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# Nuclear long term operation in Europe:

*Challenges, opportunities and future plans*

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In a 2012 OECD Nuclear Energy Agency study, *The Economics of Long-Term Operation of Nuclear Power Plants*, the findings concluded that in nearly all cases the continued operation of nuclear power plants for at least ten more years is profitable even when taking into account the additional costs of post-Fukushima modifications. Nuclear Energy Insider takes into account the recent successes of plant life extension programmes and speaks to LTO decision makers from across Europe to get their fresh perspective on why the LTO business model is the likely way forward.

On the business case alone, long-term operation is likely to be the way forward for Europe and in some cases a combination of long-term operation management (LTO) and new-build as is the case for Eastern Europe, Finland and France. The reasoning behind this trend is recent examples of plant upgrades that are illustrating to plant operators and owners that life extensions are proving less expensive and less time consuming than building a new nuclear plant.

# Nuclear long term operation in Europe: challenges, opportunities and future plans

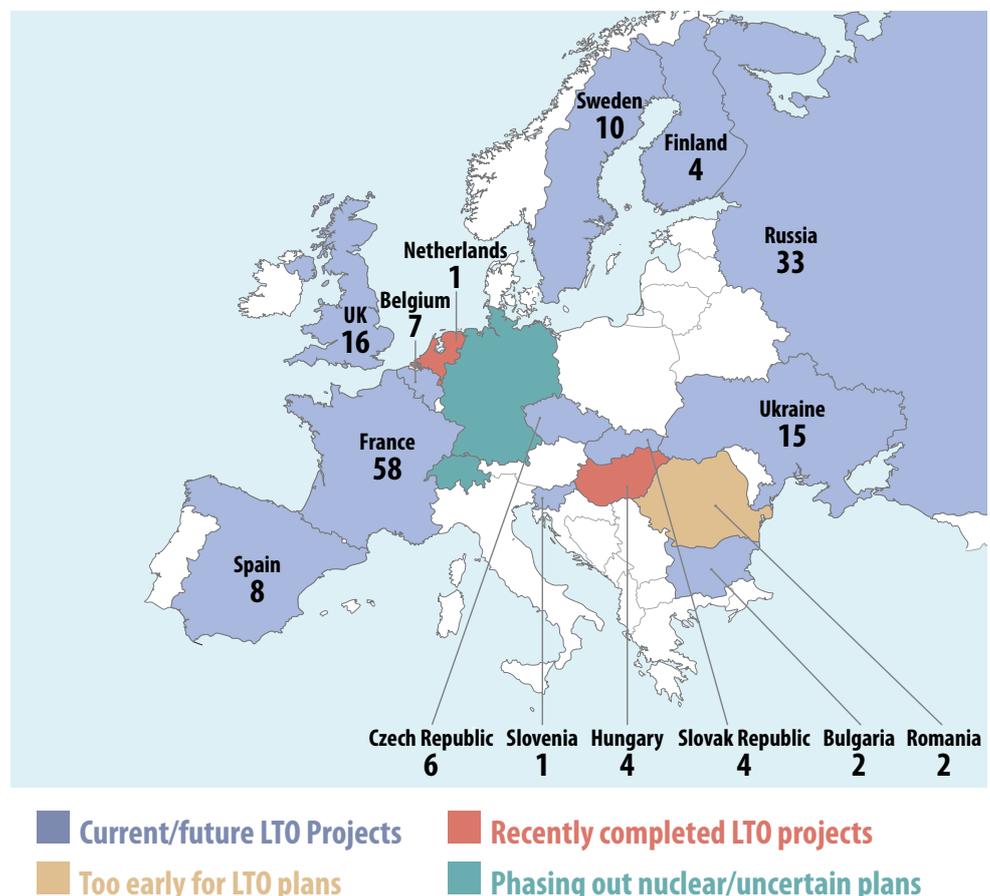
## LTO: risks and uncertainties

Despite the promising economic figures reported by plant upgrades, such as those mentioned in the aforementioned OECD report, <http://www.oecd-nea.org/ndd/reports/2012/7054-long-term-operation-npps.pdf>, there are risks and uncertainties that must be considered and those are primarily public acceptance of LTO, national policies on energy and security concerns. Those countries that have historically taken the LTO route have done so through a license renewal process or through periodic safety reviews from their respective national nuclear energy regulator.

As countries across the globe grapple with their carbon and greenhouse gas reduction programmes utilities must keep what clean baseload energy they have online to counterbalance any intermittent power sources coming onto the grid, such as wind and solar. But according to the OECD report, with around 289 reactors across the world aged more than 25 years old and just 45 new units connected to the grid between 2000 and 2011 (OECD), there is a strong trend towards life extension and licence renewal.

To exclude life extension and licence renewal from a national energy policy will be in direct correlation of those previously mentioned risks and uncertainties. When those risks are limited or reduced then the business case for LTO drastically increases. Without life extensions, generally, nuclear capacity will fall dramatically in the next decade, especially if new nuclear plants do not make up the balance due to financial or political constraints or concerns.

## European Nuclear LTO Landscape: number of reactors and LTO plans



## Upgrades in a post-Fukushima world

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In the first half of 2013, there were a reported 131 reactors online in 14 countries, with 57 power plants in operation, and now Brussels, the centre of the European Parliament, is hungry to see action being taken on safety and more stringent stress tests.

The European Parliament has adopted a non-binding resolution that all safety improvements recommended following stress tests on nuclear reactors in all European Union (EU) countries must be carried out urgently, and the EUR 25bn that they estimate the upgrades will cost, must be paid for by nuclear operators.

In response to the recommendations from the European Parliament, a spokesperson from RWE reflects according to a May 1, 2013 Nuclear Energy Insider article: "As stated in the European Nuclear Safety Directive and in German nuclear law accordingly, the licensee is responsible for the safe operation of its plants. This also comprises the implementation of upgrades and safety measures as needed."

André de Jong, responsible for the LTO Assessment Project at the Netherlands-based EPZ-run Borssele nuclear power plant, sees a big future for the LTO supply chain across Europe. "The nuclear industry in Europe at the moment is not in an easy position. Some countries are really trying to get out of nuclear, some countries are still in doubt, and really new build is only going on in two countries in Europe: Finland and France," says De Jong.

"For countries like the Netherlands, which are small nuclear countries, LTO is definitely the way forward. A lot of countries in Eastern Europe are thinking about new build, but they are also working on LTO and I think that's the big thing for nuclear in Europe," he says.

While he notes that a lot of countries in Europe are in the middle of LTO programmes, with many in Western Europe in the early LTO phase, he believes: "LTO is the thing for the upcoming years." "Maybe for Eastern Europe it's both, LTO and probably also new build," De Jong adds.

However, LTO brings its own bag of challenges. In the case of the recent licence renewal programme at Borssele, De Jong and his colleagues were stretched. "We did a lot of work in only the space of a few years, so that was a challenge for us," De Jong continues: "The other challenge was that we were in a phase where a lot of experienced people from the plant were going into retirement. The regulator and the technical support organisations faced the same problem. Therefore in this and other LTO-projects a lot of new people with limited nuclear experience were involved. That was a big challenge but also gave us the opportunity to quickly integrate new people in the business."

## LTO: the way to go?

When asked why LTO is so important to operators, De Jong points to the business case as the answer. "When you look at long term operation, it has a very positive business case when you relate it not only to nuclear new build, but also to other electrical power new build. It's the most positive business case of all. With a relatively small amount of money, you can keep going, in our case and I think in most cases, about 20 years longer than you originally planned to do. And when you compare that to the price you pay for a new nuclear power plant or a new gas fired power plant, then it's far cheaper to carry out long term operations work."

Thomas Houdré, Director of the Nuclear Power Plants Department at Autorité de Sûreté Nucléaire (ASN), France's national nuclear regulator, highlights that LTO and upgrades are highly influenced by a nation's existing energy mix. You have to remember the French context in the production of electricity, says Houdré, about 80% of the electricity in France comes from nuclear power at the moment, with nuclear power plants that have been built during a short time period."

He stresses: "In the framework of LTO, ASN has set two objectives: firstly, the ageing management of the operating plants has to be demonstrated, secondly an ambitious safety re-evaluation, taking the safety objectives defined for the new reactors as a reference, has to be performed. The ASN will also require the shutdown of the plants that fail to comply with these objectives. To prevent a conflict between nuclear safety and the need for production of electricity in France, it is then important that the appropriate investments in terms of electrical power new build are done in due time."

France's EDF knows all too well that it must be prepared in advance for any periodic safety reviews. Notably, in recent weeks, the ASN has expressed that it is content for EDF to operate after its third ten-yearly inspection. The regulator has set out a list of works to be carried out at Fessenheim 2 that owner EDF will have to complete this year as part of that ASN decision.

The nuclear units are France's second-oldest nuclear unit to continue to operate beyond its third ten-yearly inspection. The latest ten-yearly review of Fessenheim 2 was conducted between April 2011 and March 2012.

Works will include strengthening of the reactor's concrete basemat to increase its resistance to corium, and the installation of extra emergency cooling. Similar work has already been completed at Fessenheim 1, which is of a similar design to unit 2, to the satisfaction of ASN, according to EDF.

While nuclear plant operators in the European Union understand that they must foot the bill for upgrades in-line with the post-Fukushima stress test initiatives, the additional costs following the events in Japan were not necessarily planned for many utilities or at the very least expected to be enacted as quickly. De Jong offers some insights into standard LTO work costs, based on his experience at Borssele.

"I can give you a number on the project that I am doing, but that's only the cost for doing the Ageing Management Reviews and revalidation of Safety Analyses and that's

## Nuclear long term operation in Europe: challenges, opportunities and future plans

somewhere between €10m and €20m," says De Jong. "Of course there are a lot of other costs when going into LTO. For instance, because of obsolescence, you have to buy new I&C equipment. Those upgrades in particular cost a lot of money and are more expensive than delivering the safety case as we did for the LTO assessment."

De Jong says the O&M side of the industry could benefit with more opportunities for counterparts to come together to share and learn from LTO, upgrade and license renewal experiences. While fleet management has helped in this regard for those utilities with multiple sites across one country, more cross-industry dialogue is required.

### Newbuild v. LTO

Ulf Johansson, Manager Fleet O&M Development at Swedish utility Vattenfall, expresses that the rapid level of newbuild growth that many in the nuclear industry were hoping for is not coming to fruition.

"I think there will be some growth potential, but it will take more time than the people in the industry are hoping for. It will take time before it really takes off," says Johansson.

While a rapid newbuild growth trend is not likely to emerge out of Europe, Johansson states: "Vattenfall is working to collect information in order to decide on a course of action for possible future investment in replacement reactors, but it will take time because of the demand on the grid, lots of renewables coming in, the prices are currently very low and it costs a lot of money to build a new plant. But on the other hand, there's lots of potential for my area, maintenance, in life extension or LTO, because of course we have to live with older plants for longer."

He continues: "There is a lot of potential in terms of work on existing fleets as you can see in our case in Sweden, where we have already started talking about getting to 60 years. For most of our plants it's a long time until they reach 60 years, so we have a lot of work to do and there's still a lot of potential in production capacity in the old ones."

Vattenfall's new "business driven fleet management" approach will encourage co-operation between their two plants, which had previously operated as separate holding companies. Johansson explains: "In the past, if we had the same problem at Ringhals and Forsmark, they often found two different solutions to fix it. But hopefully in the future we can find one solution; it's easier and cheaper with procurement, spare parts and carrying out the project itself."

Much like his counterparts in Europe and the US, he says there is a strong case for life extensions of plants. For example, at Swedish nuclear power plants, Ringhals and Forsmark, there will be life extensions "for sure", according to Johansson.

He explains: "Our oldest plants, Ringhals 1 & 2, will reach 40 years in 2015/2016, and they are planning for 50 years. The other plants have longer to wait, but they will certainly have life extensions when they need them."