Cross-Reference Guide: Science 30 Alberta Science with Project WILD and Below Zero *

Unit D: Energy and the Environment **General Outcome 1** *Students will* explain the need for balancing the growth in global energy demands with maintaining a viable biosphere. **Specific Outcomes for Knowledge**	**Project Wild***	**Below Zero***
30–D1.1k compare the energy consumption of contemporary society with that of traditional cultures and precontact Aboriginal societies, and investigate and analyze the exponential growth of global energy consumption in recent history		
30–D1.2k compare Canada's per-capita energy consumption with developed and developing countries and identify factors that affect consumption; *e.g., economy, lifestyle, level of technology, geography, climate*		
30–D1.3k apply the concept of sustainable development to increasing the efficient use of energy; *e.g., efficient use of energy in the home, in industry and in transportation*	335 What Did Your Lunch Cost Wildlife?	
30–D1.4k explain the need to develop technologies that use renewable and nonrenewable energy sources to meet the increasing global demand		
30–D1.5k describe the environmental impact of developing and using various energy sources; i.e., conventional oil, oil sands, solar power, wind power, biomass, hydroelectricity, coal- burning power, nuclear power, geothermal	312 To Dam or Not to Dam 337 Flip the Switch For Wildlife	
30–D1.6k describe how the Aboriginal perspective of an interconnected environment demonstrates the need to balance resource extraction with environmental impact.		

* See end notes for abbreviations

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Unit D: Energy and the Environment **General Outcome 1** *Students will* explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.		Project Wild*	Below Zero*
Specific Outcomes for Science, Technology and Society (STS) (Social and Environmental Contexts Emphasis)			
30-D1.1sts explain that science and technology are developed to meet societal needs and expand human capability (SEC1) [ICT F2–4.4, F2–4.8]	• investigate and assess the need for strategies *(e.g., co-generation, waste-energy recovery, electrical load scheduling)* and policies to increase energy efficiency as a means of balancing global energy demands with maintaining a viable biosphere.	335 What Did Your Lunch Cost Wildlife? (m)	

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Unit D: Energy and the Environment **General Outcome 1** *Students will* explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.		Project Wild*	Below Zero*
Specific Outcomes for Skills (Social and Environmental Contexts Emphasis)			
Initiating and Planning **30–D1.1s** formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues	• identify questions to investigate that arise from science- and technology-related issues; *e.g., "Which energy sources and technologies best balance the need for global energy demand with acceptable environmental impacts?"* (IP–SEC1) [ICT F2–4.8]	337 Flip the Switch For Wildlife (m)	
	• *predict the time frame by which world oil reserves may reach near-depletion levels, based on the current rates of consumption and estimates of resources* (IP–NS3) [ICT C7–4.2].		
Performing and Recording **30–D1.2s** conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information	• *research current information relevant to global oil and gas reserves or sustainable development initiatives* (PR–SEC1) [ICT C2–4.1, F2–4.7]		
	• *compile and organize findings as part of a briefing for a public hearing on an issue such as the proposed development of an energy source in an ecologically sensitive area* (PR–NS4) [ICT C6–4.2, P2–4.1].		

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Unit D: Energy and the Environment **General Outcome 1** *Students will* explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.		Project Wild*	Below Zero*
Specific Outcomes for Skills (Social and Environmental Contexts Emphasis)			
Analyzing and Interpreting 30–D1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions	• analyze data charts, tables and graphs on global energy consumption in the past, in the present and predicted for the future [ICT C7–4.2]		
	• *evaluate the bias, reliability and validity of electronically accessed information on alternative and renewable energy sources* (AI–SEC1) [ICT C2–4.2, C3–4.1, C3–4.2]	337 Flip the Switch for Wildlife (m)	
	• *identify new questions, such as those that relate to humanity's global energy future or those that relate to energy consumption by various sectors, such as metallurgy, petrochemical, pulp and paper, transportation* (AI–SEC4)		
	• *assess policies intended to facilitate efficient use of energy and reliance on renewable energy sources* (AI–SEC2).		
Communication and Teamwork 30–D1.4s work collaboratively in addressing problems and apply the skills and	• *present a visual display of initiatives taken by industry to protect the environment* (CT–SEC2) [ICT C1–4.4, P6–4.1]		

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Unit D: Energy and the Environment **General Outcome 1** *Students will* explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.		Project Wild*	Below Zero*
Specific Outcomes for Skills (Social and Environmental Contexts Emphasis)			
conventions of science in communicating information and ideas and in assessing results	• *develop and present an energy policy, based upon a set of criteria, in relation to a possible energy crisis in Canada* (CT–SEC3)		

Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms.	Project Wild*	Below Zero*
Specific Outcomes for Knowledge		
30–D2.1k explain how Hess's Law, $\Delta H^\circ = \sum \Delta f H^\circ$(products) – $\sum \Delta f H^\circ$(reactants), leads to prediction of heats of combustion		
30–D2.2k contrast the proportion of solar energy that creates wind and drives the water cycle with the small proportion captured by photosynthesis as chemical potential energy		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms. **Specific Outcomes for Knowledge**	**Project Wild***	**Below Zero***
30–D2.3k describe the conversion of solar energy into renewable forms (e.g., wind, hydropower, chemical potential energy by photosynthesis) and nonrenewable forms (e.g., coal, oil and gas) and further conversion into electrical and thermal energy		
30–D2.4k describe the functioning of renewable energy technologies and assess their advantages and disadvantages, including active and passive solar-heating technologies, wind turbines, hydroelectric power, biomass energy, geothermal energy, hydrogen fuel cells		
30–D2.5k explain the difference between fission and fusion and balance simple nuclear reaction equations to show the conservation of nucleons; *e.g.,* ${}_1n + {}^{235}U \rightarrow {}^{141}Ba + {}^{92}Kr + 3{}^{1}n$; ${}^{2}H + {}^{2}H \rightarrow {}^{3}He + {}^{1}n$		
30–D2.6k describe the main types and sources of radioactive decay and resulting ionizing radiation; i.e., alpha (α), beta (β) and gamma (γ) decay		
30–D2.7k describe mass-energy changes in fission and fusion reactions, as represented by the formula $E = mc^2$		
30–D2.8k describe, in general terms, the operation of a fission reactor (*e.g., the Canadian Deuterium Uranium [CANDU] Reactor*) and the current state of fusion research		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms. **Specific Outcomes for Knowledge**	**Project Wild***	**Below Zero***
30–D2.9k trace the relationship between nuclear energy and geothermal energy		
30–D2.10k compare and contrast conventional coal, oil-fired or hydroelectric power stations with nuclear power stations, in terms of purpose, process of energy conversions, design and function		
30–D2.11k contrast, quantitatively, the orders of magnitude of energy produced by nuclear, chemical and phase changes		
30–D2.12k explain the source of tides, in terms of gravitational attraction and the relative motions of the sun, moon and Earth		
30–D2.13k describe the energy transformations involved in converting tidal energy to electrical energy and compare tidal power to hydroelectric power; *e.g., tidal generating stations at the Bay of Fundy, Canada and La Rance, France*.		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms. **Specific Outcomes for Science, Technology and Society (STS)** (Social and Environmental Contexts Emphasis)		**Project Wild***	**Below Zero***
30-D2.1sts explain that decisions regarding the application of scientific and technological development involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations (SEC4b) [ICT F2–4.2, F3–4.1]	• evaluate the environmental and economic implications of energy transformation technologies; *e.g., nuclear, geothermal, fossil fuel, hydroelectric, wind, tidal power or hydrogen-cell power in a risk-benefit analysis*	312 To Dam or Not To Dam 337 Flip the Switch for Wildlife	
30–D2.2sts explain that science and technology are developed to meet societal needs and expand human capability (SEC1) [ICT F2–4.4, F2–4.8]	• *determine how the allocation of funds for research into the development of new energy conversion devices and sources balances the needs of society with preservation of the environment.*		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms.		**Project Wild***	**Below Zero***
Specific Outcomes for Skills (Social and Environmental Contexts Emphasis)			
Initiating and Planning **30–D2.1s** formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues	• *design an experiment and identify specific variables to compare the heat produced by various fuels* (IP–NS2) [ICT C6–4.2].		
Performing and Recording **30–D2.2s** conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information	• *research, integrate and synthesize information from various print and electronic sources on sustainable development initiatives, such as fuel cells* (PR–SEC1) [ICT C1–4.1, C2–4.1, C3–4.1, C3–4.2].		
Analyzing and Interpreting **30–D2.3s** analyze data and apply mathematical and conceptual models to develop and assess possible solutions	• calculate heats of combustion using Hess's Law; *e.g., calculate and compare fuels currently used with those used in the past* (AI–NS3) [ICT C6–4.1]		
	• calculate mass-energy changes in fission and fusion reactions, using the equation $E = mc^2$ (AI–NS3) [ICT C6–4.1]		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms. **Specific Outcomes for Skills** (Social and Environmental Contexts Emphasis)		**Project Wild***	**Below Zero***
	• investigate, quantitatively, the efficiency of a device, using energy input and energy output data; *e.g., solar collector, photovoltaic cell, fossil fuel or biomass burner, biogas generator* (AI–ST1)		
	• *identify new questions, such as those that relate to nuclear fusion becoming a global source of energy* (AI–SEC4)		
	• *assess risks and benefits of scientific and technological developments, such as cogeneration, hybrid vehicles, fuel efficiency, waste-energy recovery, electrical load scheduling* (AI–SEC2) [ICT F3–4.1].		
Communication and Teamwork 30–D2.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and	• *use advanced menu features within word processing software to insert tables and energy budgets for a risk-benefit analysis of an energy transformation technology* (CT–ST2) [ICT P4–4.3]		

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Unit D: Energy and the Environment **General Outcome 2** *Students will* describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into useable forms. **Specific Outcomes for Skills** (Social and Environmental Contexts Emphasis)		**Project Wild***	**Below Zero***
ideas and in assessing results	• *consult a wide variety of sources to evaluate varied perspectives on topics such as cogeneration, fuel efficiency, waste-energy recovery, electrical load scheduling and policies that facilitate energy efficiency and increase reliance on renewable energy sources* (CT–SEC1) [ICT C2–4.1, C2–4.2].		

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*** End Notes** (for all tables)

bold - very strong correlation of activity with outcome/expectation

m - minor modification required for SLE

\# - relevant step in activity procedure

e - include extension activity

aq - aquatic extension

eval - evaluation section of activity

var - variation section of activity

* See end notes for abbreviations