Chemical Engineering Technology – Lab and Process Control	Diploma
Civil Engineering Technician/Technologist	Diploma
Construction Engineering Technician	Diploma
Earth Resources Technician	Diploma
Electrical Engineering Technician/Technologist	Diploma
Electromechanical Engineering Technician	Diploma
Energy System Engineering Technician	Diploma
Energy Systems Technology	Diploma
Environmental Control	Diploma
Environmental Science Technician/Technologist	Diploma
Gas and Oil Burner Technician/Geomatics Technician	Diploma
Heating, Ventilation, and Air Conditioning (HVAC)	Diploma
Instrumentation Engineering Technician/Technologist	Diploma
Manufacturing Engineering	Diploma

Manufacturing Management	Diploma
Mechanical Engineering Technician/Technologist	Diploma
Power Engineering	Diploma
Powerline Technician	Diploma
Quality Assurance – Manufacturing and Management	Diploma
Renewable Energy Technician	Diploma
Sustainable Energy and Building Technology	Diploma
Transportation Engineering Technology	Diploma
Utilities Systems Operator	Diploma
Wind Turbine Technician	Diploma

### *University*

Architectural Science	Bachelor's degree
Chemistry	Bachelor's degree
Engineering Physics	Bachelor's degree
Engineering, Chemical	Bachelor's degree
Engineering, Civil	Bachelor's degree
Engineering, Electrical	Bachelor's degree
Engineering, Electromechanical	Bachelor's degree
Engineering, Environmental	Bachelor's degree
Engineering, Geological	Bachelor's degree
Engineering, Industrial	Bachelor's degree
Engineering, Mechanical	Bachelor's degree
Engineering, Nuclear	Bachelor's degree
Engineering, Petroleum	Bachelor's degree
Environmental Science	Bachelor's degree
Geology	Bachelor's degree
Physics	Bachelor's degree
Sustainable Development	Bachelor's degree
Technology	Bachelor's Degree

### *Training for the Workplace*

Building Environmental Systems	Certificate
Computer-aided Design (CAD)	Certificate
Domestic Energy Assessment	Certificate

Heating, Ventilating and Air Conditioning (HVAC)	Certificate
Photovoltaic Installation	Certificate
Radiation Safety	Certificate
Sustainable Building Design and Construction	Certificate
Welder Fitter	Certificate

## Required Components for the SHSM–Energy

The SHSM–Energy has the following five required components:

### 1. A bundle of nine Grade 11 and Grade 12 credits

These credits make up the bundle:

- four energy major credits that provide sector-specific knowledge and skills
- three other required credits from the Ontario curriculum, in English, mathematics, and science or Canadian and world studies, in which some expectations are met through learning activities contextualized to the energy sector
- two cooperative education credits that provide authentic learning experiences in a workplace setting, enabling students to refine, extend, apply, and practise sector-specific knowledge and skills.

#### FIND IT!

See **Section A1.2** for more on SHSM credits.

Credits		Apprenticeship Training		College		University		Workplace	
		Gr. 11	Gr. 12	Gr. 11	Gr. 12	Gr. 11	Gr. 12	Gr. 11	Gr. 12
<b>Energy Major</b>		<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
includes content delivered in the sector's context	<b>English</b>		<b>1</b>		<b>1</b>		<b>1</b>		<b>1</b>
	<b>Mathematics</b>	<b>1</b>		<b>1</b>		<b>1</b>		<b>1</b>	
	<b>Business Studies or Canadian and World Studies or Science</b>	<b>1</b>		<b>1</b>		<b>1</b>		<b>1</b>	
<b>Cooperative Education</b>		<b>2</b>		<b>2</b>		<b>2</b>		<b>2</b>	
<b>Total number of credits</b>		<b>9</b>		<b>9</b>		<b>9</b>		<b>9</b>	

*Note:* Multiple credits in the Ontario technological education curriculum allow additional instructional time for the practice and refinement of skills needed to develop student performance to the levels required for certification, entry into apprenticeship programs, or participation in school–work transition programs (see *The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009*, page 17).

## 2. Seven sector-recognized certifications and/or training courses/programs

The SHSM in energy requires students to complete seven sector-recognized certifications and/or training courses/programs. Of these, four are compulsory and the remaining three are electives that must be chosen from the list in the following table. Note that items in the table that are capitalized are the proper names of specific certifications or training courses/programs that are appropriate for the SHSM. Items that are lowercased are names of the areas or categories within which specific certifications or training courses/programs should be selected by the school or board. The requirements are summarized in the table below.

### FIND IT!

See **Section A1.3** for more on SHSM certifications and training.



Four compulsory			
Cardiopulmonary Resuscitation (CPR) Level A	generic (i.e., not site-specific) instruction about the Workplace Hazardous Materials Information System (WHMIS)	Standard First Aid	automated external defibrillation (AED)
Three electives from the list below			
computer-aided design and computer-aided manufacturing (CAD/CAM)	confined space awareness	customer service	electrical safety
elevated work platforms	energy efficiency training	ergonomics	extinguishing fires
fall protection	geographic information system (GIS)	global positioning system (GPS)	hazardous materials
health and safety – basic	hoisting and rigging	lift truck safety	lockout/tagging
personal protective equipment – energy	pipeline construction safety	radiation safety	trenching safety

### 3. *Experiential learning and career exploration activities*

Experiential learning and career exploration opportunities relevant to the sector could include:

- one-on-one observation of a cooperative education student at a placement in the energy sector (example of job twinning)
- a day-long observation of an energy sector worker (example of job shadowing)
- a one- or two-week work experience with a member of an industry association or a professional in the energy sector (example of work experience)
- attendance at an energy sector trade show, conference, symposium, or job fair
- a tour of an energy-efficient building to explore passive-solar design and green building materials
- participation in a local, provincial, or national contest or competition with a focus on energy
- a tour of a wind farm or generating station
- volunteering with a non-profit organization focused on energy conservation.

#### FIND IT!

See **Section A1.4** for more on experiential learning and career exploration activities.

#### POLICY

Note that volunteer activities in an SHSM cannot be counted towards the hours of community involvement required to earn the OSSD.

### 4. *Reach ahead experiences*

Students are provided one or more reach ahead experiences – opportunities to take the next steps along their chosen pathway – as shown in the following examples:

- Apprenticeship: visiting an approved apprenticeship delivery agent in the sector
- College: interviewing a college student enrolled in a sector-specific program
- University: observing a university class in a sector-related program
- Workplace: interviewing an employee in the sector.

#### FIND IT!

See **Section A1.5** for more on reach ahead experiences.

### 5. *Essential Skills and work habits and the OSP*

Students will develop Essential Skills and work habits required in the sector and document them using the OSP, a component of the SHSM.

#### FIND IT!

See **Section A1.6** for more on Essential Skills and work habits.

## Pathways for the SHSM–Energy

A table illustrating the four pathways and required credits leading to completion of the SHSM–Energy is provided below. You will also find tables illustrating sample bundles of credits, and other useful resources, on the ministry’s SHSM website.

### *Awareness building (Grades 7 and 8)*

See **Section 5.5** for more information on building awareness of SHSM programs among students in Grades 7 and 8.

### *Exploration (Grades 9 and 10)*

See **Section 5.5** for information on providing Grade 9 and 10 students with opportunities for exploration of SHSM programs. In addition, students considering this SHSM can be encouraged to enrol in the following courses to become better informed about careers and postsecondary options related to the energy sector:

- **Exploring Technologies:** This Grade 9 course is recommended for all students following SHSM pathways that have a technological education focus. The course provides students with opportunities to explore a variety of technologies, including energy sector technology, by engaging in activities related to them.
- **Career Studies (compulsory) and Discovering the Workplace:** Some of the expectations in these Grade 10 courses provide opportunities for students to explore occupations and other postsecondary options in the sector and to participate in experiential learning activities.
- **A Grade 10 course in technological education or business studies:** These courses are recommended for any Grade 10 student who is considering enrolling in an SHSM–Energy program. They provide students with opportunities to explore areas of study relevant to the energy sector, identify personal interests and aptitudes, and gain a better understanding of the program.

### *Specialization (Grades 11 and 12)*

Students acquire the sector-specific knowledge and technical skills required to earn their OSSD with an SHSM–Energy by completing its five required components. Students and their parents/guardians are encouraged to consult with guidance counsellors and teachers to select the courses that will enable students to pursue their goals.

The four major credits for an SHSM–Energy will vary according to the area of focus:

- *Power generation and distribution* focuses on energy production on a large scale and may include occupations such as electrical or mechanical engineer, electrician, powerline technician, or process operator. Also included in this area of focus are occupations associated with the construction of generating stations and distribution systems. Major credits for this area of focus might include construction technology, manufacturing technology, technological design, or physics. A construction technology course may concentrate on electricity specifically.

### TOOLS AND RESOURCES



Visit the ministry’s SHSM website at [www.edu.gov.on.ca/eng/teachers/studentsuccess/specialist.html](http://www.edu.gov.on.ca/eng/teachers/studentsuccess/specialist.html) for:

- sample bundles of credits specific to this SHSM
- a list of organizations and resources specific to this SHSM.

- *Renewable and alternative energy* focuses on new and emerging green energy technologies, such as wind, solar, biomass, geothermal, or hydrogen fuel cell technology. Occupations in this area of focus include electromechanical engineer, research and development lab technician, wind turbine technician, or solar panel installer. Major credits for this area of focus might include green industries, resource management, or environmental science.
- *Energy efficiency* focuses on reducing energy use by residential, commercial, industrial, and institutional consumers. Occupations in this area include environmental engineer, energy auditor, building renovation tradesperson, or energy systems technologist. Major credits for this area might include construction technology, environmental science, resource management, or entrepreneurship. With the advent of energy-saving building technologies such as green roofs, Green Industries may also be applicable as a major credit for this area of focus.

Students have the option of choosing a science course or a geography course depending on their SHSM focus and postsecondary plans, as shown in the following examples:

- Students focusing on power generation and distribution who have an interest in nuclear energy might take a chemistry course, whereas students interested in fossil fuel power generation might take an earth science course.
- Students focusing on renewable and alternative energy who plan to pursue a career as a research scientist or as a laboratory technician could take a course in environmental science.
- Students focusing on energy efficiency who are interested in natural resource management might take a physical geography course.
- Students planning to enter the workplace directly after graduation might take a geography course in resource management.

Students pursuing an apprenticeship training pathway should consider OYAP, which enables them to start an apprenticeship while earning their OSSD.

Students pursuing a university pathway are advised to complete their required cooperative education credits in Grade 11, in order to allow room in their timetables in Grade 12 for credits needed to meet university entrance requirements.

When helping students plan their SHSMs, particularly with respect to the selection of courses to fulfil the requirement for credits in the major, teachers should bear in mind that technological education courses can be offered as single-credit or multiple-credit courses.

## Program Pathways: SHSM–Energy

- Shaded boxes – required credits for the SHSM–Energy
- (C) – compulsory credit for the OSSD

Grade 9 <i>Exploration</i>	Grade 10 <i>Exploration</i>		Apprenticeship Training Pathway <i>Specialization</i>		College Pathway <i>Specialization</i>		University Pathway <i>Specialization</i>		Workplace Pathway <i>Specialization</i>	
	Grade 10	Grade 11	Grade 11	Grade 12	Grade 11	Grade 12	Grade 11	Grade 12	Grade 11	Grade 12
An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit
(C) English	(C) English	(C) English	(C) English	(C) English	(C) English	(C) English	(C) English	(C) English	(C) English	(C) English
(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics	(C) Mathematics
(C) Science	(C) Science	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12	Business Studies or Science or Canadian and World Studies (Geography), in either Gr. 11 or Gr. 12
(C) Geography of Canada	(C) Canadian History	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major
(C) Core French	(C) Career Studies/ Civics or Discovering the Workplace	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major	Energy Major
(C) Healthy Active Living Education	(C) The Arts	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12	May be used as a (C) Cooperative education (2 credits), related to the sector, in either Gr. 11 or Gr. 12
Exploring Technologies	Technological Education	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit	An optional or a compulsory credit