HS. Human Sustainability

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A Performance Expectations HS.ESS3.HUS

1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS.ESS3.1
2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS.ESS3.2
3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. HS.ESS3.3
4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. HS.ESS3.4
5. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. HS.ESS3.6

B Science and Engineering Practices HS.HUS.SEP

1 Using Mathematics and Computational Thinking HS.HUS.SEP.1

a Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3) HS.HUS.SEP.1A

b Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6) HS.HUS.SEP.1B

2 Constructing Explanations and Designing Solutions HS.HUS.SEP.2

a Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HSESS3-1) HS.HUS.SEP.2A

b Design or refine a solution to a complex real-world problem, based on scientific knowledge, studentgenerated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4) HS.HUS.SEP.2B

3 Engaging in Argument from Evidence HS.HUS.SEP.3

a Evaluate competing design solutions to a realworld problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2) HS.HUS.SEP.3A

C Disciplinary Core Ideas HS.HUS.DCI

1. ESS2.D: Weather and Climate HS.HUS.DCI.ESS2.D
   a. Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary to HS-ESS3- 6) HS.HUS.DCI.ESS2.D.1
2. ESS3.A: Natural Resources HS.HUS.DCI.ESS3.A
   a. Resource availability has guided the development of human society. (HS-ESS3-1) HS.HUS.DCI.ESS3.A.1
   b. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2) HS.HUS.DCI.ESS3.A.2
3. ESS3.B: Natural Hazards HS.HUS.DCI.ESS3.B
   a. Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1) HS.HUS.DCI.ESS3.B.1
4. ESS3.C: Human Impacts on Earth Systems HS.HUS.DCI.ESS3.C
   a. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) HS.HUS.DCI.ESS3.C.1
   b. Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4) HS.HUS.DCI.ESS3.C.2
5. ESS3.D: Global Climate Change HS.HUS.DCI.ESS3.D
   a. Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HSESS3-6) HS.HUS.DCI.ESS3.D.1
6. ETS1.B. Developing Possible Solutions HS.HUS.DCI.ETS1.B
   a. When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HS-ESS3-2), (secondary to HS-ESS3-4) HS.HUS.DCI.ETS1.B.1

D Crosscutting Concepts HS.HUS.CC

1 Cause and Effect HS.HUS.CC.1

- a Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1) HS.HUS.CC.1A

2 Systems and System Models HS.HUS.CC.2

- a When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6) HS.HUS.CC.2A

3 Stability and change HS.HUS.CC.3

- a Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HSESS3-3) HS.HUS.CC.3A
- b Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4) HS.HUS.CC.3B

4 Influence of Engineering, Technology, and Science on Society and the Natural World HS.HUS.CC.4

- a Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3) HS.HUS.CC.4A
- b Engineers continuously modify these systems to increase benefits while decreasing costs and risks. (HS-ESS3-2),(HS-ESS3-4) HS.HUS.CC.4B
- c New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3) HS.HUS.CC.4C
- d Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2) HS.HUS.CC.4D

5 Science is a Human Endeavor HS.HUS.CC.5

- a Scientific knowledge is a result of human endeavors, imagination, and creativity. (HS-ESS3-3) HS.HUS.CC.5A

6 Science Addresses Questions About the Natural and Material World HS.HUS.CC.6

- a Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2) HS.HUS.CC.6A
- b Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2) HS.HUS.CC.6B
- c Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2) HS.HUS.CC.6C