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## Is there a Renaissance in Nuclear Fuel?

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I want to thank WNA for giving me a chance to share some thoughts with you today. I also want to thank Joe McCourt for his contributions to this paper.

We have all heard about the nuclear Renaissance. Plant life extensions, power uprates, new programs in India, China and Finland, restrictive climate change requirements. In my mind, there is little question that we already are in the middle of the Renaissance of nuclear power generation. I have chosen to examine whether the critical nuclear fuel market is up to the task of fuelling this nuclear Renaissance.

Since we are talking about the Renaissance as a historical period where huge changes took place, it occurred to me that it would make some sense to frame this talk within a historical context using the following chart:

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Faith	Scepticism	Faith <u>and</u> Scepticism
Ascetic/Monastic ideal	Hedonism	Neo-Monasticism
Highest objective = Salvation	Highest objective = creativity	Highest objective = Survival
Founding of the universities	Expansion of knowledge/printing press	Demise of nuclear education
Lords: enhance status through war	Wealthy patrons: enhance status through art, science, discovery	Corporate groups: enhance position by litigation, lobbying

First of all, we should look into whether there is a need for a nuclear fuel Renaissance.

There are some who may disagree with a number of industry experts who have been raising a red flag for some time now, but no matter how you look at the numbers, for those who have chosen to not stick their head in the sand, the future nuclear fuel supply is, at best, extremely fragile, at worst, catastrophic.

Uranium supplies are clearly scarce as we move into the latter part of this decade. Some of the supply sources that are being exploited today will not necessarily be around in the next few years.

The infrastructure of the nuclear fuel industry is, at best, tenuous. Some uranium mines are showing their age with resulting problems that directly affect production, some new mines rely on yet unproven technology, exploration for new reserves is at a deplorable level, and there is even a question as to whether there are sufficient qualified people to revive it on a credible basis, conversion facilities are old and prone to unexpected shut downs, enrichment plants are inefficient, some old and plagued with environmental liabilities.

A good portion of current and expected supply comes from Russia (about 50% of enrichment in the US, amounting to close to 10% of all electricity required by the entire country), and while Russian suppliers have been reliable, their infrastructure and their own needs are changing.

In short, just as I believe that nuclear power generation has entered the Renaissance, I am not so sure of a Renaissance in nuclear fuel.

Let us then begin our historical journey.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Faith	Scepticism	Faith and Scepticism

**Consumers:**

**Faith that nuclear fuel will miraculously materialize.**

When I meet with nuclear fuel consumers, I always ask the same question: “Where will new supplies come from over the next 5 to 10 years?”

It is evident to me that most consumers have no clear idea of how supplies will materialize. For the most part, the answers consumers provide indicate a combination of little understanding of the possibilities, and puzzlement as to how these possibilities may come into play.

For example, while all consumers are aware that Cigar Lake may come on line over the next 5 to 10 years, they do not seem to understand that most of this new production will simply replace current Key Lake production.

It is similar with enrichment: consumers know that a GB2 may come on line, they do not appear to understand that this capacity is being built to replace GB1, and not to fill future incremental demand.

In terms of conversion, while on the one hand consumers worry about Metropolis style problems, they have little idea of how to protect themselves from potential disruptions.

Consumers of nuclear fuel today live in a world of faith: somehow, somewhere, some supplier will deliver.

**Suppliers:**

- **Sceptical of price sustainability.**
- **Wary of expanding and even maintaining current facilities (Rossing).**
- **Insufficient faith to add new capacity, only to replace current (Cigar Lake, GB2).**

Suppliers, on the other hand, exhibit scepticism and a profound lack of faith.

While prices reached a level where suppliers can justify further investment in nuclear fuel facilities, they are sceptical that such prices are sustainable, and have little faith in their ability to overcome the significant environmental, political, legal and technological challenges of new projects.

In fact, while some suppliers do have sufficient faith to invest in replacement facilities, such as GB2 or Cigar Lake, others, such as Rossing, are openly telling the market that unless consumers vote with their pocketbooks, their current facilities will need to be shut down.

If we then look at our historical progression, we find that, as was the case in the middle ages, the nuclear fuel age lives in an age of faith on the part of consumers, and an age of scepticism on the part of suppliers. Not much advancement, but at least some progression towards enlightenment.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Ascetic/Monastic ideal	Hedonism	Neo-Monasticism

Those of you who wish to have a good time and steep yourselves in some wonderful medieval art, must come to New York City and visit the Cloisters, Rockefeller's own monument to the Middle Ages, complete with the original walls of the monastery at Guilhem le Desert, including typical foliage of the period. In that serene atmosphere, with the Gregorian chants softly playing in the background, you can close your eyes and get transported to the times when the monastery was inhabited by pious monks who lived their lives in solitude and deep contemplation, unaware and unfazed by the tumult of society outside the cloister walls.

The Renaissance provided human beings new opportunities, a new vigor that was the antithesis of the monastic lifestyle.

Let us then compare these to the current status in nuclear fuel:

- **Spartan existence**
- **Obedience to Abbott's cost cutting mantra**
- **Cloistered**
- **Vows of silence and poverty**
- **Good food and wine**

Instead of the tonsured monk in his brown robes, let us imagine a nuclear fuel manager.

His resources are limited, his office has been taken away and replaced by a cell (some call it a cubicle), his needs are always subservient to any other nuclear needs.

“Cut the costs” is the Gregorian chant of the managing Abbott. Obediently, the nuclear fuel manager cuts the costs, cancels another newsletter, fires a consultant and renegotiates prices to the point of sacrificing the stability of supply facilities.

And how cloistered is our fuel manager? He needs to request permission from the Abbott to attend a conference. Foreign travel to visit a new supplier's facilities? Forget it, it isn't even worth asking the Abbott.

It is amazing to me that a company that spends tens of millions on nuclear fuel, and relies on it for its very existence, would deprive itself of keeping its critical fuel management staff up to date, well informed and well connected, by not subscribing to a newsletter, or not attending an international conference or seeing first hand the facilities where the fuel comes from.

It appears that once the Abbott has determined that you should say nothing and talk to nobody, for God's sake, you shut up. Information about the monastery is not to be shared with outsiders. And yes, if anyone asks for anything, claim poverty, just say “the budget does not allow me.”

But there are a few rewards for this pious existence. Just as was the case during medieval times, the monk is sure to receive at least a bit of terrific food and wine to ease his Spartan life. This is the case as the occasional visit to outside the cloister walls, invited by a supplier, proves inevitably to shed a bounty of culinary delight.

In short, not much Renaissance here. It all looks pretty medieval to me.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Highest objective = Salvation	Highest objective = creativity	Highest objective = survival

- **Survivors of multiple rounds of downsizing and consolidation.**
- **Little incentive other than to survive/lack of creativity.**
- **Risk avoidance.**

Over the past two decades nuclear fuel did not threaten the nuclear generation industry enough to be a high priority item. There was plenty of uranium, conversion and enrichment capacity. Military programs were being dismantled and they brought millions of SWU and kilograms of UF<sub>6</sub> into the market. Ah, yes, those were the sweet days, some are already calling them the golden age of nuclear fuel buying.

Most of us remaining in the nuclear fuel industry, both in the supply and consumer side, are survivors of two decades of extreme consolidation and multiple rounds of downsizing and cost cutting.

There is little incentive for many in the nuclear fuel industry to take up new concepts or ideas, or to pursue creative alternatives. Few of us ask questions. Even fewer of us embrace the challenges that new ideas present.

It has become a sad fact of our industry that, for the most part, very few of us are prepared to jeopardize a basic subsistence lifestyle within the monastery walls.

Here again then, one more win for the Middle Ages.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Founding of the universities	Expansion of knowledge	Demise of nuclear education

While the Middle Ages saw the creation of many centres of academia, and the Renaissance offered a virtual explosion of knowledge and education at all levels, the Nuclear Age has gone back to the Stone Age.

In a sad commentary on the interest of young talent in the nuclear industry, we have seen a continuous decline in university programs dedicated to prepare young engineers and other professionals for careers in the nuclear industry.

A mature, consolidating industry such as nuclear fuel finds it difficult to compete for young talent with growing, high paying, intellectually challenging careers in fields like information technology and law. The nuclear industry seems to be stingy with salaries, travel budgets and other perks, but they pour untold millions into the pockets of lawyers and lobbyists.

As if this were not enough, efforts such as the World Nuclear University have not been properly supported by the very industry they strive to serve.

In terms of education and attracting talent, I am afraid to say that the Middle Ages have an upper hand on the Nuclear Age.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Lords enhance status through war	Rich enhance status through art, science, discovery	Corporate groups enhance position by litigation, lobbying

The nuclear fuel industry is a direct descendant of the Cold War. Most companies involved in the production of nuclear fuel can, one way or another, trace their origins to a government defence program. Some of these companies are still owned by governments, while others, while privately owned, work very closely with their governments.

While in the Middle Ages lords and nobles enhanced their status and power by war and conquest, Renaissance wealthy patrons gained social notoriety and power by being patrons of the art and funding the sciences and discovery.

Nuclear fuel corporate groups fight their wars and spend their money on lawyers and lobbyists, and attempt to gain market power through legal proceedings.

While these costly paper wars go on, cost cutting by large nuclear fuel companies, suppliers and consumers, has decimated the small companies who supported the industry. Geologists, market consultants, mining engineers, even brokers, have disappeared.

We all know Michelangelo's David. It stands majestically over 4 meters tall at the Academia Gallery in Florence. I propose to you that if Michelangelo had been under the sponsorship of the nuclear industry, David would be the size of a deck of cards, as cost cutting requirements would have not made it possible to supply such a big piece of marble.

Let us then go to what I call the Renaissance Scorecard.

MIDDLE AGES	RENAISSANCE	NUCLEAR FUEL AGE
Faith	Scepticism	Faith <u>and</u> Scepticism <b>One foot in each</b>
Ascetic/Monastic ideal	Hedonism	Neo-Monasticism <b>Back to Middle Ages</b>
Highest objective = Salvation	Highest objective = creativity	Highest objective = Survival <b>Stone Age</b>
Founding of the universities	Expansion of knowledge/printing press	Demise of nuclear education <b>Pre-Middle Ages</b>
Lords: enhance status through war	Wealthy patrons: enhance status through art, science, discovery	Corporate groups: enhance position by litigation, lobbying <b>Back to Middle Ages</b>

Where do we stand then in this historical comparison? Overall, although there are some bright spots, there is not much Renaissance in nuclear fuel. We are living too much in the Middle Ages.

### So, what to do?

1. Encourage and reward creativity.
2. Focus on attracting and training young people.
3. Embrace the pursuit of new ideas, even if this means hiring people from outside the industry.
4. Encourage information flow.
5. Support small, independent companies.
6. Allocate the financial resources that will support these areas (for example, take 10% of your legal budget to fund these initiatives).

Despite what our Renaissance Scorecard concludes, I believe there will be a Renaissance of the nuclear fuel industry. The question that remains is: “Where are the Medicis that will be the patrons of the Nuclear Renaissance?”

Let me leave you with this thought from one of the Renaissance's brilliant thinkers:

"The Possible's slow fuse is lit By the Imagination."  
William Shakespeare (1564-1616)

Thanks for your attention.