



# Chinese thorium reactor program and DOE involvement

A Memo by Curio Solutions, LLC

## ABSTRACT

China is vigorously pursuing thorium nuclear reactors with billions of dollars invested into research and development. The U.S. has no such domestic program and DOE officials have testified to Congress that thorium is not a priority. Despite the lack of a domestic program, the DOE, under the Obama Administration, signed an MOU with China to help develop thorium reactors whereby U.S. national labs such as ORNL are engaged in R&D agreements where the research dollars come from China and the expertise on the projects is American.

October 2020

In 2008, and again in 2010, Republican Senator Orrin Hatch and then-Senate Majority Leader Harry Reid, a Democrat, introduce a bipartisan bill<sup>1</sup> to accelerate the use of thorium-based nuclear fuel in existing and future U.S. reactors. It touts the advantages of using thorium in current-generation reactors and its potential as a fuel in next-generation reactors.

Local news in Tennessee reports of a marked increase in Chinese visitors<sup>2</sup> to Oak Ridge National Laboratory (ORNL) in the years leading up to the announcement of the Chinese Thorium Reactor Program. A visiting Chinese delegation reveals their thorium reactor plans to Oak Ridge scientists in Fall of 2010.<sup>3</sup> In retrospect, the Chinese visitors were interested in ORNL because of its history as a pioneer of the Molten-Salt Reactor (MSR) design. Chinese Academy of Sciences (CAS) launches the Thorium MSR (TMSR) initiative with the backing of the Communist Party. It is the largest national thorium reactor program. At launch, the program is headed by Jiang Mianheng, son of former Chinese President Jiang Zemin, indicating support at the highest levels of the CCP. Shanghai news outlet Wen Hui Bao<sup>4</sup> notes, "...this will enable China to firmly grasp the lifeline of energy in its own hands." Jiang Mianheng speaks at the thorium nuclear energy conference in 2012 detailing China's thorium ambitions and its commitment to the program.<sup>5</sup>

Assistant Secretary of the Department of Energy (DOE) Office of Nuclear Energy (NE), Dr. Peter Lyons, is appointed in 2011. During his confirmation hearing, Dr. Lyons is asked about thorium fuel cycle reactors by Sen. Al Franken.<sup>6</sup> Dr. Lyons says that the studies they had conducted did not show a dramatic benefit to using thorium, and the differences in waste do not appear to be large. If Dr. Lyons was alluding to using thorium fuel in today's pressurized water reactors, then the comment about little benefit makes sense. Because only an MSR provides the feature set needed to exploit the distinct advantages of the thorium fuel cycle over uranium – which is the impetus for the Chinese TMSR program. In 2014, Dr. Lyons appears before the House Science, Space, and Technology Committee<sup>7</sup> for a hearing on the *Future of Nuclear Energy*. He is asked by Rep. Thomas Massie about thorium's place in our nuclear future. Dr. Lyons responds, "given that we have made a massive commitment in this country to a uranium-based cycle, I see no compelling reason to move towards a thorium cycle." Later in the hearing Rep. Dana Rohrabacher notes that

---

<sup>1</sup> Hatch, Reid Introduce New Thorium Nuclear Fuel Bill To Promote Energy Independence, Press Release, Office of U.S. Senator Orrin Hatch, Washington D.C., (March 3, 2010). <https://votesmart.org/public-statement/488093/hatch-reid-introduce-new-thorium-nuclear-fuel-bill-to-promote-energy-independence>

<sup>2</sup> Frank Munger, *The Chinese are Coming: Literally and Figuratively*, Knox News Sentinel (Mar 2011). <http://archive.knoxnews.com/opinion/columnists/frank-munger-the-chinese-are-coming-literally-and-figuratively-ep-405608890-357986431.html/?page=1>

<sup>3</sup> Richard Martin, *China Takes Lead in Race for Clean Nuclear Power*, Wired Magazine (Feb 2011). <https://www.wired.com/2011/02/china-thorium-power/>

<sup>4</sup> Xu Qimin, *The Future of Nuclear Power Plant Security 'Are Not Picky Eaters'*, Wen Hui Bao (Jan 2011).

<sup>5</sup> <https://www.youtube.com/watch?v=iLX8jCKL9I4>

<sup>6</sup> Peter B. Lyons Nomination Hearing Before the Committee on Energy and Natural Resources, U.S. Senate, 112<sup>th</sup> Congress, 1<sup>st</sup> Session, Senate Hearing 112-5, U.S. Government Publishing Office (Mar 2011). <https://www.govinfo.gov/content/pkg/CHRG-112shrg65652/html/CHRG-112shrg65652.htm>

<sup>7</sup> *The Future of Nuclear Energy, Hearing Before the Subcommittee on Energy, Committee on Science, Space, and Technology*, U.S. House of Representatives, 113<sup>th</sup> Congress, 2<sup>nd</sup> Session, House Hearing 113-99, U.S. Government Publishing Office (Dec 2014). <https://www.govinfo.gov/content/pkg/CHRG-113hrg92332/html/CHRG-113hrg92332.htm>

although Dr. Lyons suggested that the claims about thorium are not true, it is his understanding that it could help alleviate problems relating to “nuclear waste.” He goes on to note the DOE’s continued commitment to uranium fuel cycle and Light-Water Reactors (LWR) which he deems an old technology. Dr. Lyons responds saying there is a knowledge base in the U.S. on LWR technology and that small modular reactors are a bridge to the future. Rep. Rohrabacher criticizes Dr. Lyons and the DOE by noting that the DOE program “is not a bridge to tomorrow but a protection of the status quo.”

In late 2011, CAS approaches the U.S. DOE for a partnership on developing thorium reactor technology. The two parties quietly sign a “memorandum of understanding” (MOU). Dr. Lyons, having previously denounced the benefits of thorium reactor technology in his Senate confirmation hearing, becomes co-chair of the MOU executive committee. Without a domestic thorium reactor program, Mark Halper at ZDNet<sup>8</sup> questions the motives of the DOE and the benefits it sees in aiding CAS. In October of 2012, Dr. Lyons travels to Shanghai to attend the first executive meeting and reaffirms commitment to the partnership.<sup>9</sup>

While the MOU is not a secret, there is reticence on the part of the DOE to discuss details. This may be because of the unprecedented move where CAS is paying U.S. national laboratories for research expertise. This reticence, and the Freedom of Information Act request<sup>10</sup> induced as a result, is reported in a book by Victoria Bruce.<sup>11</sup> The book also quotes a top ORNL scientist saying “It’s true, China will be paying my salary.” The scientist goes on to say that, “[the Chinese] are going to do a lot of testing that we simply don’t have the money for,” and that the Chinese are going to get a lot of experienced ORNL scientists to “help provide some guidance.” In the book, Chen Kun, who acted as liaison between the Chinese and Americans on the MOU, says that “the collaboration isn’t exactly a partnership,” because “the funding contributions are not equal.” Indeed, in 2015, ORNL issues a press release<sup>12</sup> stating that they are working with CAS on a 10-year cooperative R&D agreement in return for \$5 million a year in research funding. The statement also nonchalantly explains that the CAS is providing the entirety of the funding.

In 2017, South China Morning Post reports<sup>13</sup> that the Chinese People’s Liberation Army Navy hopes that the TMSR could power aircraft carriers. It also reports a funding commitment of

---

<sup>8</sup> Mark Halper, *U.S. Partners with China on New Nuclear*, ZDNet (Jun 2012). <https://www.zdnet.com/article/us-partners-with-china-on-new-nuclear/>

<sup>9</sup> *DOE-CAS Nuclear Energy Cooperation 1<sup>st</sup> Executive Meeting, Shanghai*, Oct 22, 2012. [https://ia802900.us.archive.org/19/items/sovereignwealthus\\_337/DOE%20 %20China%20MSR%20Collaboration.pdf](https://ia802900.us.archive.org/19/items/sovereignwealthus_337/DOE%20%20China%20MSR%20Collaboration.pdf)

<sup>10</sup> U.S. DOE Office of Hearings and Appeals, Case no. FIA-14-0019 (Apr 2014). <https://www.energy.gov/sites/prod/files/2014/04/f15/FIA-14-0019.pdf>

<sup>11</sup> Victoria Bruce, *Sellout: How Washington Gave Away America’s Technological Soul, and One Man’s Fight to Bring It Home*, Chapter 21 – The First to Eat a Crab, Bloomsbury Publishing USA, 1<sup>st</sup> Edition (Jun 2017).

<sup>12</sup> *ORNL and Shanghai Institute of Applied Physics cooperate on development of salt-cooled reactors*, ORNL (March 17, 2015). <https://www.ornl.gov/news/ornl-and-shanghai-institute-applied-physics-cooperate-development-salt-cooled-reactors>

<sup>13</sup> Stephen Chen, *China Hopes Cold War Nuclear Energy Tech Will Power Warships, Drones*, South China Morning Post (Dec 2017). <https://www.scmp.com/news/china/society/article/2122977/china-hopes-cold-war-nuclear-energy-tech-will-power-warships>

\$3.3 billion to perfect the technology. A promotional video by the CAS,<sup>14</sup> released in 2018, touts collaboration with several U.S. institutions including ORNL, INL, Georgia Tech, UC Berkeley, and MIT. The video details the achievements and the aspirations of the TMSR program. In its efforts, the CAS has made great advances and has succeeded in reviving ancillary technologies such as corrosion-resistant alloys, large-scale lithium-7 separation, graphite manufacturing etc.<sup>15</sup> As part of these developments, SINAP in association with the Australian Nuclear Science and Technology Organization reports in 2017 that they have created a new class of corrosion-resistant alloys.<sup>16</sup> These developments clearly demonstrate that the CAS projects are aimed at establishing a supply chain and signify China's intentions on commercializing the technology.

---

<sup>14</sup> [https://www.youtube.com/watch?v=aFMRQ\\_lmLV8](https://www.youtube.com/watch?v=aFMRQ_lmLV8)

<sup>15</sup> Xiaohan Yu, *Update on SINAP TMSR Research*, ORNL (2016). <https://public.ornl.gov/conferences/MSR2016/docs/Presentations/MSR2016-day1-15-Hongjie-Xu-Update-on-SINAP-TMSR-Research.pdf>

<sup>16</sup> *Molten Salt Reactor Research Develops Class of Alloys*, World Nuclear News (Feb 2017). <https://world-nuclear-news.org/NN-Molten-salt-reactor-research-develops-class-of-alloys-08021701.html>