The Pallas business case - between dream and reality

Summary

Henk van der Keur,
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If everything goes according to plan, in 2023 the new research reactor Pallas will enter in business. This nuclear reactor (expected costs doubled to 600 million euro in a few years) will replace the current High Flux Reactor (HFR) at Petten, The Netherlands. Unlike before with Pallas the emphasis is not on nuclear research, but on the production of medical isotopes. According to the NRG, the current operator of the HFR and of the possible future reactor, in 2030 around 70% of the income should be provided with the production of those isotopes. For the remaining 30% NRG must look for commercial nuclear research.

In 2010 Laka Foundation published a report (*'Medical Radioisotope Production Without A Nuclear Reactor'*) that showed nuclear reactors are not necessary for the production of medical isotopes.

The business case for the Pallas-reactor is therefore mainly determined by the future demand for medical isotopes produced by nuclear reactors: the market forecast from 2023 on. By that time, on the basis of the current rapid changes in the market of medical isotopes, the current dominant SPECT imaging technique will have lost ground against the now rapidly emerging imaging technique PET. SPECT uses mainly reactor isotopes, while PET uses isotopes derived from cyclotrons only.

The Reactor Institute Delft (April 2009) outlines a future scenario in which is assumed that SPECT will be a cheap alternative to the more expensive PET. Due to the growing world population and aging, RID expects that absolute demand for reactor-isotopes will continue to increase: annually worldwide by 10%. Based on these findings, the NRG claims that it has a sound business case for Pallas. The company expects the Pallas-reactor will make a profit from 2034 on with selling isotopes.

The Laka Foundation raises serious doubts on these forecasts. It's report *'The Pallas business case - between dream and reality'* shows that the growth of medical isotopes from cyclotrons -at the expense of reactor-isotopes – will be much faster than current projections. Laka wishes to highlight three important developments. First, the rapid global modernization of existing medical cyclotrons, which produce both PET and SPECT isotopes, led by Canada. Secondly, a trend in American cardiology: Higher fees for PET at the cost of reduced fees for SPECT for many outpatient treatments common. It turns out that treatment with the more expensive PET scan is more cost-effective than treatment with SPECT. The consequences of this remuneration policy are great because cardiology is the last medical discipline where SPECT dominates. Market analysts expect that market for SPECT in cardiology in the next decade will collapse. Thirdly, the report highlights the lack of demand for SPECT in Asia, especially when at the same time, demand for the most modern PET technology is booming.

The Netherlands and Canada now have an almost equal position in the market for medical isotopes. Canada with the National Research Universal (NRU) reactor leads. The Netherlands is the second largest producer with the HFR. Unlike The Netherlands Canada will in 2016, when the NRU is permanently shut down, change to isotope production with particle accelerators. In the short term mainly with cyclotrons and over time increasingly with linear accelerator (linacs). Canada reacts to a global trend which was born out of necessity during the serious 2009-2010 crisis in the supply of reactor isotopes. Many hospitals switched to isotopes produced by local and regional cyclotrons. After upgraded with modern technology, those cyclotrons had a greatly increased production capacity of both PET and SPECT isotopes. Thus, those hospitals are assured of a safe and secure supply of medical isotopes. Even the International Atomic Energy Agency (IAEA) sees this change since 2011 as a worldwide trend.

Due to the short life medical isotopes are produced continuously and - after being processed in a radiopharmaceutical - end up at the doctor as soon as possible. In contrast to the production with a reactor (large scale, centralized, so long supply lines) production with cyclotrons operates with a completely different concept: continuous production from a network of cyclotrons, always backup neighbouring cyclotrons, and short supply lines (little transport). The times between ordering, production and delivery of radiopharmaceuticals are very short, only a few hours. A very different logistics model, but a system without supply shortages. Canada is developing a national network of cyclotrons. Cyclotrons which includes also the production of the 'reactor isotope' technetium-99m (^{99m}Tc). Over 80% of all medical procedures worldwide in radiodiagnostics are done by 99mTc. A cyclotron can produce sufficient ^{99m}Tc for a large city. In March 2013 the Canadian government rewarded the promising results of the cyclotrons and linacs projects with an additional investment on top of the total budget of C$ 40m.

In 2011, OECD / NEA expected that the share of treatments with reactor-^{99m}Tc for diagnostic imaging in the overall market would decrease, but that the absolute demand for reactor-^{99m}Tc would not fall between now and 2030. A year later, in August 2012, OECD / NEA announced that the current trend appears to be exactly the opposite: since 2011 the absolute number of treatments remained the same and the absolute demand for reactor-^{99m}Tc dropped by nearly 20 percent. This reversal is confirmed by the trend identified by the IAEA that cyclotrons now also produce 'reactor isotopes' at the expense of the production of those isotopes in reactors.

> The benefits of isotope production with cyclotrons compared to a research reactor are evident:
> * most isotopes are of better quality, less volume of radioactive waste, and no long-lived and highly radioactive waste; much lower investment and more confident return.
> * Secondly, the production is decentralized. Cyclotrons are located hospital-based, by which the delivery of pharmaceuticals to patients is much more secured. In addition the risk of transport accidents is practically zero.
> * Thirdly, there are no risks due to nuclear-power accidents, because there is no need for controlled chain reactions.
> * Fourthly, there is no nuclear proliferation risk.

Since all medical isotopes can be made with cyclotrons and linacs, the research reactor will become less important for the production of medical isotopes. Chances are that if the Pallas-reactor will start operation the unhealthy current subsidization of reactor-isotopes will continue, because the distribution of reactor-isotopes will be dropped dramatically by that time.

Parallel to the decreasing demand for reactor isotopes, also commercial nuclear research in the HFR and consequently the Pallas may not take the high flight NRG expects. The Laka report summarizes the current market for nuclear research at the HFR and concludes that the expected decrease in capital for nuclear research as a result of the Fukushima disaster and other developments, it is by no means, obvious that the NRG will make a profit from commercial nuclear research.

The Laka Foundation concludes that the business case for Pallas is outdated and wonders whether, in these times of financial crisis, an investment of at least € 600 million in the Pallas project is actually justified. The likelihood that the government will have to step in is very large. It is a subject on which a clear decision should be made to protect future generations from a burden due to wrong policies. The decision to stop the development of the new Pallas reactor and instead switch to the production of medical isotopes by a 21st century technology should be taken in the short term. Otherwise, that 'pioneering' technological field will already be occupied by Canada and Asian countries. The Netherlands could anticipate developments in Canada. For example, by building linacs for both the production of PET and SPECT isotopes. And by doing so, new businesses are created with plenty of opportunities for the creation of new jobs.