Introduction
We examine the types of emergent language 8th grade students in rural Maine middle schools use when they discuss energy in their first experiences with Project-Based Inquiry Science: Energy, a research-based curriculum that models a specific language for talking about energy. By comparative analysis of the curriculum materials to students’ language, we find that students’ talk is more aligned with a Stores and Transfer model of energy than the Forms model supported by the curriculum.

Language and Learning Physics
How students talk about energy is likely to provide clues about how they think about energy. Lemke asserts that “Learning science means learning to talk science” (pg. 1) and Roth and Lawless note that “science as culture is strongly characterized by its language.” (pg. 369) Microanalytic treatment of students’ emergent discourse in science classrooms has proven to be a powerful tool in exploring how students develop new ideas.

PBIS Model of Energy
a) Objects have energy
b) Energy is the ability to cause change and involves change.
c) Energy has different types and can be transformed from one type to another.
d) Energy can be transferred from one object to another.

Forms Model
Objects have different forms of energy that are associated with observable, changeable properties of objects.

Students Talk about Energy
An introductory activity asks students to identify energy transformations in a Rube Goldberg-like cartoon and record their observations on a worksheet. We analyzed selected video episodes for the language students used to describe the energy types in and out of each step in their respective Rube Goldberg machines.

(a) Narrative
- descriptive language
- example: “Girl dumps trash”
  - direct translation of pictures into words: no abstraction
  - venue: provide who, how, why, potentially useful for energy story - misled by students
  - further examples: Burns rope, ball goes down a ramp

(b) Physics Vocabulary
- single-word terminology descriptors.
- example: “Kinetic”
  - focus on physics terminology - application of physics concepts
  - further examples: Potential, Sound, Solar, Heat

(c) Object Acting
- verb-ing + noun
- example: “Trash falling”: Kinetic action
  - grammatical function/meaning unclear - compound word or grammatical error
  - description of the process type is undergoing - details missing
  - further examples: Hand moving, bag inflating

(d) Action on an Object
- verb-ing + noun
- example: “Dumping the trash”
  - verb-ing used at noun: second emphasis on process, trash is vanishing
  - further examples: Pushing a string, burning something

Only the category Physics Vocabulary seems directly related to the PBIS or Forms model of energy. Emphasis on processes in the categories involving verb-ing + noun goes beyond the language used in a Forms model (although processes and mechanisms are important for understanding physical scenarios). A different model places emphasis on processes of transfer and transformation: Stores & Transfer.

Stores & Transfer Model
Energy is stored in three different ways in a system.

- Energy Stores within System
- Motion/temperature, pressure, charge

While the trash is falling, energy is transferred within the system from the position store to the motion store: Transformation of energy.
Mechanism/Process: Work done by gravity.
When trash hits the wheel’s paddles, energy is transferred across the boundaries of the two systems.
Mechanism/Process: Matter transfer from trash-earth system to wheel system.

Conclusion
Students’ use of constructions involving verb-ing and a noun suggests that their thinking is focused on processes. This focus on processes would allow students to describe how energy is stored in a system (e.g. “falling” and “pulling” both describe motion), and how energy is transferred across system boundaries (e.g. matter transfer through “trash falling”, work done by “pulling a string”). We do not mean to imply that students are using the Stores and Transfer model, but rather that their language is more aligned with this model than with a Forms model as used by PBIS.

References