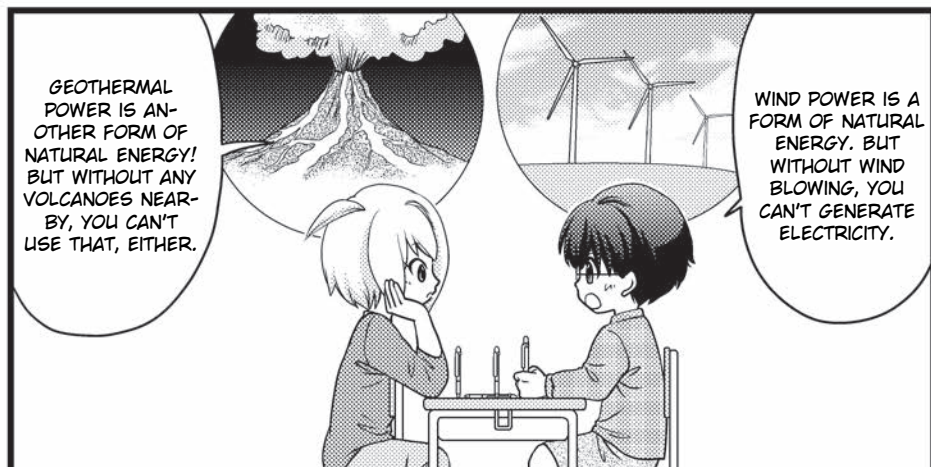
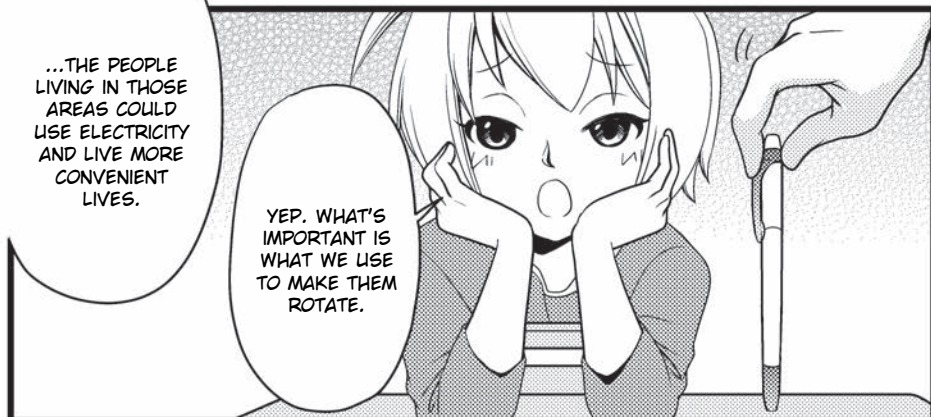
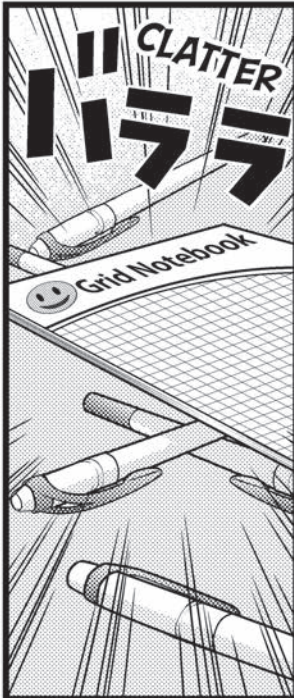
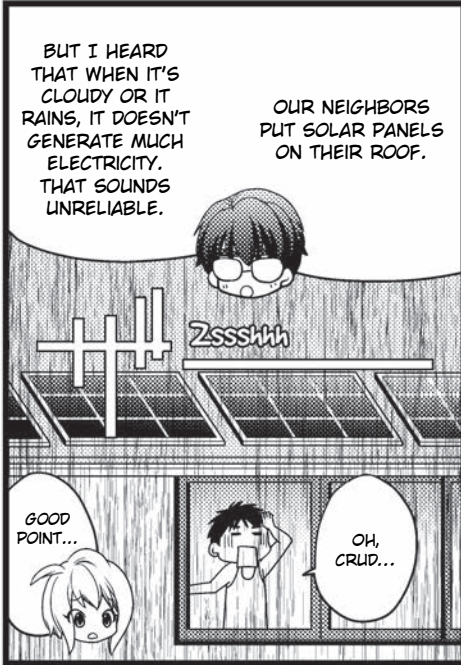


THE SECRET WEAPON IS HYDROGEN POWER!







CHAPTER 3: THE SECRET WEAPON IS HYDROGEN POWER!

TRIVIA

SOLAR POWER USES SEMICONDUCTORS MADE FROM SILICON TO TAKE IN LIGHT AND CONVERT THE LIGHT ENERGY INTO ELECTRICAL ENERGY.



Oh yeah!
THE GAS DETONATION HOSE EXPERIMENT!

ENERGY... ENERGY...
HMM? REMEMBER THE HOSE EXPERIMENT FROM THE OTHER DAY...?



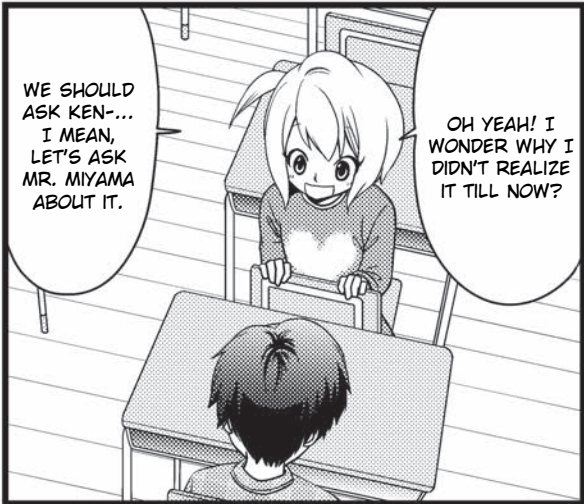
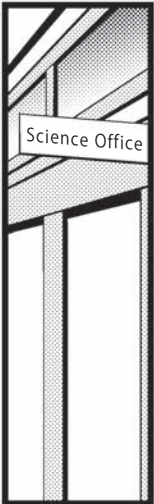
ISN'T THERE SOME OTHER FORM OF ENERGY OUT THERE...?



THAT'S RIGHT! I ALMOST FORGOT ABOUT THAT!

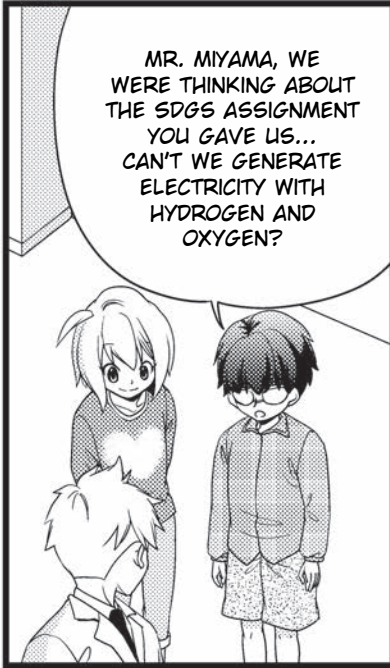
CLATTER
たた

THE ONE THAT COMBINES OXYGEN AND HYDROGEN! I WONDER IF WE COULD USE THAT ENERGY?



WE SHOULD ASK KEN... I MEAN, LET'S ASK MR. MIYAMA ABOUT IT.

OH YEAH! I WONDER WHY I DIDN'T REALIZE IT TILL NOW?



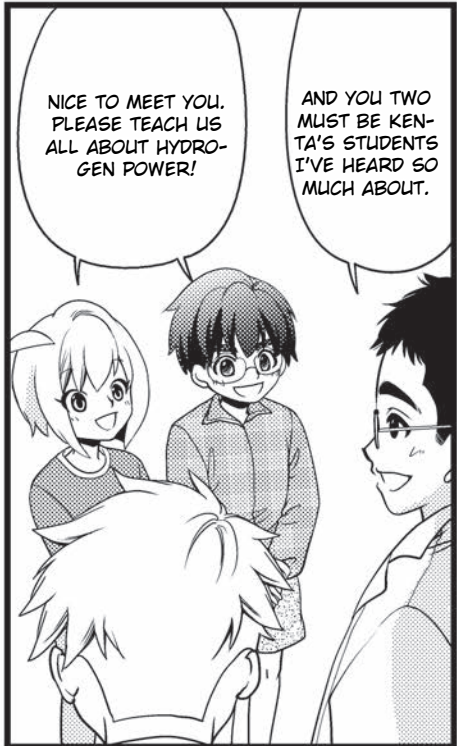


CHAPTER 3: THE SECRET WEAPON IS HYDROGEN POWER!

TRIVIA

NATURAL GAS, COAL, AND OIL ARE ANCIENT PLANTS AND ANIMALS THAT WERE BURIED UNDER THE EARTH AND SLOWLY TURNED INTO FOSSIL FUELS OVER A LONG PERIOD OF TIME.







CHAPTER 3: THE SECRET WEAPON IS HYDROGEN POWER!

TRIVIA

NATURAL GAS IS THE GAS FOUND IN THE UPPER PORTIONS OF POCKETS OF OIL LOCATED IN THE EARTH.

UNLIKE NATURAL ENERGY, THERMAL POWER LETS US GENERATE JUST THE AMOUNT OF ELECTRICITY WE NEED, WHEN WE NEED IT.

THERMAL POWER GENERATES ELECTRICITY ACCORDING TO THE AMOUNT OF FUEL. IT'S CONVENIENT BECAUSE YOU CAN VARY IT BASED ON HOW MUCH FUEL YOU USE.

BUT THERMAL POWER GENERATION EMITS CARBON DIOXIDE.

EXACTLY. ACTUALLY, OUR THERMAL POWER GENERATION EQUIPMENT IS USED IN MORE THAN 60 COUNTRIES AROUND THE WORLD.

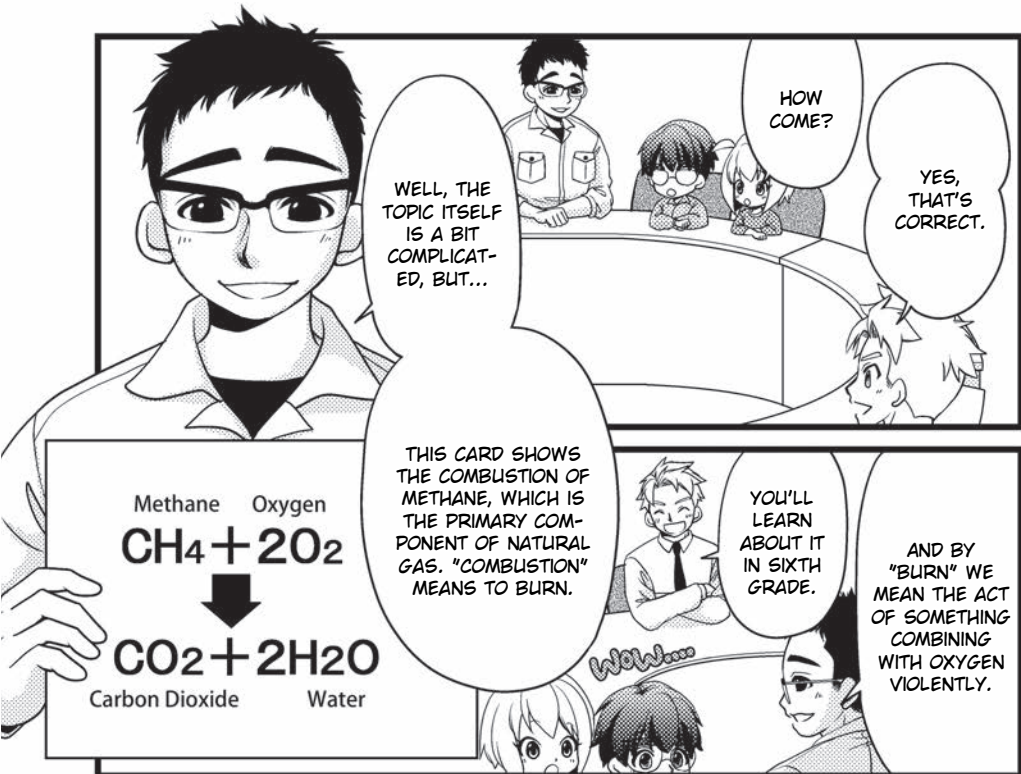
HOWEVER, THE FACT REMAINS THAT WE'RE PRODUCING CARBON DIOXIDE, SO WE AT MITSUBISHI ARE THINKING OF CONVERTING EVERYTHING OVER TO HYDROGEN POWER.

THAT'S BECAUSE HYDROGEN POWER DOESN'T PRODUCE CARBON DIOXIDE, RIGHT?

WOW, I HAD NO IDEA!

YES, BUT THE TECHNOLOGY HAS MADE GREAT ADVANCEMENTS. THE NEWEST THERMAL POWER STATIONS, WHICH BURN NATURAL GAS, PRODUCE LESS THAN HALF OF THE CARBON DIOXIDE PRODUCED BY BURNING COAL. YET, IT STILL GENERATES THE SAME AMOUNT OF ELECTRICITY.

Category	Emission Rate (g-CO ₂ /kWh)
Coal-Fired Thermal Power	~1000
Present	~500



WELL, THE TOPIC ITSELF IS A BIT COMPLICATED, BUT...

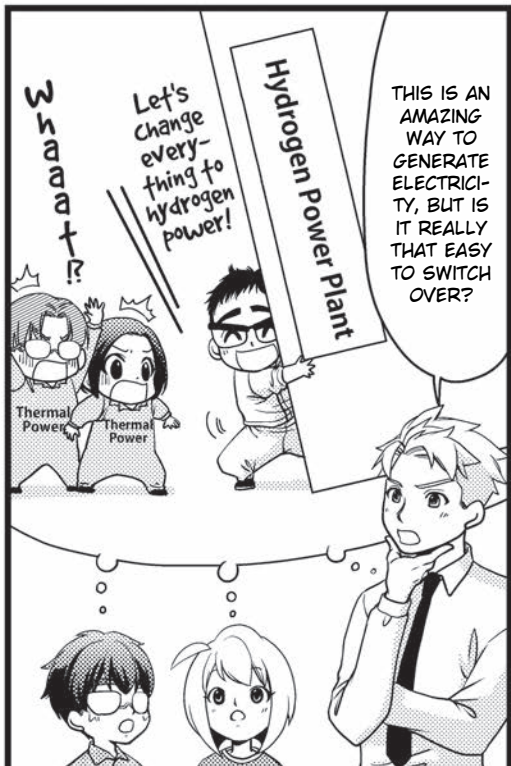
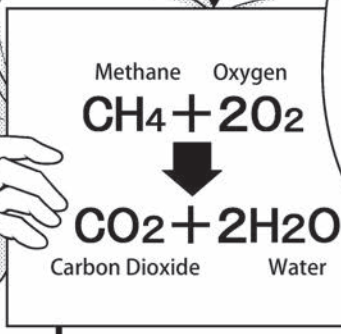
HOW COME?

YES, THAT'S CORRECT.

THIS CARD SHOWS THE COMBUSTION OF METHANE, WHICH IS THE PRIMARY COMPONENT OF NATURAL GAS. "COMBUSTION" MEANS TO BURN.

YOU'LL LEARN ABOUT IT IN SIXTH GRADE.

AND BY "BURN" WE MEAN THE ACT OF SOMETHING COMBINING WITH OXYGEN VIOLENTLY.



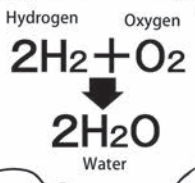
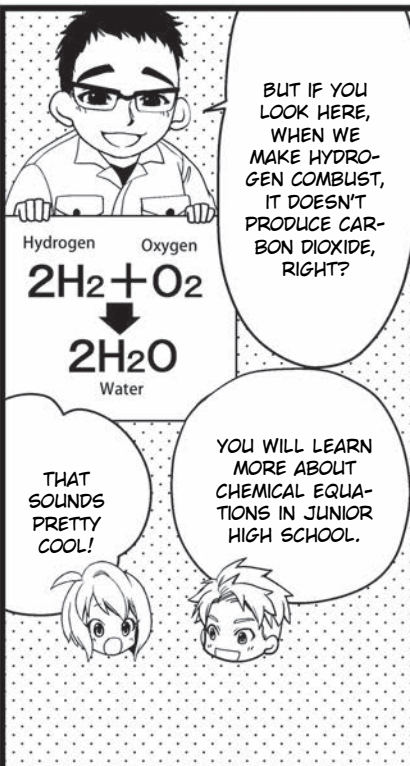
Hydrogen Power plant

THIS IS AN AMAZING WAY TO GENERATE ELECTRICITY, BUT IS IT REALLY THAT EASY TO SWITCH OVER?

Let's change everything to hydrogen power!

Swampy?!

Thermal Power Thermal Power



BUT IF YOU LOOK HERE, WHEN WE MAKE HYDROGEN COMBUST, IT DOESN'T PRODUCE CARBON DIOXIDE, RIGHT?

THAT SOUNDS PRETTY COOL!

YOU WILL LEARN MORE ABOUT CHEMICAL EQUATIONS IN JUNIOR HIGH SCHOOL.



CHAPTER 3: THE SECRET WEAPON IS HYDROGEN POWER!

CHECK OUT PAGE 12 FOR MORE!



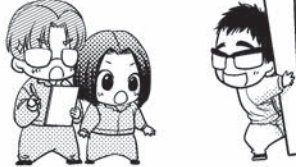
THAT'S WHY WE START BY MIXING THE FUEL SO THAT 30% OF IT IS HYDROGEN.

WELL, WE WON'T BE ABLE TO DO IT IMMEDIATELY.

WE CAN CUT OUR CARBON DIOXIDE EMISSIONS JUST BY REPLACING THE COMBUSTORS.

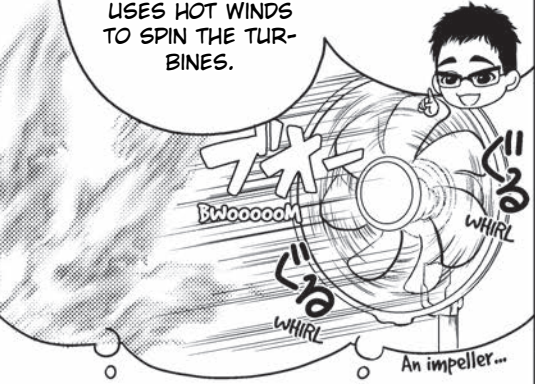


THAT WAY WE JUST HAVE TO REPLACE THE COMBUSTORS IN THE GAS TURBINES.



HAVEN'T YOU ALREADY HEARD THAT HYDROELECTRIC POWER USES THE FORCE OF WATER TO ROTATE THE WHEELS? WELL, THERMAL POWER USES HOT WINDS TO SPIN THE TURBINES.

OH, RIGHT. I HAVEN'T EXPLAINED THOSE YET. TURBINES ARE GIANT FANS THAT SPIN GENERATORS.



An impeller...

I ALSO DON'T GET WHAT A COMBUSTOR IS.

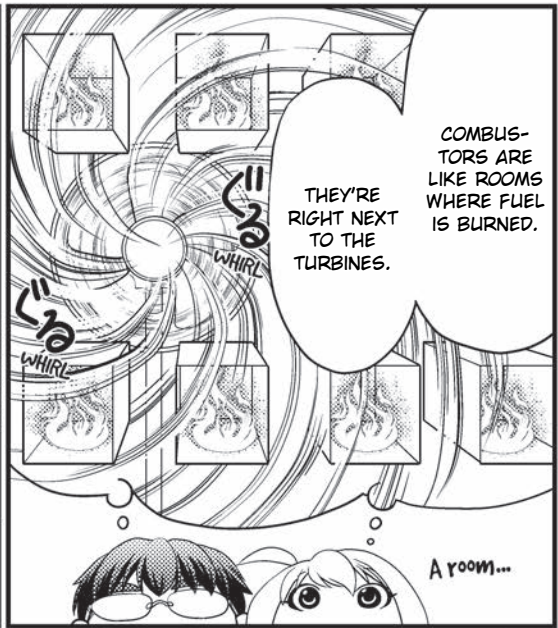
WAIT A SECOND. "TURBINE"? WHAT'S THAT?





WHEN YOU EXPLAIN IT LIKE THAT, IF ALL YOU HAVE TO DO IS REPLACE THE COMBUSTORS, IT DOES SEEM PRETTY EASY.

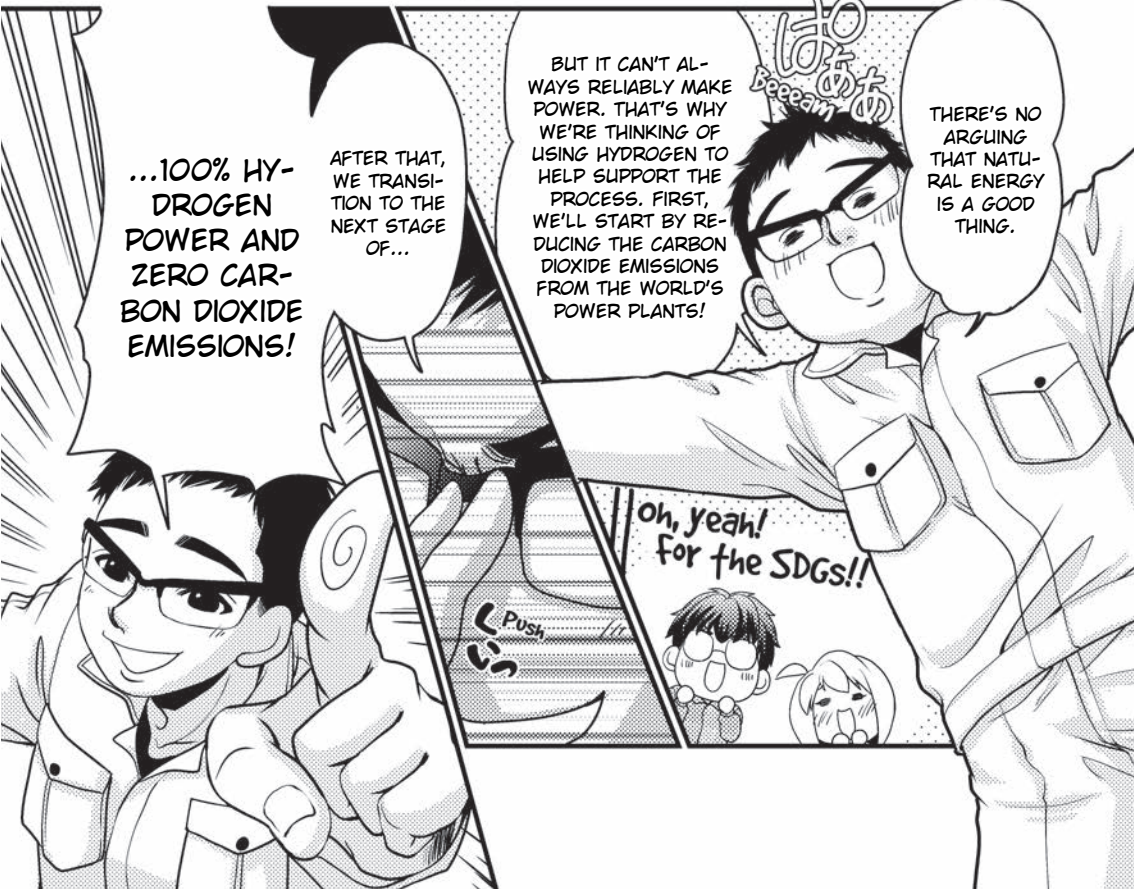
RIGHT?



THEY'RE RIGHT NEXT TO THE TURBINES.

COMBUSTORS ARE LIKE ROOMS WHERE FUEL IS BURNED.

A room...



...100% HYDROGEN POWER AND ZERO CARBON DIOXIDE EMISSIONS!

AFTER THAT, WE TRANSITION TO THE NEXT STAGE OF...

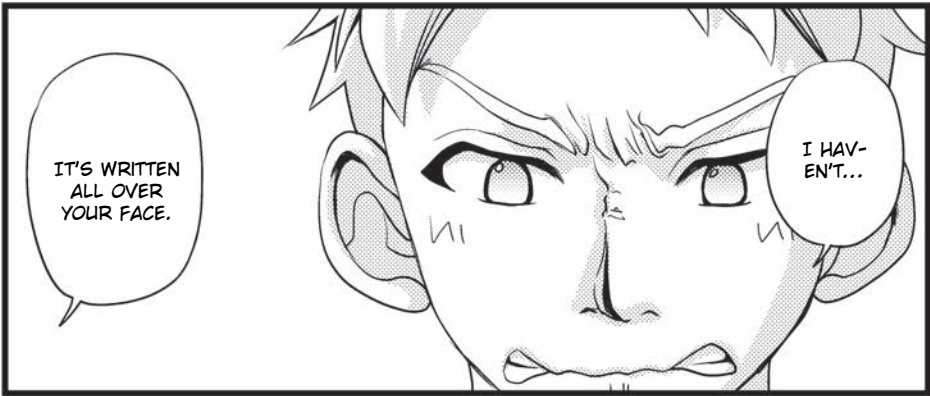
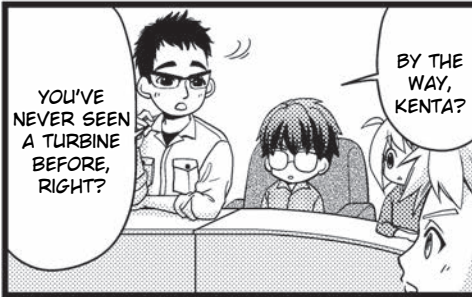
BUT IT CAN'T ALWAYS RELIABLY MAKE POWER. THAT'S WHY WE'RE THINKING OF USING HYDROGEN TO HELP SUPPORT THE PROCESS. FIRST, WE'LL START BY REDUCING THE CARBON DIOXIDE EMISSIONS FROM THE WORLD'S POWER PLANTS!

THERE'S NO ARGUING THAT NATURAL ENERGY IS A GOOD THING.

Oh, yeah! For the SDGs!!

Push...

CHAPTER 3: THE SECRET WEAPON IS HYDROGEN POWER!





WHAT'S HYDROGEN?

Hydrogen only creates water when combusted. So, what is hydrogen exactly?

The Smallest Element

Everything in our world is made up of elements. There are more than a hundred different types. Oxygen, aluminum, and iron are all elements, and hydrogen is the smallest.

WATER IS SOMETHING EVERYONE'S FAMILIAR WITH.



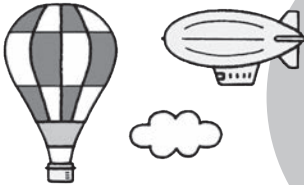
The Most Common Element in the Universe

Iron is the most common element on Earth. When we look at the universe, hydrogen is the most common, and it makes up almost 90% of everything. Our own sun is made up of about 85% hydrogen.



The Lightest Material

Hydrogen has one fourteenth the weight of air. It's the lightest material in the universe, and in older times, hydrogen gas was used to fill weather balloons and airships. Furthermore, hydrogen is harmless to the human body, colorless, transparent, tasteless, and odorless.



Ample in the Earth's Water

Most of the air we breathe doesn't have hydrogen in it, but there's a lot of it in our water. Water is made up of oxygen and hydrogen atoms and is denoted as H₂O.

Hydrogen's chemical symbol is H which comes from the "h" in "hydrogen." Hydrogen is a gas at room temperature, a liquid at -253°C (-423.4°F), and a solid at -259°C (-434.2°F).

Hydrogen Molecule H₂

Hydrogen Atom

Hydrogen Atom

Normally, when hydrogen is in gas form, it exists as a molecule made up of two hydrogen atoms.

Oxygen Atom

Hydrogen Atom

Hydrogen Atom

Water Molecule H₂O

Easily Burned

Hydrogen is a gas that burns very easily. It also burns very rapidly and at a high temperature. A characteristic of hydrogen is that it releases a massive amount of heat energy when burned.



Burn to Turn into Water

When mixed with oxygen and ignited, it combusts, becoming water. Unlike other gases, this does not create carbon dioxide.

