

“Japan: A New Age” by Tasogarenin (黄昏人)

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Chapter 7: Development stage one complete

It was September 8th and the summer heat still remained when the Fusion Reactor (FR) device was finally completed—although *finally* isn't the best choice of words since things had progressed extremely quickly given what was accomplished. At 11 a.m. Dr. Makimura stood in awe before the reactor. While the device's full operation would not be tested today, it would be switched on and brought to an excited state where its chain reaction and ability to generate power would be verified.

Present in the room was all the main members of the FR project, including development lead Professor Makimura, Dr. Yamato, Junpei and his father Yohei, along with Mr. Saito and other members of the implementation team. Ms. Hidaka and Mr. Yoshitake represented MEXT (*) together with Director Tanaka. Also present was the manager of the Yotsubishi Industries Konan factory and the main technical lead Shingo Kuriyama.

Minister Nakane also wanted to attend today, however he decided against it to avoid attracting too much attention. The project had been kept unusually secret, presumably due to the Prime Minister's words of warning. Nevertheless, probably because the work was distributed among many government ministries, whenever something big like this was about to happen there seemed to be rumors circulating. There was even whispers of nuclear fusion, but nobody paid attention to such an unlikely story.

(* *MEXT = Ministry of Education, Culture, Sports, Science and Technology*)

The fact that development took place in the small town of Konan is probably one of the reasons that the project could be, for the most part, kept confidential. A local paper ran an article about how MEXT was participating in an electric power development project at the Yotsubishi

Industries factory, and while it was mostly on point, the media didn't seem to care much.

Professor Yamamura was prepared to turn the device on, but first each member of the development team checked the systems they were in charge of and reported status. "IR selector value...OK, UR indicator...OK, output meter...OK."

"Dr. Yamamura, all systems are OK."

"Alright, I will be flipping the switch on in 60 seconds.....10, 9, 8, 7, 6, 5, 4, 3, 2, 1, switch on!"

Several seconds later, there was a roaring noise, and the status announcements returned. "Excited state established. Reactor core internal temperature rising, 100°C———200°C———300°C———400°C———488°C, chain reaction established."

"Power extractor on," announced Dr. Yamamura.

"Electric power output: 30 kilowatts, 40, 50, 70, 90, 105...stabilized at 105 kilowatts."
Hydrogen gas consumption rate is 1.05 grams per hour."

"Success!"

Unexpectedly, the crowd broke into a three-banzai cheer. Even Junpei raised his arms, screaming loudly in excitement. Everyone went around the room, shaking hands with the others one by one. The whole thing took only around 20 minutes after flipping the switch.

Dr. Yamamura spoke again. "Since everything looks to be functioning correctly, we might as well observe it for the next hour. It looks like the power transmission is also working."

"Yes sir, enough power to support the entire factory is already being generated, with the excess energy being safely rerouted to the power grid," said the factory's lead engineer in charge of power.

After some time, Dr. Yamamura raised his voice and spoke once more. “One hour has elapsed. The FR device has successfully operated without any abnormalities. I will shut down the machine now in order to run some checks...The machine is now off.”

He then turned to face the crowd.

“With this, I think we can consider the FR development project a success. All of you devoted a great amount of time to this project, which ran on an extremely tight schedule. You have my deepest thanks. I also want to thank all of those who have come a long distance to attend this event today.”

A round of applause broke out in the room.

Afterwards, they all had a buffet lunch in an adjacent room. Junpei stood next to his dad Yohei as he ate. “Whew, I really was starving.”

Shingo Kuriyama, the main technical lead from Yotsubishi Industries, started up a conversation with Mr. Tanaka from MEXT.

“Director, we have managed to keep this project highly confidential up to now, but when do you expect the government will make a public announcement?”

“We have reserved a one hour slot on the day after tomorrow, the 10th, at 7pm when a message from the Prime Minister will be broadcast. We will be making the announcement then. I think the result of today’s test will probably be leaked in some form or another, but we have requested your company refrain from making any announcements, and since little time remains I don’t think there will be much of a stir,” answered Mr. Tanaka.

“However, I believe there will be some major repercussions of the announcement, such as stock market fluctuation,” said Mr. Kuriyama.

“The ministries have all coordinated to simulate various possibilities and will be taking precautions to minimize negative effects. Nonetheless, a certain amount of stock fluctuation is unavoidable. Also, I think you are already aware of this, but when you consider the massive domestic demand that will emerge, plus the advantage of being able to drastically reduce costs to import fuel, I think it is clear that any negative effects to the market will be limited to the short term,” said Mr. Tanaka.

“I was a nuclear reactor engineer. While that technology will soon become obsolete, to tell the truth part of me is actually relieved. We received so much criticism, and yet never were able to actually tell the public it was 100% safe,” Mr. Kuriyama said with a lowered voice.

“Yes, in that sense, while this is only the start to things, technology will be seeing dramatic changes in the next few years. Thus far, energy has dominated a large part of overall costs, but we will see its cost radically reduced, and by being relieved of the uncertainty of obtaining fuel for energy in the future, our society itself will undergo great changes,” said Mr. Tanaka.

“And the person holding the key to those changes is that boy over there,” said Kuriyama as he glanced at Junpei enjoying his lunch.

On September 10th at 7pm, nearly the entire nation was staring at their TV screens.

“Now begins our special program: ‘Prime Minister Ayama’s talk on the start of an energy revolution’. Mr. Ayama, you may begin whenever you are ready.”

“Greetings everyone, this is Prime Minister Ayama.

Two days ago on the 8th of September, in Konan City a trial operation of a new nuclear fusion generator which had been in development was performed, and the result was a success.

The theoretical backing for this device was established by a team at the National Konan College by a team including physics Professor Dr. Yamato and Associate Professor Dr. Makimura. Development was done under the direction of industrial engineering Professor Yamamura, with the cooperation of many other people from Konan College and several private companies. The device itself is currently located in the Yotsubishi Industries’ factory in Konan City, and at this moment continues to generate over 100 megawatts of power.

This generator outputs 100 megawatts, using hydrogen obtained from electrolysis of tap water as fuel. Can you show the diagram please? As you can see from comparing with the image of a person here, this device has dimensions of 5m wide, 10m long, and 5m high, with a total weight of 45 tons—extremely compact for what it provides. Because the generation is achieved using nuclear fusion, some of you may be concerned about

radiation. However this device does not emit any radiation, and due to a design that generates electricity directly in the form of electrons, heat emission is relatively low, with a maximum reaction temperature of 500°C.

The generator that was built provides 100 megawatts, and assuming that one household requires one kilowatt of power, this will cover 100,000 households. In addition, compared to traditional power generation using petroleum where eight kiloliters is needed per hour, this technology requires only 1 gram of hydrogen per hour, which uses up only 0.02 liters of tap water.

Because water is the only fuel required, there is no longer any uncertainty about obtaining fuel in the future. Also, as can be predicted from the significantly smaller facilities required by this form of power generation compared to conventional methods, the overall cost is also significantly reduced. According to one expert, the costs will be roughly one-fifth of conventional methods.

However, adopting this new technology into our country will bring challenges of its own.

Firstly, there has been much debate on the matter of bringing our remaining nuclear reactors back online, but now that we have nuclear fusion available to us, this will surely never occur, and the five active reactors will be stopped eventually. This does not apply to just nuclear power, but also to thermal power, probably water power as well as solar power, all of which will most likely be abolished sooner or later. The reason is simple—they all are inferior in terms of cost. By cost, I mean the price of electricity which the people of our nation have to bear.

This means that the assets held by power companies—power plants and related equipment—will cease to be assets. Or perhaps I should say they will become liabilities which require teardown and disposal.

This effect is not limited to only power companies. In fact, at the same Konan College which I just mentioned, groundbreaking advances are being made on theories that apply the nuclear fusion ideas to batteries and motors, and we feel that for reasons of cost we should convert not just power generation, but also all automobiles to use electric power. As a result, companies which import crude oil or process it, as well as their facilities, will all lose value. I think many other industries will have a similar effect.

On the other hand, our country is spending around \$150 billion each year to import fossil fuels such as crude oil. It is thought that once the

conversion to these new technologies occurs, these import costs will be reduced by around \$120 to \$130 billion yearly.

Furthermore, for many years our country has suffered deflation resulting from insufficient demand. Due to all the many clear advantages of switching from devices which leverage conventional technology to those which use this new technology, I expect everyone will want to transition as quick as possible. The direct demand that will be generated, just considering our country alone, will be around \$500 billion in the next few years. At the same time, stored in our banks is a tremendous amount of money for which there is no use, and if possible I would like private companies to use their funds to invest in new power facilities. Investment opportunities like this which clearly have high returns will be welcomed by many.

When taking all this into consideration, the asset losses I just mentioned will be relatively inconsequential to our country as a whole.

However, this burden will not affect everyone equally, for example power companies and oil refinery companies will be hit particularly hard. That's why I request all of our nation's companies to help bear this burden together. For example, even if electricity rates are going to be lowered soon in accordance with overall cost reduction, I would like these to take into account lost assets and repayment of debt.

On the other hand, for some companies such as petroleum refinement where the demand itself will virtually go to zero, special consideration should be made. We are thinking that transitioning these companies to deal in completely new industries may work well. We have decided on our overall strategy for handling these problems, and there will be an announcement from METI (*) tomorrow at 10 a.m. Some of the suggested measures require new legislation, and while things are not finalized yet, we believe that the members of the National Diet will understand what needs to be done and work with us.

(* METI = Ministry of Economy, Trade and Industry)

Additionally, these new technologies should solve the problem of global warming that has worried us for quite some time. The power plants themselves will be extremely compact, hence the amount of carbon dioxide emissions during construction will be very low. The power generation itself will produce absolutely no carbon dioxide, so from an environmental point of view, emissions are ideal. From an international perspective, we intend

to make efforts to export this technology to other countries, giving priority to friendly nations. However, we are in the process of recommending measures to the MFA which take into account careful consideration of national interests.

In our nation, an energy revolution has just begun.

There is no turning back. And yet, this is a peaceful revolution, and one that will relieve us of much uncertainty about the future, which is why I am extremely proud to hold the position of Prime Minister during these times.

Several years from now, I'd love to be able to say that this revolution was great for our country, and that everyone did their best to make the world a better place."

Dr. Makimura had returned home early from work and watched the TV broadcast with his wife Sanae while they talked.

On the nearby sofa, his daughter Mai was already fast asleep.

"This was really a great announcement," said his wife. "Listening to it made me feel somehow better about everything. By the way, what was that they said about us moving?"

"Yeah, at this stage it seems like it's hard to protect us here, and they are in the process of searching for a new location for us. I heard that Junpei's family is also moving, and may end up in the same building, or at least very close.

I also heard that they are already guarding Junpei, though in secret. In addition, they are planning to building a new building on campus for the college's technical development corporation. The government will build it and lease it out to the corporation. Junpei's research lab will be inside there.

However for the time being, they are going to use a building next to the campus. They are using several government agencies that I am unfamiliar with, but it looks like this temporary building was forcefully vacated and is being prepared for Junpei. We were having some problems where we were holding his seminars, so this will be a great help.

One more thing—in May a related paper was accepted by *Nature* and is supposed to be published next month. The Prime Minister's speech really stirred things up so this is probably perfect timing."

"They finally released Junpei's name publicly, right?" asked his wife

“Yeah, they are taking a defiant stance after deciding that they can’t hide him anymore. Actually, even I was inspired by Junpei’s seminars and have been formulating the framework of a new theory in a different domain, which I think you’re going to be happy to hear about.”

“Hmm...Nobel prize, huh? I wonder what sort of dress I should wear...”

“Hold on now, I think you’re getting a little ahead of things.”

The next morning when Dr. Makimura scanned through various newspapers and sites on the net, yesterday’s announcement from the Prime Minister was on the top of every front page.

As there was not enough time for interviews, there was little actual content, although they had interviewed a couple of experts and some guesses that were fairly accurate. On the whole, the coverage of both the Prime Minister’s actions and the development was pretty favorable, however one newspaper gave the usual line: “When considering things from the perspective of world peace, am I the only one who thinks that there is something wrong with our country monopolizing use of this technology?”

The response was great from the US, in a different time zone. There was no official comment by the government yet, however the Press Secretary to the President stated that, “We are closely observing the progress of this matter, and if this new technology turns out to be a real and effective source of power generation, judging from our ties with Japan we expect that they will share it with us.” When Dr. Makimura went to Konan College as usual and checked the stock prices out of curiosity, the market had just opened but there was little movement. This likely meant everyone was waiting for an official announcement from MEXT.

While he was doing that, a call from Professor Yamato came in on his internal extension.

“Hey Dr. Makimura, we’re doing a press conference at the college. It’s tomorrow at 10 a.m. The speakers will be myself, Professor Yamamura, mechanical engineering Professor Sano, electrical engineering Professor Mizutani, and yourself. So keep your schedule open.”

“A press conference?”

“Yeah, since doing things one reporter at a time would take forever. Oh, and let’s watch the METI announcement together. Want to come to my room?”

“Yes, I’ll see you there.”

A few minutes before 10 a.m., Dr. Makimura arrived in Professor Yamato’s office and they turned on the TV.

The announcement was given by the head of the department of industry guidance at METI in his 40s. Below is the summary of the announcement:

1. Adjustment of electricity rates by power companies should take into account the depreciation of current facilities. However, it is requested that allowances are made for staff reduction due to the introduction of nuclear fusion generators (due to a major reduction of maintenance personnel) as well as cost reductions in the administrative department.
2. Companies related to petrochemicals and the manufacturing of power plants that will be largely affected should transition to the manufacture and construction of nuclear fusion generation technology, the demand for which is expected to grow significantly in the near term. The government will assist with financing to support this transition.
3. In accordance with the upcoming transition to electric automobiles, major industry changes will be required due to a reduction of engines manufactured and the obsolescence of many parts. The government will cooperate with the manufacturers to insure things go smoothly. Because charging the new high-capacity batteries must be done at the factory, whenever possible existing gas stations will be converted to battery charging stations.
4. Aluminum production will give priority to the small-scale nuclear fusion generators, with an effort made to increase the production efficiency by leveraging reduction of production costs. One of the reasons is because aluminum is required in large amounts for a critical part of the new motor.
5. The financing needed for the large loans that will be required for all these efforts will fundamentally be handled by commercial banks. However, for loans that satisfy a certain set of conditions, the government will provide financial assistance including interest subsidies and other types of compensation.

“They really thought things through,” said Professor Yamato. “I think because of the extra measures they are taking, there probably won’t be any major problems. However, the industries that are no longer relevant will have no choice but disappear. I really feel bad for the people in those companies.”

“Yes, I know how you feel since I also have a few friends who work in energy-related companies,” said Dr. Makimura.

Professor Yamato then brought up an unexpected topic. “Well now, tomorrow is our press conference, and after that it looks like things are going to get pretty busy again.

METI also mentioned this, but we’ll have to quickly begin construction of more FR devices, and since there is no expert engineers familiar with these technologies, let’s have people who are going to lose their jobs help out with this work. To facilitate that, we’ll gather people from all over the country and hold an intensive training seminar. The instructors will be those who participated in the FR development so we’ll have to keep things small, but for the first run we will accepting 100 people.”

“What? 100 people? When does this start?” Dr. Makimura asked in surprise.

“Today is the 11th, but the plan is for everyone to arrive in Konan City on Sunday the 21st.

The large lecture hall on campus will be used when everyone meets up together, but for other times the building prepared for the technical development company will be utilized. Also, while it will happen a little later, there are also plans to give training for the new battery and motor technologies.

The manufacturing process for the new battery has been established at Konan Mekatronix where Junpei’s father works, so the only remaining question is how to efficiently manufacture a large quantity of these in order to distribute them to various parts of the country quickly. For this to go smoothly, the automobile manufacturers will also have to be on board, so first we need to have a conference with them. This is scheduled for the 15th. Junpei is also planning to attend this,” Dr. Yamato explained coolly.

“Oh, you going to use *that* building? By the way, how is the new building coming along?” asked Dr. Makimura.

“I went to take a look, and the first floor has been significantly renovated for extra security. They are setting up your room on the second floor. Because all of the members of your research lab have participated in the development to a certain extent, they will have to help out with instruction,” Dr. Yamato responded.

“I guess it would be better for all of them to have a place to work in the next building as well. Is that possible?”

”Yes, much of the space in the new building has not been allocated yet. It has five stories, so with that much area two floors should be enough for us. After all, you and your students will probably not use up even half of a single floor. I’d like you stop by there and tell them how you would like the interior done for your graduate students’ rooms as well as your own. The person on this card is in charge of the renovations, so please give him a call before you go over,” said Dr. Yamato as he passed a business card to Dr. Makimura.

That day there were large fluctuations in the stock prices, but there was no extreme movement like they had feared. The measures taken by METI had proven to be effective.

The next day at 10 a.m., the press conference began in the college’s large hall.

An unexpected number of people attended—over 200—including even media from overseas.

“I’d like to thank all of you for attending today.

We will now begin the press conference concerning the recently developed nuclear fusion generator, as well as the new ultra-efficient battery and motor.

We will start with a brief explanation of the device, its history, and development. Please refer to the handouts which you all received,” Dr. Yamato said to kick off the conference. For the time being, he had decided to keep quiet about Junpei.

“The reaction utilized by this nuclear fusion device is completely different from that used by the previously developed nuclear fusion device, and does not require a plasma reaction as that one did.

Its theoretical backing was established by a team lead by Associate Professor Makimura who sits here beside me, the details for which have been submitted to *Nature* and will be published in next month's issue. The second key characteristic is that hydrogen isotopes such as deuterium or tritium, which were required by the prior fusion reactor design, are no longer needed, and simple hydrogen can be used instead. Furthermore, while the conventional nuclear reaction generates heat which is then used to spin a turbine and generate electricity, the new design allows directly extracting electricity from the reactor core in the form of a flow of electrons. These things make implementation extremely convenient, and are also the reasons that the device is so compact and simple.

Based on this theory, in November of last year we received a federal subsidy for new technology development and began work on constructing an actual device. This stage was done under the leadership of Professor Yamamura who is also with us today, and thanks to the cooperation and hard work of many people, institutions, and companies, we succeeded in passing a trial run of the device after a little over nine months. This occurred on September 8th, and since there was no problems in an examination of the system after one hour of operation, the system has stayed running until now. As you all know, the nominal output of the reactor is 100 megawatts, with the actual power output around 105 megawatts. The fuel is 1.2 g/hr of hydrogen, which comes from electrolysis of only 20 cc/hr of tap water. The total power usage of the Yotsubishi Industries' factory where the device is located is around 30 megawatts, which means it is returning over 70 megawatts back to the power company's grid.

This ends the overview. We will now be available to answer questions, although this portion will be limited to a total of 30 minutes. Please be aware that we may stop a question early to prevent a single person from taking up too much time.

Before we get started, I know that there are some people who are eager to see the actual device, so we will poll to see who is interested. For those who wish to see the nuclear fusion generator in the Yotsubishi Industries' factory, please raise your hand. Alright, I see nearly all of you are interested. We will prepare a bus for transportation there, so please come to the main gate one hour from now. Once the viewing is completed, you will be returned to the campus. Please be aware that no other vehicles except this bus will be allowed inside the factory. Alright, now let's start the questions."

“Hello, I’m Yamada from the *N* paper. I’m very excited about this terribly groundbreaking invention, but I was wondering if there was anything that inspired the theory of this new type of nuclear fusion generator?”

“I’m Makimura and I’ll answer this one. In recent years, research for nuclear fusion has focused on imitating the reaction which occurs inside the sun, however around 15 years ago there was some discussion of a *cold fusion reactor*, and while I was quite young then, I thought it was a pretty interesting idea. So if there was anything like an inspiration, I think that would be it. We felt there might be something to that idea, and after a lot of trial and error we finally stumbled upon this new theory.”

And thus the question and answer session began. Below is the main (or memorable) questions which were asked.

Q: “Around how much money was spent on development?”

A: “The budget was set at \$20 million, but as of now only \$18 million has been used, with \$12 million of that for the device itself.”

Q: “Are there any plans for future development to further advance this technology?”

A: “Fundamentally, we will be finished with development after completion of the standard designs for each size: 100, 500, and 1000 megawatts.

Q: “How many new power plants are planned, and where will they be located?”

A: “From what I have heard, there are plans early next year to begin construction of several plants for private companies. Yotsubishi Industries, who has participated in the development, is on this list. Of course, the government will be coordinating this, so you should ask METI directly for details. Apparently one terawatt devices will be installed as necessary at the location of each plant which has a transmission supply network.

Q: “How are plans proceeding to form alliances and provide this technology to other countries?”

A: “We intend to follow the government’s policies, and the college has not considered anything specific regarding this.”

Q: “Japan has caused so much trouble for my country, so I think you should supply this technology to us for free...” (This guy kept trying to persistently talk, and had to be kicked out by a security officer)

Q: “The students from my country who are attending Konan College have been recently getting kicked out their research projects. This is discrimination!”

A: "This is not limited to research at Konan College, and it is due to a government policy to disallow overseas students from participating in any research that is sensitive to national interests. A similar thing is done in other countries besides Japan."

Q: "I've heard that there is a very large number of scientific breakthroughs being made at Konan College lately. Is this true?"

A: "Certainly, as you say there will probably be significant papers and results published this year. I feel this is thanks to our college's unique educational system."

Q: "What do you mean by 'educational system'?"

A: "Our strategy is to have group sessions where various people with technical knowledge on a certain topic gather and have discussions, resulting in new ideas and proposals."

Q: "There is no way that such a system alone could result in scientific breakthroughs."

A: "But these breakthroughs are happening in reality."

Q: "Have you already gotten patents on these ideas? Whose name are the patents in? Also, what amount of licensing fees do you expect to get?"

A: "We expect to acquire patents on the technologies already made public based on their novelty. The respective patents in the US have already been established. The members here are included in these patents, however the patent license itself will be owned by the college, with the inventors each receiving their share of compensation."

Q: "How much money will these generate?"

A: "Regarding the device itself, for domestic usage we will ask for \$10/kw at startup time, and \$0.1 cent/kilowatt for all power generated. We intend to double these rates for overseas usage. As for the total cost, you can go ahead and calculate each yourself."

Q: "Don't you think increasing the fees for overseas is unfair?"

A: "This is a government-funded college. It's only natural to contribute to our country."

While a length of 30 minutes was announced, the questions ended up taking up a full hour, and the press conference ended at 11:30.

When they went outside, the overseas reporter who had been kicked out was waiting there.

"Hey Yamato! You're insulting my people, so you better apologize!" Other journalists standing around stared in shock at the spectacle, but a few of them approached.

Yamato said with a straight face, “No, I’m not insulting your people. I’m simply insulting you, a man who lacks even a scrap of decency.”

“You Japanese people are all the same. I’m going to talk to the embassy and lodge a complaint!”

“Go ahead, lodge a complaint or do whatever you like. Just don’t ever show your face again. You’re prohibited from joining the viewing,” Yamato said as he glanced toward a security guard.

“Yes, sir,” the guard said with a bow.

Dr. Yamato turned around and quickly walked away. “Hey everyone, see how they treat us!” He looked around at the others, but only received cold stares from the crowd.

The man screamed in some foreign language as he ran away.

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