

# Engineering and Energy Systems Career Program



Opportunities for Success

This career program is focused on the varying sources, methods of delivery, and multiple uses of energy. All career and technical education programs provide students opportunities for practical application of academic concepts. The Strengthening Career and Technical Education for the 21<sup>st</sup> Century Act (Perkins V) emphasizes student achievement in science, English language arts, and mathematics. To assist local education agencies in selecting courses best suited for this purpose, specific CTE courses with emphasis on these subjects have been highlighted below. Courses best suited for science applications are shown in yellow, mathematics are shown in blue, and English language arts are shown in orange. Local boards of education may allow CTE courses to be substituted for graduation requirements. Refer to [105 Illinois Compiled Statutes 5/27-22](#) and [105 ILCS 5/27-22.05](#) for more information.

## Science Applications

## Math Applications

## ELA Applications

CAREER CLUSTER	Science, Technology, Engineering, & Mathematics	Energy	Energy	Energy
CIP	15.0000	15.1701	15.1703	15.1704
TEACHER LICENSURE ENDORSEMENT	<a href="#">PEL with TEED (Technology Education)</a> <a href="#">ELS with SENS (STEM &amp; Energy Systems)</a>	<a href="#">PEL with TEED (Technology Education)</a> <a href="#">ELS with SENS (STEM &amp; Energy Systems)</a>	<a href="#">PEL with TEED (Technology Education)</a> <a href="#">ELS with SETT (Solar Energy Technology/Technician)</a>	<a href="#">PEL with TEED (Technology Education)</a> <a href="#">ELS with WETT (Wind Energy Technology/Technician)</a>
PATHWAY	Engineering Technology, General	Energy Systems Technology/Technician.	Solar Energy Technology/Technician.	Wind Energy Technology/Technician.
GROUP 1: ORIENTATION COURSES				
ORIENTATION COURSES	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001	Career Exploration 22151A001
	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002	Introduction to Technology and Engineering (Industrial) 21052A002
	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001	Energy Utilization Technology 20101A001
	Transportation Technology 20001A001			
	Production Technology 13052A001			
	Communication Technology 11002A001			
GROUP 2: INTRODUCTORY COURSES				
INTRODUCTORY COURSES	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001	Foundations of Technology 21052A001
	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001	Industrial Safety 13004A001
	Introduction to Engineering Design 21006A001	Introduction to Renewable Energies 17109A001	Introduction to Renewable Energies 17109A001	Introduction to Renewable Energies 17109A001
	Blueprint Reading 21108A001	Blueprint Reading 21108A001	Blueprint Reading 21108A001	Blueprint Reading 21108A001
	Geometry in Construction 17017A002	Beginning Electricity 17102A005	Beginning Electricity 17102A005	Beginning Electricity 17102A005
			Introduction to Solar Energy 17105A001	Introduction to Wind Energy 21060A001

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CAREER CLUSTER	Science, Technology, Engineering, & Mathematics	Energy	Energy	Energy
CIP	15.0000	15.1701	15.1703	15.1704
<b>GROUP 3: SKILLS COURSE (Minimum Selection 1)</b>				
<b>SKILLS COURSES</b>	Principles of Engineering 21004A001	Energy & Power 20101A002	Solar Energy Systems 17105A002	Wind Turbine Mechanics and Service 21061A001
	Principles of Technology I 21001A001		Photovoltaic System Application I 17102A006	
	Technological Design and Innovation 21054A001			
<b>GROUP 4: ADVANCED COURSES</b>				
<b>ADVANCED COURSES</b>	Technology, Society, and Sustainability 21054A004	Technology, Society, and Sustainability 21054A004	Technology, Society, and Sustainability 21054A004	Technology, Society, and Sustainability 21054A004
	Emerging Technologies 21053A001	Emerging Technologies 21053A001	Emerging Technologies 21053A001	Emerging Technologies 21053A001
	Digital Electronics 21008A001	Digital Electronics 21008A001	Digital Electronics 21008A001	Digital Electronics 21008A001
	Robotics 21009A001	Robotics 21009A001	Robotics 21009A001	Robotics 21009A001
	Principles of Technology II 21001A002		Photovoltaic System Application II 17102A007	
	Engineering Design 21006A002			
	Aerospace Engineering 21013A001			
<b>GROUP 5: WORKPLACE EXPERIENCE COUR</b>				
<b>WORKPLACE EXPERIENCE</b>	STEM Workplace Experience 21998A001	Energy Workplace Experience 21098A002	Energy Workplace Experience 21098A002	Energy Workplace Experience 21098A002
	Engineering Workplace Experience 21048A001	Energy Systems Technology Workplace Experience 21098A001	Solar Energy Workplace Experience 21098A003	Wind Energy Workplace Experience 21098A004
	Secondary Transitional Experience Program (CTE) 22151A003	Secondary Transitional Experience Program (CTE) 22151A003	Secondary Transitional Experience Program (CTE) 22151A003	Secondary Transitional Experience Program (CTE) 22151A003
A quality CTE program delivers all required elements of Illinois' definition of Size, Scope, Quality. CTE program elements include: a sequence of courses, each educational entity offering approved courses provides assurance that the course content includes at a minimum the State course description, meets the State's minimum requirements for course offerings by program, curriculum aligned to state recognized learning standards & industry standards, career pathway guidance, resources to support program/course delivery (licensed & qualified staff, appropriate facilities, adequate equipment, instructional materials, work-based learning experiences, special populations support services, an active affiliated CTSO chapter), articulation/dual credit agreements, documentation of state agency certification or licensing requirements for occupations regulated by law or licensure, & content which prepare students for reflective of current labor & opportunity for workplace experience or a structured capstone course. Orientation courses are suggested to be taught at the prior-to-secondary or 9th grade levels. Introductory level courses are suggested to be taught at the 9th-11th grade level. Skill level courses are suggested to be taught at the 10th – 12th grade levels. Workplace Experiences Courses are suggested to be taught at the 12th grade level.				

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Group	State Course Code	State Course Title	State Course Description
Group 1	22151A001	Career Exploration	Career Exploration courses help students identify and evaluate personal goals, priorities, aptitudes, and interests with the goal of helping them make informed decisions about their careers. These courses expose students to various sources of information on career and training options and may also assist them in developing job search and employability skills.
Group 1	21052A002	Introduction to Technology and Engineering (Industrial)	Introduction to Technology & Engineering is comprised of the following areas: Production, Transportation, Communication, Energy Utilization and Engineering Design but is not limited to these areas only. This course will cover the resources, technical processes, industrial applications, material sciences, technological impact and occupations encompassed by that system.
Group 1	20101A001	Energy Utilization Technology	Energy Utilization Technology is a course designed to foster an awareness and understanding of how we use energy in our industrial technological society. Areas of study include conversion of energy, electrical fundamentals, solar energy resources, alternate energy resources such as wind, water, and geothermal; fossil fuels, nuclear power, energy conservation, and computer uses in energy technology. Students use laboratory experiences to become familiar with current energy technologies.
Group 1	20001A001	Transportation Technology	Transportation Technology is a course designed to foster an awareness and understanding of the various transportation customs that make up our mobile society. Through laboratory activities, students are exposed to the technologies of and career opportunities involved in material handling, atmospheric and space transportation, marine transportation, terrestrial transportation, and computer uses in transportation technology.
Group 1	13052A001	Production Technology	Production Technology is a course designed to foster an awareness and understanding of manufacturing and construction technology. Through a variety of learning activities, students are exposed to many career opportunities in the production field. Experiences in manufacturing include product design, materials and processes, tools and equipment including computers, safety procedures, corporate structure, management, research and development, production planning, mass production, marketing, and servicing. In construction, students are exposed to site preparation, foundations, building structures, installing utilities, and finishing and servicing structures.
Group 1	11002A001	Communication Technology	Communication Technology is a course designed to foster an awareness and understanding of the technologies used to communicate in our modern society. Students gain experience in the areas of design and drafting, radio and television broadcasting, computers in communication, photography, graphic arts, and telecommunications.
Group 2	21052A001	Foundations of Technology	The course employs teaching/learning strategies that enable students to build their own understanding of new ideas. It is designed to engage students in exploring and deepening their understanding of “big ideas” regarding technology and apply technological processes to solve real problems and develop knowledge and skills to design, modify, use and apply technology in the following areas: engineering design, manufacturing technologies, construction technologies, energy & power, information & communication technologies and emerging technologies.
Group 2	13004A001	Industrial Safety	Industrial Safety courses provide students with instruction in safe operating procedures related to various trades. Course topics may include the importance of standard operation procedures, agencies and regulations related to occupational safety and hazard prevention, and the dangers of particular materials.

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Group 2	17109A001	Introduction to Renewable Energies	Introduction to Renewable Energies courses will provide students with basic competencies and skills associated with various energy sources, and electrical power generation, transmission, and distribution. Students will be introduced to competencies and understanding in the history of energy; basics of electrical wiring and equipment; best practices in safety; the global impact of renewable and nonrenewable resources; career opportunities; energy technology, energy resources; alternative energy sources and their respective advantages and disadvantages; the impact of conventional and alternative energy sources on the environment; and emerging future energy technologies.
Group 2	21006A001	Introduction to Engineering Design	Engineering Design courses offer students experience in solving problems by applying a design development process. Often using solid modeling computer design software, students develop, analyze, and test product solutions models as well as communicate the features of those models.
Group 2	17102A005	Beginning Electricity	Beginning Electricity—course provides a survey of the theory, terminology, equipment, and practical experience in the skills needed for careers in the electrical field. This courses typically include AC and DC circuitry, safety, and the National Electrical Code and may cover such skills as those involved in building circuits; wiring residential, installing lighting, power circuits, and cables.
Group 2	21108A001	Blueprint Reading	Blueprint Reading courses provide students with the knowledge and ability to interpret the lines, symbols, and conventions of drafted blueprints. They generally emphasize interpreting, not producing, blueprints, although the courses may provide both types of experiences. Blueprint Reading courses typically use examples from a wide variety of industrial and technological applications.
Group 2	17017A002	Geometry and Construction	Geometry in Construction courses provide students with an integrated way to learn Geometry through the application in Construction. The construction concepts within the course are organized to complement the skills and the knowledge that align to High School - Geometry standards. Students will apply these skills and knowledge to the completion of construction projects.
Group 2	17105A001	Introduction to Solar Energy	Students will examine, operate, and evaluate a small solar powered electrical generation system while exploring the solar energy industry and career opportunities. The course will include identification and analysis of the components of basic photovoltaic systems and solar thermal technologies and how they apply to the solar energy industrial systems. Students will use standard hand tools and materials, learn the basics of electrical wiring and equipment, and learn best practices in safety. Students will learn how to test operating voltages and calibrates to systems. Small solar labs should be used to provide students with hands-on experience installing and troubleshooting solar energy installations.
Group 2	21060A001	Introduction to Wind Energy	Students will examine, operate, and evaluate a small wind powered electrical generation system while exploring the wind energy industry and career opportunities. The course will include identification and analysis of the components and systems of a small wind turbine and how it applies to industrial wind turbines. Students will use standard hand tools and materials, learn the basics of electrical wiring and equipment, and learn best practices in safety. Students will learn how to calculate and use air flow and power measurement instruments. Small wind labs should be used to provide students with hands-on experience installing and troubleshooting small wind installations.
Group 3	21004A001	Principles of Engineering	Principles of Engineering courses provide students with an understanding of the engineering /technology field. Students typically explore how engineers use various technology systems and manufacturing processes to solve problems; they may also gain an appreciation of the social and political consequences of technological change.

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Group 3	21001A001	Principles of Technology I	This course provides learning experiences related to the principles that underlie today's high technology: force, work, rate, resistance, energy, power, and force transformers. The course deals with these principles as they apply in each of the four systems that make up both the simplest and the most complex technological devices and equipment: mechanical systems, fluid systems, electrical systems, and thermal systems. Learning experiences are designed to allow students to acquire knowledge and skills which are transferable to postsecondary technical programs.
Group 3	21054A001	Technological Design and Innovation	In this course, technological design and innovation are presented through practical applications. Students apply technology, science, and mathematics concepts and skills to solve technological /engineering problems and innovative designs. Students research, develop, create simulations, test, and analyze engineering designs using criteria such as design effectiveness, public safety and human factors.
Group 3	20101A002	Energy & Power	Energy/Power courses focus on one or several aspects of energy and power in transportation and work. Course content may include various sources of energy and their use in society (for example, characteristics, availability, conversion, storage, environmental impact, and socioeconomic aspects of various energy sources); principles involved in various means of energy transfer, such as electricity/electronics, hydraulics, pneumatics, heat transfer, and wind/nuclear/solar energies; and the transmission and control of power through mechanical or electrical devices such as motors and engines.
Group 3	17105A002	Solar Energy Systems	Solar Energy System courses cover the operating principles, function, location and application of photovoltaic and thermal electric systems. The content includes solar energy basics, site surveys, available technologies, installation options, cost estimation, and project justification. The course should touch upon residential, commercial and industrial applications and will include both lecture as well as hand-on lab sessions.
Group 3	17102A006	Photovoltaic System Application I	The Photovoltaic System Applications I course covers the skills and knowledge necessary to work as a technician in the photovoltaic electricity industry. Subjects addressed include safety training, the function and interrelation of the systems located in a photovoltaic system. As well as a systems view of the equipment needed to provide usable electricity from sunlight. The course will focus primarily on the selection and application of photovoltaic equipment needed to provide both grid tied and off grid power.
Group 3	21061A001	Wind Turbine Mechanics and Service	Wind Turbine Mechanics and Service courses examine the skills and knowledge necessary to work as a technician in the wind industry. Subjects addressed include safety training, the identification and analysis of the components of a wind turbine, and the function and interrelation of the systems located in a wind power system. Students will develop a systems view of the propulsion and generation equipment typically located in a nacelle, gearboxes and other mechanical systems that make up the subsystems of today's wind turbine. These courses will also enable students to study site preparation and construction, operation and maintenance programs, and data acquisition and assessment.
Group 4	21054A004	Technology, Society, and Sustainability	Technology, Society and Sustainability course will provide an overview of the importance of, impact on, and relationships between technological endeavors and society at large. This course typically emphasizes environmental factors, economics impacts and the influences of society on technological/environmental endeavors.
Group 4	21053A001	Emerging Technologies	Emerging Technologies courses emphasize students' exposure to and understanding of new and emerging technologies. The range of technological issues varies widely but typically include lasers, fiber optics, electronics, robotics, computer technologies (software engineering), Game Art and Design, CAD/CAM, communication modalities, and transportation technologies.

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Group 4	21008A001	Digital Electronics	Digital Electronics courses teach students how to use applied logic in the development of electronic circuits and devices. Students may use computer simulation software to design and test digital circuitry prior to the actual construction of circuits and devices.
Group 4	21009A001	Robotics	Robotics courses develop and expand students' skills and knowledge so that they can design and develop robotic devices. Topics covered in the course may include mechanics, electrical and motor controls, pneumatics, computer basics, and programmable logic controllers.
Group 4	21001A002	Principles of Technology II	This course includes learning experiences related to the principles that underlie today's high technology: momentum, waves and vibrations, energy converters, transducers, radiation, optical systems, and time constraints. The course deals with these principles as they apply in each of the systems that make up both the simplest and the most complex technological devices and equipment: mechanical systems, fluid systems, electrical systems, and thermal systems. Learning experiences are designed to allow students to acquire knowledge and skills which are transferable to postsecondary technical programs.
Group 4	21006A001	Engineering Design	In this course, engineering scope, content, and professional practice are presented through practical applications. Students in engineering teams apply technology, science, and mathematics concepts and skills to solve engineering design problems and create innovative designs. Students research, develop, test, and analyze engineering designs using criteria such as design effectiveness, public safety, human factors, and ethics. This course is the capstone experience for students who are interested in Technology, Innovation, Design, and Engineering.
Group 4	21013A001	Aerospace Engineering	Aerospace Engineering courses introduce students to the world of aeronautics, flight, and engineering. Topics covered in the course may include the history of flight, aerodynamics and aerodynamics testing, flight systems, astronautics, space life systems, aerospace materials, and systems engineering.
Group 4	17102A006	Photovoltaic System Application II	The course will cover the advanced principles of photovoltaics and how to effectively incorporate PV systems into stand-alone or interconnected electrical systems. The course will cover site evaluations, operation, design and sizing, installation, and advantages and disadvantages of different systems. Students will develop a better understanding of how to apply the skills learned in Photovoltaic System Applications I or Solar Energy Systems.
Group 5	21998A001	STEM Workplace Experience	<b>Science, Technology, Engineering &amp; Mathematics Workplace Experience courses provide work experience in fields related to the Science, Technology, Engineering &amp; Mathematics cluster. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.</b>
Group 5	21048A001	Engineering Workplace Experience	<b>Engineering Workplace Experience courses provide students with work experience in an engineering-related field. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could</b>

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			include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21098A002	Energy Workplace Experience	Energy Workplace Experience courses provide work experience in fields related to the Energy cluster. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21098A001	Energy Systems Technology Workplace Experience	Energy Systems Technology Workplace Experience courses provide students with work experience in a field related to technological systems and structures. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week, involving further study of the field, discussion of relevant topics that are responsive to the workplace experience and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include: Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21098A003	Solar Energy Workplace Experience	Solar Energy Workplace Experience courses provide students with work experience in a field related to technological systems and structures in the solar industry. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week involving further study of the field, discussion of relevant topics that are responsive to the workplace experience, and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology programs; Internships; and Apprenticeship programs, including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	21098A004	Wind Energy Workplace Experience	Wind Energy Workplace Experience courses provide students with work experience in a field related to technological systems and structures in the wind industry. Goals must be set cooperatively by the student, teacher, and employer (although students are not necessarily paid). These courses must include classroom instruction at least once per week involving further study of the field, discussion of relevant topics that are responsive to the workplace experience, and employability skill development. Workplace Experience courses must be taught by an approved WBL educator-coordinator. These courses should be aligned to a Career Development Experience that could include Student-led Enterprises; School-based Enterprises; Immersion Supervised Agricultural Experiences; Clinical Experiences in Health Science and Technology

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			programs; Internships; and Apprenticeship programs, including Youth Apprenticeships, Pre-apprenticeships, and Registered Apprenticeships.
Group 5	22151A003	Secondary Transitional Experience Program (CTE)	This course code should be used for students participating in a STEP program that are also participating in assigned Career and Technical Education (CTE) courses. If the STEP program is not connected to a CTE program, the code 22151A002 should be used instead. STEP is a program approved by ISBE and provided by the DHS Division of Rehabilitation Services (DHS/DRS) that helps schools provide mandated transition services. These courses provide a built-in linkage to DHS/DRS, an agency that can assist students with disabilities with their post-school employment and career development goals. The program provides work experiences that coincide with post-secondary employment goals that could include paid employment or internships. This allows students to gain school credit towards graduation, while gaining hands-on work experience, with as-needed support services. The program also promotes the provision of the following Pre-employment Transition Services (per WIOA - the Workforce Innovation and Improvement Act): a. Job Exploration Counseling, b. Workplace Readiness Training, c. Counseling on Post-Secondary Education, d. Instruction in Self-Advocacy, and e. Work-Based Learning Experiences. Participation in the Secondary Transition Experience Program may include classroom activities, as well, involving further study of the Pre-Employment Transition Services topics. Thus, STEP can be offered in combination with miscellaneous vocational courses such as: 22151A000 Career Exploration, and 22152A000 - Employability Skills.