

Learning by Ear – General Knowledge, Episode 5 “How do you get electricity from sunrays?”

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Directing infos

People:

Announcer

Jenny: ca. 14-year-old girl

Jack: ca. 15-year-old boy

Daniel: ca. 16-year-old boy

Engineer/shopkeeper Man, ca. 30-40 years old

Locations:

Schoolyard

In front of a sports ground/football ground

At Daniel's home

In the shop

Atmos / Sounds:

Whirring insects in the heat...

School bell (Gong... whatever is typical depending on region)

Children's voices, noisy, talking across each other, loud

Steps coming closer

Steps, strolling, coming closer

Fast steps going away

Steps, slow, going away

Sports ground: children's voices' playing (football game?), from a distance

A pile of books crashes to the ground (not thrown but "put down with force")

Knocking at the door, door is opened

Metal screeching

Metal hook latches into the eye, the pot-lid rattles onto the latch,

Pamphlets rustling

Jenny points at the lines on the pamphlet

Opening of newspaper, smoothing out pages

Electric shop bell, door opens
Newspaper rustles

INTRO (Announcer):

Hello and a warm welcome to all of you who want to learn with your ears. You're listening to a brand new episode from Learning by Ear's "General Knowledge" series. The series about all those things we take for granted without really taking time to find out how they work. This time, we're going to find out all about solar energy, and about photovoltaics. Jack and Jenny are sweltering again and not only because it's hot. Today, they've put all their energy into finding out how the sun works and whether it can produce electricity. And it's hard work -- especially as they have two different opinions, of course! Moreover, they've got a bet running to see who's right. It could be embarrassing for the loser!

1. Scene:

- 1. Atmo:** **Whirring insects in the heat...**
- 2. Atmo:** **School bell (Gong... whatever is typical depending on region)**
- 3. Atmo:** **Children's voices, noisy, talking across each other, loud**

Steps coming closer

Jenny: *(comes running, calling, out of breath, wheezing)*
"Jack! Jaa-ack ... hang on a second"... *(gasps)* ...

Jack: "Jenny! Great to see you! How are you?"

Jenny: "Great, of course! I'm on my way to training! Football, remember? We're starting up a girl's team. Hey -- why don't you come? You could surely show us a couple of tricks!"

Jack: "In this heat? Sheer waste of time! You're crazy -- all you football girls are going to faint one after the other in this heat!"

Jenny: *(laughing)*
"Chicken! That little bit of sun -- what can it possibly do to us?"

Jack: *(annoyed, jealous of Jenny's "football fever")*
"Seems to me that that little bit of sun has managed to dry up your brain! Girls and football! Tut! *(know-it-all and superior)* My dear Jenny, don't you know that the sun can run whole power stations? Power stations, which in turn, can supply electricity to whole cities."

Jenny: *(a bit annoyed now, dry)*
"Of course it can! And I can de-root a tree with one puff! Where does this nonsense come from -- as if the sun could produce electricity!"

Jack: *(triumphant)*
"I read it somewhere."

Jenny: "You read it somewhere -- well that's a surprise now! So how does it produce electricity then?"

Jack: *(uncertain, wrong-footed)*
"Er, um, er, well, the sun rays shine and then the heat and the..."

Jenny: *(triumphant)*
"Now I understand."

Jack: *(a bit sheepishly)*
"Oh Jenny, you don't know anything yourself so you can always make fun! But there really are solar power stations!"

Jenny: *(conciliatory)*
"Listen: I've got football training in an hour's time from now. I give you an hour to find out how the sun produces electricity and in the meantime I'll do a bit of my own research. Let's meet at the sports ground later and discuss what we've found out -- if you're talking rubbish you have to play football with us!"

Jack: *(shocked, eager)*
"But if I'm right and you finally understand have an inkling of how solar power works then you have to skip football and come drink a Coke with me. OK?"

Jenny: "OK you're on! Let's go then -- see you in an hour!"

4. Atmo: Fast steps going away

MUSIC

2. Scene:

1. Atmo: **Whirring insects in the heat...**

2. Atmo: **Sports ground: children's voices' playing (football game?), from a distance**

3. Atmo: **Fast steps coming closer
wheezing / breathing out (Jenny comes running up,
out of breath, gasping)**

Jack: "There you are finally, Jen! (*teasing*) It must have taken you ages to find out what you didn't want to find out! You look exhausted!"

Jenny: (*triumphant*)
"Oh you can make fun of me! But you won't be laughing later when you're playing football with us -- I'm sure you'll be a good goalkeeper! You may as well start putting on your socks and trainers, my dear because I have won the bet!"

Jack: (*amused*)
"Oh really? So tell me what you found out, or didn't find out, rather! I am all ears, my dear!"

Jenny: "Well, I was at Daniel's"

Jack: *(interrupts her shocked)*
"At DANIEL'S? Daniel from eighth grade -- that Daniel?"

Jenny: *(a bit superior)*
"Yes, that Daniel! *(aping Jack)* The Daniel who actually thinks before he speaks! I remembered that his dad works for an environmental organization and I went to see him and: *(as if making an unpleasant admission)* yes, they are actually making something to do with solar energy..."

Jack: *(calmed, already triumphant)*
"You see!"

Jenny: *(interrupting Jack)*
"Not too fast mister! *(small pause, then chatters on)* I ran to Daniel's thinking I would ask his dad..."
chatterchatterchatter...

(fade away during the chatter and cross-fade in next atmo)

5. Atmo: **Knocking at door (Jenny knocks at Daniel's), door is opened**

Daniel: *(surprised)* "Jenny!" *(flattered)* Are you looking for me? Come in! What can I do for you?"

Jenny: "Hello Daniel! Well I was actually looking for your father. Is he here? He works for that environmental organization doesn't he?"

Daniel: *(disappointed)*
"Oh, I see... No, he isn't here but, yes, he does work for an environmental organization. *(eagerly)* But maybe I can help -- I often go with him on trips. What do you need to know?"

Jenny: *(hesitant)*
"Well, it's just that Jack was saying that the sun can produce electricity. And I don't believe that. *(now "committed")* And we've got a bet going that neither of us will manage to convince the other within the space of one hour. Basically I have to manage to persuade him that the sun doesn't produce electricity and he..."

Daniel: *(interrupts Jenny)*
"I understand *(showing off)* Relax *(making fun)*
Electricity from the sun! Typical Jack -- what a madman! Of course, you're right! And I can explain why -- come with me!"

6. Atmo: Metal screeching

Daniel: "Look at this, this is a solar cooker. This is what my dad is setting up with his environmental organization. This big, shallow, shiny dish is a mirror. A pot can be

suspended over it with this bracket here just above the most concave part of the mirror. Like this..."

7. Atmo: **Metal hook latches into the eye, the pot-lid rattles onto the latch,**

Daniel continues:

"Then you place the cooker right in the direct sunlight so that the rays shine onto the device. The rays bounce off the mirror, which is curved in a particular way, and all of them focus on a particular point, located conveniently just under the pot and then it can get as hot as a fire."

Jenny: *(impressed)*
"Wow!"

Daniel: *(enthusiastic)* "It's great, isn't it? So you can use this pot to cook without making a fire -- without having to burn any wood. The sun is enough! But that has nothing to do with electricity! Sorry Jacky-boy!!"

8. Atmo: **Rustling of paper**

Daniel: "Here, you can take a pamphlet in case he doesn't believe you!"

9. Atmo: **Whirring insects in the heat...
Sports ground: children's voices' playing (football game), from a distance**

Jenny: *(talking to Jack again, triumphant)*
"So, here it is, Jacky -- black on white!"

10. Atmo: **Jenny points at the lines on the pamphlet**

Jenny: "The sun can heat water and even cook but provide whole cities with electricity -- I doubt it!!"

Jack: *(cool, jealous too)*
"I'm impressed Jenny. But you and your clever Daniel have missed out half of the equation and that's photo-voltaics. It's not enough to use your dad's recycled knowledge if you want to show off, Danny-boy! Jenny listen to me and look at this newspaper... Look here!"

11. Atmo: **Opening of newspaper, smoothing out pages**

Jack, continuing:
"... Here...*(reading)* 'Africa's largest solar power plant, located in Kigali, the capital of Rwanda, has started feeding electricity into the grid.' That was in June 2007. I remember it from then."

Jenny: *(a bit huffily, imitates him)*
"I remember it from then!" But anyway you didn't know how this photo-vol- whatever power plant works!"

Jack: *(annoyed as well)*
"Oooh, listen to you! Let me continue *(reading aloud)* '
The solar power station consists of 4,000 thin-film
modules with a module surface area of about 3,000 m².
The operator estimates the station will produce some
325,000 kilowatt-hours of electricity annually.' There
you are! But I needed to find out what thin-film modules
and kilowatt-hours actually are. So I went to ask Mr.
Mbaná -- you know that guy who studied engineering
and now sells everything to do with electricity..."
blablabla

(fade out during the blabla and cross-fade with next atmo)

12. Atmo: **Electric shop bell, door opens**

Jack: "Hello, anybody here?"

Engineer/

shopkeeper: *(busy, a bit distracted)*

"Hello, what's up? Do you need new batteries for your
walkman?"

Jack: "No, not really -- I wanted to ask, well basically Mr.
Mbaná, do you know what a thin-film module is?"

Händler: "A thin-film module? For a walkman?"

Jack: *(impatient)*

"No, not a walkman, I'm talking about a solar power plant. I read about a solar power plant in Rwanda. Look here:"

13. Atmo: **Jack flips through to the right page in the newspaper**

Jack continues:

"It's in Kigali apparently and it's the biggest solar power plant in Africa. I just want to know how a solar power plant actually works and I thought you might be able to help me out..."

Engineer/

shopkeeper: *(stroppily)*

"Listen, either you want to buy something or you can just get out -- I've got no time for all this nonsense..."

Jack: "Please! It's an emergency situation! If I can't explain how it works I'm going to have to play football in a girls' team!!!!"

Engineer/

shopkeeper: *(immediately showing solidarity)*

"Oh my God! We can't let that happen, can we? Show me the newspaper article!"

14. Atmo: **Newspaper rustles**

Engineer/shopkeeper continues:

"Well, look here on the photo there are long rows of metal frames. And there are these bluish-black squares on them, which are shining. Like huge table tops all next to each other. These plates are solar panels. They can be bluish-black or bluish-silver or even pink depending what they're made of. The bluish-silver ones are made of wafer-thin layers of silicone whereas the darker ones here could well be made of Cadmium Telluride -- that's a heavy metal. And then on top of them there is a glass plate for protection. When the sun shines on these cells they produce electricity."

Jack: "That's easy. Can it also work with an old scrap of metal? Aluminum for instance?"

**Engineer/
shopkeeper:** "No! You have to use a material which has photoelectric qualities."

Jack: "Photoelectric qualities? What does that mean?"

**Engineer/
Shopkeeper:** "There are tiny particles in the layers of silicone or Cadmium Telluride called electrons. And sunlight is also made up of tiny particles -- photons. And when the sun shines on the solar panels, the photons jostle the electrons and they start to move around."

Jack: "Like if I got hit by a fast ball playing football and began to wobble a bit and may be fall over...."

Engineer/

shopkeeper: *(laughing)*

"Exactly, you would start wobbling from the impact and you would jostle somebody, who would go reeling, and then might jostle somebody etc etc. You're worked up about his football match, aren't you? But we'll get you out of it, you'll see... In the solar panel, the electrons are basically pushed behind one another and then they march out of the side of the solar panel, so to speak."

Jack: "So one solar particle makes an impact and then lots of little particles in the solar panel all make a step in the same direction and because there are so many of them making steps one after the other a whole movement is created?"

Engineer/

shopkeeper: "Exactly! And that movement is electricity! And that's why it's called photo-voltaic because it's a photoelectric effect."

15. Fade in atmo: sports ground in the background

Jack: **(talking to Jenny again, proudly)**

"'Great,' I said to Mr. Mbana 'thanks for getting me out of the girl's football game'. You do agree, Jen, that I've won the bet, don't you?"

Jenny: *(meekly)*

"Um"

Jack: *(triumphant)*

"By the way, the solar power plant in Kigali produces enough electricity for 15,000 people a year!"

Jenny: *(a bit stropily)*

"OK, OK, I get the picture. No football for me after all -- let's go drink that Coke then..."

16. Atmo: **Steps**

Jenny: *(surprised, annoyed)*

"Come on then! Why are you still sitting there?"

Jack: *(embarrassed)*

"Jenny, to be honest, I don't, erm, I don't, I'm completely broke, I don't have any money ... *(showing off, cool)* But how about I come with you to football and I show you and the other girls a few tricks... Come on let's go..."

(fade out and cross fade next atmo)

**15. Atmo: Jenny laughs, fast steps, getting quieter
 Football game atmo (getting louder)
 (Jack und Jenny walk away teasing each other,
 making their way towards the football game)**

OUTRO (Announcer):

After the game, Jenny and her friends were very impressed by Jack's back-heels, his curving crosses and his step-overs but not so impressed that he had to keep pausing because of the heat! Thanks for listening to this episode of "General Knowledge" and don't forget to tune in next time for another journey into science. Today's journey was undertaken by our writer, Lydia Heller. If you would like to hear it again or find out more, please visit our website www.dw-world.de/lbe.