

## THE APPLE STORY—ANALYSIS FOR TEACHERS

FCHgo EPDM Team, October – December 2019

The Apple Story offers a narrative introduction to the subjects of food/fuel and energy and the concepts necessary for pupils to get an intuitive understanding of the role of fuels in our life.

The story setting is an everyday-life environment, and tells about food and natural processes, which are familiar for children of age 8-12.

During production of the story and the illustrations, the authors have imagined roughly 7 or 8 year old children hearing the story. For this reason, hydrogen and fuel cells are not mentioned explicitly. However, sunlight, fuel producers (leaves), fuels (the food in the apples), and “users of fuels” (the children eating the apples) make an appearance and can be taken as an analogy to a purely technical system consisting of Sun, PV cells, electrolyzer, hydrogen, and fuel cell.

In particular, the story deals with:

- forces of nature as agents in natural and technical processes
- energy as a substance-like quantity carried by the agents representing forces of nature

The story introduces pupils to concepts and keywords used in the following didactical path.

With this document, the teacher will learn to recognize and apply the concepts presented in “Hydrogen and fuel cells – How, what for and why?” This should be achieved by analyzing the metaphorical expressions presented in the story. The same metaphors should be recognized in the language of children’s discourses and writing when they describe their everyday life experiences.

The aim of this guide is to help identifying the metaphors used when speaking about forces of nature and energy, and the analogies we use when comparing forces of nature.

In the guide we present, page by page...

- the parts of text which the analysis refers to;
- the analogies between different forces of nature;<sup>1</sup>
- the metaphorical expressions and the underlying metaphor(s);
- [in square brackets] remarks, additional consideration for the teacher, ideas for further discussion.

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<sup>1</sup> Note that an analogy between two subjects is constructed when the same metaphors are used to explain the two subjects. An analogy is recognized by the presence of “like” or “such as” etc. Example of analogy: The food for the body is like the fuel for the car. The metaphors behind this analogy are: FUEL IS A (POWERFUL) SUBSTANCE; FOOD IS A (POWERFUL) SUBSTANCE. Fuel and food allow the machines (car and body) to work



## The Apple Story: Text

p.1. Anna is with her parents at the nearby gas station. She comes from the store. Her father bought her an apple because she said she was very, very hungry. Her mother smilingly says that the fuel she puts in the gas tank of their car is food for the car. Anna eats her apple right away to “fuel up” and to “get her engines running.” “It seems your batteries are recharging,” said her father.

p.2. At home, Anna sees their big apple tree in the yard. It is early Spring. The tree has beautiful new light green leaves. There are still blossoms, and the first tiny apples can be seen hanging from the branches.

It is starting to get darker. Her parents call Anna to dinner. Soon it is time for her to go to sleep. As Anna is falling asleep, she thinks that she can hardly wait for the first apples to grow and become ripe for her to eat!

p.3. In the Summer months that followed, the tree slowly changed. Its leaves grew denser and darker green. Many of the little apples fell from the tree and covered the ground. Those that stayed on the branches of the tree grew bigger and bigger. And very slowly, the skin of the apples turned a golden red.

During this time, the Sun shone, it rained, and the wind blew through the branches and leaves. Unseen by Anna and her friends who often played in the yard, forces were at work changing the tree and making the apples grow. And these forces worked tirelessly, day and night, all Summer long.

p.4. Much of the work of these forces was done in the leaves. On warm, sunny days, in the dry summer wind that gently blew through the tree, the leaves pushed out a lot of water into the air, and the wind carried it away. The water that went away with the wind needed to be replaced in the branches and leaves. The tree drew this water up from under ground where the roots of the tree reached as deep as they could, like big hands in search of water. They took up all the water they could find.

p.5. But some of the water in the leaves had better things to do... The water joined with the sunlight striking the leaves and with the air that went through the pores into the leaves.

p.6. By joining and blending, they created food. Like ghosts, water, light, and air melted into each other and disappeared. In their place, a powerful new agent appeared —FOOD.

p.7. Together, sunlight, air, and water were very powerful. Especially the light from the Sun brought plenty of energy with it. As water, air, and light joined, they freed their energy. The food



took up the energy given to it by the three ghostly substances. It became a powerful substance in their place.

The food kept all its energy until it was needed, until it was used to make the tree grow and be strong. And until it was used by people and animals who would eat the fruit of the tree.

p.8. The food served the tree itself. It made the tree grow stronger... It was also there for the seeds in the apples. When an apple fell to the ground, it could produce a new tree from a seed...

And the food was also there for Anna, and her friends, and her parents. It could serve anyone who ate the beautiful apples the tree was making.

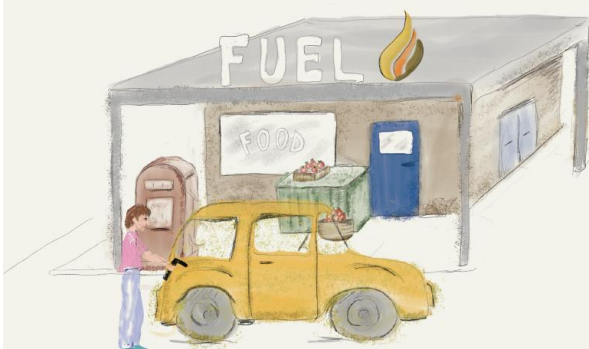
p.9. Food was continuously produced in the leaves from air, sunlight, and water, all summer long. From the leaves it travelled into all parts of the tree and into the growing apples. In the apples, the food was stored—it was not used right away. It was there for the future, for Fall, for Anna.

p.10. On a beautiful Fall day, Anna is playing in the yard with her friends. They are playing long and hard, tirelessly, it seems. They see the tree with its big, red, ripe apples. They go to where a branch, heavy with apples, is hanging especially low. They each pick what they think is the most beautiful apple.

But even children can get tired. They eat their apples. Right away they feel their energy return. Anna's mother is looking out from the window and calls to them. "Well, it seems your batteries are all charged again!"

## The Apple Story: Analysis

Anna is with her parents at the nearby gas station.



She comes from the store.  
Her father bought her an  
apple because she said she  
was very, very hungry.

Her mother smilingly says  
that the fuel she puts in  
the gas tank of their car is  
food for the car.

Anna eats her apple right away to "fuel up" and to "get  
her engines running."

"It seems your batteries are recharging," said her father.

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"Her mother smilingly says that the fuel she  
puts in the gas tank is like food for the car"

Analogy:

The food for the body is like the fuel for the  
car.

Underlying metaphors:

FUEL AND FOOD ARE BOTH SUBSTANCES.

THE CAR AND THE BODY ARE BOTH MACHINES

Other connected metaphors:

SUBSTANCES ARE ENERGY CARRIERS; THE BODY AND THE  
CAR ARE THE COUPLERS/EXCHANGERS.

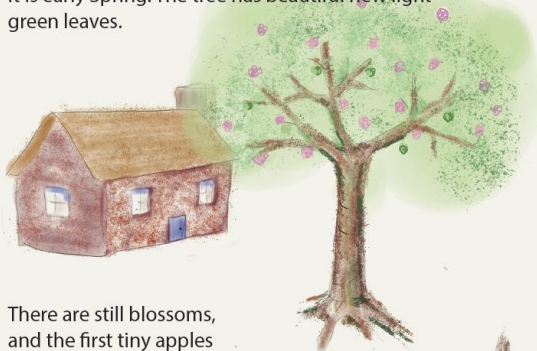
["Anna eats her apple right away to fuel up  
and to "get her engines running." The analogy  
mentioned above is present when Anna feels  
the effect of the apple in her body.]

"It seems your batteries are recharging", said  
her father."

Metaphor:

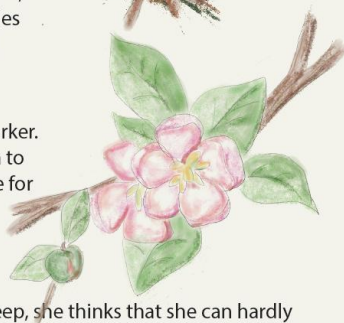
THE BODY IS A CONTAINER OF ENERGY

At home, Anna sees their big apple tree in the yard. It is early Spring. The tree has beautiful new light green leaves.



There are still blossoms, and the first tiny apples can be seen hanging from the branches.

It is starting to get darker. Her parents call Anna to dinner. Soon it is time for her to go to sleep.



As Anna is falling asleep, she thinks that she can hardly wait for the first apples to grow and become ripe for her to eat!

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“Her parents call Anna to dinner. Soon is time to go to sleep.”

[Anna’s body needs to restore its power through food she gets at dinner or eating the apples when they are ripe. The food restores the energy in the body.]

In the Summer months that followed, the tree slowly changed. Its leaves grew denser and darker green. Many of the little apples fell from the tree and covered the ground.

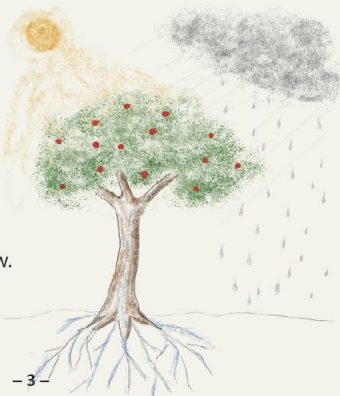
Those that stayed on the branches of the tree grew bigger and bigger.



And very slowly, the skin of the apples turned a golden red.

During this time, the Sun shone, it rained, and the wind blew through the branches and leaves.

Unseen by Anna and her friends who often played in the yard, forces were at work changing the tree and making the apples grow. And these forces worked tirelessly, day and night, all Summer long.



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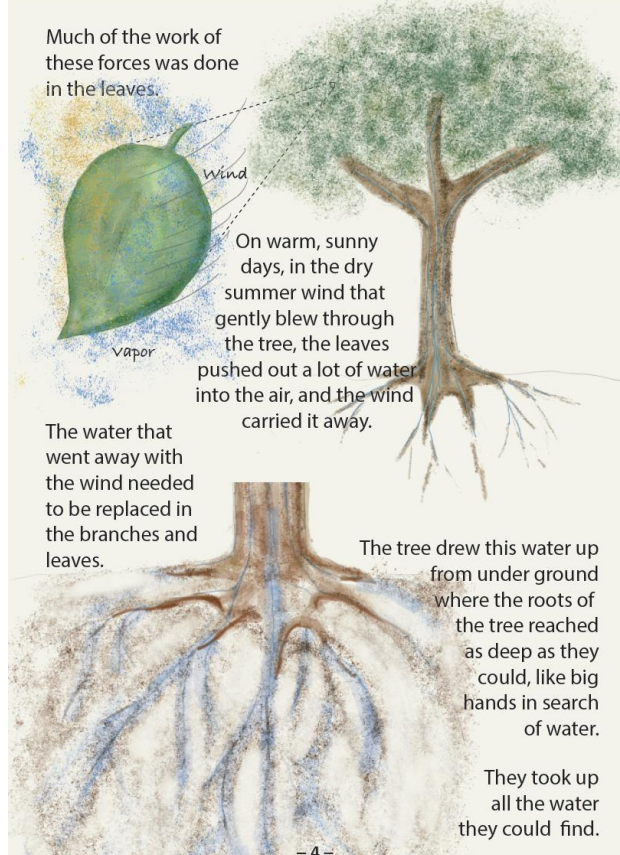
“...the tree slowly... bigger and bigger.”  
[the tree grows like Anna]

“During this time...”

Metaphor:

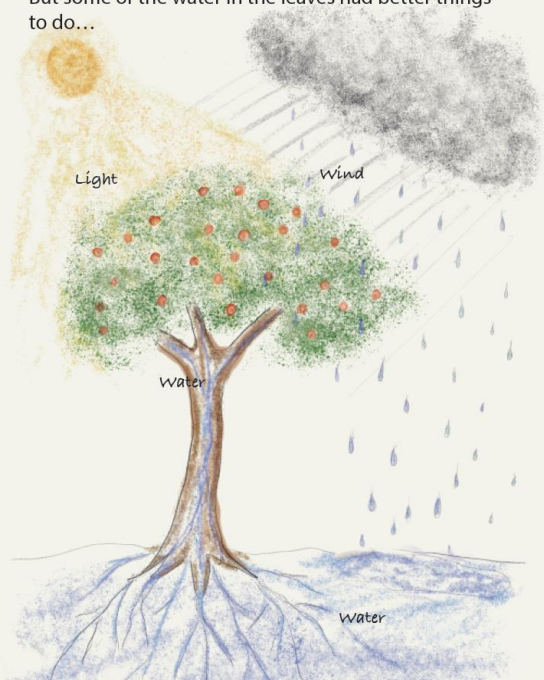
SUNLIGHT, RAIN AND WIND ARE FORCES.

[More scientifically the forces of nature in this story are light, water and CO<sub>2</sub> in the air.]

 <p>Much of the work of these forces was done in the leaves.</p> <p>On warm, sunny days, in the dry summer wind that gently blew through the tree, the leaves pushed out a lot of water into the air, and the wind carried it away.</p> <p>The water that went away with the wind needed to be replaced in the branches and leaves.</p> <p>The tree drew this water up from under ground where the roots of the tree reached as deep as they could, like big hands in search of water.</p> <p>They took up all the water they could find.</p> <p>— 4 —</p>	<p>“Much of the work of these forces was done in the leaves.”</p> <p>Metaphors: SUNLIGHT, RAIN AND WIND ARE FORCES. LEAVES ARE MACHINES OR FACTORIES.</p> <p>“The water that went away with the wind needed to be replaced in the branches and leaves.” [One of the functions of the leaves is to allow evaporation, letting the tree absorb new water from the ground. This, together with capillarity, is the driving force for the circulation of the water in the tree.]</p> <p>“... the roots of the tree reached as deep as they could, like big hands in search of water” Analogy: Roots are like hands.</p> <p>Metaphors: ROOTS ARE INSTRUMENTS (THAT CAN REACH AND CATCH THINGS). HANDS ARE INSTRUMENTS.</p>
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But some of the water in the leaves had better things to do...



The water joined with the sunlight striking the leaves and with the air that went through the pores into the leaves.

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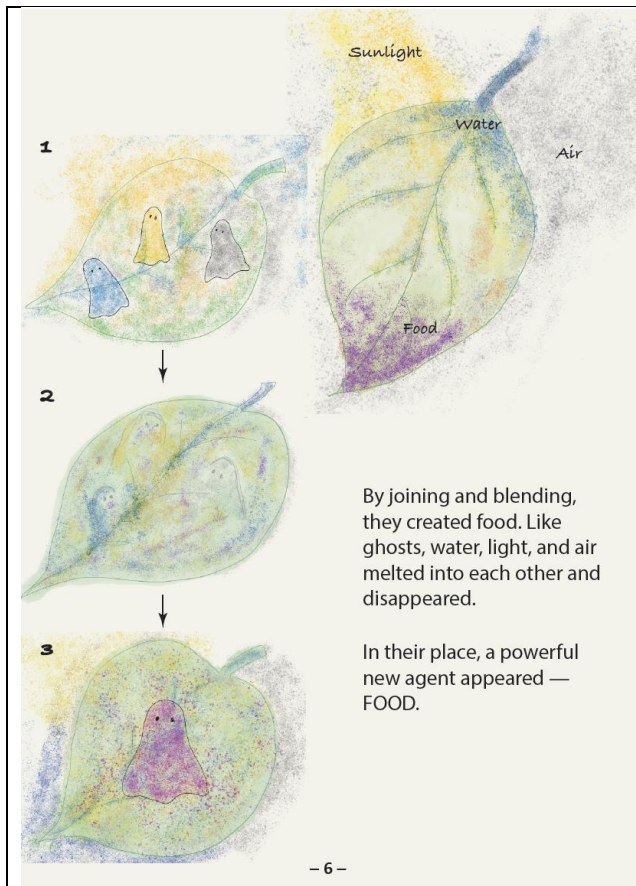
“But some of the water in the leaves had better things to do.”

Metaphor:

WATER IS AN AGENT (THAT CAN DO THINGS)

[Agents represent forces.]





“By joining and blending, they created food.”

Metaphor:

SUNLIGHT, RAIN, WIND, AND FOOD ARE FORCES.

“Like ghosts, water, light and air melted into each other and disappeared. In their place, a powerful new agent appeared: food”.

Analogy:

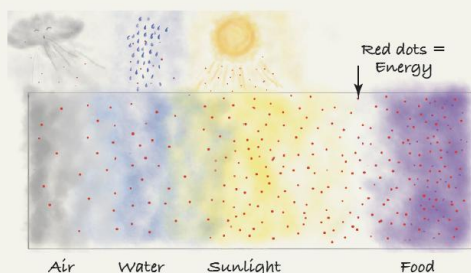
Water, light and air, and food, are like ghosts (agents).

Metaphor:

GHOSTS, WATER, LIGHT, AIR, AND FOOD ARE FORCES.

[Ghosts, like water, air and light, and food disappear and appear.]

Together, sunlight, air, and water were very powerful.  
Especially the light from the Sun brought plenty of energy with it. As water, air, and light joined, they freed their energy.



The food took up the energy given to it by the three ghostly substances. It became a powerful substance in their place.

The food kept all its energy until it was needed, until it was used to make the tree grow and be strong. And until it was used by people and animals who would eat the fruit of the tree.



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“Together, sunlight, air, and water were very powerful. Especially the light from the sun brought plenty of energy with it. As water, air and light joined, they freed their energy.”

Metaphor:

SUNLIGHT, RAIN AND WIND ARE FORCES.

“Especially...”

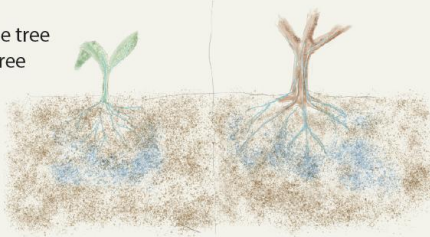
Metaphor:

ENERGY IS A SUBSTANCE AND CAN BE CARRIED/STORED (energy is carried/stored in air, water, light, and food; air water light, and food are energy carriers.)

Metaphorical expressions:

(“...the light from the sun brought plenty of energy with it”; “they freed their energy the food took up the energy carried by the ghostly substances”; “the food kept all their energy”.)

The food served the tree itself. It made the tree grow stronger...



It was also there for the seeds in the apples. When an apple fell to the ground, it could produce a new tree from a seed...



And the food was also there for Anna, and her friends, and her parents. It could serve anyone who ate the beautiful apples the tree was making.



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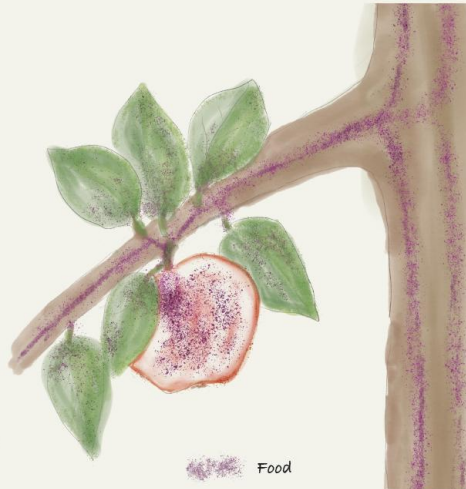
“The food served... It made...”

Metaphor:

THE FOOD IS AN AGENT/FORCE.

(“It made the tree grow stronger”; “it was also there for the seeds”; “the food was also there for Anna and her friends and her parents”.)

Food was continuously produced in the leaves from air, sunlight, and water, all summer long.



From the leaves it travelled into all parts of the tree and into the growing apples. In the apples, the food was stored — it was not used right away. It was there for the future, for Fall, for Anna.

\* \* \* \* \*

“food was continuously produced...”

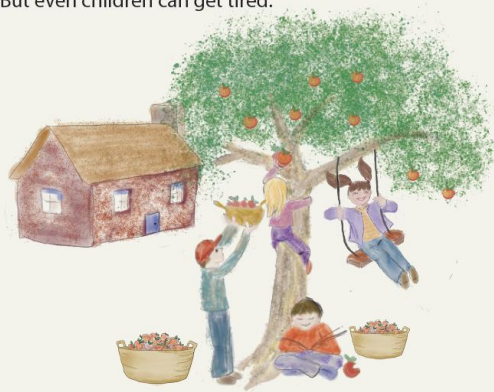
**Metaphor:**

FOOD IS A SUBSTANCE (THAT CAN BE PRODUCED, CAN BE TRANSFERRED, CAN BE STORED)

[Forces/agents/ghosts have a “substantial” aspect—there is more or less of them, they can be “big” or “small”.]

On a beautiful Fall day, Anna is playing in the yard with her friends. They are playing long and hard, tirelessly, it seems.

But even children can get tired.



They see the tree with its big, red, ripe apples. They go to where a branch, heavy with apples, is hanging especially low. They each pick what they think is the most beautiful apple.

They eat their apples. Right away they feel their energy return. Anna's mother is looking out from the window and calls to them. "Well, it seems your batteries are all charged again!"

"They eat their apples. ..."

**Metaphor:**

FOOD (APPLE) IS A FORCE.

"Well, it seems your batteries are all recharged again!" (reference to the father's expression in page 1)

**Metaphors:**

THE BODY IS A CONTAINER OF ENERGY

THE BODY IS A GENERATOR FOR ACTIVITY

[In this story, the human body is the analog of a fuel cell—it uses fuel to drive activities.]