LESSON

House as a System

BIG IDEA(S)

A system is an organized group of related objects or components; a house is a single system of interrelated parts.

OBJECTIVES

Students will:

- Apply concepts of House as a System to a variety of scenarios
- Explain the interrelatedness of the components of the house as a system

TASK LIST SUBCATEGORY

802 Describe the interconnection of systems

106 Describe the impact of energy systems (social, economic, health, and environmental)

OVERVIEW

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. A house is a single system of connected parts. Simple systems can work in predictable ways; dynamic systems exhibit more complex and unpredictable behaviors.

STANDARDS

PA/SDP

3.1.12.A8. Change and Constancy: Describe and interpret dynamic changes in stable systems

3.2.12.A5. Change and Constancy: Predict the shift in equilibrium when a system is subjected to a stress

3.4.10.A2. Interpret how **systems** thinking applies logic and creativity with appropriate comprises in complex real-life problems.

3.4.12.B1. Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of **technologies**.

3.4.12.C3. Apply the concept that many technological problems require a multi-disciplinary approach.

3.4.12.E3. Compare and contrast energy and power **systems** as they relate to pollution, renewable and non-renewable resources, and conservation.

INSTRUCTIONAL

TEXT/REFERENCES

Energy Conservation Handbook. pp. 89 – 92

MATERIALS NEEDED

Content: Videos linked below

Technology: Device with internet to watch YouTube video

BRIGHT SOLAR FUTURES

WEATHERIZATION

TOPIC OF STUDY

Building Sciences

90 MINUTES

KEY TERMS

equilibrium
feedback loop
system
systems thinking

IMPLEMENTATION (LESSON PLAN)

PART I – HOUSE AS A SYSTEM COMPONENTS

ENGAGE

- Using think-pair-share method ask the class to brain storm examples of systems. Teacher can list all of the different systems on the board. Responses might include: solar system, healthcare system, human body systems, computer system, software/ operating system, weather systems, natural social system (beehive), mechanical systems (electrical)
- Show PBS video: https://lsintspl3.wgbh.org/en-us/lesson/syslit-il-pdsystems/3 (2:30)

EXPLORE

- Using the list of examples of systems constructed in the engage section above, ask pairs of students to use the following list of questions to determine whether or not the examples are truly systems.

	Yes	No
1. Are there parts?		
2. Do the parts affect each other?		
3. Does it matter how the parts are arranged?		
4. Does the behavior of the system change if a key part is taken away?		
5. Does the interaction of the parts produce an effect that is different than that of any of the parts on its own?		

EXPLAIN

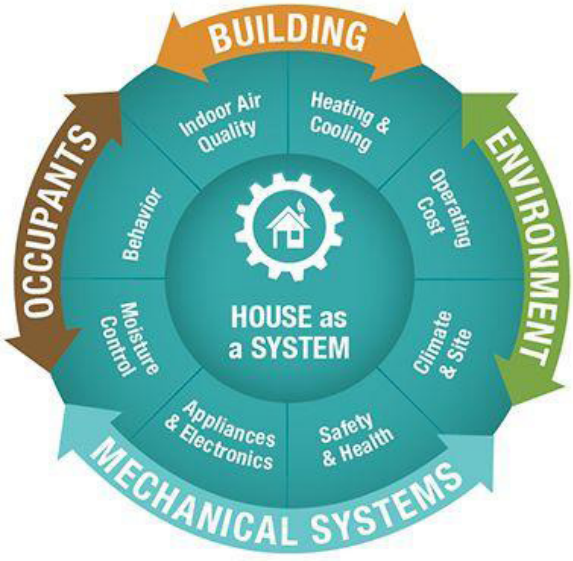
- Review students' results from the questions as a whole class.
- Watch "Clem Marvels at a Mangrove" video (https://lsintspl3.wgbh.org/en-us/lesson/syslit-il-pdsystems/6). Ask students to identify the system and its parts from the video.

EXTEND

- Introduce "House as a System." Ask students if a house is a system. Ask students to apply the five questions from the above Explore section to a house. In pairs have student address each question. Use the *House as a System Worksheet* to answer questions.

EVALUATE

- Teacher may select in advance or ask students to use the diagram below to select two components of the House as a System. Students should then write a one paragraph essay analyzing how the two components are interrelated and ultimately can impact the home's energy efficiency. An alternative assignment could be to turn this into a class game by adding a spinner to the diagram. Students would then spin twice to select their components and verbally analyze the components.



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RESOURCES/LINKS

Basic Building Science webinar by The Energy Center of Wisconsin

https://www.youtube.com/watch?v=vCSAjgVUplA

Building Science Basics materials

https://www.energy.gov/eere/wap/downloads/weatherization-installertechnician-fundamentals-20-building-science-basics

Building Science Concepts

https://www.wbdg.org/resources/building-science-concepts

Building Science Concepts: Northern Arizona University

https://mediaspace.nau.edu/media/Building+Science+Concepts/0_9gnqhk0n/69035282

Energy Star Qualified Homes Building Science Introduction

https://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/ENERGY_STAR_V3_Building_Science.pdf

Introduction to Building Science powerpoint slides

https://www.tboake.com/2013/172-building_science_13.pdf

National Energy Education Development (NEED) Project: Building Science booklet

https://www.need.org/Files/curriculum/guides/BuildingScience.pdf

PBS Teaching About Systems

https://whyy.pbslearningmedia.org/resource/syslit14-sci-sys-ilpdsystems/teaching-about-systems/#.X2VKLi-ZPVo

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APPENDIX

SCIENCE STANDARDS

NGSS Crosscutting Concepts

4. Systems and System Models

Show Tips

Below is the progression of the Crosscutting Concept of Systems and System Models, followed by Performance Expectations that make use of this Crosscutting Concept.

4. Systems and System Models			
A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.			
Primary School (K-2)	**Elementary School (3-5)**	**Middle School (6-8)**	**High School (9-12)**
Systems in the natural and designed world have parts that work together. Objects and organisms can be described in terms of their parts.	A system can be described in terms of its components and their interactions. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. Models are limited in that they only represent certain aspects of the system under study.	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. Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. Systems can be designed to do specific tasks.

Source: https://ngss.nsta.org/CrosscuttingConcepts.aspx?id=4