China is gearing up for the fastest deployment of nuclear energy in history, fuelled by Australian uranium. At least thirty new reactors are planned to be built in the fifteen years. Nearly all will be Pressurised Water Reactors, the most common type in the world. But one will be the first commercial Pebble-Bed Reactor, a radically different Chinese design that researchers claim is ‘meltdown proof’ and ‘inherently safe’. As Australia debates whether we should build our own reactors, one thing is clear: our nuclear future is inextricably linked with China. Catalyst visits two reactors in China to search for answers, in the first Australian science TV report about the practicalities of making nuclear energy in the world’s most populous nation.	China beeilt sich für die schnellste Entwicklung der Atomenergie in der Geschichte, getankt durch australisches Uran. Mindestens werden dreißig neue Reaktoren geplant, in den fünfzehn Jahren errichtet zu werden. Fast alle sind unter Druck gesetzte Wasserreaktoren, das allgemeinste eintippen die Welt. Aber man ist der erste Handelsc$Kugel-bett Reaktor, entwerfen ein radikal anderer Chinese, dass Forscheranspruch ` Einschmelzenbeweis' und das sichere ` in sich selbst' ist. Während Australien debattiert, ob wir unsere eigenen Reaktoren errichten sollten, ist eine Sache klar: unsere Kernzukunft wird unentwirrbar mit China verbunden. Katalysator besucht zwei Reaktoren in China, um nach Antworten, im ersten australischen Wissenschaft Fernsehbericht über die praktischen		

	Anwendbarkeiten der Herstellung von Atomenergie in der einwohnerstarksten Nation der Welt zu suchen.		
TRANSCRIPT			
Narration: The fastest growing economy in the world is racing to find enough energy to feed itself. You only have to look at both sides of the Pudang River in Shanghai to get a sense of what's driving the energy explosion. Mark Horstman: The contrast along this river symbolises China's booming growth and rapid change. Over the last century, people have looked to this side to see China's prosperity. But in just the last fifteen years, this futuristic skyline has risen from the other side. As the Chinese saying goes: jiude buqu, xinde bulai: if the old doesn't go, then the new can't come. Narration: China is being transformed. Energy consumption is skyrocketing, expected to double in the next fifteen years.	ABSCHRIFT Erzählung: Die am schnellsten wachsende Wirtschaft in der Welt läuft, um genügend Energie zu finden, um sich einzuziehen. Sie müssen beide Seiten des Pudang Flusses in Shanghai nur betrachten, um zu erhalten eine Richtung von, was die Energieexplosion fährt. Kennzeichen Horstman: Der Kontrast entlang diesem Fluss symbolisiert Chinas dröhnendes Wachstum und schnelle Änderung. In dem letzten Jahrhundert haben Leute zu dieser Seite geschaut, um Chinas Wohlstand zu sehen. Aber gerade in den letzten fünfzehn Jahren, sind diese futuristischen Skyline von der anderen Seite gestiegen. Wie das chinesische Sprechen geht: jiude buqu, xinde bulai: wenn das alte nicht geht, dann kann das neue nicht kommen.		

	Erzählung: China wird umgewandelt. Energieverbrauch ist das Emporschnellen, erwartet, um sich in den folgenden fünfzehn Jahren zu verdoppeln.		

Even then, it will still consume less than the United States. But from China's perspective, there's a lot of catching up to do.	Sogar dann, verbraucht es noch kleiner als die Vereinigten Staaten. Aber von Chinas Perspektive, gibt es viel Aufholen, zum zu tun.
Professor Zhang Zuoyi: People in China like to have a big house, they like to have a better living standard. And it certainly needs some nuclear energy.	Professor Zhang Zuoyi: Leute in China mögen ein großes Haus haben, sie mögen einen besseren Lebensstandard haben. Und er benötigt zweifellos etwas Atomenergie.
Narration: That's where Australia comes in. As the only major uranium producer in the world without its own nuclear power stations, we've signed an agreement to supply our uranium to China.	Erzählung: Das ist, wohin Australien hereinkommt. Als der einzige Uran hauptsächlichproduzent in der Welt ohne seine eigenen Atomkraftwerke, haben wir eine Vereinbarung unterzeichnet, unser Uran an China zu liefern.
Australia will need to mine twice as much yellowcake just to meet China's future demand.	Australien muss so viel Urangelb zweimal gerade gewinnen, um Chinas zukünftige Nachfrage zu befriedigen.
Our nuclear future will be shaped by what we can learn from China's experience in nuclear energy.	Unsere Kernzukunft wird geformt durch, was wir von Chinas Erfahrung in der Atomenergie lernen können.
Professor Zhang Zuoyi: If China can use a safe and cost-effective energy source, it will be better for this country and I think it will be better for the world.	Professor Zhang Zuoyi: Wenn China eine sichere und kosteneffektive Energiequelle verwenden kann, ist es für dieses Land besser und ich denke, dass es für die Welt besser ist.
Narration: At the other end of the uranium trail, to the north and south of Shanghai are most of China's nine commercial nuclear reactors.	
This is the massive Qinshan complex of five nuclear reactors, generating 3000 megawatts of electricity.	
One of them is China's newest, and that's the one we've come to visit – like all of the power plants here, it's a Pressurised Water Reactor, or PWR.	
As our Catalyst crew arrives, we're met by an army of Qinshan's highest ranking executives.	

Yang Lan He: Our nuclear power plant is just like a garden. The PWR type of nuclear power unit is the most mature, the safest, and the most reliable. In the spirit of China's nuclear industry, declares this billboard, caution is everything. That's why their government has adopted the PWR, a standard design that's been in use around the world for nearly fifty years. Guide: We call it a nuclear island. Mark Horstman: Nuclear island? All the fuel is stored in this containment. Narration: Inside the reactor are bundles of fuel rods filled with pellets of enriched uranium. The core generates intense heat by splitting uranium atoms and controlling the chain reaction. The Pressurised Water Reactor gets its name from the water used to cool it, kept under high pressure to stop it boiling. The super-heated water is used to make steam, which drives turbines. Its efficiency is how much heat it takes to make a megawatt of electricity. Mark Horstman: What is the efficiency of this reactor? Ye Danmeng: Its efficiency is about thirty one percent. Narration: Surprisingly, that's less efficient than a coal-fired power station in Australia. And there's much more at stake running a water-cooled reactor like this one. Pipes become brittle; water becomes radioactive; valves have to withstand enormous pressures; and if the cooling system fails, the core can melt down. There's only seconds to make the right decision in an emergency.	Erzählung: Am anderen Ende der Uran Spur zum Nord und Süd von Shanghai sind die meisten Chinas neun kommerziellen Kernreaktoren. Dieses ist der enorme Qinshan-Komplex von fünf Kernreaktoren und erzeugt 3000 Megawatt Strom. Eins von ihnen ist neuesten Chinas, und das ist das, das wir gekommen sind zu besuchen - wie alle Kraftwerke hier, ist es ein unter Druck gesetzter Wasserreaktor oder PWR. Während unsere Katalysatormannschaft ankommt, werden wir von einer Armee von Qinshans hoch Exekutiven getroffen.

Ye Danmeng: If you want to shut down the reactor, here. Mark Horstman: Have you ever had to use these buttons? Ye Danmeng: No. Narration: That's good news for the millions of people in eastern China at the end of the powerlines. But for the farming families living next door to Qinshan, it's too close for comfort. Villager: The nuclear power plant is expanding, this way, that way. We will be surrounded by the nuclear power plant. Narration: There'll be many more generations growing up in the shadow of reactors, as another thirty are built over the next fifteen years. That's at least two every year. The fastest rollout of nuclear power in history is a program of national scientific pride. But for a country that speaks of 'out with the old and in with the new', China is building the kinds of reactors that are being demolished elsewhere in the world.(BOOM!)…like the cooling tower of this PWR in Oregon, shut down 20 years early because it wasn't worth fixing its leaky steam pipes anymore. If the PWR has had its day, what could come next? We don't have to go far to find out. Mark Horstman: This is the outskirts of Beijing. And I'm at the gate of one of the only nuclear reactors of its type in the world. We've been trying to get approval for months, and now hopefully we're going to get inside. Mark Horstman: Kept under wraps inside this innocuous box at Tsinghua University is a Chinese prototype reactor that researchers claim is uniquely safe. Professor Zhang Zuoyi: This reactor currently is	Mark Horstman: Dieses ist der Stadtrand von Peking. Und ich bin am Tor vor dem einzigen Kernreaktor dieses Typs in der Welt. Wir haben Monate versucht, Erlaubnis zu erhalten, und jetzt hoffen wir hinein zu kommen. Mark Horstman: Geheim innerhalb dieses harmlosen Kastens an der Tsinghua-Universität steht ein chinesischer Versuchsreaktor, der nach Forscher-Anspruch einzigartig sicher ist.

the only pebble-bed test reactor in the world. Narration: Because When Professor Wu Zongxin started nuclear research in the early sixties, water-cooled reactors were all the rage. So were the hats. The pebble bed reactor he runs now is radically different. Professor Wu Zongxin: This vessel is steam generation, this is for the reactor. Narration: Because instead of fuel rods, his reactor is filled with 27,000 of these, the nuclear pebble. Professor Wu Zongxin: (drops the pebble) OK, no problem. Narration: Luckily they're built strong enough here to be dropped 50 times before they break. Each pebble is a perfect graphite sphere, filled with specially coated particles of enriched uranium. Mark Horstman: These are the radioactive particles? The heart of the fuel? Professor Wu Zongxin: Yeah, this is the heart of the fuel here and outside we coat it with four layers. Narration: Eight thousand particles inside a hollow sphere means that each pebble works like a mini reactor. The pebbles are recycled around and through the core. Professor Wu Zongxin: This is the fission energy produced in the core. Narration: Its high running temperatures are more efficient for generating electricity. Because these reactors use helium gas for cooling instead of complicated plumbing, they should also be safer to operate. Mark Horstman: That is very different from other	Professor Zhang Zuoyi: Dieser Reaktor ist z.Z. der einzige Kugelbett-Testreaktor in der Welt. Erzählung: Weil, als Professor Wu Zongxin Kernforschung in den frühen Sechziger Jahren begann, waren wassergekühlte Reaktoren das ganze Rennen – Auch diese Hüte ! Der Kugelbettreaktor, den er jetzt laufen lässt, ist radikal anders. Professor Wu Zongxin: Diese Behälter ist der Dampferzeuger, für den Reaktor. Erzählung: Weil anstelle der Brennstäbe dieser Reaktor mit 27.000 dieser Brennelemente gefüllt wird. Professor Wu Zongxin: (lässt die Kugel hüpfen) O.K., kein Problem. Erzählung: Glücklicherweise sind sie fest genug und können 50mal springen, bevor sie brechen. Jede Kugel ist eine perfekte Graphitkugel, gefüllt mit speziell beschichteten Partikeln angereicherten Urans. Mark Horstman: Dies sind die radioaktiven Partikel? Das Herz des Brennstoffs? Professor Wu Zongxin: Ja, dieses ist das Herz des Brennstoffs, und außen beschichten wir es mit vier Schichten. Erzählung: Acht tausend Partikel innerhalb des Hohlraums bedeutet, dass jede Kugel wie ein Minireaktor arbeitet. Die Kugeln werden durch den Kernbehälter (Core) zirkuliert. Professor Wu Zongxin: Das ist die Spaltungsenergie, die im Kern produziert wird. Erzählung: Seine hohen Betriebs-Temperaturen sind für die Strom-Erzeugung leistungsfähiger. Weil diese Reaktoren Heliumgas zum Kühlen anstelle der schwierigen Verrohrung benutzen, sollten sie auch sicherer im Betrieb sein.

reactors where it's water under pressure.	Mark Horstman: Das ist sehr unterschiedlich zu anderen Reaktoren, in denen es Druckwasser gibt.
Professor Wu Zongxin: Yeah. So it's a feature of the reactor is your helium for the coolant. That is the main difference.	Professor Wu Zongxin: Ja. So ist es. Eine Funktion des Reaktors ist Helium als Kühlmittel. Der ist der Hauptunterschied.
Narration: It all leads to a daring safety test that would be unthinkable in any other power plant.	Erzählung: All das führt zu einem kühnen Sicherheitstest, der in jedem anderen Kraftwerk undenkbar sein würde.
Professor Zhang Zuoyi: For this reactor, I think that basically we can prove it is a meltdown-free reactor.	Professor Zhang Zuoyi: Für diesen Reaktor denke ich, dass im generell beweisen können, dass es ein GAU-freier Reaktor ist.
Narration: The Professor invites scientists from around the world to watch what happens when you deliberately set up an accident by switching off the cooling system.	Erzählung: Der Professor lädt Wissenschaftler aus der ganzen Welt ein, zu beobachten, was geschieht, wenn man absichtlich einen Störfall herbeiführt, indem man das Kühlsystem abschaltet.
Mark Horstman: That sounds like a dangerous thing to do in a nuclear reactor, to get it running, get it critical, then turn off the cooling system.	Mark Horstman: Das klingt gefährlich in einem Kernreaktor, ihn hochzufahren, kritisch zu fahren und dann, das Kühlsystem abzustellen.
Professor Wu Zongxin: Yeah, sure, it's very, very dangerous, of course.	Professor Wu Zongxin: Ja sicher, es ist sehr, sehr gefährlich, ganz klar.
Technicians: Start testing now. OK, understood. The helium power is shut down.	Techniker: Wir beginnen den Test. O.K., verstanden. Das Heliumgebläse wird geschlossen.
Narration: What they do here is exactly what causes catastrophic meltdowns at water-cooled reactors, as happened at Chernobyl and Three Mile Island.	Erzählung: Was wir hier tun, ist genau, was in Tschornobyl den GAU verursachte, wie es im Three Mile Island geschehen. (oder auch in Fukushima, Anm. d. Übers.)
Mark Horstman: But is it dangerous here?	Mark Horstman: Aber, ist es auch hier gefährlich?
Professor Wu Zongxin: No, because always we have the passive way to remove all the decay heat.	Professor Wu Zongxin: Nein, weil wir immer die passive Wärme-Abfuhr haben, um die ganze Nachzerfallswärme zu entfernen.
Mark Horstman: So the reactor is able to get rid of more heat than it can actually hold in itself?	Mark Horstman: So ist der Reaktor in der Lage, mehr Wärme abzuführen, als bei sich zu halten?
Professor Wu Zongxin: Yeah.	Professor Wu Zongxin: Ja.
Narration: The nuclear physics inside this reactor means that the higher the temperature, the slower the chain reaction. Unlike a water-cooled reactor, the pebble-bed doesn't go into meltdown. The reactor goes to sleep, and the test is a success.	Erzählung: Die Kernphysik innerhalb dieses Reaktors bedeutet: je höher die Temperatur, desto langsamer die Kettenreaktion. Anders als in einen wassergekühlten Reaktor beginnt beim Kugelbett

The philosophy here is that reactor safety should rely on physics, not reinforced concrete. Professor Zhang Zuoyi: Safety is number one. We should avoid the nuclear accident. Narration: Just when I thought the safety issues were solved. Professor Wu Zongxin: We'll go real quick. Narration: We're in the elevator going to see some barrels in the basement. The waste storage facility is secured behind some wooden doors. What to do with growing piles of nuclear waste is a problem that not even this reactor can solve. Mark Horstman: Do you believe pebble bed reactors are the safest form of nuclear? Professor Wu Zongxin: I think so. It is most recognised by the international nuclear community. Mark Horstman: So in the future, new reactors could all be pebble bed reactors? Professor Wu Zongxin: No, I don't think so. Narration: The Professor laughs, because he understands the commercial realities. Another ten water-cooled reactors will be built before the first pebble-bed is even up and running. And what does this mean for Australia? Professor Zhang hopes that one day we will use pebble-bed reactors from China. But for now, he's surprisingly frank about our own nuclear capability. Prof Zhang Zuoyi: It's better not to use nuclear energy for Australia. Because for nuclear you need a lot of infrastructure, you need a lot of experienced people you should be careful. I think the best way is you can share the uranium. I think it is the best way. You just get money and you don't need a lot of work.	nicht die Kernschmelze. Der Reaktor geht „schlafen", der Test ist ein Erfolg. Die Philosophie hier ist, dass Reaktorsicherheit auf Physik beruhen sollte, nicht auf Stahlbeton. Professor Zhang Zuoyi: Sicherheit ist Nummer Eins. Wir sollten den Nuklearunfall vermeiden. Erzählung: In einem Gedankenblitz wurden die Sicherheitsfragen gelöst. Professor Wu Zongxin: Wir sind wirklich schnell. Erzählung: Wir sind im Aufzug, um einige Fässer im Keller zu sehen. Die Abfall wird hinter Holztüren gesichert. Was mit zunehmendem Atommüll zu tun ist, kann nicht einmal dieser Reaktor lösen. Mark Horstman: Glauben Sie, Kugelbettreaktoren sind die sicherste Form von Kernenergie? Professor Wu Zongxin: Ich denke so. Sie werden von der internationalen Nukleargemeinschaft am höchsten bewertet. Mark Horstman: So könnten in der Zukunft alle neue Reaktoren Kugelbettreaktoren sein? Professor Wu Zongxin: Nein, ich denke nicht. Erzählung: Der Professor lacht, weil er die Wirklichkeiten der Wirtschaft versteht. Weitere zehn wassergekühlte Reaktoren werden gebaut, bevor das erste Kugelbett betriebsfertig ist. Und was bedeutet dies für Australien? Professor Zhang erhofft den Tag, wo Australien chinesische Kugelbettreaktoren nutzt. Aber fürs Erste ist er überraschend ehrlich zur australischen Kerntechnik. Prof Zhang Zuoyi: Es ist für Australien besser, Atomenergie nicht zu verwenden. Weil man viel Infrastruktur benötigt, viele erfahrene Leute, daher sollte man vorsichtig sein. Ich denke, am besten verkaufen Sie uns das Uran.

	Sie erhalten sofort Geld und brauchen nicht viel Arbeit zu leisten.
Topics: Environment, Others, Technology	
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Related Info

Institute of Nuclear Energy and new Energy Technology (INET)

Technical report on safety demonstration test

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YOUR COMMENTS

>> Add a Comment

J. Lopez Arambula - 02 Jan 2010 1:15:56pm

I worked on the previos 2 commercial High Temperature Reactors in the world here in the United States. They were both built by General Atomic. Thje first one was Peach Bottom in Pennsylvania, it was a 40MW electric plant operated by Philadelpia Electric in the 1960's. The second one was Fort St. Vrain at Plattville Colorado it was a 330 MW plant that also operated commercially. The first one used sperical graphite fuel elements and the second one used prismatic carbon blocks for the fuel. So ths Pebble Bed Reactor that is being buit in China will be the fourth High Temperature Reactor built in the world. Although the second using Circulat Fuel balls containing the fuel.
This concept of reactor is the best from every point of view, safety, efficiency, and with temperatures high enought to produce hydrogen gas directly. The reason the pressurized water reactor concept is used throughout the world is because Admiral Rickover of the US Navy developed this reactor for the US Naval submarines in the 1950's and has the best and longest operating record of any reactor concept. The US was the original developer of this reactor type, but now the French, Japanese, and Chinese also built them. We don't anymore! even though it was invented here! I started my nuclear carrier working for Westinghouse Electric the builder of the nuclear sub reactors for the navy. I worked in Idaho at a site that tested the first reactor for the 1st. nuclear submarine, the "Nautilus". I am happy that the HTGR Concept has been recognized by China and is manufacturing this plant for all of us in the world to use and help the world not choke on carbon dioxide from polluting power plants.
>> Reply

unknown personsplz - 02 Aug 2009 3:42:22pm

Even though professor said that it's very safe, I still believe power plants will cause disasters. It does pollute the enviroment, which is still dangerous, because nuclear energy is pretty radioactive. No matter how safe it is, I still believe it is dangerous.
I wish there was another energy source that can be used; which is safe, non-pollutive (I just made that word up) and cheap.
Someone should really advance the wind energy thing. It's probably the best energy source that can be used by any country.
>> Reply

> Dr. Cheung (Zhang) - 12 Mar 2010 8:59:32pm
>
> So that I am not misunderstood to be the same Dr. Zhang with the China nuclea. The principle of the graphite ball physics is that the hotter it gets, the chance the neutron hitting to split the atom distance is farther apart so that the ball cools down by itself, which is the basic of the atomic principle. It is inherently safe.
> >> Reply

Dr. Hoo J. Cheung - 04 Jun 2009 5:34:22am

When it is this safe, the government should probably fund them now to include all future reactor to use this technology.So, as a physician, we do not need to worry about treating millions of people from accidents.

Much thanks for the knowledge of the innovations
>> Reply

power - 13 Nov 2008 10:49:30pm

ahh yes i do agree, but austrailia pwnz
>> Reply

Chrisw - 03 May 2009 9:41:45pm

Professor was quite patronizing, I don't suppose anyone in Australia is listening. China would just love it if there was one less competitor for precious Uranium. One day we will be their slaves, they will have all the minable Uranium and we will be scratching. China will have it ready to use as heavy metal penetrators against our defence, and nuclear weapons against our cities. At the very least we need our own nuclear industry.
>> Reply

ludwig - 29 Nov 2009 3:05:36pm

as soon as possible
>> Reply

Dr. Cheung (Zhang) - 12 Mar 2010 9:05:28pm

Hi, I don't think that shortage of uranium is something we need to worry about. There is the 'Bleeder Reactor' that distill more 'yellow cake' than it uses. And then, there is the H4 minerable soon.
>> Reply

Dr. Vincent Loke - 11 Apr 2010 4:40:14am

Patronizing as it may sound to some, the nuclear option is currently prohibitively expensive. Solar, wind and geothermal are much more viable options for Australia. By all means, continue the nuclear and cutting-edge research such as fusion, anti-matter and zero-point energy; they may turn out to be the most viable option in decades to come.

Von Dr. Bonnenberg

www.abc.net.au/catalyst/stories/s1854362.htm