

A small Sun on Earth

ITER

イーター

Vol.3

~ The Spirit of Monozukuri and the Way to ITER ~



CHARACTERS



TAIYO TENNO

An art major in the thick of job hunting. He became drawn to ITER after his chance encounter with Soléane in France. He previously completed an internship at ITER in Volume 2.



SOLÉANE

A French researcher working at ITER in Saint-Paul-les-Durance. Currently lives in Aix-en-Provence. She was the one who initially got Taiyo interested in ITER.



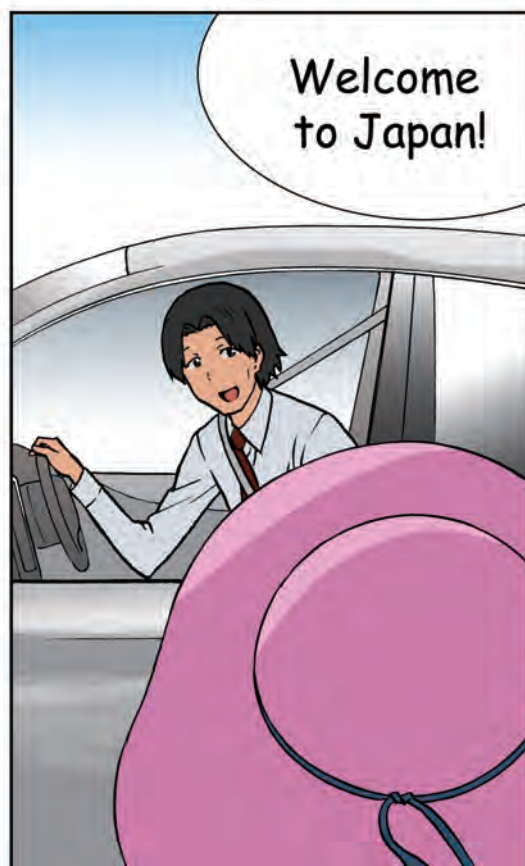
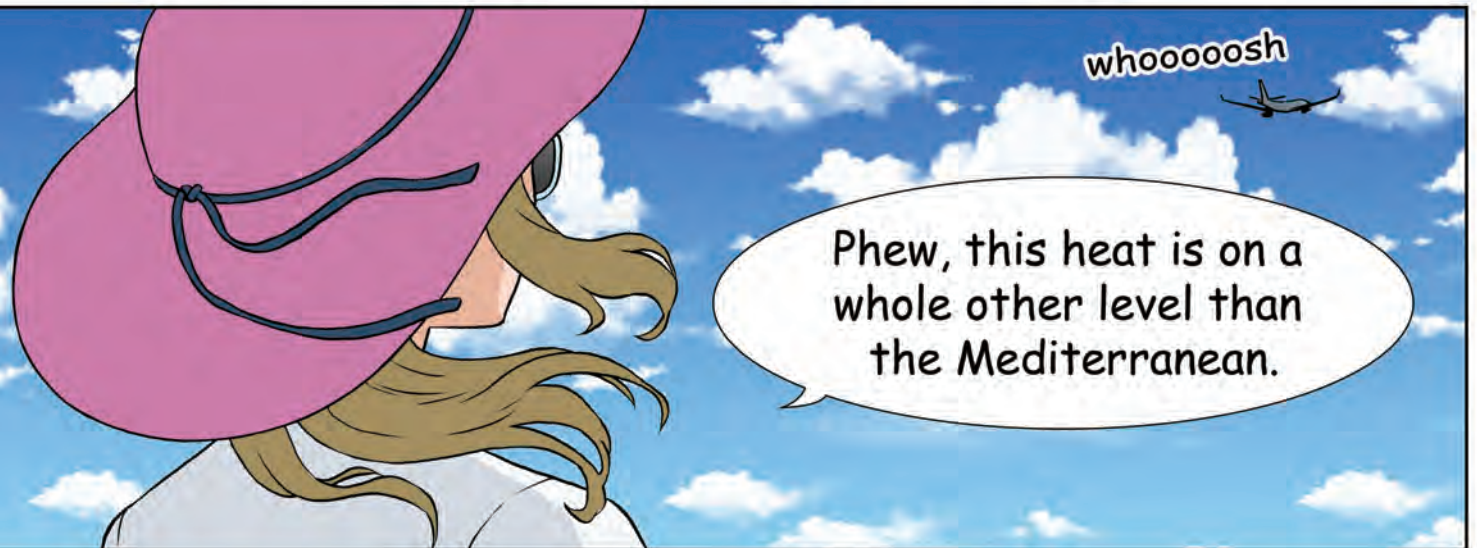
HAYATO NAKA

Employee of the Japanese domestic agency for the ITER Project, QST (National Institutes for Quantum and Radiological Science and Technology).



KOSEI HIGASHIDE

The head engineer for the toroidal field (TF) coils, which generate the magnetic field required to confine plasma in order to produce nuclear fusion. He takes great pride in his work.





Thanks,
Naka-san♪

Soléane



vroom

Mind if we
take a little
detour first?



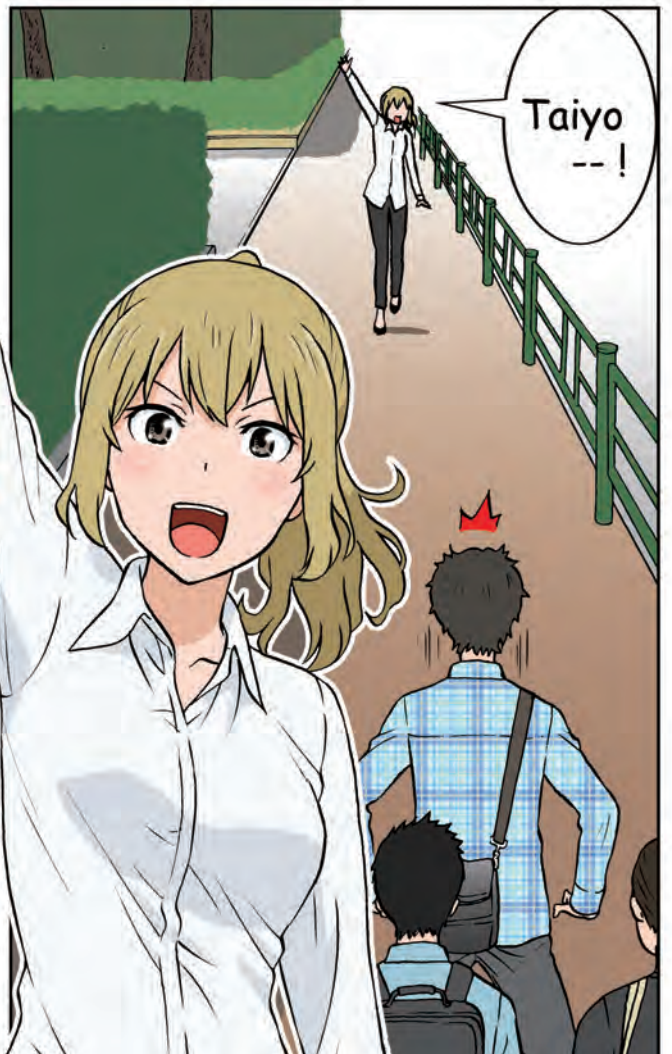
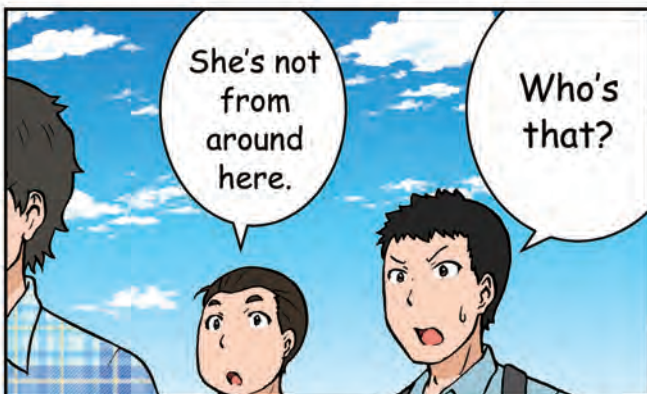
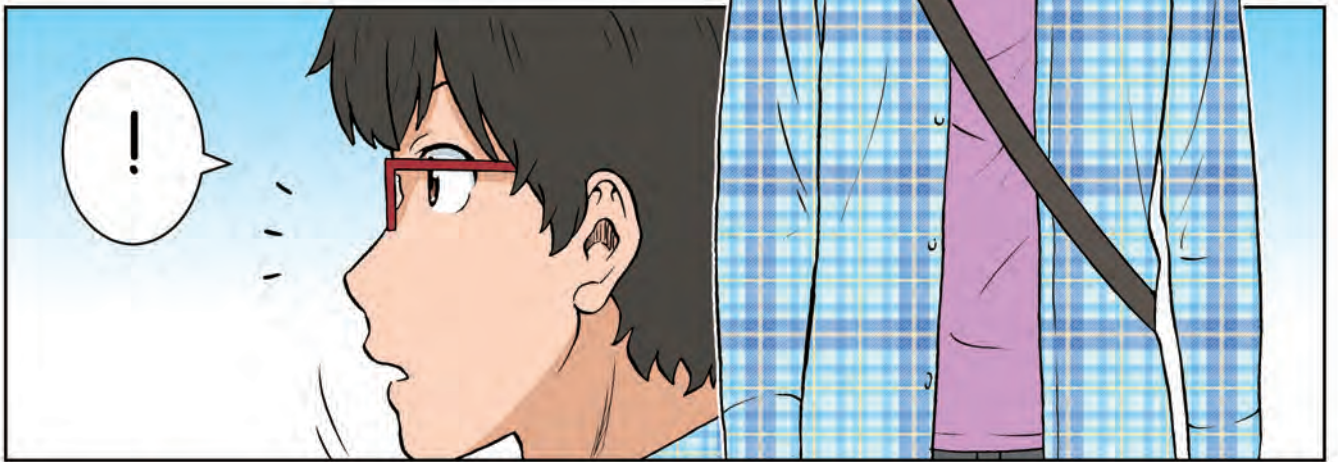
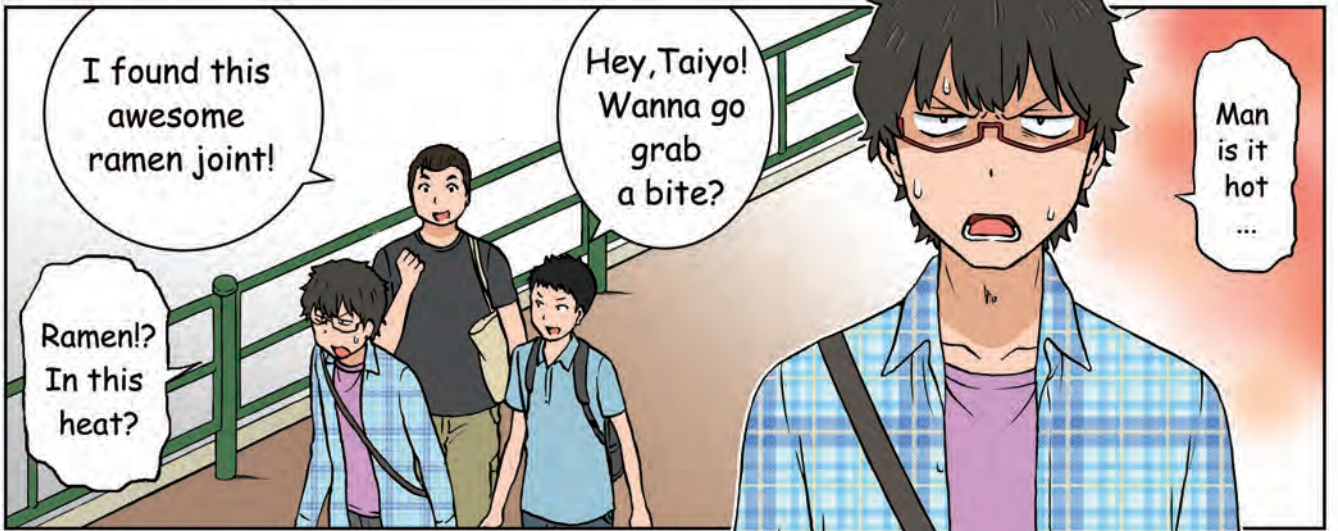
You're
the
best.

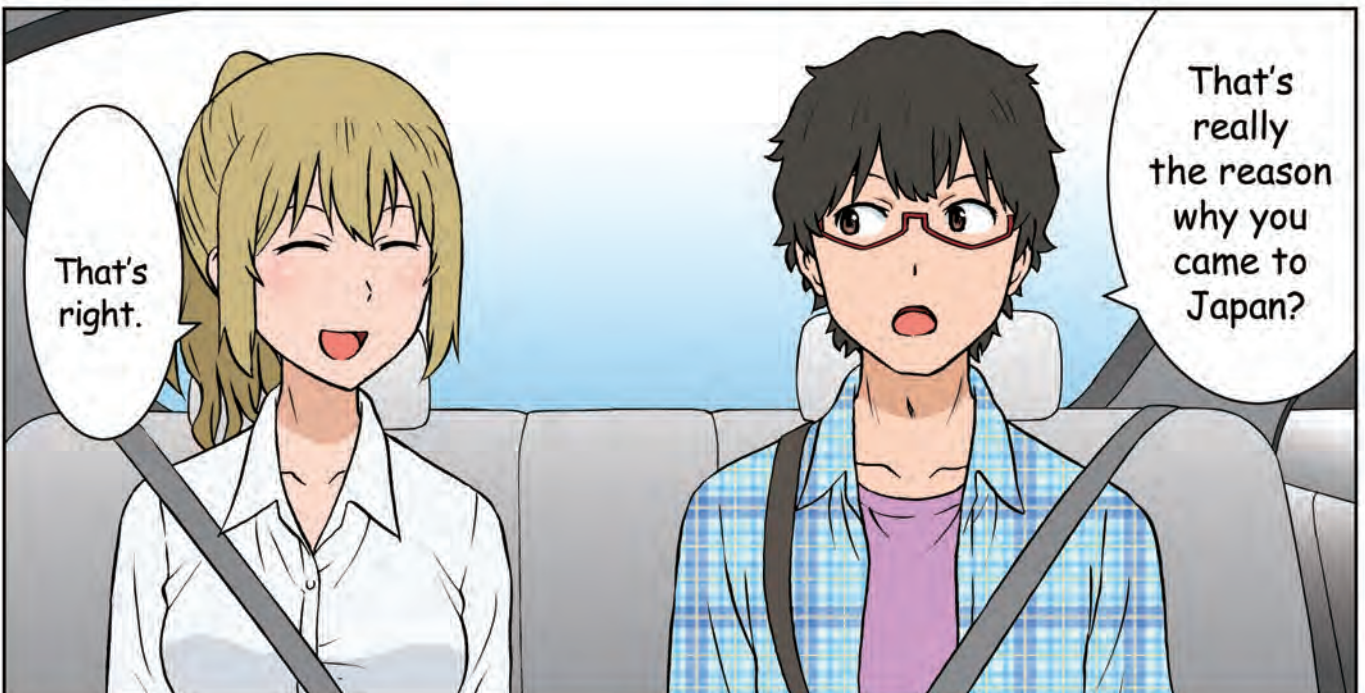
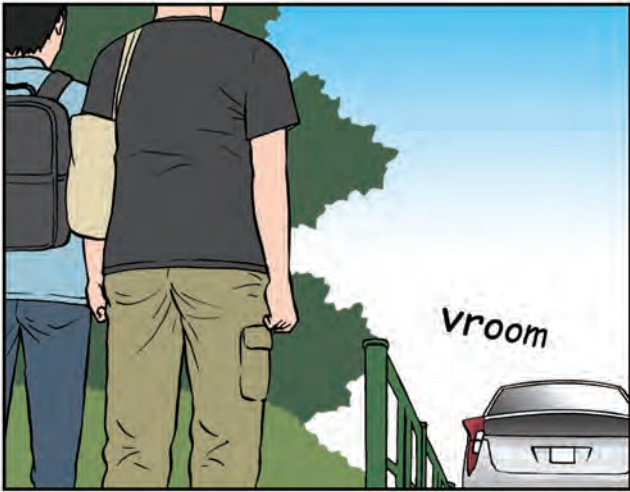


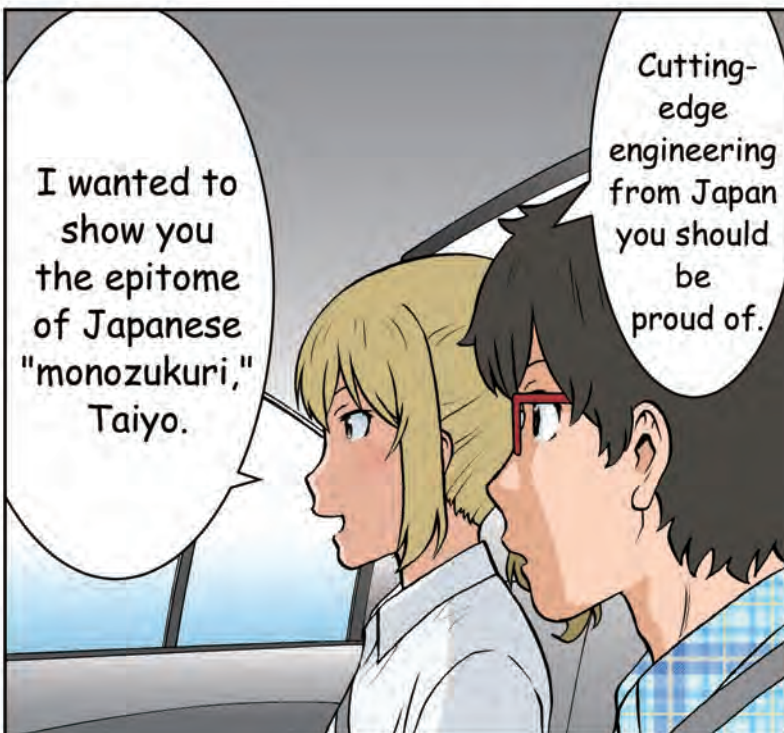
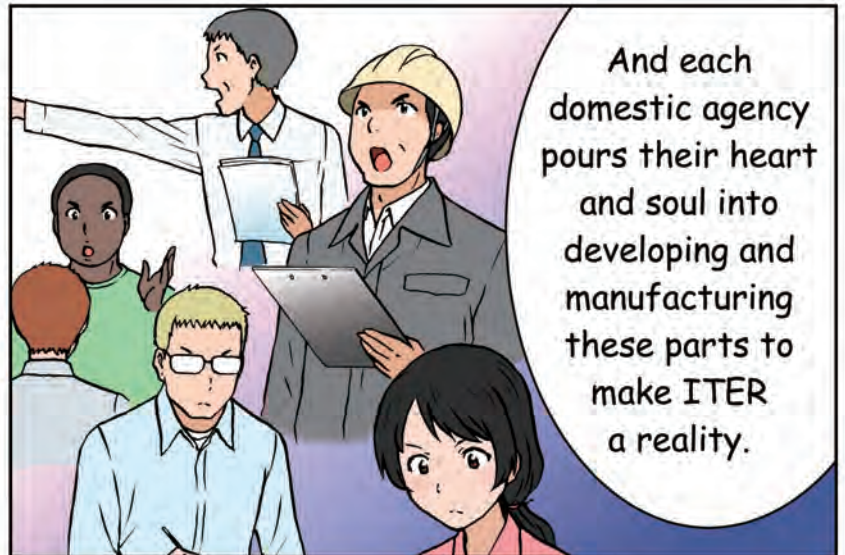
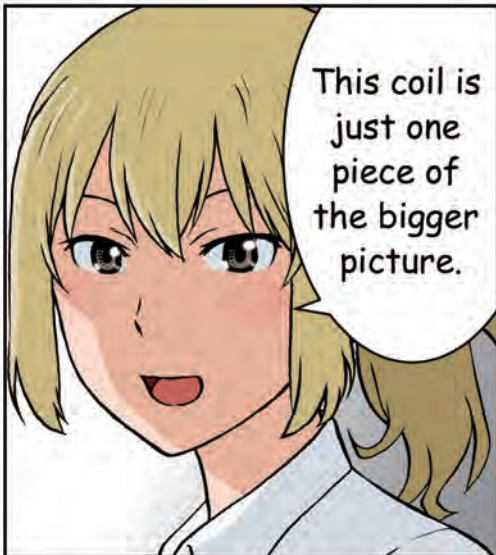
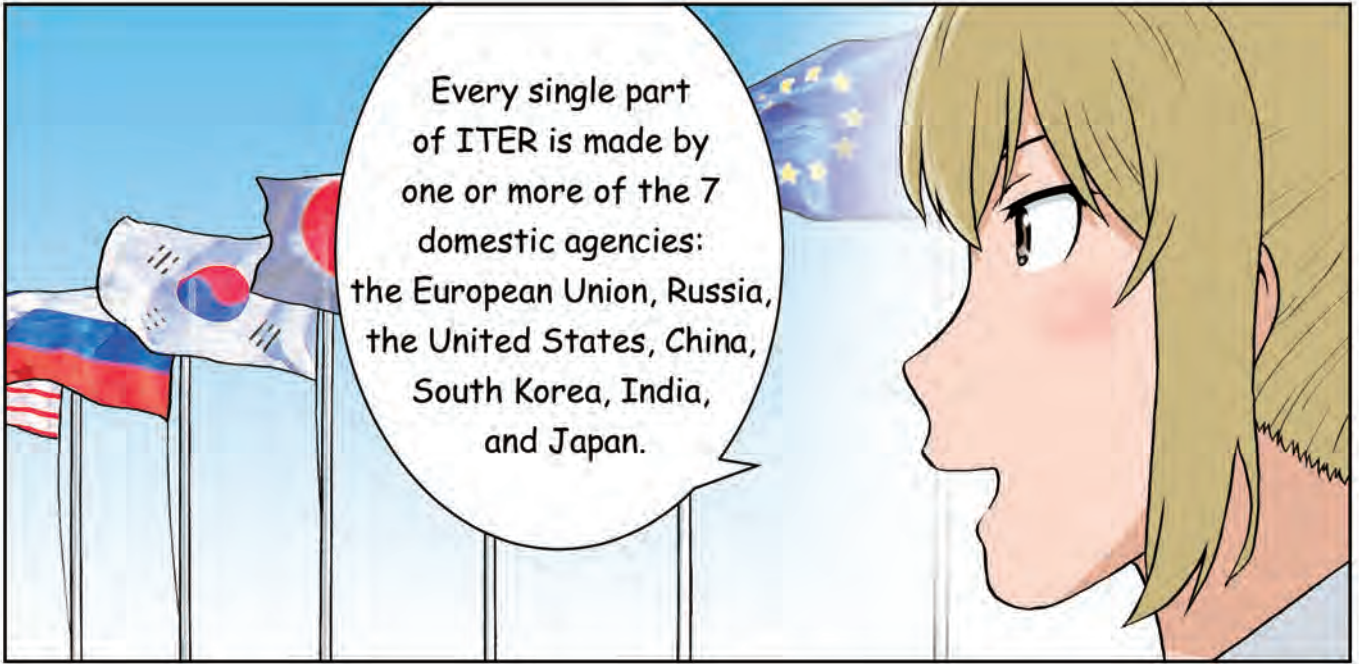
For you,
sure thing.

Gotta go
see about
that guy,
huh?

QST employee (National Institutes for Quantum and Radiological Science and Technology)





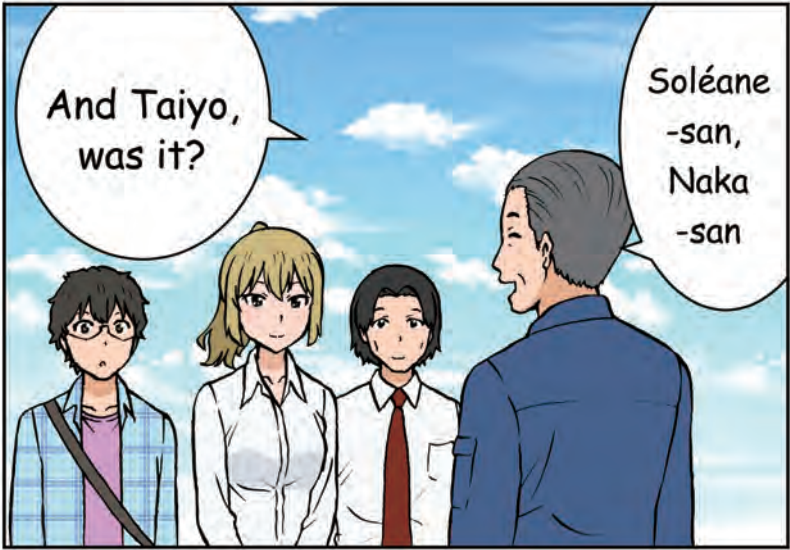




of
monozukuri
...

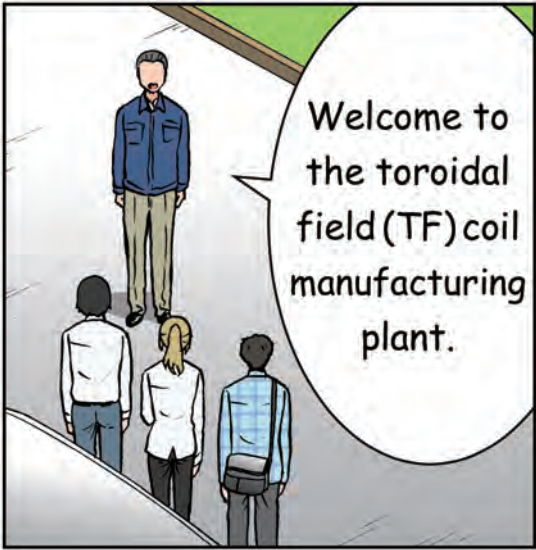


The
epitome...

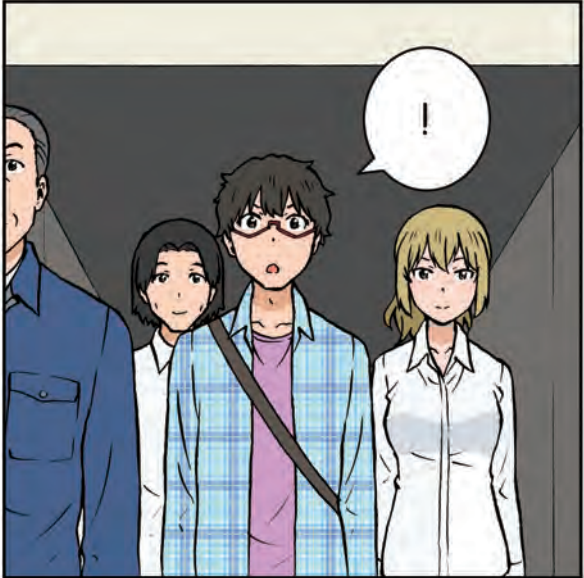


And Taiyo,
was it?

Soléane
-san,
Naka
-san



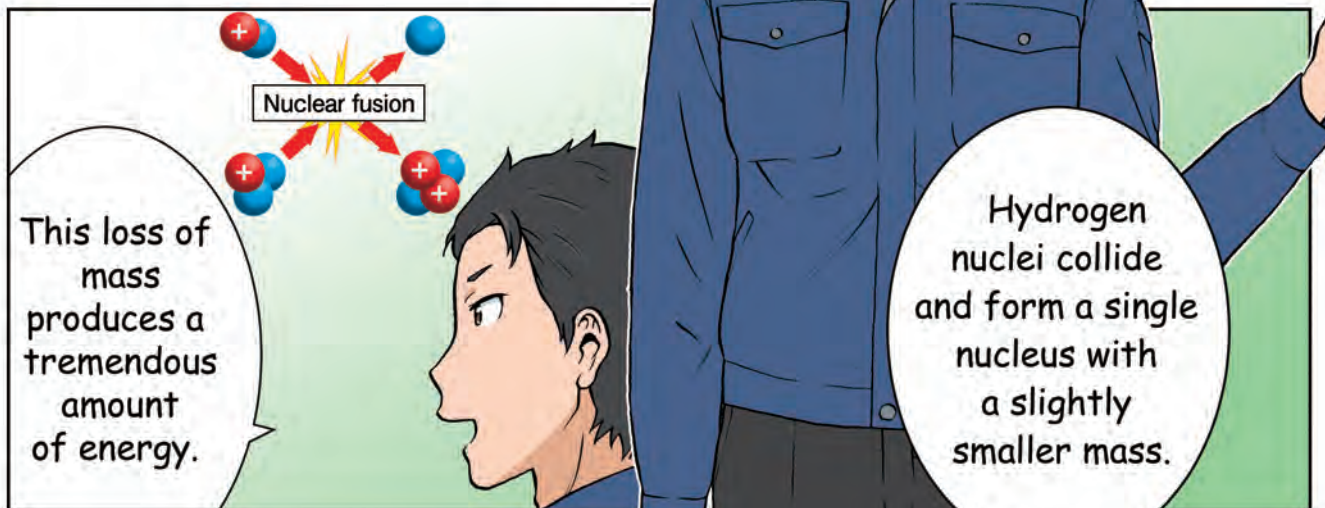
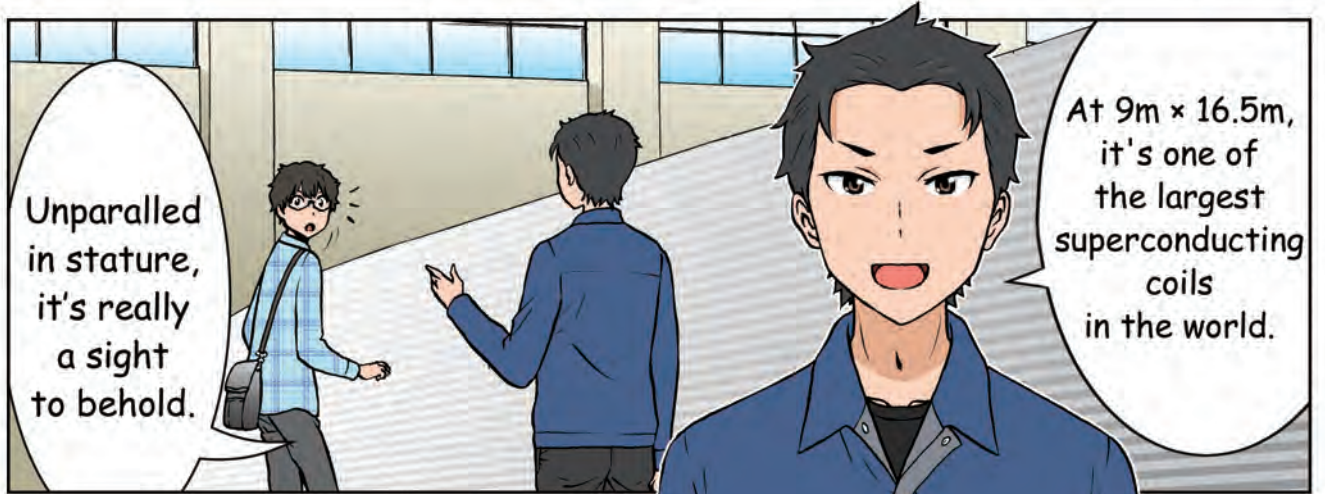
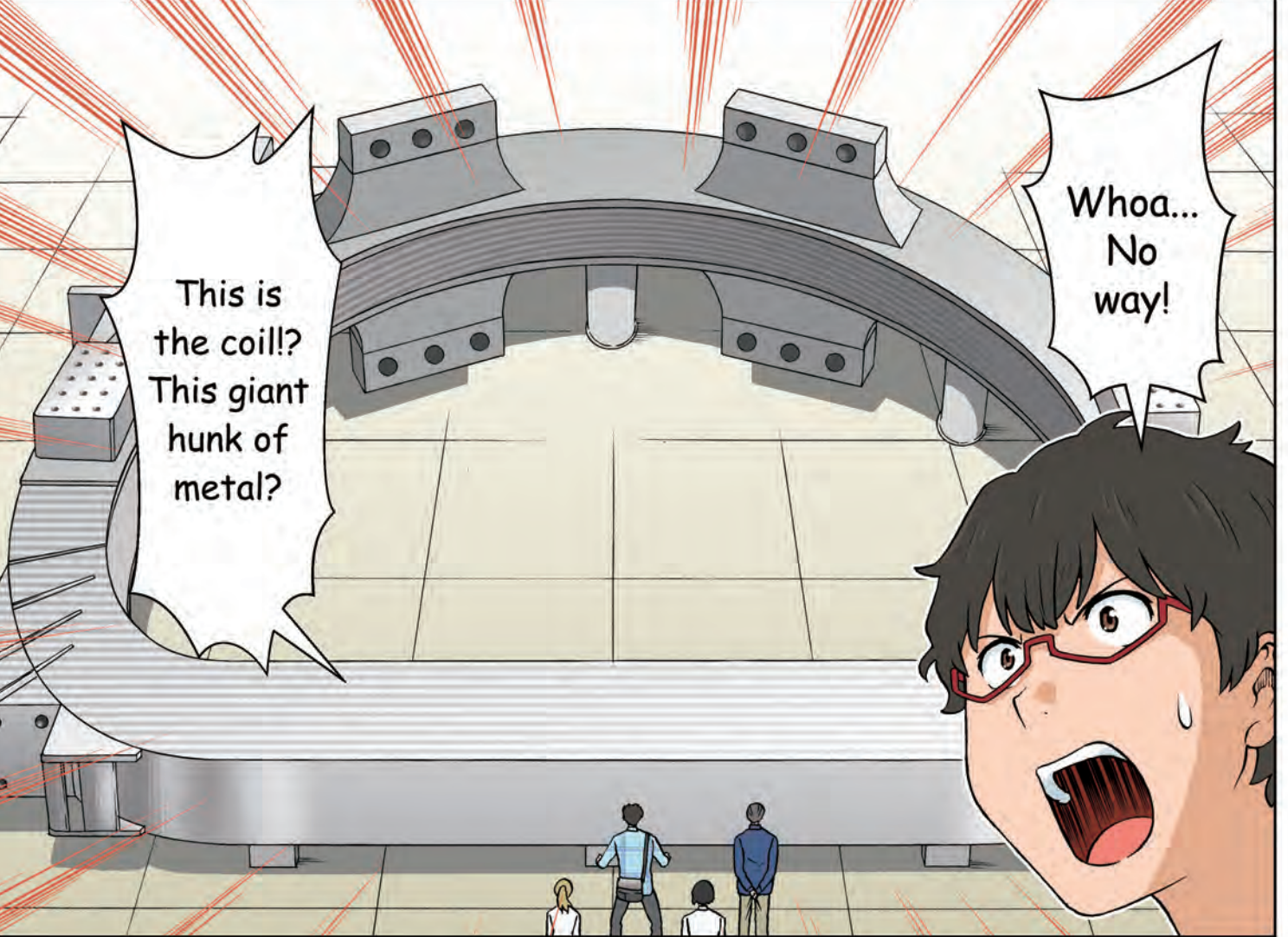
Welcome to
the toroidal
field (TF) coil
manufacturing
plant.

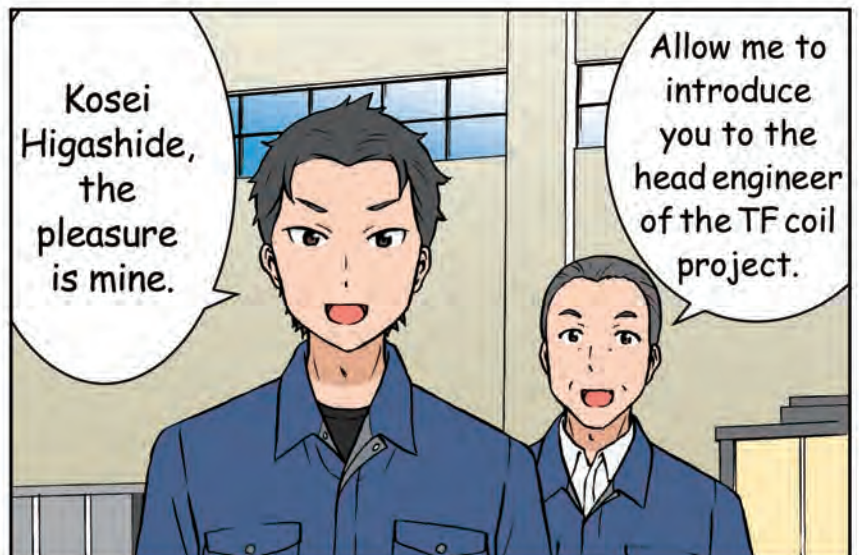
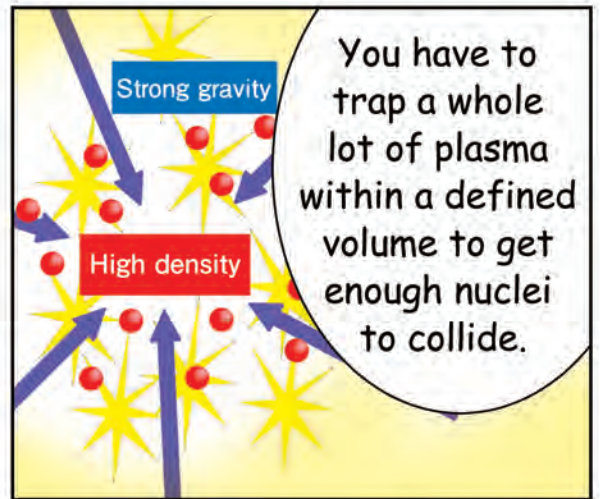
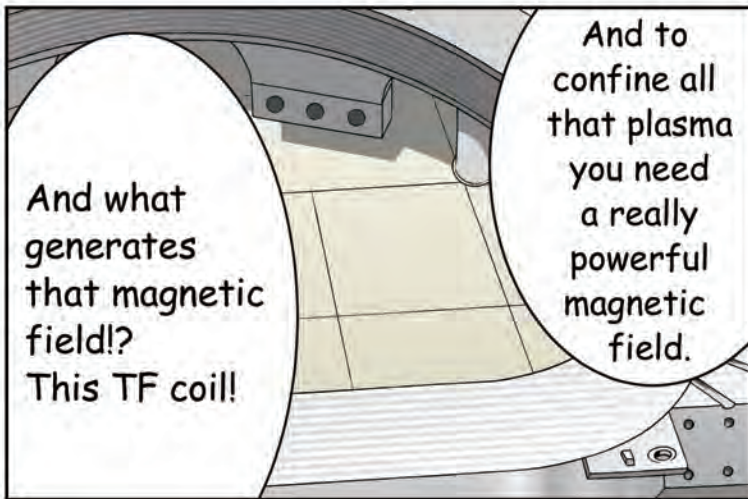
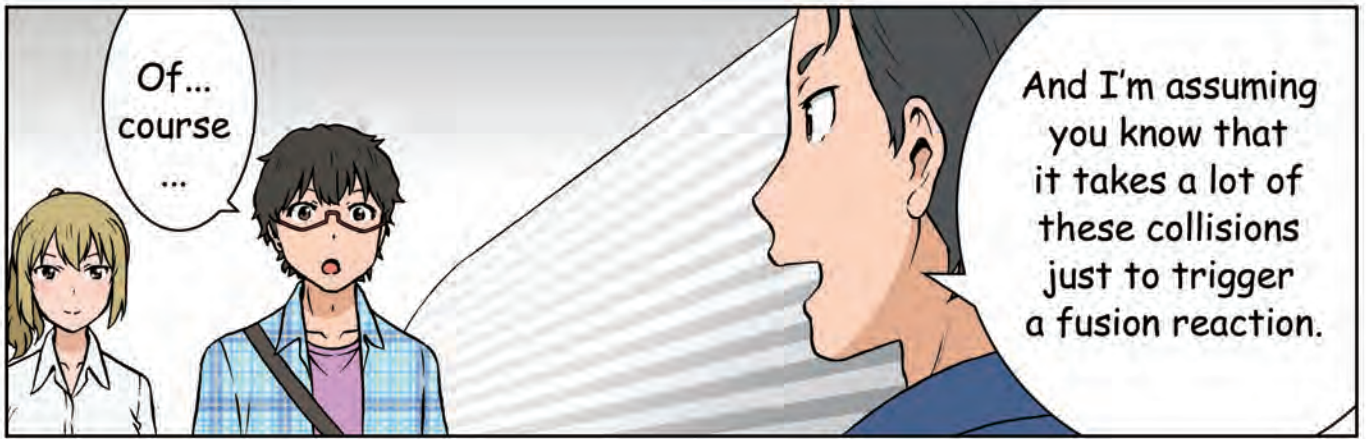


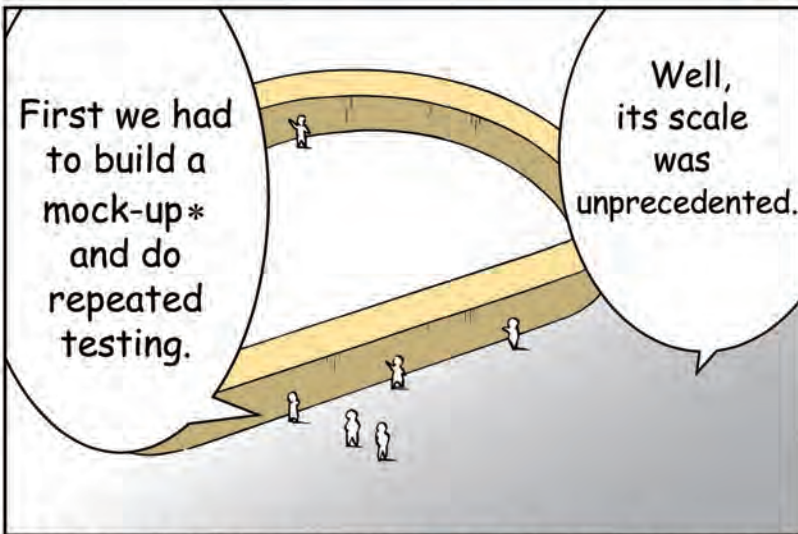
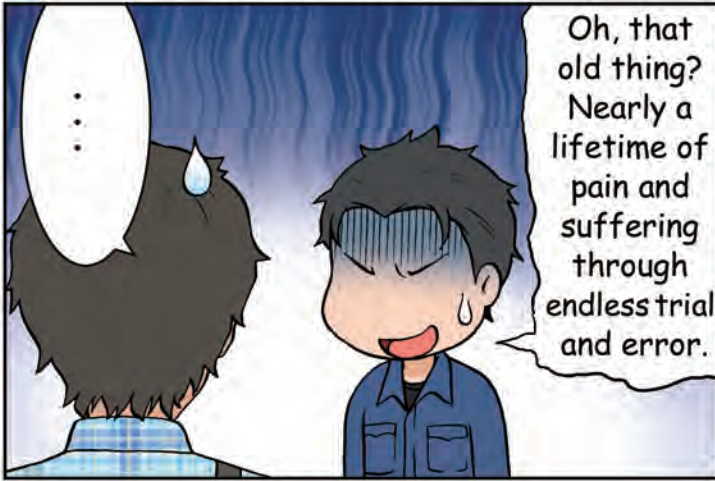
!



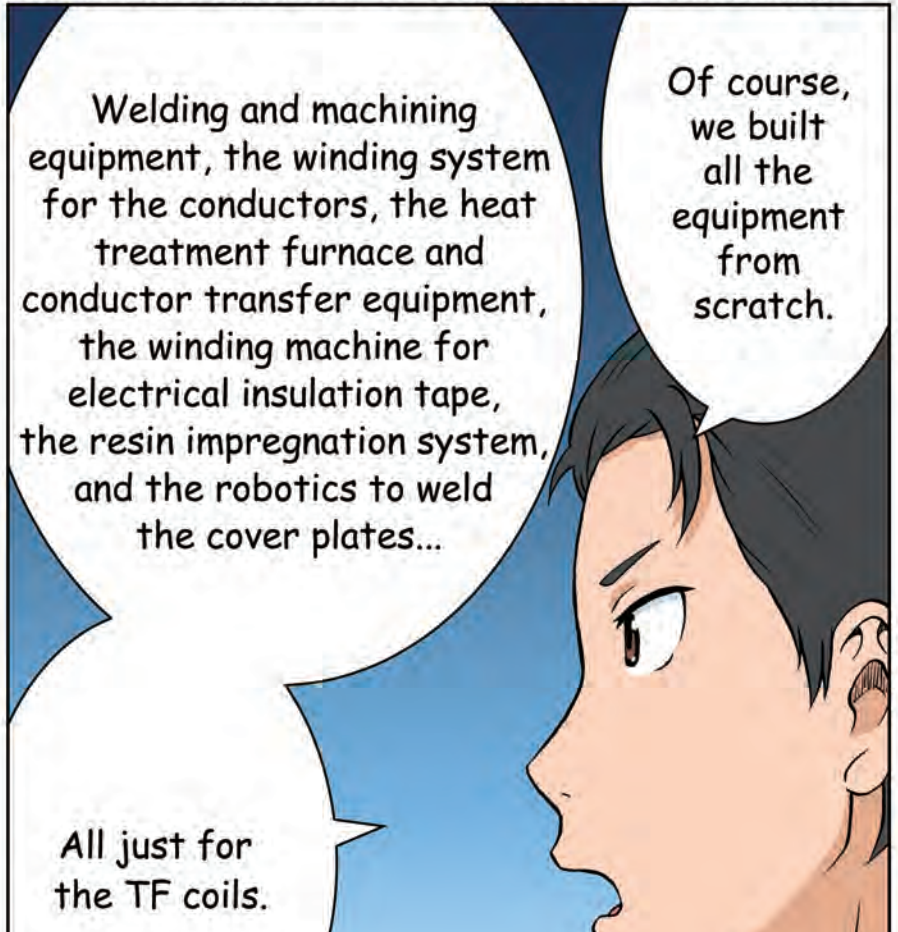
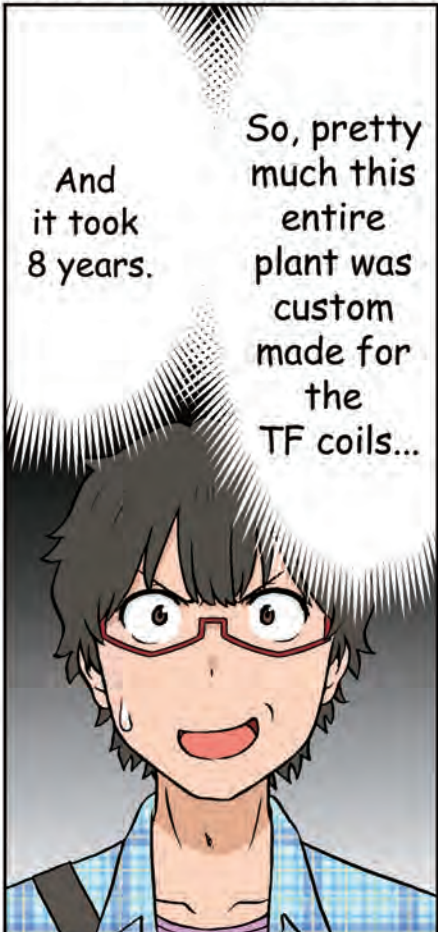
Come
on in.







* Full-scale prototype used to simulate the real component in the design phase of manufacturing





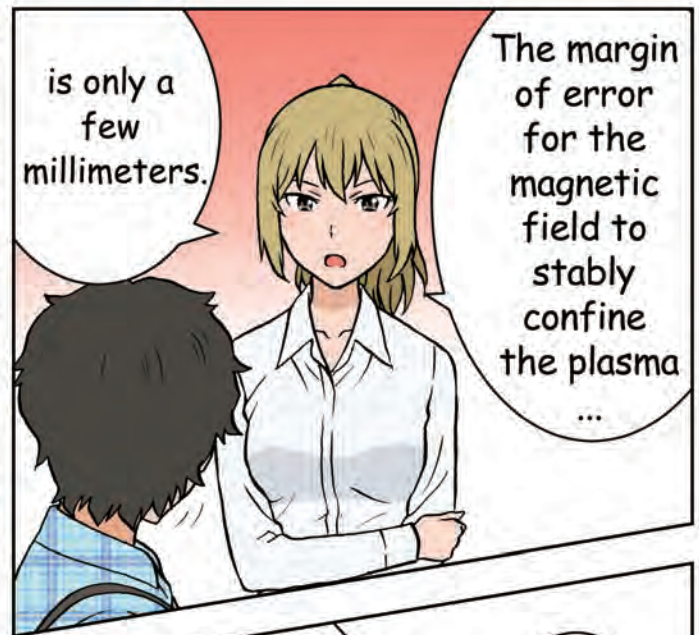
Level of precision ...?

The level of precision required for the dimensional tolerances gave us the most trouble.



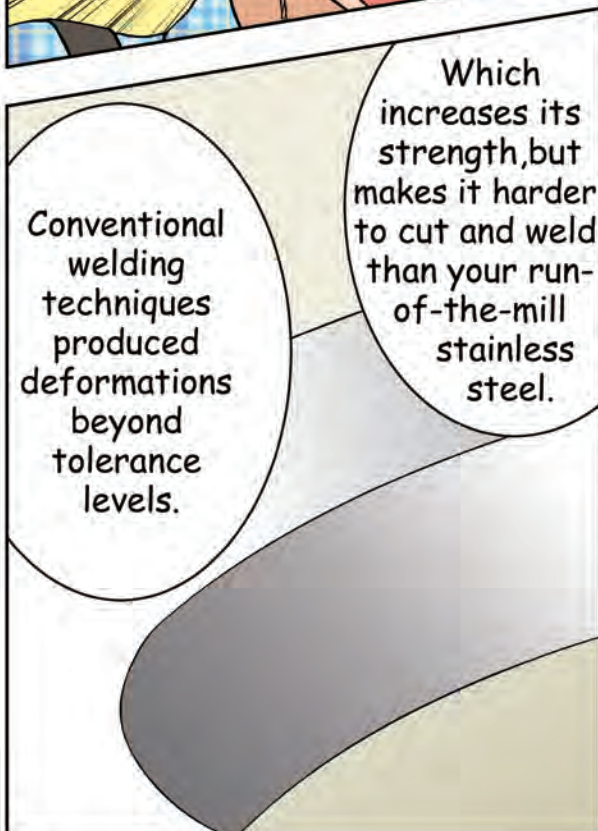
For this ginormous coil, you only have a few millimeters to work with?

A few millimeters!?



is only a few millimeters.

The margin of error for the magnetic field to stably confine the plasma ...



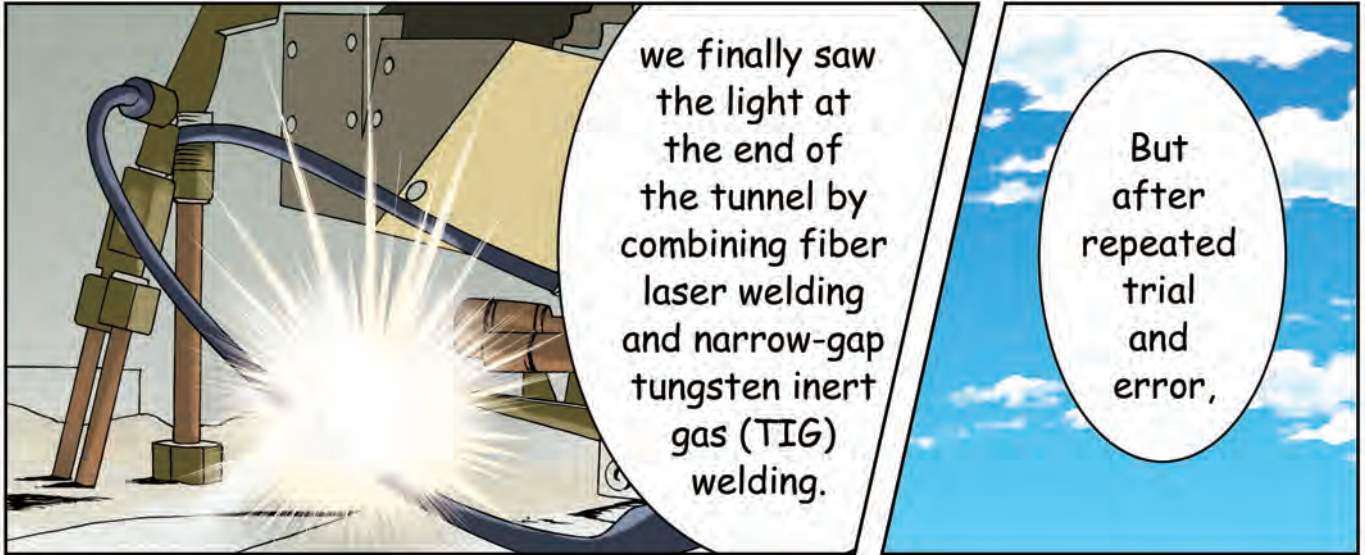
Conventional welding techniques produced deformations beyond tolerance levels.

Which increases its strength, but makes it harder to cut and weld than your run-of-the-mill stainless steel.



Yep

And the part that houses the TF coil conductors, the radial plate, is made from wrought high nitrogen stainless steel.



we finally saw the light at the end of the tunnel by combining fiber laser welding and narrow-gap tungsten inert gas (TIG) welding.

But after repeated trial and error,



to weld the segments together, starting from the center and going out 25 mm in both directions, then finishing the edges with TIG welding.

the most powerful fiber laser we could get our hands on at the time,

We ended up using a 30-kW fiber laser,

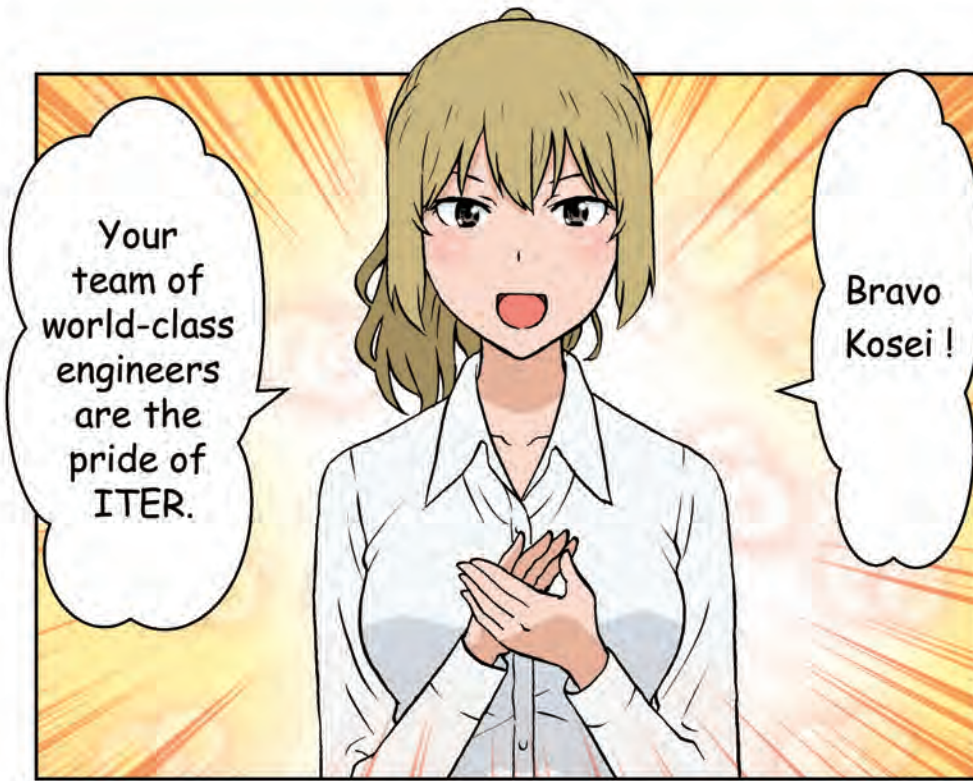


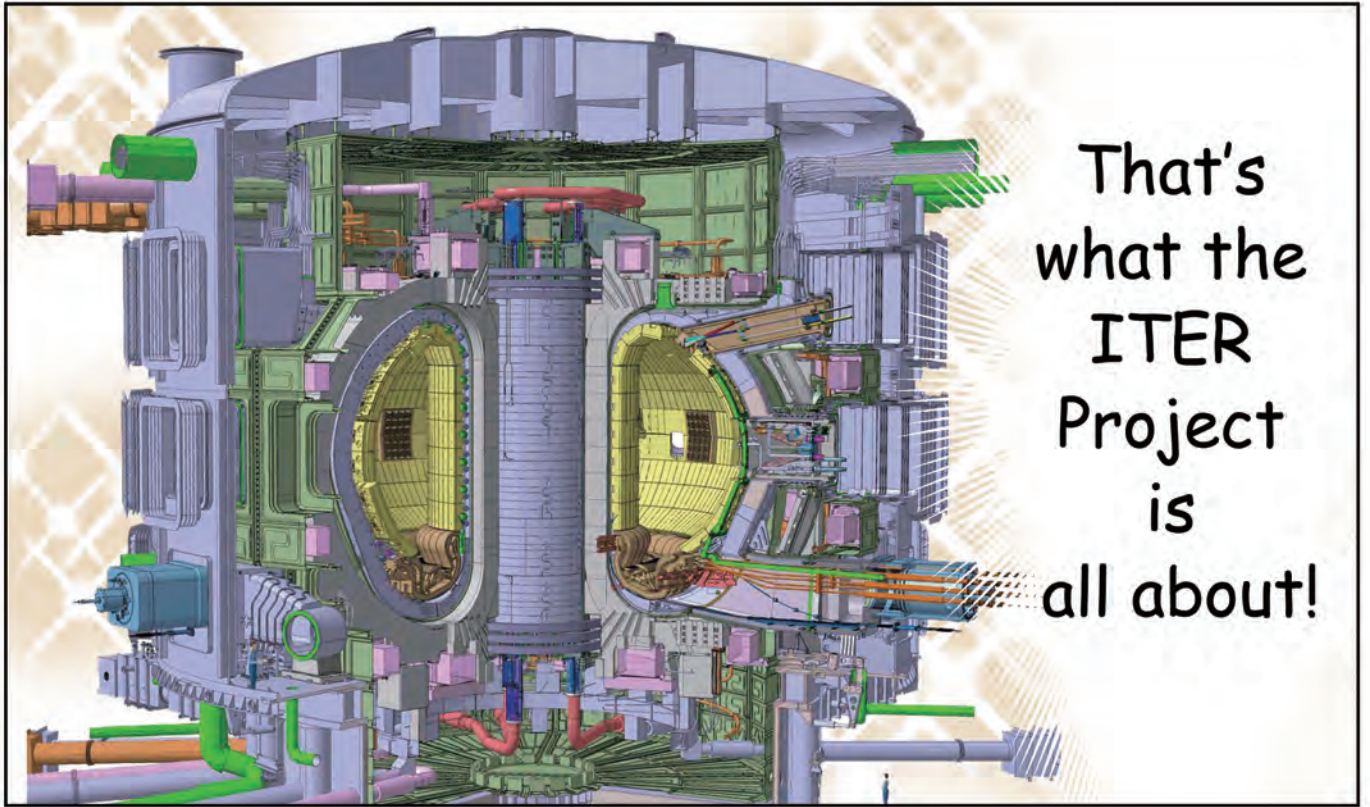
we were finally able to get the flatness tolerances under 1 mm!

After shedding much blood, sweat, and tears,

Silence...





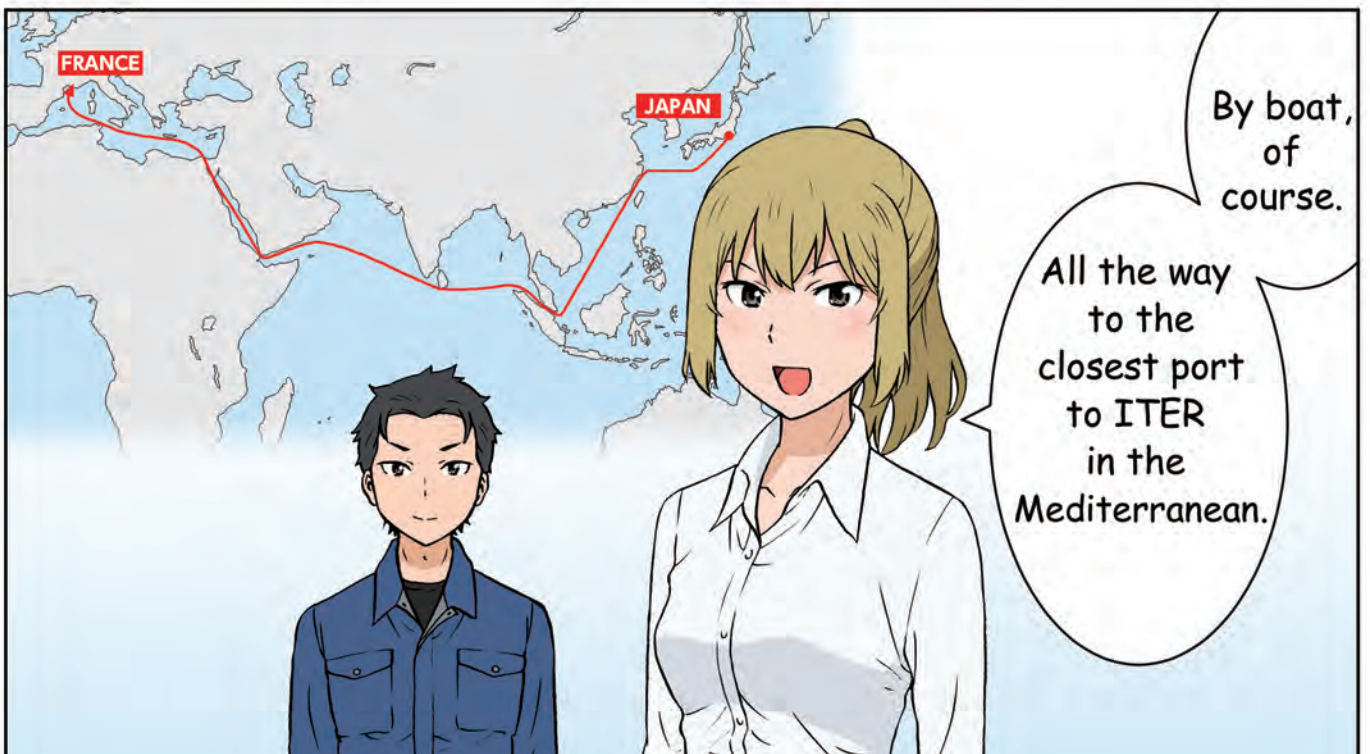


That's
what the
ITER
Project
is
all about!



How
exactly
do you plan to
get that giant
coil to the ITER
Organization
in France?

I just
have
one
question
...



By boat,
of
course.

All the way
to the
closest port
to ITER
in the
Mediterranean.



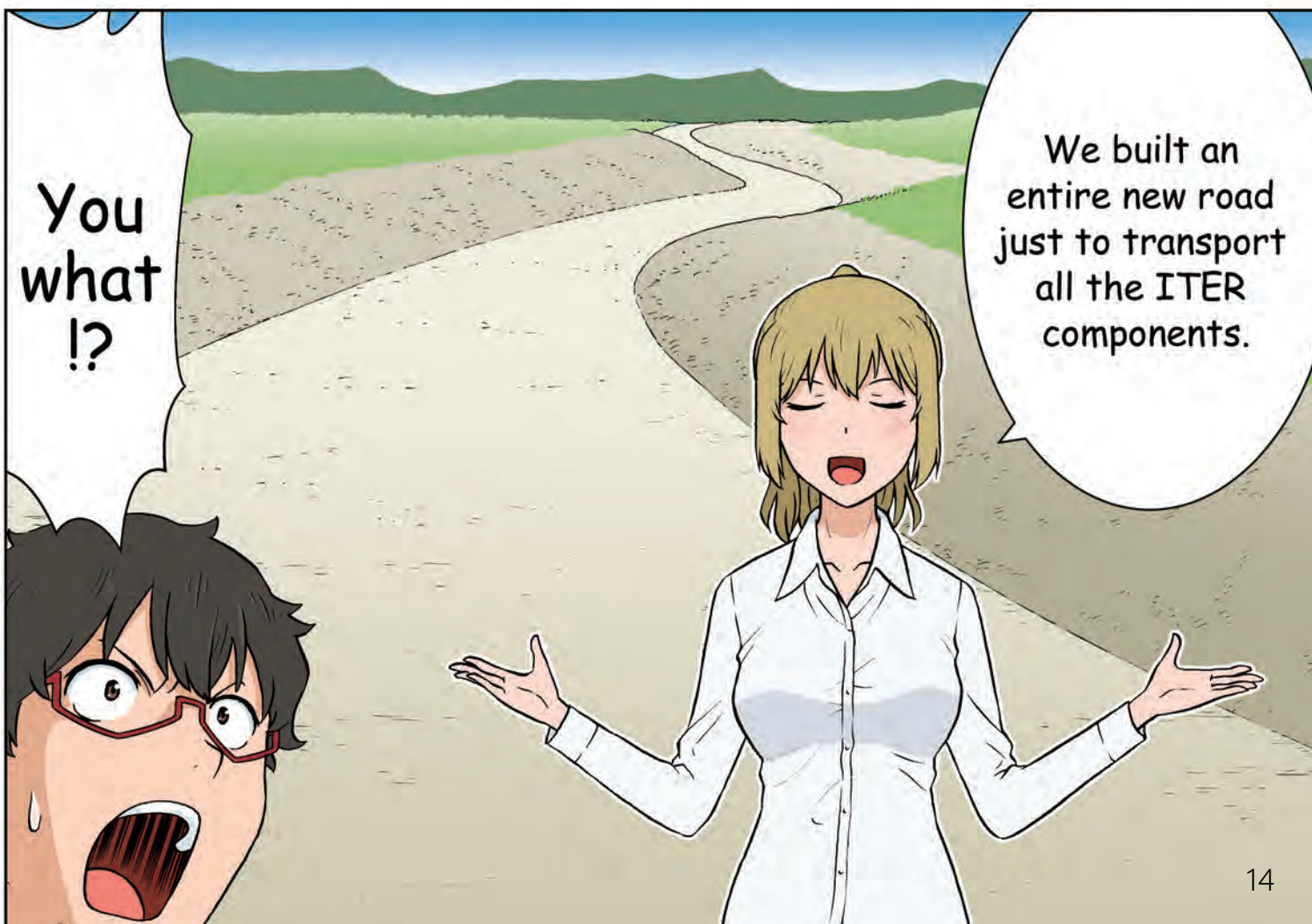
I don't see how you're going to get it there using the local roads...

I remember it was a bit of a ways from the port to ITER.

Yeah, but what about after that?



Au contraire



You what !?

We built an entire new road just to transport all the ITER components.

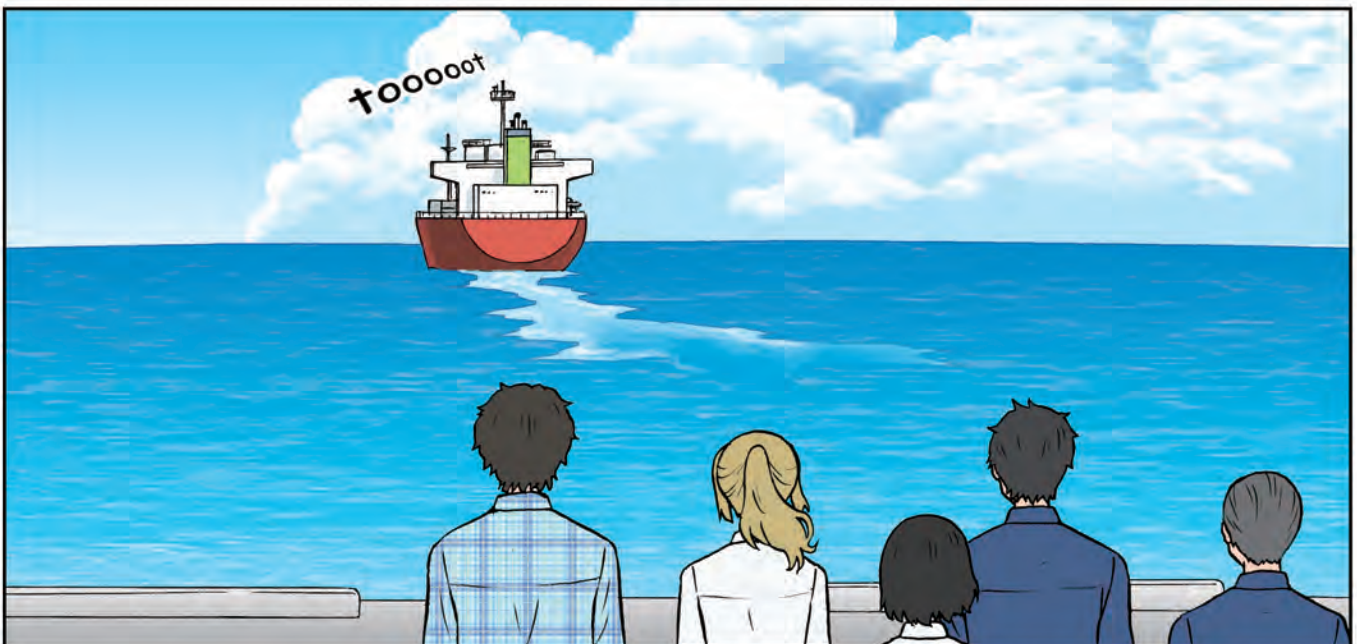
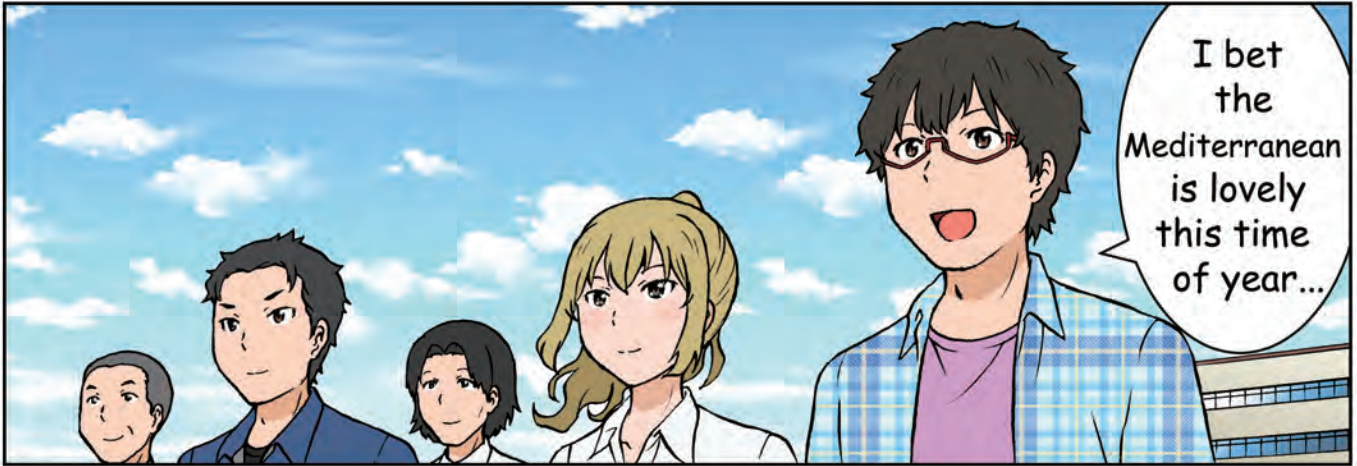
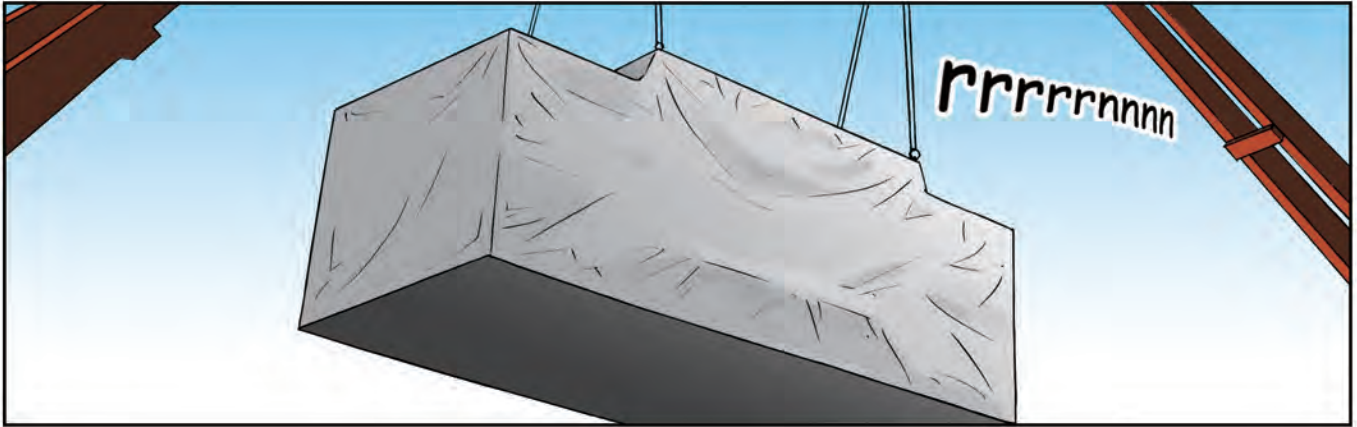


104-km-long,
it can support
up to
900 tonnes.

rumble
rumble



ITER
continually
pushes the
limit of
human
achievement.



This story is fiction based on actual events

to be continued ...

How ITER Toroidal Field (TF) Coils are made

Conductors are wound



and heat treated.



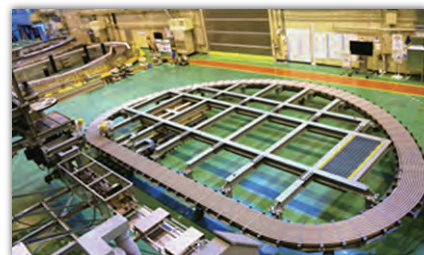
A radial plate is inserted



DPs are then stacked



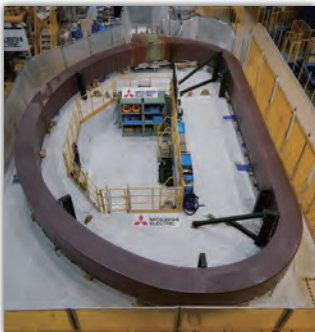
to form a double pancake (DP) module.



Fabrication of Radial Plate (RP)



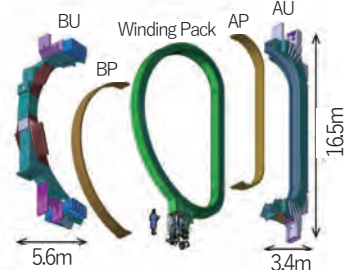
and impregnated with resin



to complete a winding pack.



Coil Sub-assemblies



AU...Inboard AP...AU Cover
BU...Outboard BP...BU Cover

TF Coil Structure





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