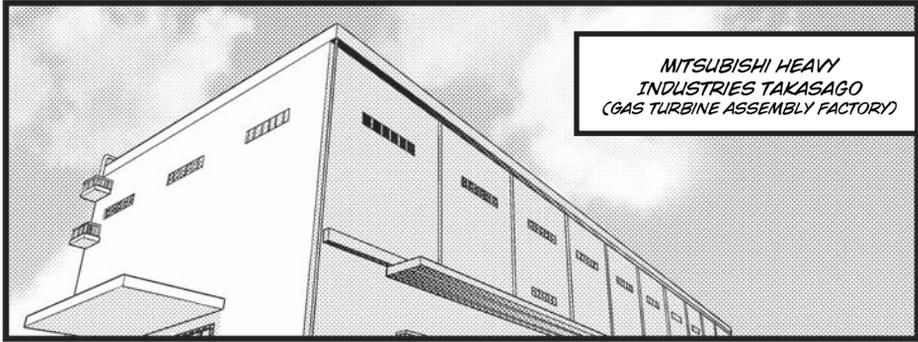


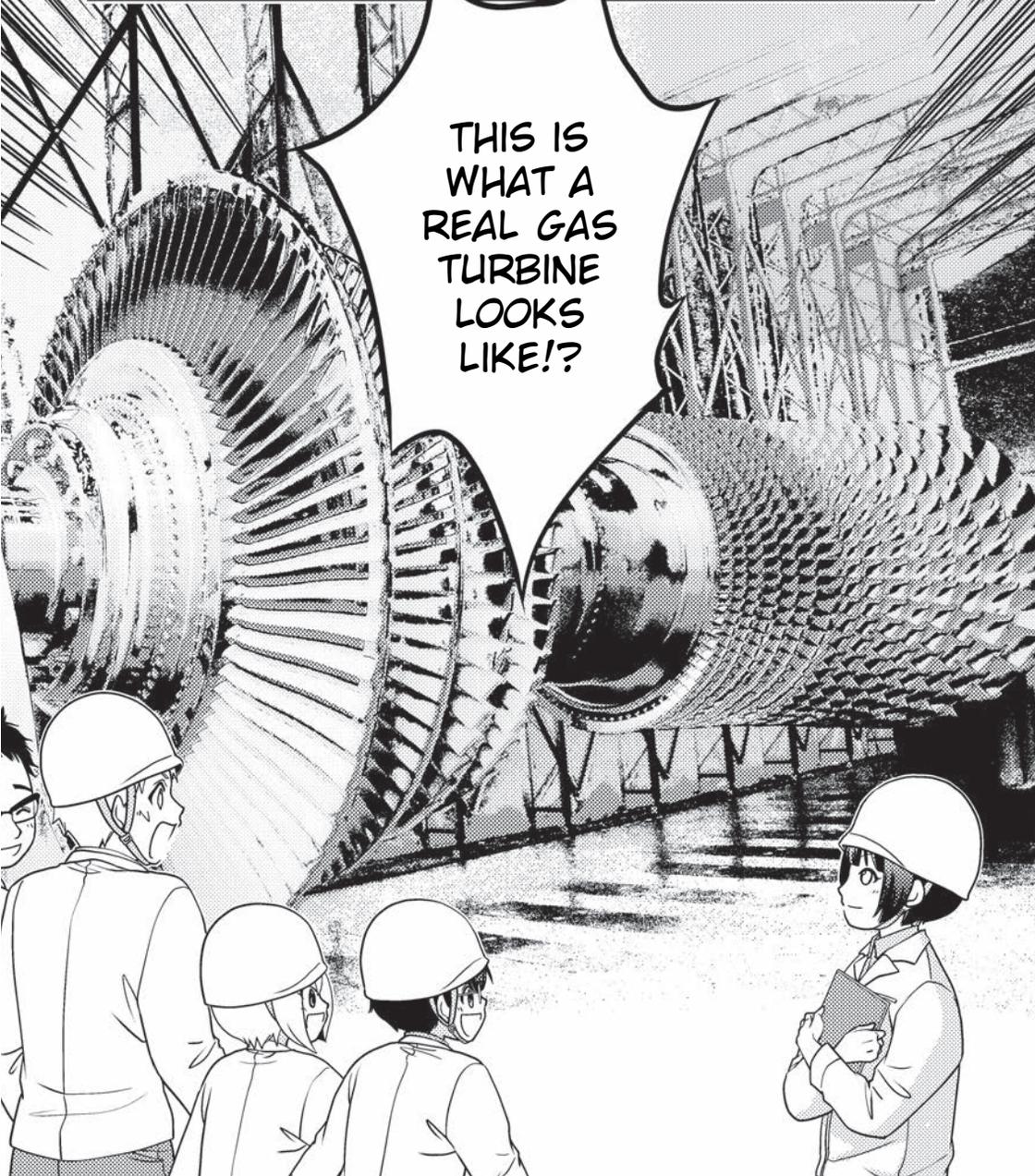
# A CHANGING WORLD.





WHOA!!

THIS IS  
WHAT A  
REAL GAS  
TURBINE  
LOOKS  
LIKE!?





# CHAPTER 4: A CHANGING WORLD

TRIVIA

A MACHINE THAT GENERATES MOTION VIA A SPINNING SHAFT WITH BLADES ATTACHED IS CALLED A TURBINE. IT USES GAS (E.G. AIR), WATER, OR STEAM.



THOSE ARE CALLED BLADES.

LOOK AT ALL THE WINGS ON IT!



IT'S ABOUT FIFTEEN METERS IN LENGTH AND FIVE METERS IN DIAMETER.

I DIDN'T REALIZE THAT GAS TURBINES WERE THIS BIG!



WHEN IT'S GENERATING ELECTRICITY, IT SPINS 3,600 TIMES PER MINUTE.

OF COURSE!

THIS WHOLE THING SPINS?

AND COOL...

IT'S KINDA PRETTY IN A WAY...

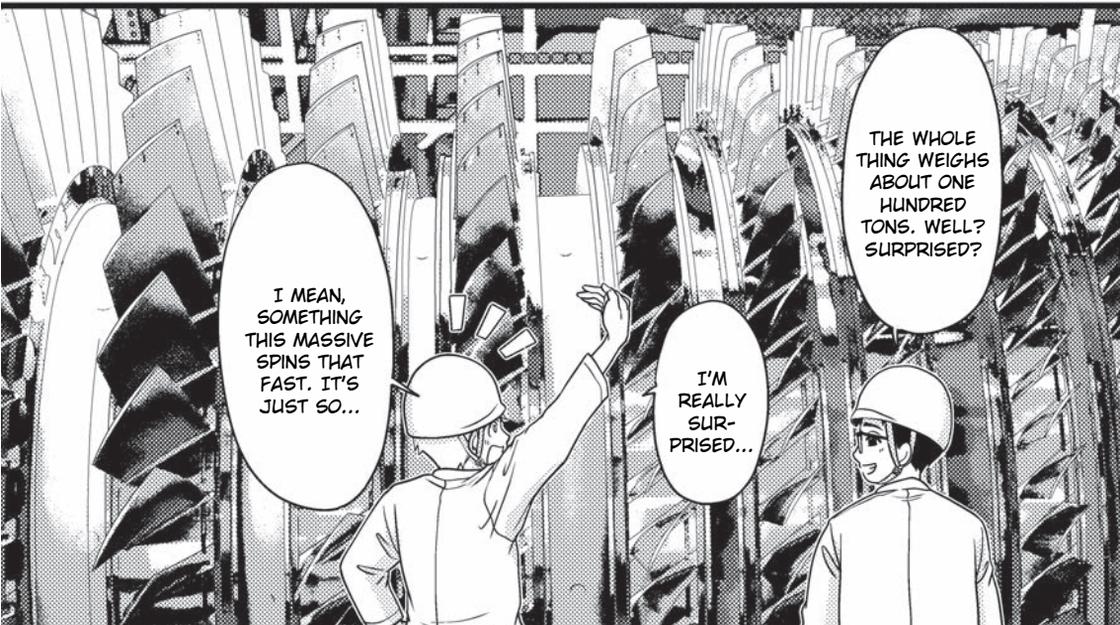
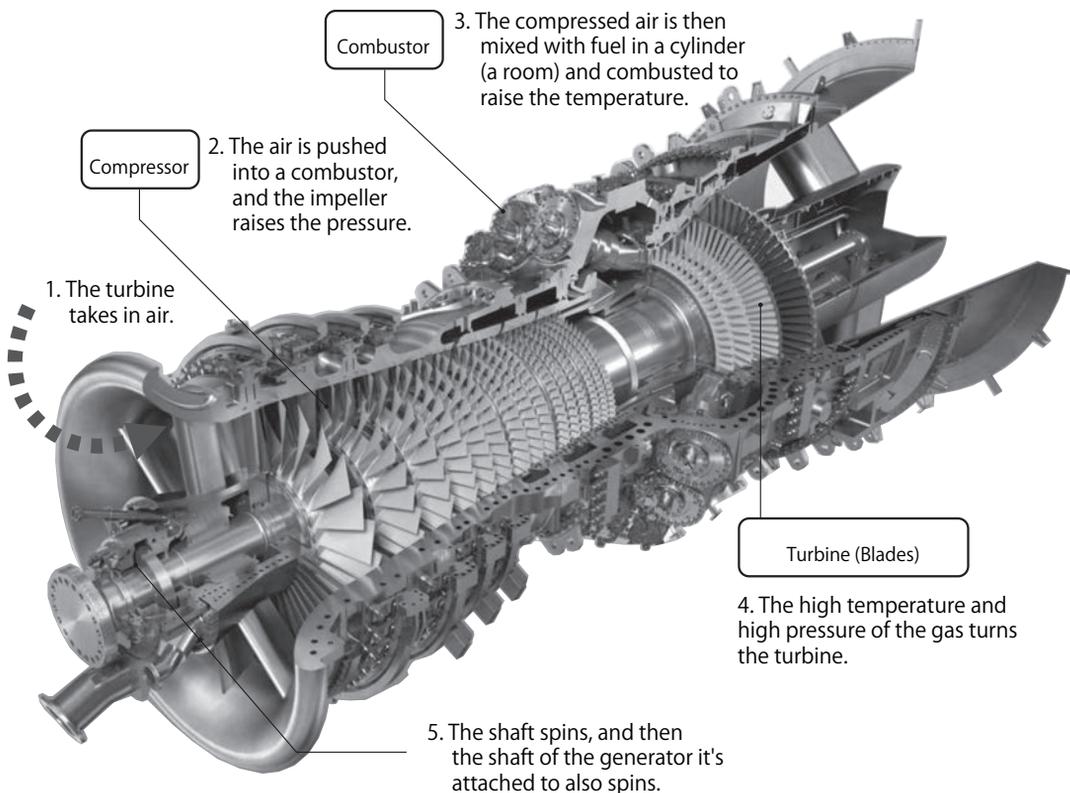


No way !!

IT SPINS SIXTY TIMES PER SECOND.

WHICH MEANS...

## THE PARTS OF A GAS TURBINE





# CHAPTER 4: A CHANGING WORLD

TRIVIA

ONE LITER OF AIR WEIGHS 1.3 GRAMS. SO, A ROOM THAT'S 5M X 4M X 3M HAS A VOLUME OF 60 SQUARE METERS, MEANING ALL OF THE AIR IN THAT ROOM WOULD WEIGH 78 KILOGRAMS.

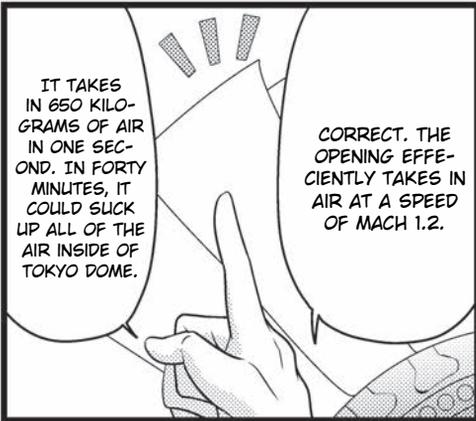


I'LL SHOW YOU A BIT LATER, BUT THE POWER GENERATED BY THIS TURBINE AND A STEAM TURBINE WORKING TOGETHER AS A SET IS ENOUGH TO POWER 1.5 MILLION HOMES.



BECAUSE WE WANT TO PRODUCE THE MOST ELECTRICITY AT THE MOST EFFICIENT RATE.

WHY DOES IT SPIN SO FAST...?



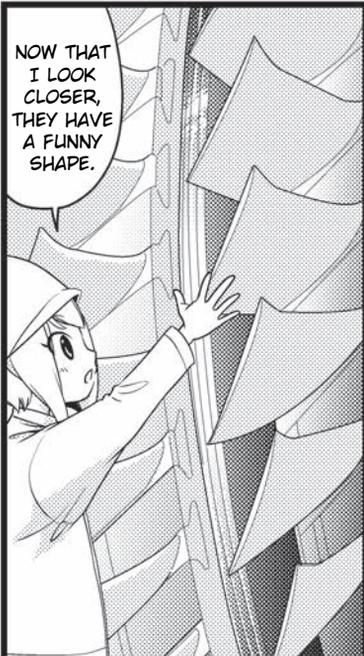
IT TAKES IN 650 KILOGRAMS OF AIR IN ONE SECOND. IN FORTY MINUTES, IT COULD SUCK UP ALL OF THE AIR INSIDE OF TOKYO DOME.

CORRECT. THE OPENING EFFICIENTLY TAKES IN AIR AT A SPEED OF MACH 1.2.



DOES THAT MEAN CARBON DIOXIDE EMISSIONS GO DOWN, TOO?

LARGE AND EFFICIENT GAS TURBINES CAN GENERATE MUCH MORE ELECTRICITY WITH THE SAME AMOUNT OF FUEL.



NOW THAT I LOOK CLOSER, THEY HAVE A FUNNY SHAPE.



THAT MEANS IT TAKES IN A LOT.

THAT'S SO COOL, I CAN'T EVEN IMAGINE!



650 KILOGRAMS OF AIR IN ONE SECOND... WAIT, BUT AIR ISN'T VERY HEAVY, RIGHT?

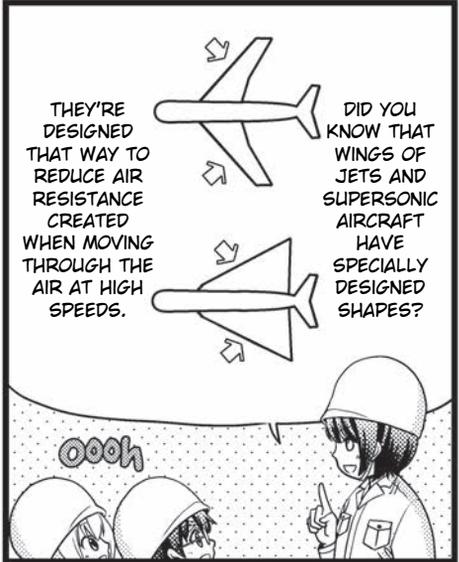
MACH SPEED! IT MOVES 1.2 TIMES THE SPEED OF SOUND!



IS THIS IRON?

THEIR DESIGN HELPS ADJUST THE FLOW OF AIR AND HELP THE ENGINES OPERATE EFFECTIVELY.

Oh!! See!



THEY'RE DESIGNED THAT WAY TO REDUCE AIR RESISTANCE CREATED WHEN MOVING THROUGH THE AIR AT HIGH SPEEDS.

DID YOU KNOW THAT WINGS OF JETS AND SUPERSONIC AIRCRAFT HAVE SPECIALLY DESIGNED SHAPES?

Oooh



BUT IF IT MELTED, IT'D BECOME USELESS, SO WE ALSO WORK TO COOL THE BLADES.

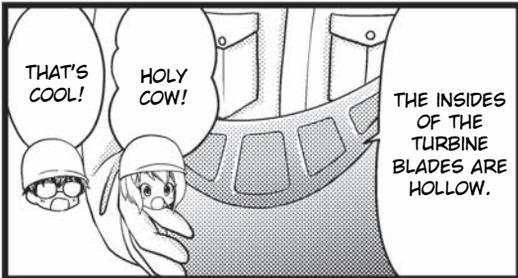
Yup.

HIGH SPEED MEANS HIGH TEMPERATURES, AFTER ALL.



IT'S MADE OF A SPECIAL METAL.

IT WOULD MELT IF IT WAS MADE OF NORMAL IRON. THIS GAS TURBINE HITS 1650°C\* WHEN IT'S SPINNING.



THAT'S COOL!

HOLY COW!

THE INSIDES OF THE TURBINE BLADES ARE HOLLOW.



THE AIR FLOWS THROUGH THEM, COOLING THE BLADES. EVEN THOUGH THEY'RE COOLED, THE AIR STILL REACHES MORE THAN 400°C\*.

\*400°C = 752°F.

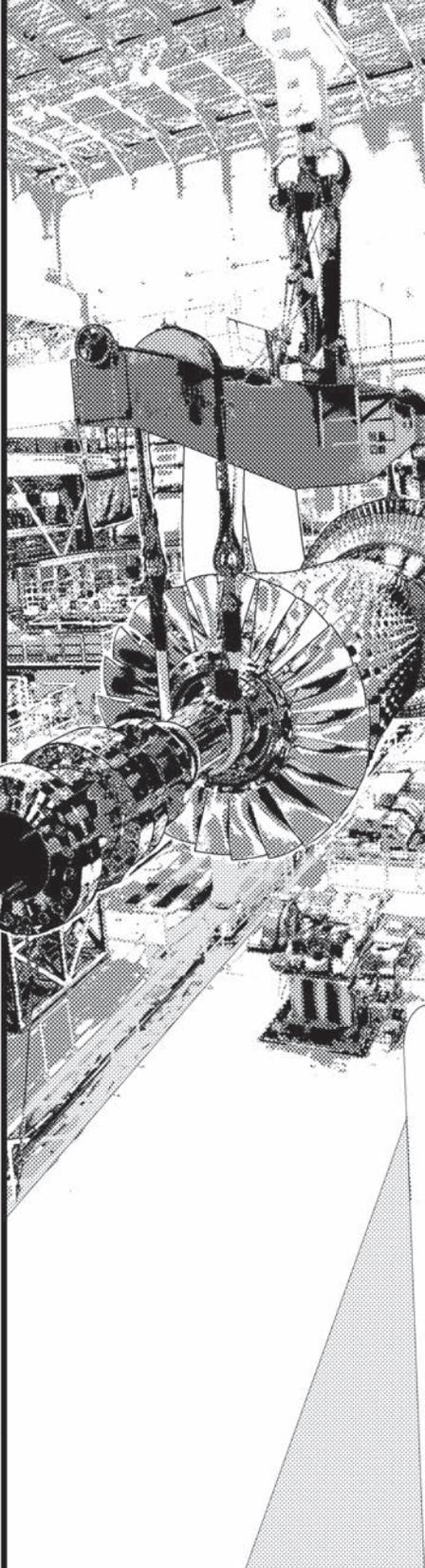
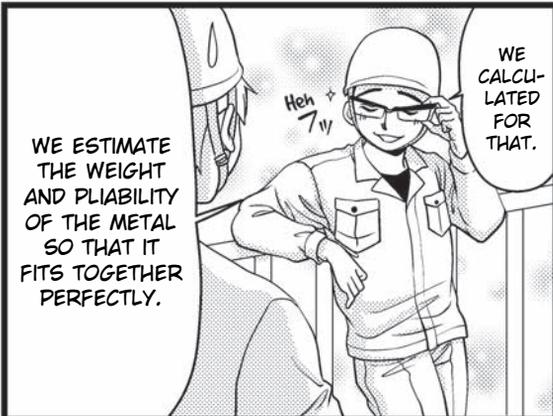
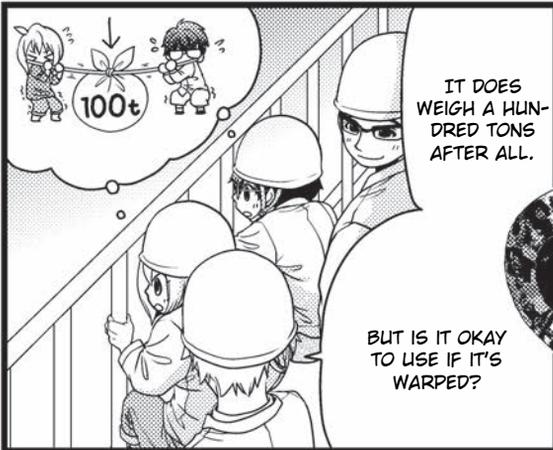
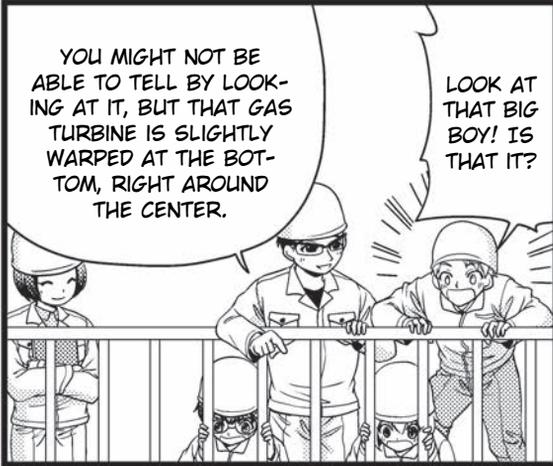
\*1650°C = 3002°F.

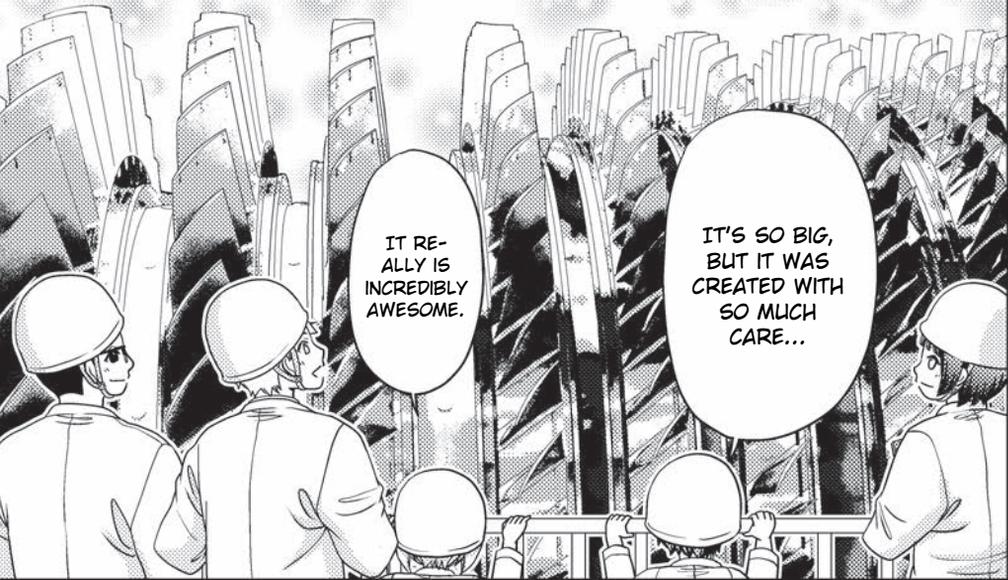


# CHAPTER 4: A CHANGING WORLD

TRIVIA

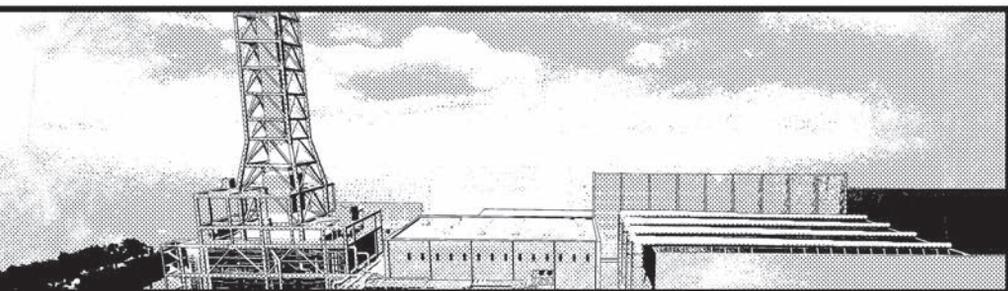
THE BLADES OF A GAS TURBINE ARE MADE FROM A SPECIAL NICKEL-BASE SUPERALLOY.





IT REALLY IS INCREDIBLY AWESOME.

IT'S SO BIG, BUT IT WAS CREATED WITH SO MUCH CARE...



THESE ARE TURBINES?



WE'RE NOT SPINNING ONE AT THE MOMENT, SO IT'S SAFE TO TAKE A LOOK.

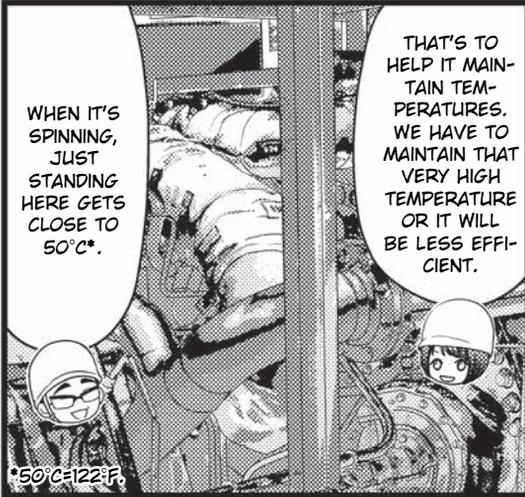
THIS IS WHERE WE TEST-SPIN THE TURBINES.



# CHAPTER 4: A CHANGING WORLD

TRIVIA

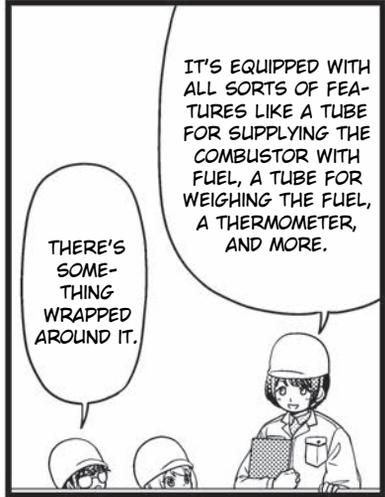
WHEN GAS IS COMPRESSED, IT HEATS UP. FOR EXAMPLE, IF YOU TAKE AIR AT 15°C (59°F) AND COMPRESS IT TO 25 ATM (OR 1/25TH ITS NORMAL VOLUME), IT REACHES A TEMPERATURE OF OVER 400°C (752°F).



WHEN IT'S SPINNING, JUST STANDING HERE GETS CLOSE TO 50°C\*.

THAT'S TO HELP IT MAINTAIN TEMPERATURES. WE HAVE TO MAINTAIN THAT VERY HIGH TEMPERATURE OR IT WILL BE LESS EFFICIENT.

\*50°C=122°F.



THERE'S SOMETHING WRAPPED AROUND IT.

IT'S EQUIPPED WITH ALL SORTS OF FEATURES LIKE A TUBE FOR SUPPLYING THE COMBUSTOR WITH FUEL, A TUBE FOR WEIGHING THE FUEL, A THERMOMETER, AND MORE.



THAT'S MORE THAN SIX TIMES FASTER THAN JAPAN'S BULLET TRAIN!

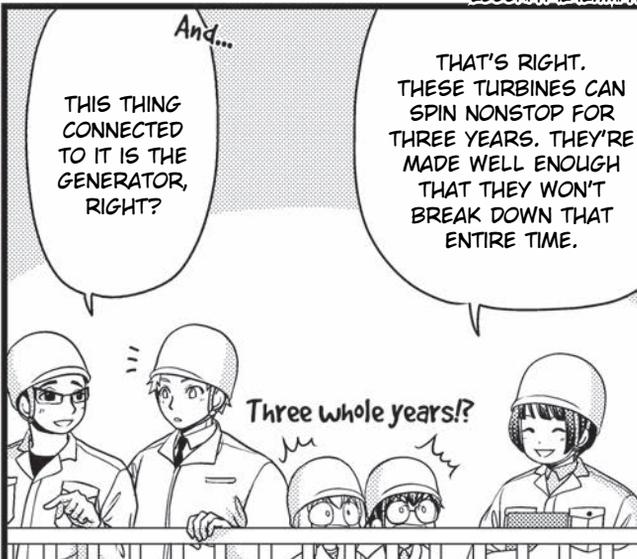
SINCE IT SPINS SIXTY TIMES IN ONE SECOND, THAT MEANS IT MOVES AT A SPEED OF TWO THOUSAND KILOMETERS PER HOUR\*!

\*2000KPH=1242.7MPH



REALLY!?

IT GETS REALLY LOUD, TOO.

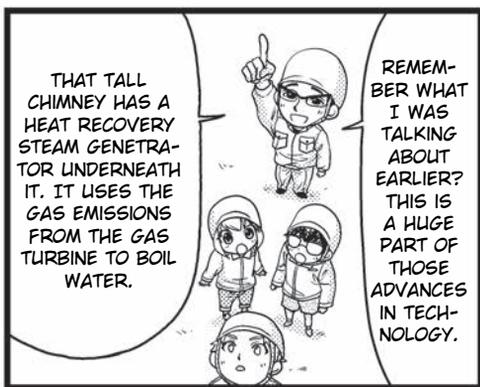
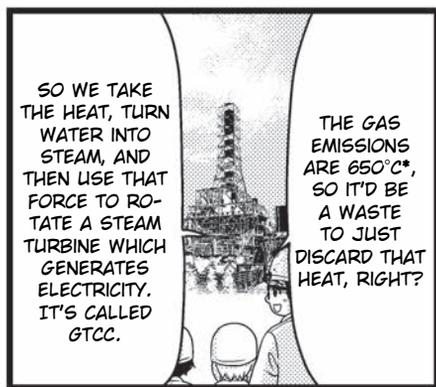
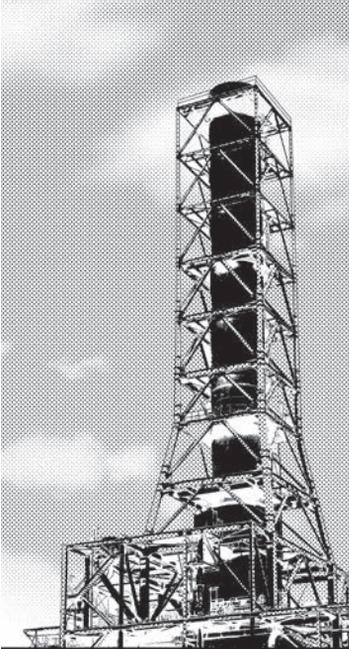


And...

THIS THING CONNECTED TO IT IS THE GENERATOR, RIGHT?

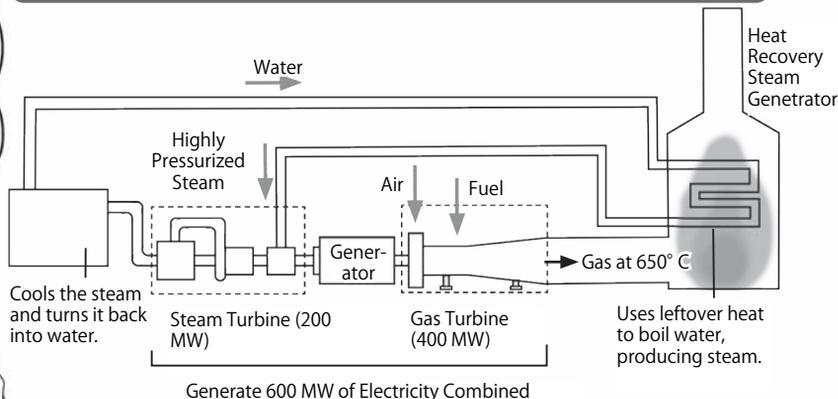
THAT'S RIGHT. THESE TURBINES CAN SPIN NONSTOP FOR THREE YEARS. THEY'RE MADE WELL ENOUGH THAT THEY WON'T BREAK DOWN THAT ENTIRE TIME.

Three whole years?!



\*650°C = 1202°F.

## WHAT'S GTCC? (GAS TURBINE COMBINED CYCLE POWER PLANTS)





# CHAPTER 4: A CHANGING WORLD

## TRIVIA

BECAUSE GAS TURBINE COMBINED CYCLE POWER PLANTS BY MITSUBISHI HEAVY INDUSTRIES CONVERT HEAT INTO MOTION ENERGY, THEY ARE DESIGNED TO BE RELEASE THE LEAST WASTE POSSIBLE (AS OF 2020).

THIS PROCESS IS REFERRED TO AS "COMBINED CYCLE ELECTRICITY GENERATION."

SO WE'RE ALREADY REDUCING OUR CO<sub>2</sub> EMISSIONS!

WITH A DESIGN LIKE THIS, WE CAN USE THE SAME AMOUNT OF FUEL AS BEFORE BUT GENERATE 1.5 TIMES THE AMOUNT OF ELECTRICITY.

AND THAT FORCE MAKES THE PISTON ROTATE? IT'S LIKE A STEAM LOCOMOTIVE!

WHEN THE WATER CHANGES FROM A LIQUID TO A GAS IN THE FORM OF STEAM, ITS VOLUME INCREASES 1,700 TIMES.

Water

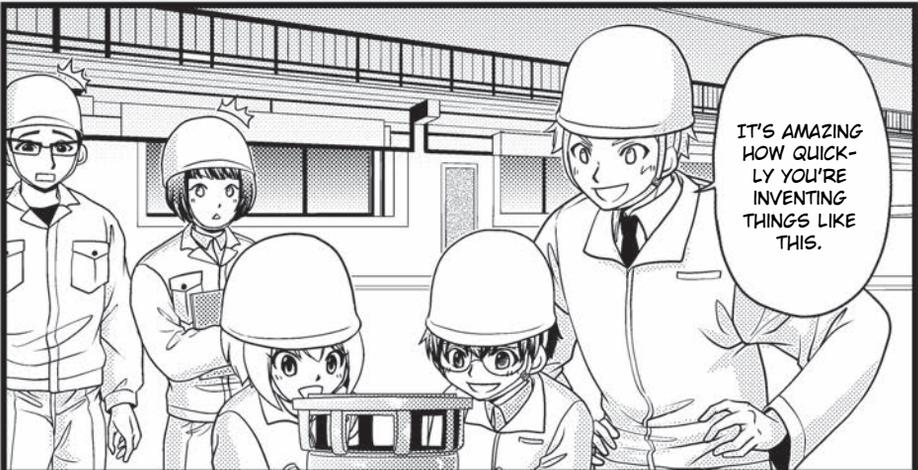
Steam

NO CO<sub>2</sub> EMISSIONS! IT WILL ONLY MAKE WATER!

AND THIS IS A COMBUSTOR FOR THE NEXT STAGE WHICH IS 100% HYDROGEN. WE'RE SO CLOSE TO FINISHING IT.

AND NOW IT'S TIME FOR WHAT WE'VE ALL BEEN WAITING FOR! THIS HERE IS A COMBUSTOR THAT HAS 30% OF ITS FUEL REPLACED WITH HYDROGEN!

WE ARE GOING TO SWAP THIS WITH A COMBUSTOR INSIDE THE GAS TURBINE WE SAW EARLIER.



IT'S AMAZING HOW QUICKLY YOU'RE INVENTING THINGS LIKE THIS.



HUH?



HOLD ON A SECOND.



WELL, YEAH, THAT'S TRUE... THIS IS MY FIRST YEAR AT THE COMPANY.

NOW NOW, MR. ISHIDA. IT'S NOT LIKE YOU'VE EXPERIENCED THE WORK YOURSELF.



WE MAKE SLOW AND STEADY PROGRESS BY WORKING REALLY HARD AND FAILING COUNTLESS TIMES.

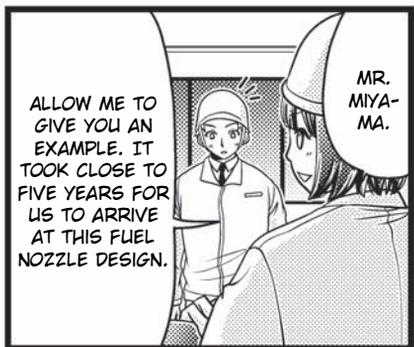


THESE THINGS DON'T GET INVENTED OVER-NIGHT, YOU KNOW.



FIVE YEARS ...

EACH OF THESE YOU SEE IS A FUEL NOZZLE.



ALLOW ME TO GIVE YOU AN EXAMPLE. IT TOOK CLOSE TO FIVE YEARS FOR US TO ARRIVE AT THIS FUEL NOZZLE DESIGN.

MR. MIYAMA.



# CHAPTER 4: A CHANGING WORLD

## TRIVIA

WHEN SOMETHING IS IN ROTATION, FORCE MOVES OUTWARD, AWAY FROM THE CENTER OF ROTATION. THIS IS CALLED CENTRIFUGAL FORCE. ONE BLADE OF A TURBINE REQUIRES ONE HUNDRED TONS OF CENTRIFUGAL FORCE TO MOVE.

WHEN WE MIX AIR AND HYDROGEN AND TRY TO BURN THEM...

Fuel Nozzle

WHILE HYDROGEN IS EASILY BURNED, THAT ALSO MAKES IT A DIFFICULT FUEL SOURCE TO WORK WITH.

BUT THE DOWNSIDE OF THAT IS THAT IT'S MORE LIKELY TO RE-RELEASE NITROGEN OXIDE, WHICH POLLUTES THE AIR.

HOWEVER, IF WE INJECT THE AIR AND HYDROGEN SEPARATELY AND, TO A CERTAIN EXTENT, LIMIT THE LOCATION OF IGNITION, WE CAN PREVENT FLASHBACKS.

Air

Air

Fuel (Hydrogen)

Fuel Nozzle

Ignition Position

THAT'S RIGHT.

THAT MIGHT MELT THE PARTS ...

...IT CAN EASILY TRIGGER SOMETHING CALLED A FLASHBACK WHERE THE FLAME IGNITES BACKWARDS UP THE FUEL NOZZLE.

crackle

crackle

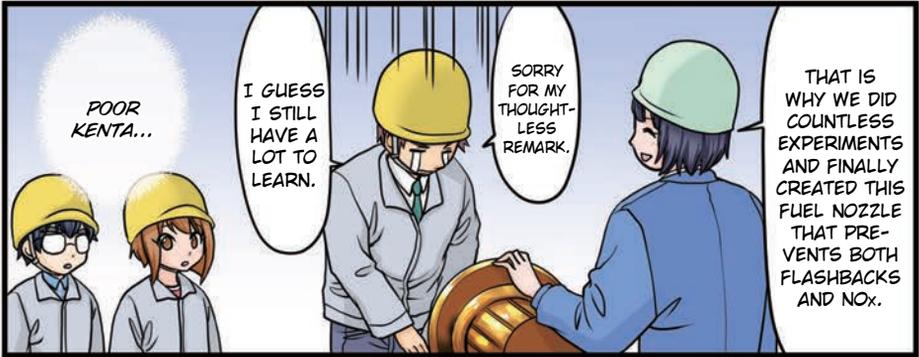
That's hot!

IT WOULD DESTROY THE ENVIRONMENT.

IF WE LOWER THE COMBUSTION TEMPERATURE, WE CAN PREVENT NO<sub>x</sub> FROM BEING RELEASED, BUT IF WE DO, THEN WE ALSO LOWER THE EFFICIENCY OF THE MACHINERY. WE CAN'T PRIORITIZE EFFICIENCY AND ALLOW NO<sub>x</sub> EMISSION.

YES.

NITROGEN OXIDE IS DENOTED AS NO<sub>x</sub>. IT'S ONE OF THE CAUSES OF PHOTOCHEMICAL SMOG.



\*FIT REFERS TO THE "FEED-IN TARIFF" SYSTEM AND IS A SPECIAL MEASURE INTRODUCED TO ENCOURAGE THE PROCUREMENT OF RENEWABLE ENERGY ELECTRICITY BY ELECTRICITY COMPANIES.



# CHAPTER 4: A CHANGING WORLD

TRIVIA

RIISING SEA LEVELS AS A RESULT OF CLIMATE CHANGE ARE A SEVERE PROBLEM FOR COUNTRIES LIKE THE NETHERLANDS, WHICH HAVE A VERY LOW ELEVATION. THEY ARE IN DANGER OF LOSING A LARGE PART OF THEIR LAND.



FIFTY YEARS AGO? THEN IT ISN'T RELATED TO THE SDGS!

WE ALSO HAVE PLANS TO SOON START BUILDING POWER GENERATION FACILITIES THAT USE THIS.

THIS IS ALSO A 100% HYDROGEN-FUELED COMBUSTOR. IT ISN'T VERY WELL KNOWN, BUT IT WAS USED TO BURN HYDROGEN AS FAR BACK AS FIFTY YEARS AGO.

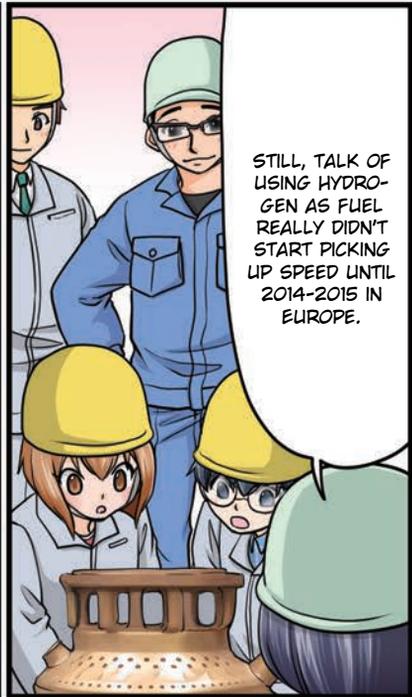


BOSS!



THAT'S WHY WE'RE WORKING HARD TO HURRY AND PREPARE GOOD-QUALITY PRODUCTS THAT HAVE BEEN TESTED SO THAT THEY'RE AVAILABLE FOR THE WORLD.

WE WANT WHAT WE MAKE TO BE AVAILABLE THE MOMENT IT'S NEEDED, AND WE WANT IT TO BE USED FOR A LONG, LONG TIME.



STILL, TALK OF USING HYDROGEN AS FUEL REALLY DIDN'T START PICKING UP SPEED UNTIL 2014-2015 IN EUROPE.



WHY DON'T WE GO CHECK IT OUT?

THE HYDROGEN FOR THE EXPERIMENT HAS ARRIVED!



WHEN YOU MAKE HYDROGEN, TOO, YOU HAVE TO MAKE SURE YOU DON'T RELEASE CO<sub>2</sub>, RIGHT? WHEN HYDROGEN POWER TAKES OFF FOR REAL, HOW ARE YOU GOING TO PROCURE THE HYDROOGEN?

THE WORLD STILL HASN'T REACHED THE AGE OF HYDROGEN, SO IT'S NOT EASY TO GATHER HYDROGEN IN LARGE AMOUNTS.

SO THAT LONG THING OVER THERE HAS HYDROGEN IN IT, RIGHT?

DOES THAT MEAN YOU BURY CO<sub>2</sub> GAS IN THE GROUND!?

Factory

CO<sub>2</sub> CO<sub>2</sub>

CO<sub>2</sub> CO<sub>2</sub>

WATER!

BUT FIRST, WE START BY CREATING HYDROGEN FROM NATURAL GAS. CO<sub>2</sub> IS RELEASED WHEN THAT HAPPENS,

BUT WE CAN STORE IT UNDERGROUND.

ONE DAY, WE WILL BE ABLE TO CREATE HYDROGEN THROUGH ELECTROLYSIS OF WATER, WHICH WILL BE POWERED THROUGH NATURAL ENERGY SOURCES LIKE WIND AND THE SUN.

Water

H<sub>2</sub>

O<sub>2</sub>

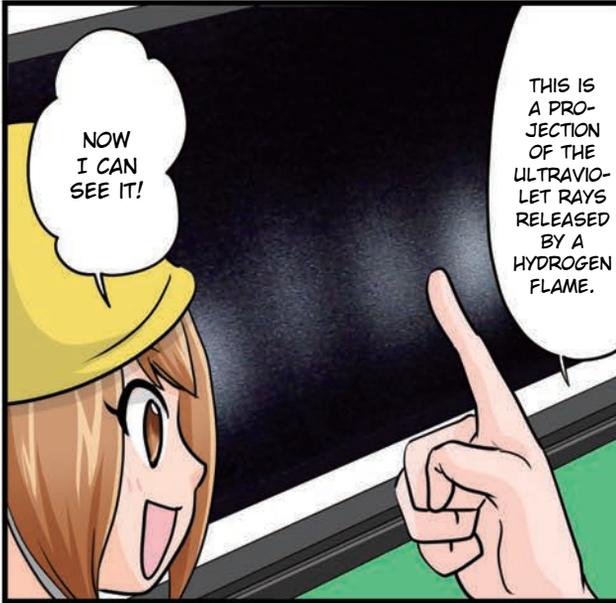
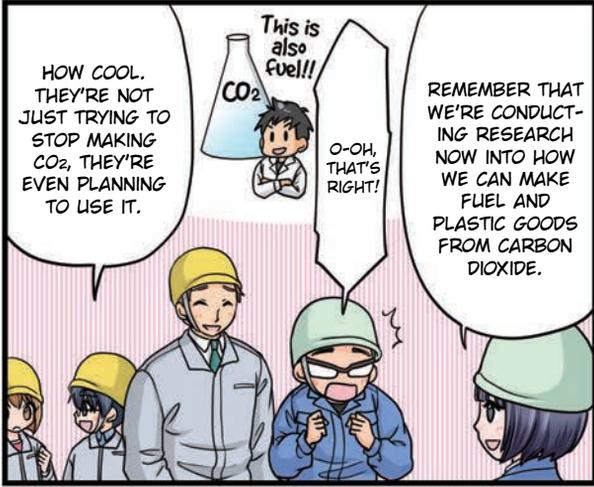
H<sub>2</sub>O



# CHAPTER 4: A CHANGING WORLD

TRIVIA

IT'S EASIER TO TURN AMMONIA INTO A LIQUID THAN HYDROGEN. AMMONIA ALSO HAS A GREATER CONCENTRATION OF HYDROGEN ATOMS BY VOLUME.





BUT WHEN YOU BURN THINGS THAT AREN'T LIVING, YOU GET ALL SORTS OF COLORS.

PLANTS AND ANIMALS CONTAIN CARBON IN THEM, SO THEY ALL TEND TO GIVE OFF THE SAME COLORS WHEN THEY BURN,



Lithium (Red)	Sodium (Yellow)	Potassium (Red-Violet)	Calcium (Orange)	Barium (Yellow-Green)	Copper (Blue-Green)
---------------	-----------------	------------------------	------------------	-----------------------	---------------------

WOOD IS OBVIOUS, BUT GAS AND OIL USED TO BE PLANTS AND ANIMALS AT ONE POINT, TOO.

AKARI, MOST OF THE FIRE WE'RE USED TO SEEING IS MADE BY BURNING SOMETHING THAT WAS LIVING.

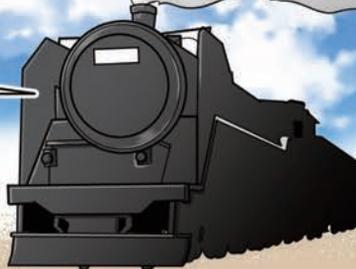


IT COULD JUST BE WE'VE ARRIVED AT AN ERA WHERE WE WILL BURN SOMETHING ELSE.

IT'S ONLY BEEN BETWEEN ABOUT 500,000 TO 750,000 YEARS SINCE HUMANS DISCOVERED FIRE. WE'VE BEEN BURNING LIVING THINGS AS FUEL AND GENERATING CO<sub>2</sub> THE WHOLE TIME.



THINK ABOUT THE COLORS YOU SEE IN FIREWORKS. AMONG THEM, HYDROGEN JUST HAPPENS TO BE COLORLESS.

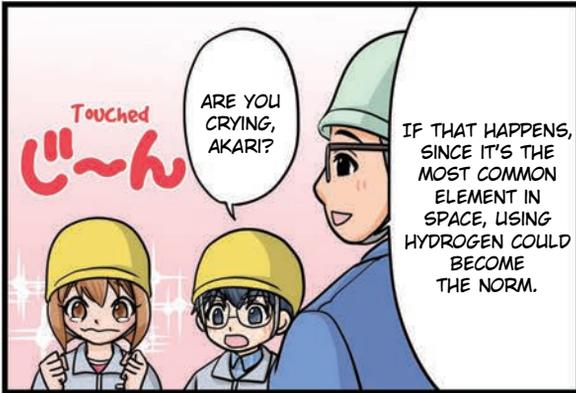




# CHAPTER 4: A CHANGING WORLD

TRIVIA

USING AMMONIA IN THERMAL POWER ALSO DOESN'T PRODUCE CO<sub>2</sub>, SO SOME POWER STATIONS ARE BEGINNING TO USE AMMONIA.





EVEN COMPLICATED SHAPES CAN BE AUTOMATICALLY CREATED ACCORDING TO SPECIFICATIONS, WHICH SAVES TIME.

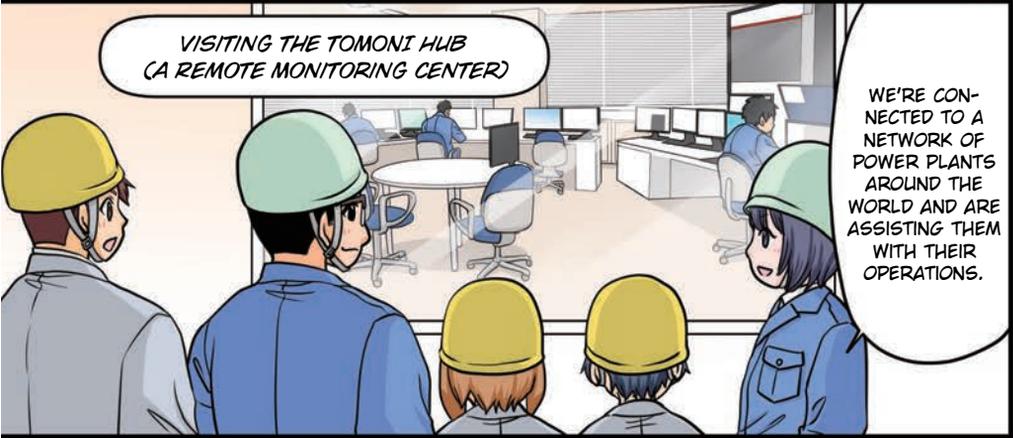


A 3D PRINTED METAL PROTOTYPE



OOOH! THAT'S COOL!

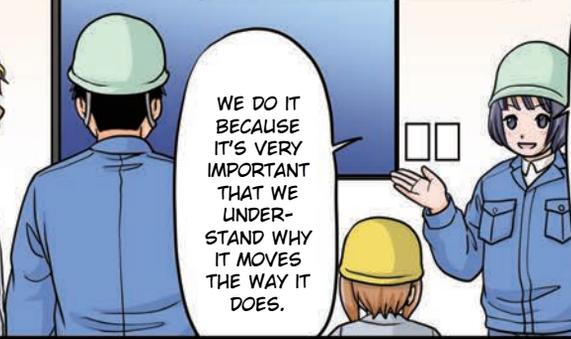
VISITING THE TOMONI HUB (A REMOTE MONITORING CENTER)



WE'RE CONNECTED TO A NETWORK OF POWER PLANTS AROUND THE WORLD AND ARE ASSISTING THEM WITH THEIR OPERATIONS.

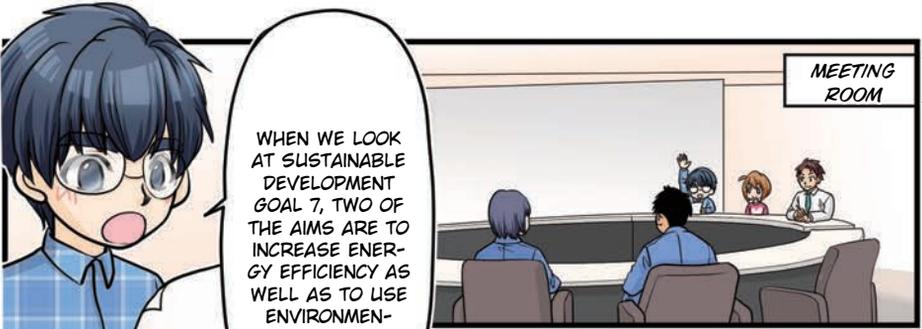
AI-GENERATED SIMULATION

AND THAT IS HOW THE THREE WERE GIVEN A TOUR OF THE FACILITIES.

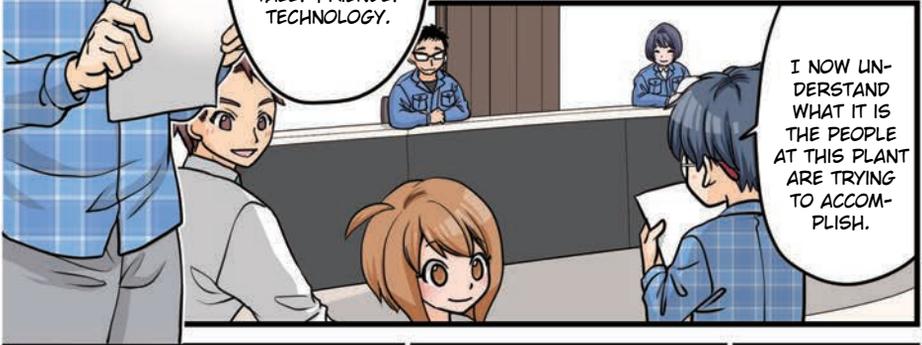


WE DO IT BECAUSE IT'S VERY IMPORTANT THAT WE UNDERSTAND WHY IT MOVES THE WAY IT DOES.

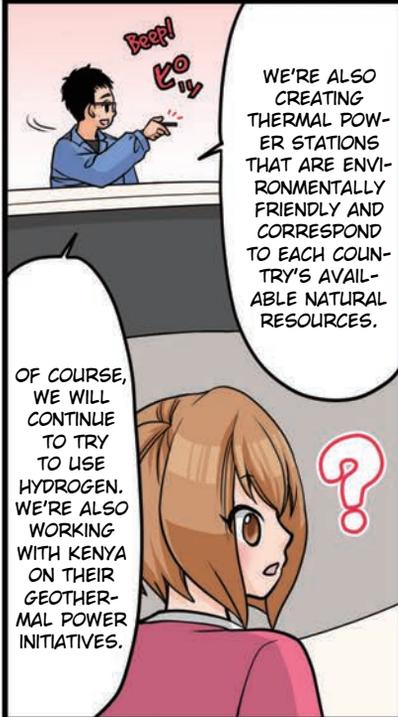
USING ARTIFICIAL INTELLIGENCE, WE CAN RUN SIMULATIONS TO SEE HOW GAS MOVES.



WHEN WE LOOK AT SUSTAINABLE DEVELOPMENT GOAL 7, TWO OF THE AIMS ARE TO INCREASE ENERGY EFFICIENCY AS WELL AS TO USE ENVIRONMENTALLY FRIENDLY TECHNOLOGY.

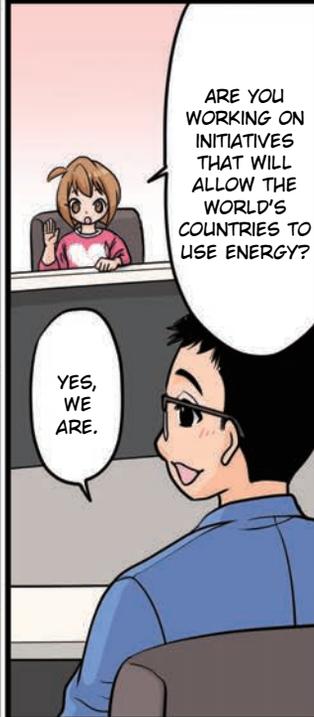


I NOW UNDERSTAND WHAT IT IS THE PEOPLE AT THIS PLANT ARE TRYING TO ACCOMPLISH.



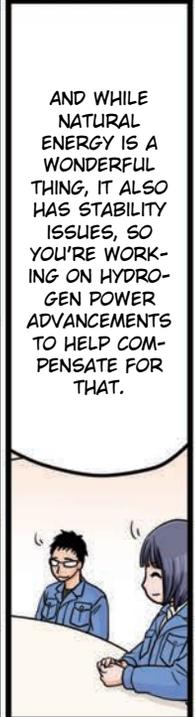
WE'RE ALSO CREATING THERMAL POWER STATIONS THAT ARE ENVIRONMENTALLY FRIENDLY AND CORRESPOND TO EACH COUNTRY'S AVAILABLE NATURAL RESOURCES.

OF COURSE, WE WILL CONTINUE TO TRY TO USE HYDROGEN. WE'RE ALSO WORKING WITH KENYA ON THEIR GEOTHERMAL POWER INITIATIVES.

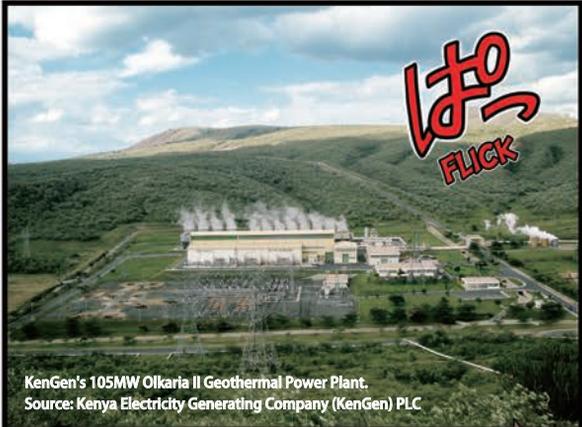


ARE YOU WORKING ON INITIATIVES THAT WILL ALLOW THE WORLD'S COUNTRIES TO USE ENERGY?

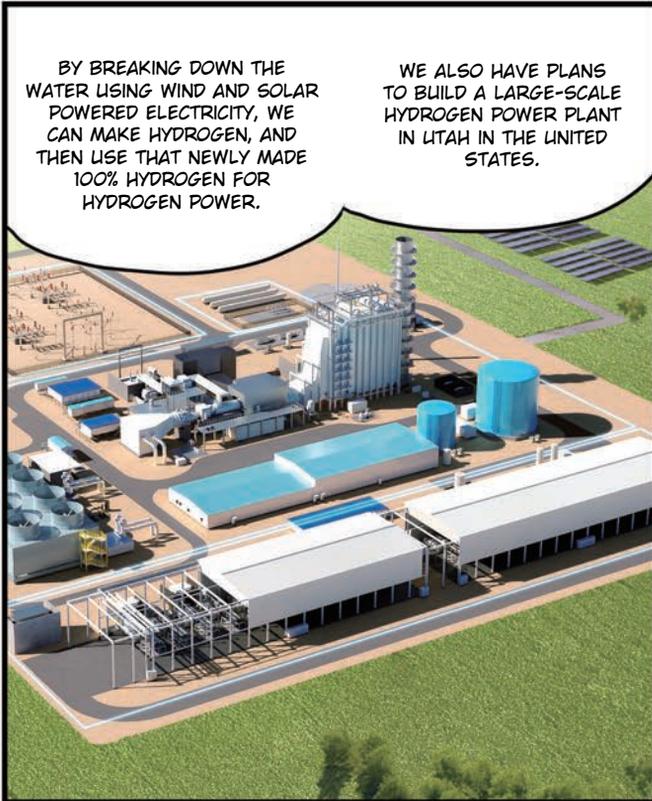
YES, WE ARE.



AND WHILE NATURAL ENERGY IS A WONDERFUL THING, IT ALSO HAS STABILITY ISSUES, SO YOU'RE WORKING ON HYDROGEN POWER ADVANCEMENTS TO HELP COMPENSATE FOR THAT.



LEO  
FLICK



## CHAPTER 4: A CHANGING WORLD

AND SO,  
THEY  
WERE  
ALSO  
ABLE TO  
LEARN  
ABOUT  
THEIR  
EFFORTS  
FOR  
GLOBAL  
OUT-  
REACH  
AS WELL.

### United Kingdom

Currently building a hydrogen power facility that aims to raise hydrogen power use from 30% to 100% hydrogen.

### The Netherlands

Planning a 100% hydrogen power plant.

### Southern United States

Construction of an electrical power plant to allow for a switch over to 100% hydrogen.

### Utah, United States

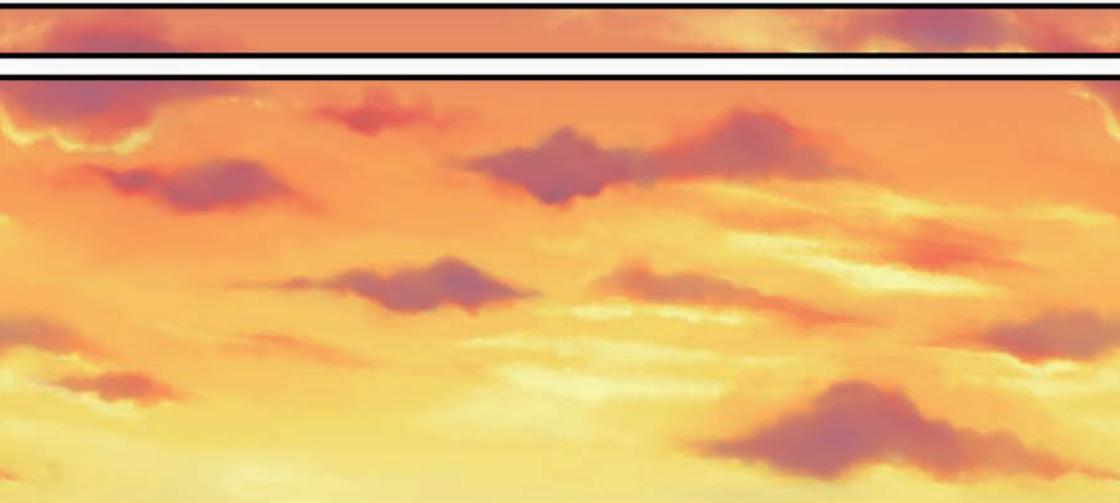
Hydrogen production and construction of a 100% hydrogen power plant.

### Singapore

Construction of a 30% hydrogen power plant.

### Southern Australia

Hydrogen and ammonia production via natural energy sources.



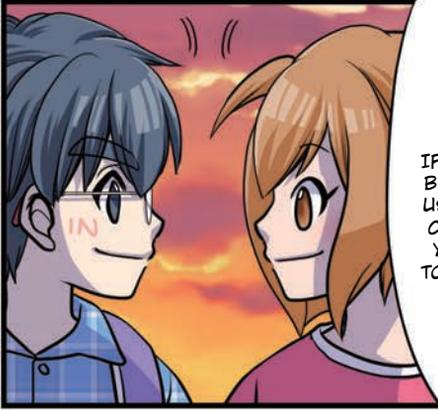
# EPILOGUE





**TRIVIA**

GAS TURBINE PRODUCTION USES BERNOULLI'S PRINCIPLE, THERMAL CONDUCTION, AN ADIABATIC COMPRESSION, AND OTHER CONCEPTS ARE TAUGHT IN MIDDLE SCHOOL AND HIGH SCHOOL SCIENCE CLASSROOMS.



IF YOU TWO TRY TO BE MINDFUL ABOUT USING ENERGY YOU CAN PROUDLY SAY YOU'RE WORKING TOWARD THEM TOO.



YOU'RE TRYING TO ACCOMPLISH THE SDGS ON YOUR OWN, TOO.



THE FACTORY HEAD TOLD US.

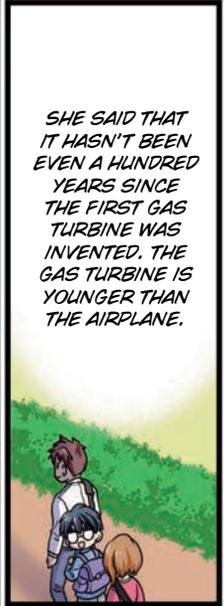
THIS IS AN OLDER TURBINE...



WILL CONTINUE TO CHANGE AND EVOLVE.

IN THE FUTURE, ALL TYPES OF ENERGY GENERATION...

THIS TYPE OF RAPID ADVANCEMENT IS AMAZING.



SHE SAID THAT IT HASN'T BEEN EVEN A HUNDRED YEARS SINCE THE FIRST GAS TURBINE WAS INVENTED. THE GAS TURBINE IS YOUNGER THAN THE AIRPLANE.



Let's think about future jobs related to the SDGs!

Name: Hiroki Tomono

Scientist

Explanation

I want to research energy!

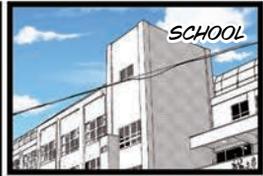
Let's think about future jobs related to the SDGs!

Name: Akari Miyama

Engineer

Explanation

To make things that will help all of humanity.



Let's think about future jobs related to the SDGs!

Name

Explanation

BUT STARTING TODAY, I'M NOW IN CHARGE OF TEACHING EVERYONE ABOUT THE SDGS.

YEAH, I KNOW.

THIS IS SUPPOSED TO BE GENERAL STUDY TIME. TODAY WE'RE LEARNING ABOUT SDGS.

My Grrr

Slide

HUH? MR. MIYAMA...?

IT'S NOT TIME FOR SCIENCE CLASS

...AND THEN I GOT ASKED TO TEACH YOU ALL ABOUT THE SDGS INSTEAD.

I TOLD THE PRINCIPAL THAT WE SHOULD PUT SOLAR PANELS ON THE ROOF OF THE SCHOOL...

Haha!!

## THIS BOOK'S GOAL

IT'S BEEN A WHILE SINCE SOMEONE SAID THAT CHILDREN HAVE STOPPED READING BOOKS, BUT DESPITE THE EXISTENCE OF THAT VERY SITUATION, I WONDERED WHY COMIC BOOKS AND MANGA REMAIN POPULAR. I BELIEVE THAT IT IS BECAUSE MANGA AND COMIC BOOKS ARE EASY TO READ FOR CHILDREN, AND THEY FIND THEM ENJOYABLE.

OUR COMPANY THEN DECIDED TO AIM TO TURN EDUCATIONAL MATERIALS INTO A COMIC BOOK LIKE THIS ONE. IT NEEDED TO BE EDUCATIONAL WHILE ALSO MAKING IT POSSIBLE FOR CHILDREN TO WANT TO CONTINUE READING ALL THE WAY TO THE END WITHOUT RESISTANCE. THAT WAS WHAT LED TO THE BIRTH OF *THE GAKKEN: LEARNING WITH MANGA SERIES*. THE STORIES ARE COMPILED TO EXPOSE ELEMENTARY STUDENTS ENCOUNTER TO A VARIETY OF ASPECTS OF REAL SOCIETY WHICH ARE DEEPLY CONNECTED TO THEIR LIVES THROUGH AMPLE AND ACCURATE DATA AND FIGURES.

FURTHERMORE, THE SERIES ISN'T JUST SUITABLE AS EDUCATIONAL MATERIALS FOR GENERAL STUDIES TIME AT SCHOOL, BUT IS ALSO VERY WELL-RECEIVED FROM BOTH EDUCATORS AND PARENTS. *THE GAKKEN: LEARNING WITH MANGA SERIES* HAS ALSO BEEN DONATED TO ELEMENTARY SCHOOL LIBRARIES AND MAJOR PUBLIC LIBRARIES.

### FEATURES OF *THE GAKKEN: LEARNING WITH MANGA SERIES*

#### ● IMPARTS A VAST AMOUNT OF KNOWLEDGE

THIS BOOK ALLOWS CHILDREN TO ACQUIRE VAST AMOUNTS OF KNOWLEDGE THROUGH THE THEMES PRESENTED AND THEIR ARRANGEMENT, AS WELL AS HISTORY, WHILE PRESENTING IT IN AN EASY TO COMPREHEND FORMAT. EACH PAGE HAS A PIECE OF TRIVIA RELATED TO THE INFORMATION AND KNOWLEDGE PRESENTED ON THE PAGE.

#### ● USEFUL FOR GENERAL STUDIES

THIS BOOK IS USEFUL FOR HELPING TO DRAW OUT A CHILD'S INTEREST AND CONCERNS DURING CLASSES SET ASIDE FOR GENERAL STUDIES.

#### ● COMIC BOOK FORMAT

THIS ALLOWS CHILDREN WHO AREN'T THE STRONGEST OF READERS TO STILL ENJOY THE STORY AS THEY PROGRESS.

#### ● BURSTING WITH INFORMATION

THIS BOOK FEATURES A WIDE BERTH OF PICTURES AND ILLUSTRATIONS. THEY'RE PRESENT TO ASSIST WITH UNDERSTANDING WHILE PROVIDING VALUE ON THEIR OWN AS DOCUMENTS.

#### ● FEATURES THEMES & JOBS BASED ON MODERN SOCIETY.

THE STORIES ARE PREPARED WITH THE GOAL OF GETTING CHILDREN INTERESTED IN WORK AND MODERN SOCIETY IN AN EASILY UNDERSTOOD MANNER.

#### ● FULFILLS THEIR DESIRE TO LEARN MORE

PRESENTS CHILDREN WITH SPECIALIZED INFORMATION ABOUT THE UNIQUE WORKINGS OF A COMPANY AND JOBS SO THAT IT WILL ANSWER THEIR QUESTIONS AND CONCERNS.

## The Secrets of SDGs 7

### Affordable and Clean Energy

- ▶ **Cooperation**  
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- ▶ **Photographs and materials**  
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- ▶ **Manga illustrations**  
MAKO.

Manga artist and illustrator from Fukuoka, Japan.  
Her representative works are “COMICxSTUDY Manga de Wakaru Chugaku Shakai Geography”, “Wangari Maathai (Gakken Manga NEW Sekai no Denki)” (Gakken), “47 Todofuken Hontou ha Kowai Mukashibanashi” (Rironsha), “Manga de Yoku Wakaru Badminton” (Oizumi Shoten), “Tetsugaku Friends” (PHP Institute), “Robot wo Ugokasou! mBot de Omoshiro Programming” (Ric Telecom), etc.

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#### References

“Sekai ga Gutto Chikaku Naru SDGs to Bokura wo Tsunagu Hon” (Gakken)  
“Gakken Perfect Course Chugaku Rika” (Gakken)

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<https://www.un.org/sustainabledevelopment/>

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#### Information on the “Learning with Manga series” (in Japanese)

**[Gakken Manga Himitsu Bunko]** <https://bpub.jp/gakken-himitsu>

**[Gakken Manabista]** <https://gakken.jp/manabista/himitsu>

**[Gakken Kids Net]** <https://kids.gakken.co.jp/himitsu/>

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