

Towards a New NRG

Summary

This paper is written to try and divert the NRG Executive from their current path, towards a safer, more financially secure future, or reach a decision to enter decommissioning.

The paper addresses issues around Strategy at NRG and Government levels, as well as the effects of the application of the strategy and 'Scenario 2D'. the sections are:

- Strategy at Government Level
- Current NRG position
- The 'Full Cost Recovery' model consequences
- People Management
- Safety
- Project Delivery
- A safer, more financially secure future

Please note that addressing any of the issues and opportunities raised here is conditional on having an exec team that has: the trust of the workforce; the capabilities to understand the consequences of their decisions; an understanding of governance in a nuclear context; and independent challenge (Non execs at board level) Also that steps are taken to introduce 'headroom' for addressing more than the urgent/important issues at critical levels of management.

The last section of this paper gives a way forward, at reduced costs.

Strategy at Government level

The site is operable as long as the benefits to cancer patients and the provision of a critical mass of Nuclear Knowledge within the Netherlands outweigh the environmental costs of nuclear wastes.

The State is not subsidising the business; except by providing a loan at commercial rates.

Key products are used to treat circa 40M patients worldwide, of which circa 10M are in Europe.

If, as most people on site believe, the S2D plan is undeliverable and the market will not support 'full cost recovery' then there are 3 options:

1. To provide a state subsidy against a realistic plan
2. To put the site into decommissioning
 - a. Immediately
 - b. After the supply from the remaining market players provides sufficient medical isotopes to support treatment demand.
3. To provide state subsidy to bridge the site to a safer, more financially secure future.

A decision will depend on understanding the political position and drivers, international consequences, the accelerator effects on local economics, the NPV of decommissioning costs, and the long term effects of the need to maintain a critical mass of 'Nuclear Knowledge' to support the needs of Netherlands.

Current NRG Position

NRG planning baseline is currently ‘Scenario 2D’ (S2D). This scenario is held at executive level as a commercial secret.

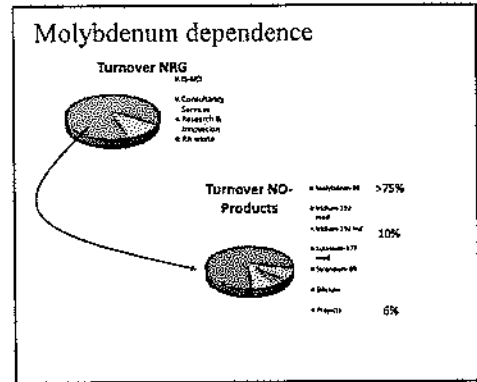
S2D is obviously sensitive to Isotope sales, HFR reactor reliability, and growth in Service contracts.

Isotope sales are flat, pricing is well above market rates, HFR reliability assumptions are not underpinned, growth in service contracts is a soft assumption.

Strong signal: *Plan not achievable*

Strategy is underpinned by the assumption that ‘full costs recovery’ can be achieved from the market.

ALL reactor competitors are state subsidised.



Reactor Facts

- HFR has been operated at twice it's designed power since mid 70's; (result is reduced equipment redundancy, reduction in cooling capacity margin, and potentially reduced life.)
- Reliability assumption in S2D 95%
- Reliability 2008-2014 69%
- Reliability 2015 87%
- Benchmarking suggests currently 20% undermanned against comparable reactors which run at lower powers and throughputs
- AIP 2013 ~25% complete at Jan 2016
- HFR shut down if 2 authorised people leave the business

HFR Performance

Strategy is underpinned by the assumptions on reactor reliability, assuming 95% can be achieved every year.

Strong Signal; *Plans are not factually underpinned, or resource loaded*

The ‘Full Cost Recovery’ model consequences

The use of a ‘full cost recovery’ model and the consequent ‘loan’ for capital expenditure to bring the assets up to required condition drive behaviours that consider commercial concerns ahead of safety in decision making. Recently the term ‘Licence to Earn’ has been introduced by the executives and given equal status against ‘Licence to Operate’.

Strong Signal: *Safety is not ‘our overarching priority’*

The model also requires a commercial loan. The loan, the conditions of the loan, and the need to recover costs reinforce the need to priorities commercial targets. These effects are fundamentally unsafe, and drive what are referred to as ‘Perverse Behaviours’ around safety.

Benchmark Example:

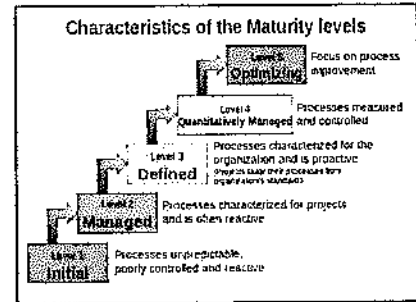
UK ONR Handbook of Site Licence Conditions:
Licence Condition 36: Organisational capability

- The licensee shall provide and maintain adequate financial and human resources to ensure the safe operation of the licensed site.

Strong Signal: *‘Commercial Loan’ model provides perverse incentives on safety.*

People Management

NRG is an organisation at Maturity level 1, where we are dependent on people rather than systems to deliver.



Management behaviours are signalling to people that:

Extract from the NRG Vision:

NRG is a dependable and inspiring employer, where people enjoy working in a high tech environment with innovation spearheaded in an international market. Employees are challenged and encouraged to continually develop their knowledge and skills. The employees are the most important asset of the company.

- They are part of the problem
- They are not trusted, or empowered
- There will be consequences if you speak out especially on safety, or do not conform.
- That decisions are taken hierarchically
- That people will be held to account to deliver targets that are undeliverable with the current system maturity.
- That performance management is used punitively
- That there is no interest in them, and that attention is paid only to outputs, and not to inputs, needs and support.

- **Strong Signal:** *Financial pressure drives a 'people do not matter' culture*

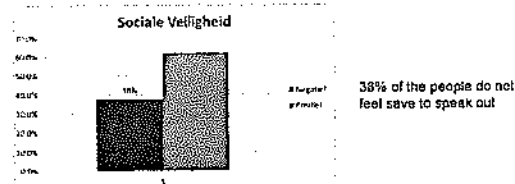
Turnover: Key people

4 Manager NOs in a year
 4 HCL Facility Managers in 2 years
 3 HFR Facility Managers in 3 years
 50% turnover in the Project Office in <1 year
 100% turnover in HR team in 2 years
 HFR maintenance vacancies not filled for 2 years

2016 Budget: education cut from 4% to 2%

Information Extracted from NRG Employee Survey Dec15

SPEAK OUT FREELY



Safety

There are recognised principles for Nuclear Safety Culture, as shown opposite. Areas highlighted in red are adversely effected by behaviours from the executive team.

Principles for a Strong Nuclear Safety Culture

Safety culture: An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority.

1. Everyone is personally responsible for nuclear safety.
2. Leaders demonstrate commitment to safety.
3. Trust permeates the organization.
4. Decision-making reflects safety first.
5. Nuclear technology is recognized as special and unique.
6. A questioning attitude is cultivated.
7. Organizational learning is embraced.
8. Nuclear safety undergoes constant examination.

Strong Signal: *Decision making and behaviours from executive team adversely affects safety culture.*

Nuclear Facilities at NRG are safe, although HCL is 'fragile' with a new team in place to address this. Lack of critical mass on Nuclear Management and Engineering gives concern in the medium term. Short term safety on site is impacted by workload and stress taking individuals beyond their mental or physical limits (burnout). A significant portion of the workforce do not trust the leadership, and many are afraid to speak out, or raise safety concerns. Key authorised individuals report coming under 'Moral Stress'.

Strong Signal: *Safety is fragile, individuals are suffering harm*

In the short to medium term there is a need to restore the 'critical mass' of Nuclear Management and Engineering capability within Nuclear Operations, including training positions for future 'Authorised Positions'. These were removed from the 2016 business plan

Strong Signal: *'Defence in depth' at management level is potentially compromised.*

Projects

The strategy chosen for delivering 180 plus projects at an estimate circa Euro 80M was to manage using internal resources supplemented by contract Project Managers and Engineers.

At the end of 2016 is clear to most people that projects are 'out of control' and 'failing to deliver'.

Failure to put sufficient Project Management Systems, and Quality Controls in place has led to a situation where delivery is dependent on 'heroic actions' by individuals.

People come into this area, find they cannot deliver, or are held accountable for failing to deliver, and either leave or are pushed out. Over half of the PM team members have left this year, and it is suggested that around 80% have left over 2 years. (records are not in place to verify this).

- several key business projects are 'in distress' with 2016 deliver targets. (HEU to LEU conversion timescales are at risk)
- the skills to address project delivery are not available internally.

There are 6 URGENT ACTIONS that are required to start to introduce 'certainty of delivery to time and cost' :

1. Introduce sufficient processes and quality controls either by an internal dedicated improvement team, or by bringing in a competent partner.
2. Separate Projects from Nuclear Operations. They are different competencies and priorities. It is not possible for Manager NO to deliver the required income in 2016, while being distracted by trying to fix the projects.
3. Separate 'glorified maintenance' from 'real' projects and give the Facility Managers sufficient resources to maintain their plans to the required standards.
4. Introduce a project board system around 6 programmes and bring the roles above facility management level.
5. Put Engineering resources back in at facility level, and restore Engineering and Product Authorities (note that the headroom for this was removed from the 2016 business plan)
6. Conduct external reviews of the projects scopes, costs and achievements to give independent FACTS to take action against.

Strong Signal: *Individuals do not understand the Consequences of their 'executive decisions'.*

Strong Signal: *Leaders are not picking up distress signals from our people*

A safer, more financially secure future

There are several potential strategies that may take the site to a sustainable income and cost model.

Note that some of these can be implemented to improve 2016 outlook.

There are several strands to examine:

- Underutilisation of HFR creates the opportunity to run at lower power (20MW the original design power) while maintaining close to current throughputs.
This restores equipment redundancy, should increase reliability and will increase reactor life (against the fact the PALLAS timescales are moving to the right). There would also be a 50% reduction in fuel costs (saving approx Euros 3.5M per year).
- A 'Technology Demonstration' project that would apply emerging but mature technologies to change our concepts from Hot Cell Laboratories (HCL) to Hot Operations (Hotops), and introduce automation to Isotope production operations. (Note that NRG has this technology and has applied it to ITER, so it is at at least Technology Readiness Level 8 (TRL8)) This would reduce both fixed and variable costs and if positioning within an HFR compound would remove internal transport costs and associated security issues, as well as reducing the combined HFR/HCL security costs.
- To go 'up the value stream' on Isotope production to reduce costs, increase income and profit.
This would increase influence over the value chain, give better pricing options in a commoditised market, lead to efficiency savings, and increase barriers to entry from subsidised market players.
This could potentially be achieved by investment in M&A activity and/or redirecting capex from improving outdated facilities.
- Partnering for 'Project Delivery' to decrease risks to costs and timescales, and enable 'commercial projects' to be resourced in parallel with LTO projects.
- Redefining current projects scope and purpose will give cost savings:
e.g. 1- combining the security fence projects to provide a 'nuclear area' would decrease future security operating costs by around Euro 1.2M per year, by having one security control rather than 3. this would also give the potential to redefine the security levels on the remainder of the site.
e.g. 2- investment in RAP to produce a 'Waste Hub' rather than RAP specific solutions provides a platform for future decommissioning business, and a better solution for other site waste streams. the use of 'Hotops' philosophy would also give a potentially radical cost reduction.
- Investing in internal capability creates market opportunities
 - Example 1; becoming world class in the area of Nuclear transport container management gives the opportunity for a service, management, or hire business
 - Example 2: we need to be very good at increasing reactor reliability. This gives opportunities for C&S if we can become recognised as world class.

Molybdenum Value Stream

Profitability on the Molybdenum value stream turnover is ~30% at Mallinckrodt, and ~0% at NRG, despite NRG charging ~5x world market prices.

Strong Signal: Top down decision making, and not involving the talents and intellects of NRG people gives sub optimal solutions.

Lutetium value stream

NRG customer IDB is making use of the process developed at NRG.
NRG sold this long ago without a revenue share agreement
In the meantime this has become a fast growing medical product using a fully automated Hot Cell Process.