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| **MS.ESS-HI Human Impacts** |
| Students who demonstrate understanding can:  **a. Use system models and representations to explain how human activities significantly impact: (1) the geosphere, (2) the hydrosphere, (3) the atmosphere, (4) the biosphere, and (5) global temperatures.** [Clarifying Statement: System models and representations include diagrams, charts, and maps. Examples of human impact are changes in land use and resource development (geosphere); water pollution and urbanization (hydrosphere); air pollution in the form of gases, aerosols, and particulates (atmosphere); changes to natural environments (biosphere); release of greenhouse gases (global temperatures).]  **b. Generate and revise qualitative explanations from data for the impacts on Earth’s systems that result from increases in human population and rates of consumption.** [Assessment Boundary: Students should be provided with modified regional databases on human populations and rates of consumption. “Impacts” include changes to the appearance, composition, and structure of Earth’s systems as well as the rates at which they change.]  **c. Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases.**  **d. Ask questions to refine and develop an explanation for the way technological monitoring of Earth’s systems can provide the means of informing the public of ways to modify human impacts on Earth’s systems.**  **e. Use empirical evidence to evaluate technologies that utilize renewable energy resources.** [Assessment Boundary: Students will evaluate these technologies based on their cost, benefit, sustainability, and environmental impacts.] |

**NEXT GENREATION SCIENCE STANDARDS – HUMAN IMPACT**

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| **HS.ESS-HS Human Sustainability** |
| Students who demonstrate understanding can:  **a. Construct arguments for how the developments of human societies have been influenced by natural resource availability including: locations of streams, deltas, and high concentrations of minerals, ores, coal, and hydrocarbons.**  **b. Reflect on and revise design solutions for local resource development that would increase the ratio of benefits to costs and risks to the community and its environment.** [Clarification Statement: Examples of local resource development include soil use for agriculture, water use, mining for coal and minerals, pumping for oil and natural gas.]  **c. Construct scientific claims for how increases in the value of water, mineral, and fossil fuel resources due to increases in population and rates of consumption have sometimes led to the development of new technologies to retrieve resources previously thought to be economically or technologically unattainable.**  **d. Construct scientific arguments from evidence to support claims that natural hazards and other geologic events have influenced the course of human history.** [Clarification Statement: Famines that result from reduced global temperatures can follow large historic volcanic eruptions. Large earthquakes and tsunamis can destroy cities, and there is a strong correlation between historic climate changes and the number of wars.]  **e. Construct scientific claims about the impacts of human activities on the frequency and intensity of some natural hazards.** [Clarification Statement: Natural hazards to include floods, droughts, forest fires, landslides, etc.]  **f. Identify mathematical relationships using data on the rates of production and consumption of natural resources in order to assess the global sustainability of human society.** [Assessment Boundary: Students construct equations for linear relationships, but not expected to construct equations for non-linear relationships.]  **g. Construct arguments about how engineering solutions have been and could be designed and implemented to mitigate local or global environmental impacts.** [Clarification Statement: Environmental impacts to include acid rain, water pollution, the ozone hole, etc.]  **h. Use results from computational General Circulation Models (GCMs) to investigate how the hydrosphere, atmosphere, geosphere, and biosphere are being modified in response to human activities.** |