Market forces

The market mechanism of solar panels

Preliminary version

Summary	
This lesson plan is about the effect that occurs when the cost price of the solar panel rises due to circumstances. The government subsidizes sustainable products such as solar panels, but due to the cost increase, this may affect the supply and demand of these products. The pupil investigates the consequences of the cost price increase, but also looks at a possible solution.	
School:	
First name:	
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Comments by teacher:	

1. Introduction

Fewer solar panels in the Netherlands leads to rising raw material prices
The manufacturers of solar panels have to deal with an increase in raw material prices (Figure 1). The price mechanism on the market for solar panels will lead to households installing fewer solar panels. The government fears that its goal of reducing CO2 emissions will not be achieved as a result. That is why the government is considering giving a subsidy to the producer for every solar panel they produce to ensure that more solar panels are installed.

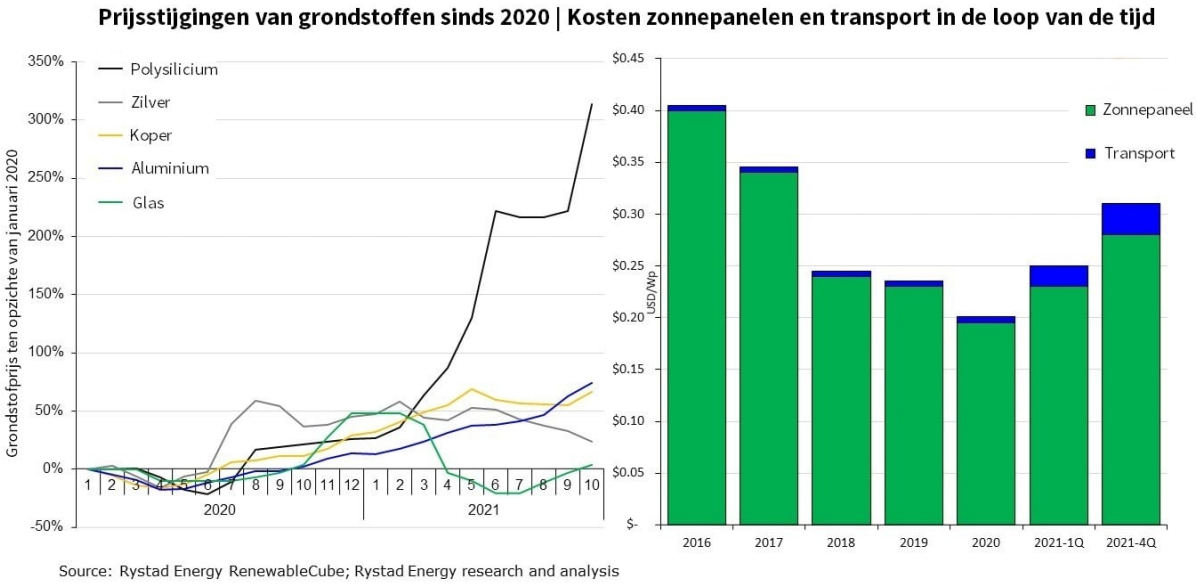


Figure 1. An overview of the raw material prices of a solar panel and the corresponding increase compared to the previous year.

2. Starting Dynalearn

Via a code:

1. Go to Dynalearn (https://create.dynalearn.nl/).
2. Click on 'log in with code', at the bottom left.
3. Enter the project code and your (school) email address.
4. Copy the code from the sender's confirmation email dynalearn.nl (see spam folder) and fill in the other details.
5. Log in to Dynalearn.

By invitation:

1. Copy the login code from the sender's invitation email dynalearn.nl.
2. Go to Dynalearn (https://create.dynalearn.nl/).
3. Log in to Dynalearn.

Let's check!
After logging in, you will automatically enter the workspace of the assignment. You can recognize it by the gray question mark on the right side of the screen  . Is the question mark missing? Then first:

- In Dynalearn, click  . Click on 'Select template'.
- Choose 'Market forces' and press 'Load'.

1. Click on  top left. Change the name to 'Market forces' and click on 'Save'.
2. How do you proceed? Just follow the steps in this workbook. Note! You can't skip steps. Ask for help if you can't figure it out at a certain step. The video function  in Dynalearn shows how a model ingredient can be made. The boxes contain a brief explanation about the model ingredient. Put a check mark √ next to the step you performed. This way you keep track of where you left off.

3. The basic model

1. Read Box 1 about the model parts.

Box 1. Entity and quantities.

An entity is usually a physical thing (e.g., car, human) in a system.
A quantity is a measurable property of an entity (e.g., temperature, length).

2. Read Box 2.

Box 2. Help function

If the question mark or an ingredient in your model is red, then something is wrong. Click the question mark for a hint. Then click on a number, for example 1 to see where the error is in your model.

3. Try out the help function by changing the *Cost price* quantity to, for example, *Price*. See which error message you get. Then change the name back to *Cost price*. Only use the question mark if you can't figure it out yourself!

4. Read Box 3.

Box 3. A cause-effect relationship

In Dynlearn, there are two types of relationships:

- Positive relationship: the quantities change in the same direction (if quantity 1 increases, then quantity 2 also increases)
- Negative relationship: the quantities change opposite (if quantity 1 increases, then quantity 2 decreases. Or vice versa: if quantity 1 decreases, then quantity 2 increases)

5. Complete the model so that it shows: how an increase in raw material prices leads to a decrease in the purchase of solar panels by households. To do this, place **four** cause-effect relationships (see ->). Start with the quantity *Cost price* and reason the relationships with the other quantities.
   a. Pay attention to the right direction (from which quantity to which other quantity?)
   b. Is it a negative or a positive connection?

6. You can keep the model organized and clear by using a number of buttons at the bottom of the screen. Click to align everything neatly. Click to make your model fit on the screen. Use these buttons regularly.

Has the question mark turned gray in the meantime? If so, you have completed steps 1 to 3 correctly.

4. The effect of cost price

You will now check the model through a simulation.

1. Read Box 4.

Box 4. Change of a quantity.

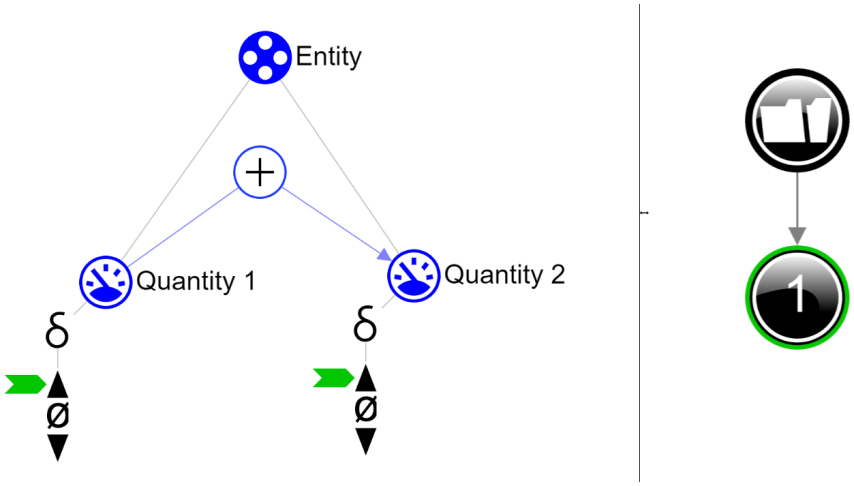
A quantity can change. This is indicated by . The delta symbol (δ) is the mathematical sign for change (also called the derivative). The down arrow (▼) is a decrease, the zero (Ø) is constant and the up arrow (▲) is an increase.

2. There are three possible initial situations. The amount of *Cost price* may decrease, remain the same or increase. Set as initial change (see ->):
   a. Let's start with an amount of sunlight that increases. Under *Cost price,* click ▲ and choose . It looks like this:

3. Read Box 5.

Box 5. Read the outcome of a simulation.

After starting a simulation (with), a window appears on the right in which the possible states of the system are indicated. There is one possible state in this example .



You can click on the state to view the outcome. The condition then acquires a green edge. In the model, the change for this state is indicated by a green arrow . The model shows that in state Quantity 1 increases (due to an increasing exogenous influence) and that therefore Quantity 2 also increases.

4. Read Box 6.

Box 6. Help function

If the explanation mark appears ⓘ, something is wrong during the simulation. Click on the explanation mark ⓘ for a hint. Then click on a number, for example ❶, to see where the error is in your simulation.

5. Start the simulation .

6. Make the following sentence correct (by always keeping 1 option):

If the cost/profit margin of solar panels for producers increases, then the cost/profit margin of solar panels for producers will *decrease/remain the same/increase*. As a result, the amount of solar panels produced by producers will *decrease / remain the same / increase*. As a result, the price of solar panels for traders will *decrease/remain the same/increase*, after which the quantity of solar panels purchased by households will *decrease/remain the same/increase.*

5. What quantity influences market forces?

1. Add the entity *Government* (see ->).

2. Add the quantity *Subsidy* (see ->).

3. The quantity *Subsidy* has a cause-effect relationship with one other quantity in this model.

   Add the missing cause-effect relationship to the model (see ->).
   a. Pay attention to the right direction (from which quantity to which other quantity?)
   b. Is it a negative ⊖ or a positive ⊕ relationship?

You will check the model again with the help of a simulation.

4. In addition to the initial situation of the cost price, the initial situation of the subsidy can now also vary. It is not difficult to predict what will happen if the cost price decreases and the subsidy increases. And it is not difficult to predict that the cost price will increase, and the subsidy will decrease. But what if both increase? Put *Cost price* on increase and *Subsidy* on increase. Simulate the model.

5. How many states are there? If all goes well, there are three possible outcomes... We call this **ambiguity.**

6. Make the table below correct (remove errors or cross out). Give a brief explanation for each situation.

Results	**Amount of Families**	**Give your explanation**
State 1	*decreases/stays the same/increases*	

State 2	*decreases/stays the same/increases*	
State 3	*decreases/stays the same/increases*	

7. Read box 5 to determine if your model is complete.

Box 5. Progress bar

At the bottom of the screen is the *progress bar* (see example below).
Entity says: 4/4 /0, this means: 4 created, 4 needed, 0 error. For quantity it says : 5/17/1: this means: 5 made, 17 needed, 1 error. If all the numbers are green, that type is settled.

8. Now we are curious about which simulation outcome the government wants to achieve (so 1, 2 or 3). Define which state this is. Give a brief explanation. *So only from the simulation that reflects what the government wants to achieve!*

State ... , because ...

9. Name another example of a sustainable product similar to the market mechanism of solar panels. Also explain what exactly the government would like to achieve with that sustainable product.

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