“Towards an Alternative Nuclear Future”

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A report produced by the ThorEA organisation and submitted to the UK Minister of Science, making the case for an R & D programme leading to the establishment of a thorium-fuelled ADSR industry.

"Towards an Alternative Nuclear Future"

History

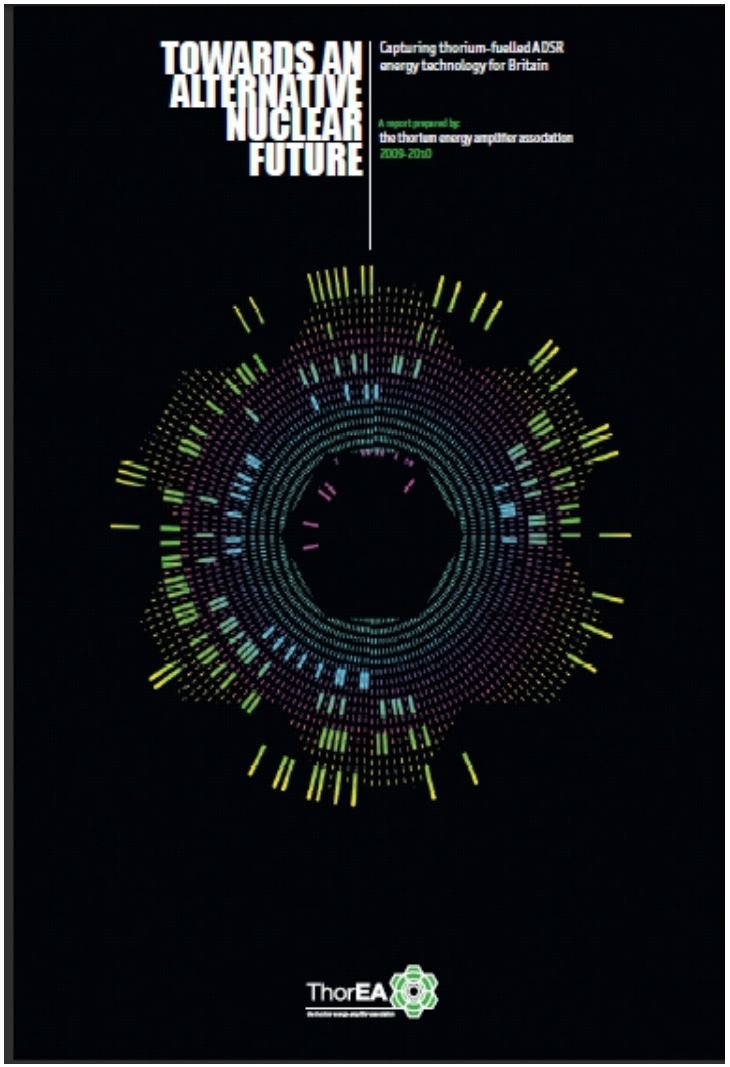
Technical content

Non-technical content

Outcome

Put together by Bob Cywinski

Available as a physical booklet and on the web



http://www.thorea.org/publications/ThoreaReportFinal.pdf

History

May 2009 Science Minister Lord Drayson visits Daresbury and learns about ADSRs. Asks for optioneering report on the possibilities for British industry

ThorEA compiles report, with help from STFC

Report submitted early 2010

Minister requests comments from experts, via STFC and NCE, to Govt Chief Scientist

Comments mostly positive but mixed – not enough to get enthusiastic acceptance

May 2010 – new government .....

Technical content

Case for Thorium and ADSRs as sustainable power source providing acceptable nuclear solution to looming energy crisis

Proposes 3 stage R & D programme AESIR
(Accelerator Energy System with Inbuilt Reliability)

LOKI – a 30 mA 35 MeV high reliability proton LINAC – 2 years to develop, cost £40M

FREA – add a booster (probably an FFAG) to get to 400 MeV, taking 3 years and £115M

THOR – a second booster, taking the energy to 1 GeV, feeding an ADSR core generating 600MW. Total cost £1-2 Bn. Operational by 2025

LOKI and FREA could be built at Daresbury, utilising existing infrastructure.

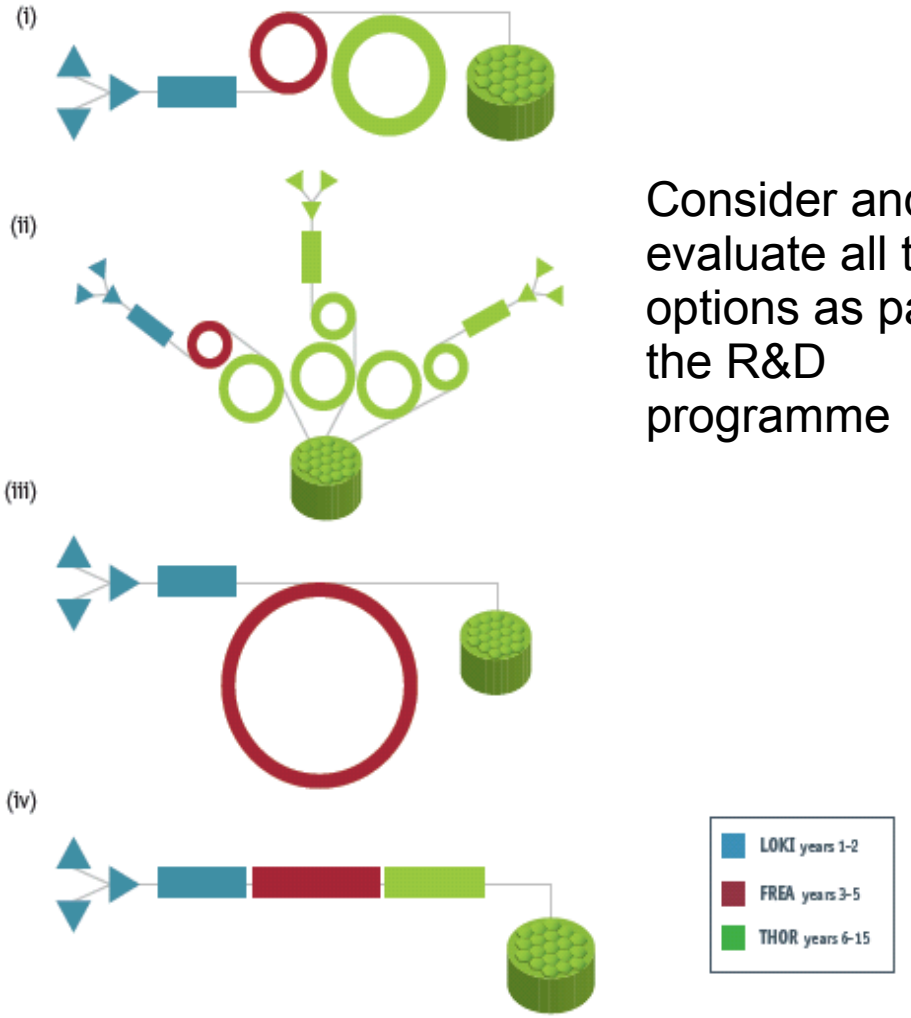
Accelerator Options

LOKI + FREA+ THOR

Threefold to boost reliabilty if nsFFAGs work

LOKI + RCS

LOKI + LINAC



Consider and evaluate all these options as part of the R&D programme

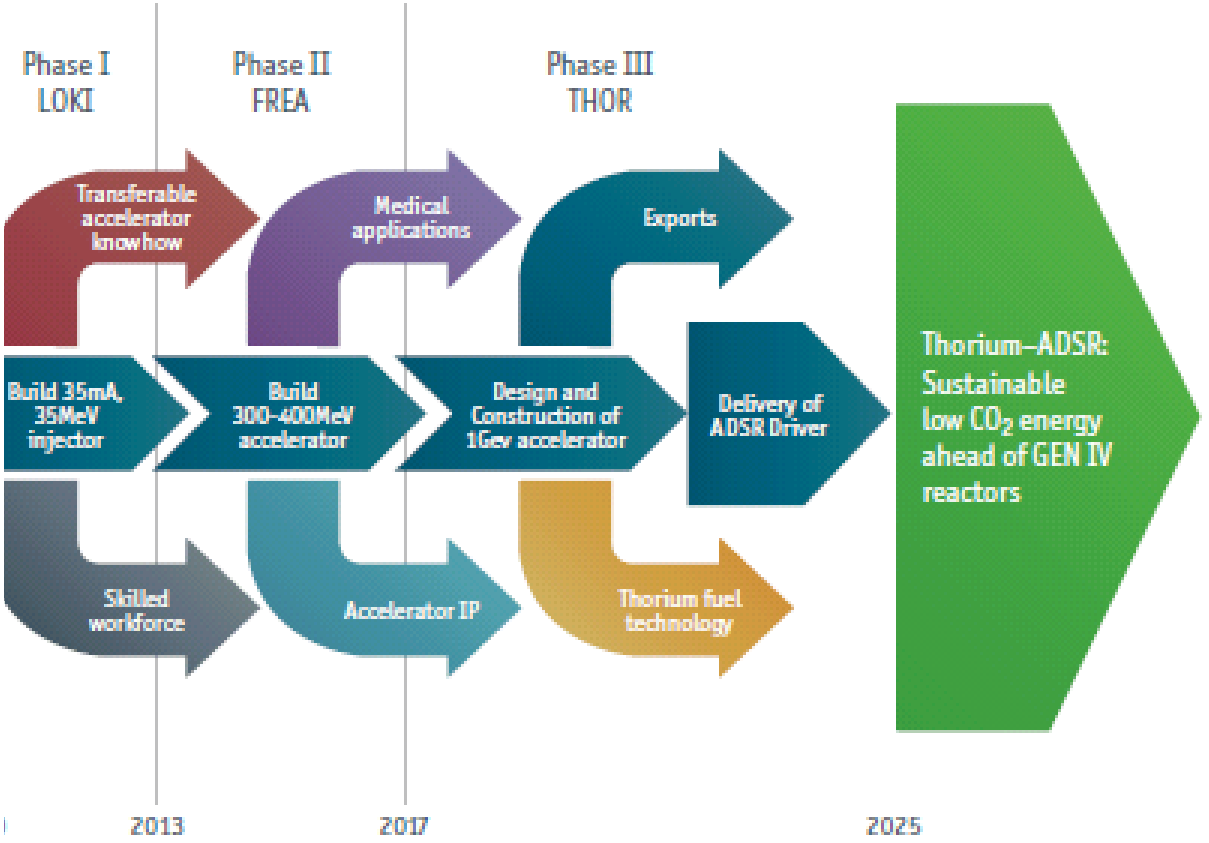
Technical content (contd)

Plan includes rigorous set of gateways, and options (e.g. alternatives to FFAG solution, different criticalities)

LOKI and FREA would be Government funded. THOR would need funds from private industry

FREA would use/benefit results of medical accelerator designs

A 400 MeV proton source at Daresbury would have many other uses (c.f. The PSI accelerator at Zurich and the TRIUMF facility in Canada)



Non-technical content (1)

Support from IAEA and from industry

Discussion of public/private partnership and organisation of the project through a specially formed limited company

Review of the history of Thorium reactors

Survey of the international picture: MYRRHA, Japan, India, USA etc.

Accelerators, reactors, targetry, coolants

Non-technical content (2)

The minister was clearly interested in the project insofar as it would benefit British industry. Hence -

- Considerable discussion of IP (Intellectual Property). Especially patents, also know-how. Aggressive patenting policy .
- Up-beat discussion of the market for Thorium ADSRs, as a potential multi-billion industry.
- Price of Thorium as fuel compared to Uranium and Carbon
- Discussion of the use of Thorium reactors for waste transmutation and for weapons decommissioning
- Stress on UK as world-leading in nsFFAGs

There is a lot of rather chauvinistic UK flag waving – when you read it, please remember the audience the report was aimed at.

The responses (1)

The Accelerator

Is now the right time?

Aren't you putting too much hope in FFAGs?

What about beam losses?

Why not do this through international collaboration?

Are the dates and costs realistic?

These responses, and our answers to them, are contained in the published report

The responses (2)

The Reactor

List 7 positive points (efficiency, abundance, low waste, compatibility, plutonium disposition, non-proliferation, safety (arguably))

And 2 negative points (cost, proliferation)

Worries about fuel manipulation and recycling (THOREX) being difficult owing to the ^{232}U.

Proliferation - weapons without the need for an enrichment step.

"In priority space, if the UK was to invest £300m of public money in nuclear R&D, it would yield greater benefits to direct this into the niche areas where the UK has historical capability and can strengthen its role and contribution in Gen IV systems and international work on developing proliferation resistant fuel cycles as part of international shared cost development programmes."

The responses

"From the nuclear energy perspective, the appropriate approach is judged to be a watching brief on the technology, and that it should not be a priority area for focus. It may be worthwhile carrying out a further paper assessment of the evidence for this technology."

We have to decide where to take it from here