WNA Worldwide Overview on Front-End Nuclear Fuel Cycle's

Growth (Supply and Demand)

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Sylvain Saint-Pierre
Director for Environment and Radiological Protection
World Nuclear Association

World Nuclear Association

World Nuclear Association - WNA

The trade association of the global nuclear industry with a worldwide membership

- Based in London, UK
- **WNA: http://www.world-nuclear.org**
- **WNN: http://www.world-nuclear-news.org**

Our membership makes us unique, global and truly representative

- Over 180 industry enterprises from over 30 countries
- Over 90% of world uranium production and nuclear power generation

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PART I

OVERVIEW OF FRONT-END NUCLEAR FUEL CYCLE'S:

GROWTH

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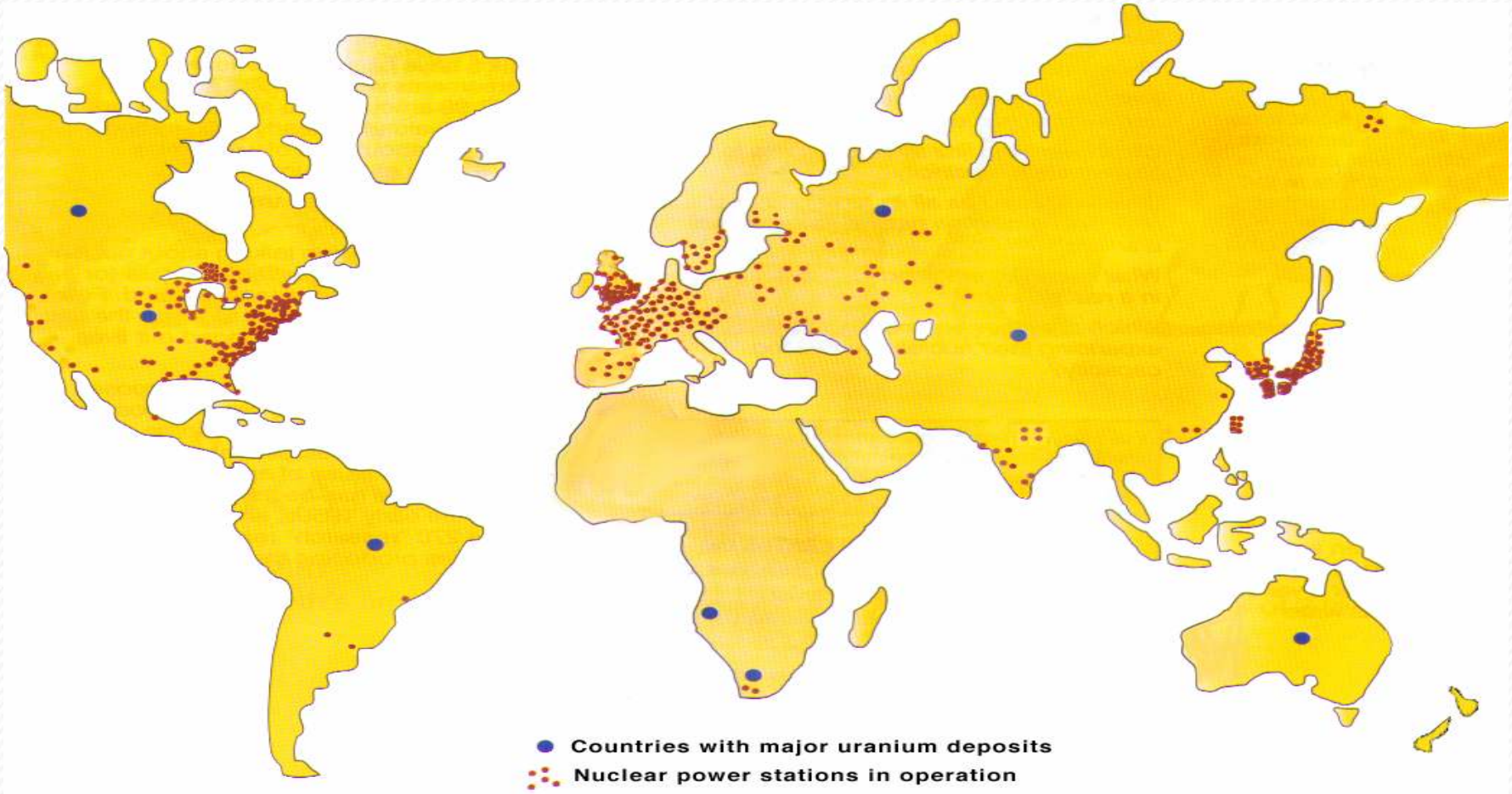
World Uranium and Nuclear Power



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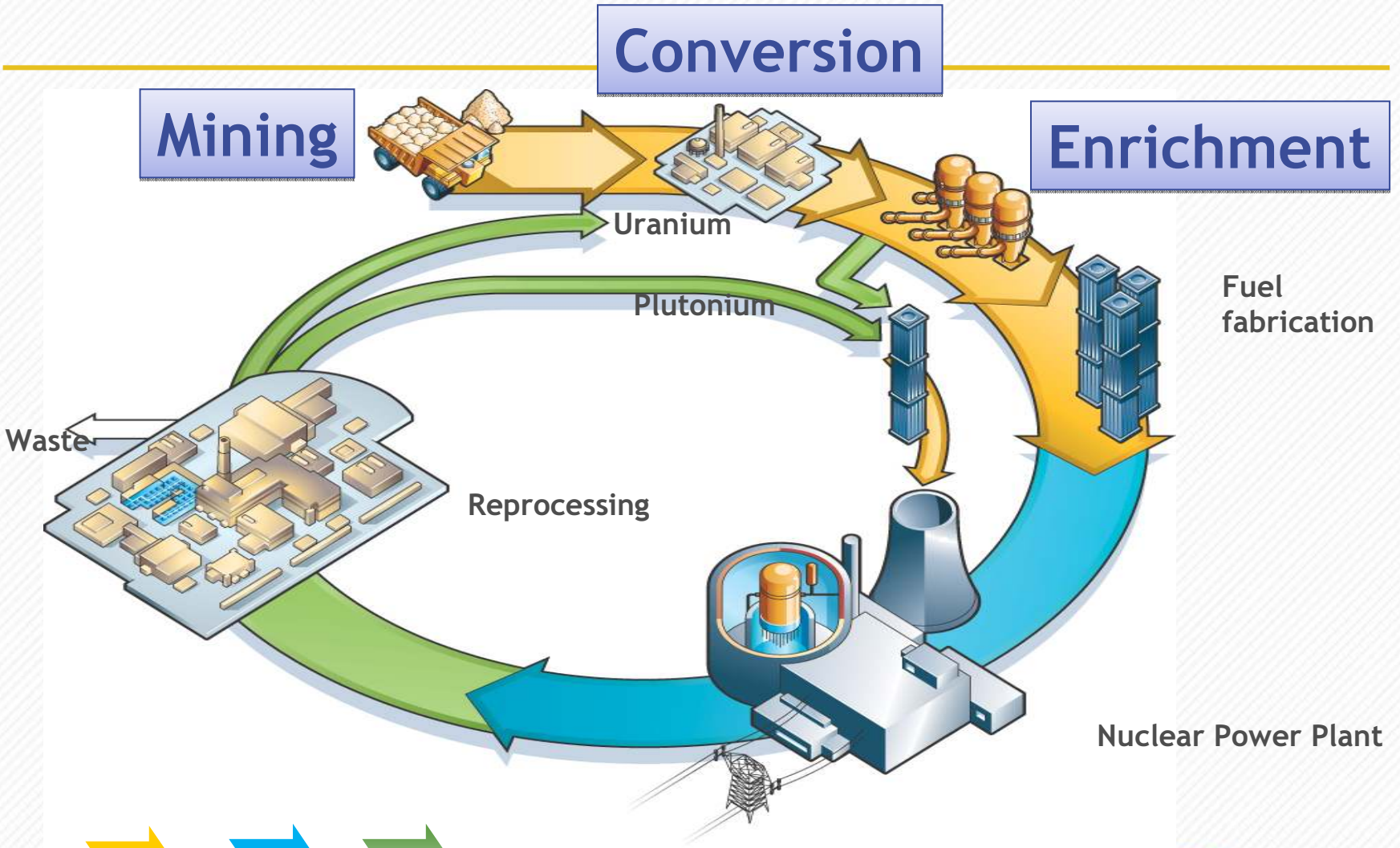
The Nuclear Fuel Cycle



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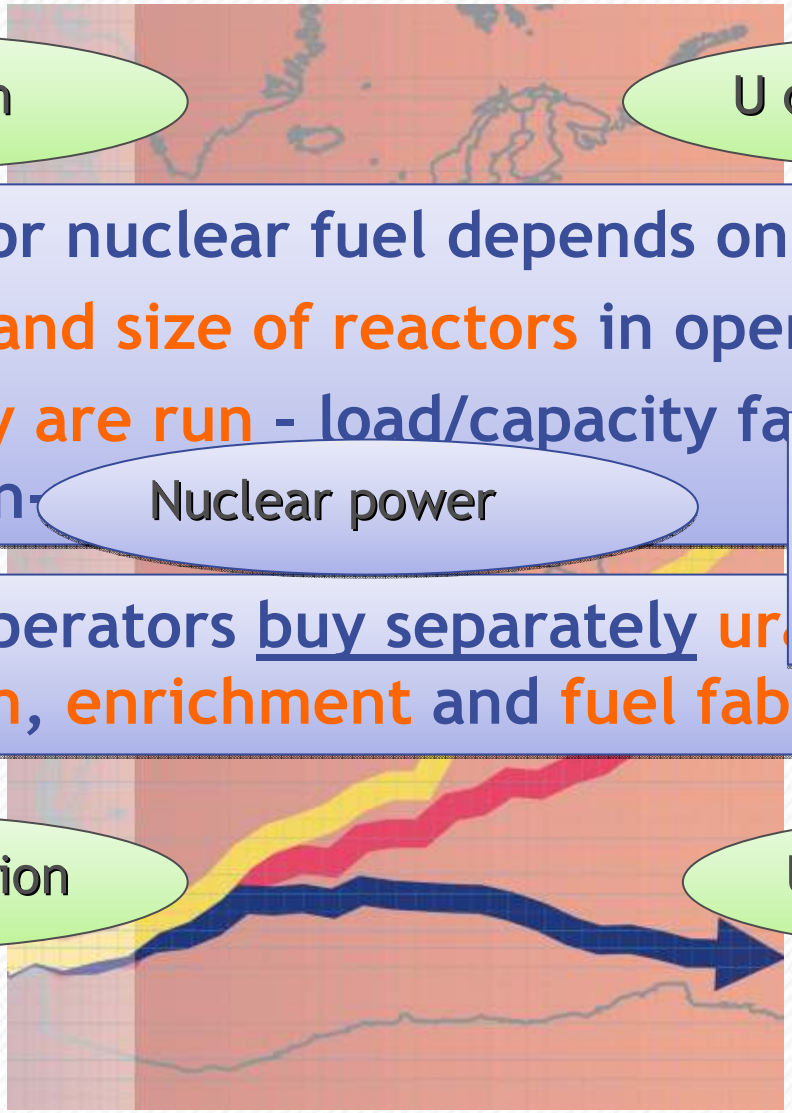
World Reference : WNA's Market Report



U production

U conversion

Demand for nuclear fuel depends on two factors

- Number and size of reactors in operation
- How they are run - load/capacity fa[illegible]

level, burn-

Nuclear power

Growth depends on Supply and Demand!

Reactor operators buy separately ur[illegible] conversion, enrichment and fuel fabrication services

Fuel fabrication

U enrichment

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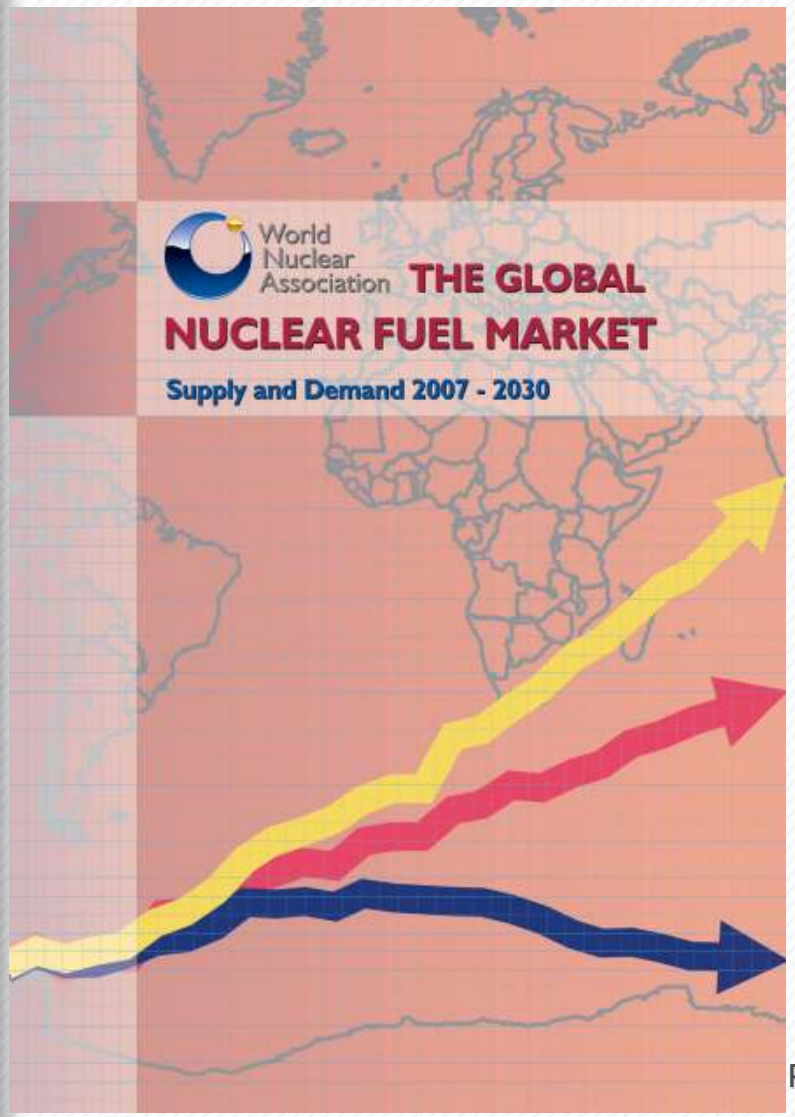

Considers 3 scenarios approach to nuclear power demand (2007-2030):

- Reference case
- Upper case
- Lower case

Generic assumptions underlie each scenario on:

- nuclear economics
- public acceptance
- impact of climate change debate and electricity market structure

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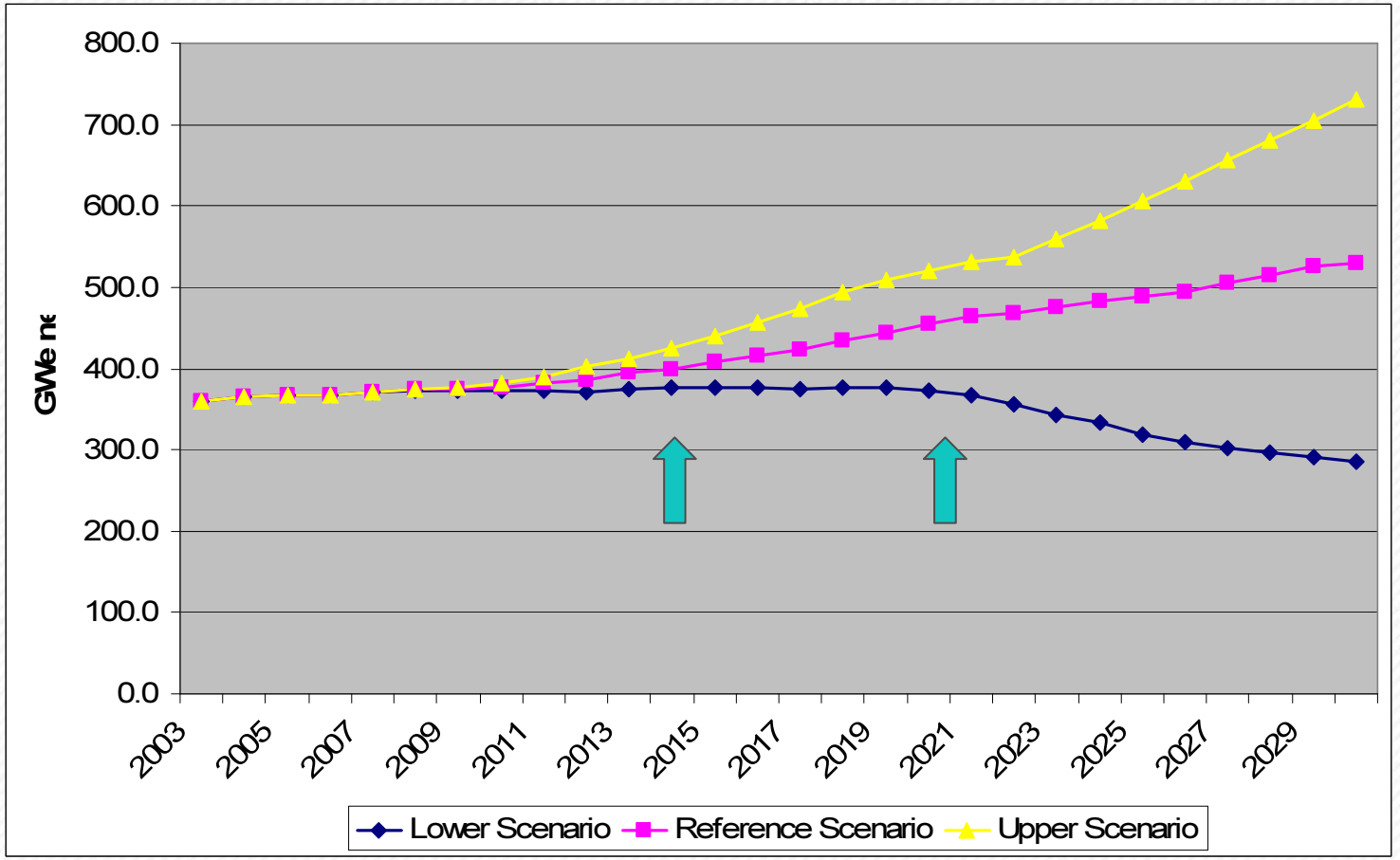
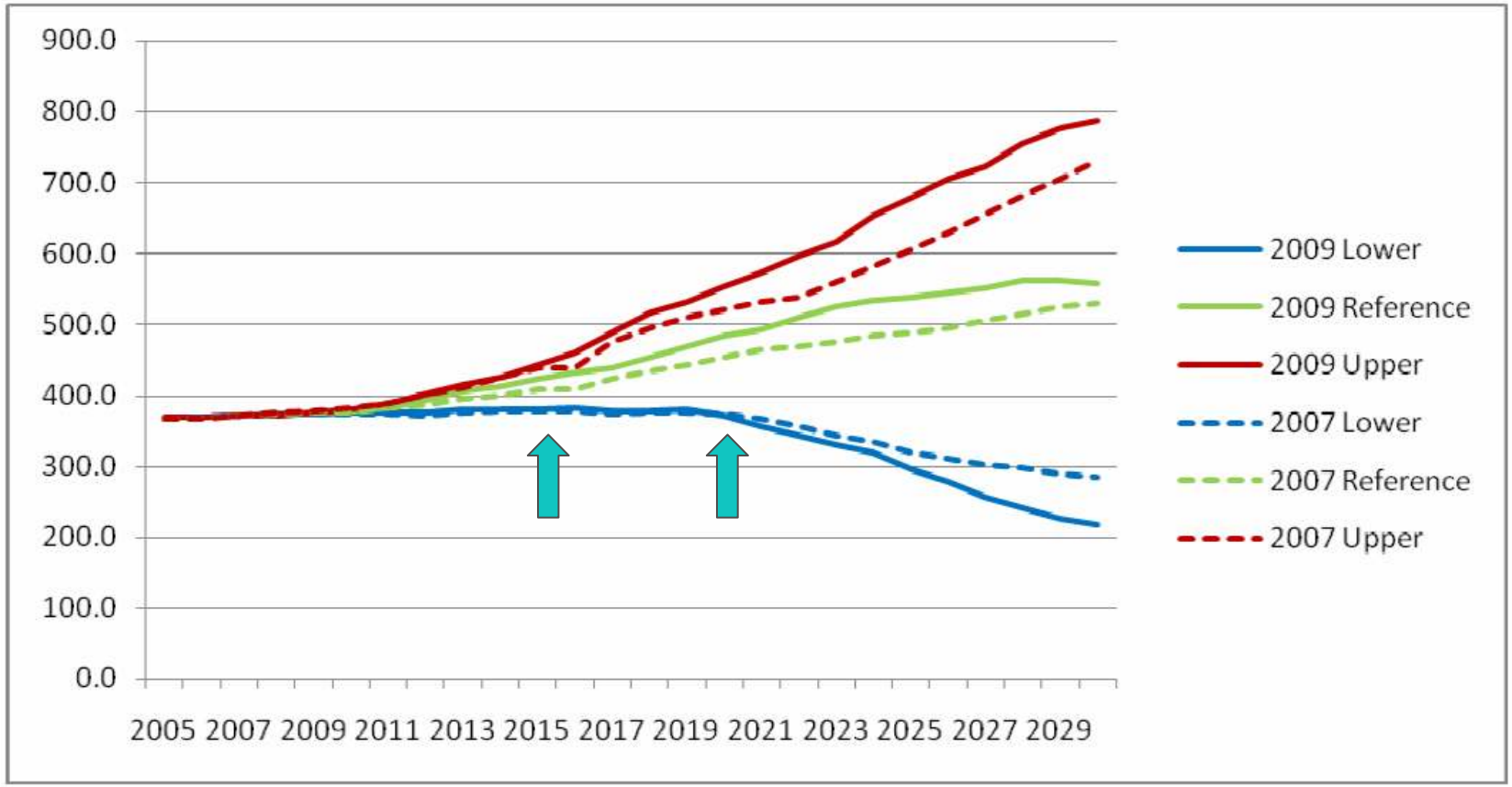
Nuclear power capacity to 2030, GWe net
2007 Market Report



Nuclear power capacity to 2030, GWe net 2009 Market Report draft



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URANIUM MINING:

GROWTH

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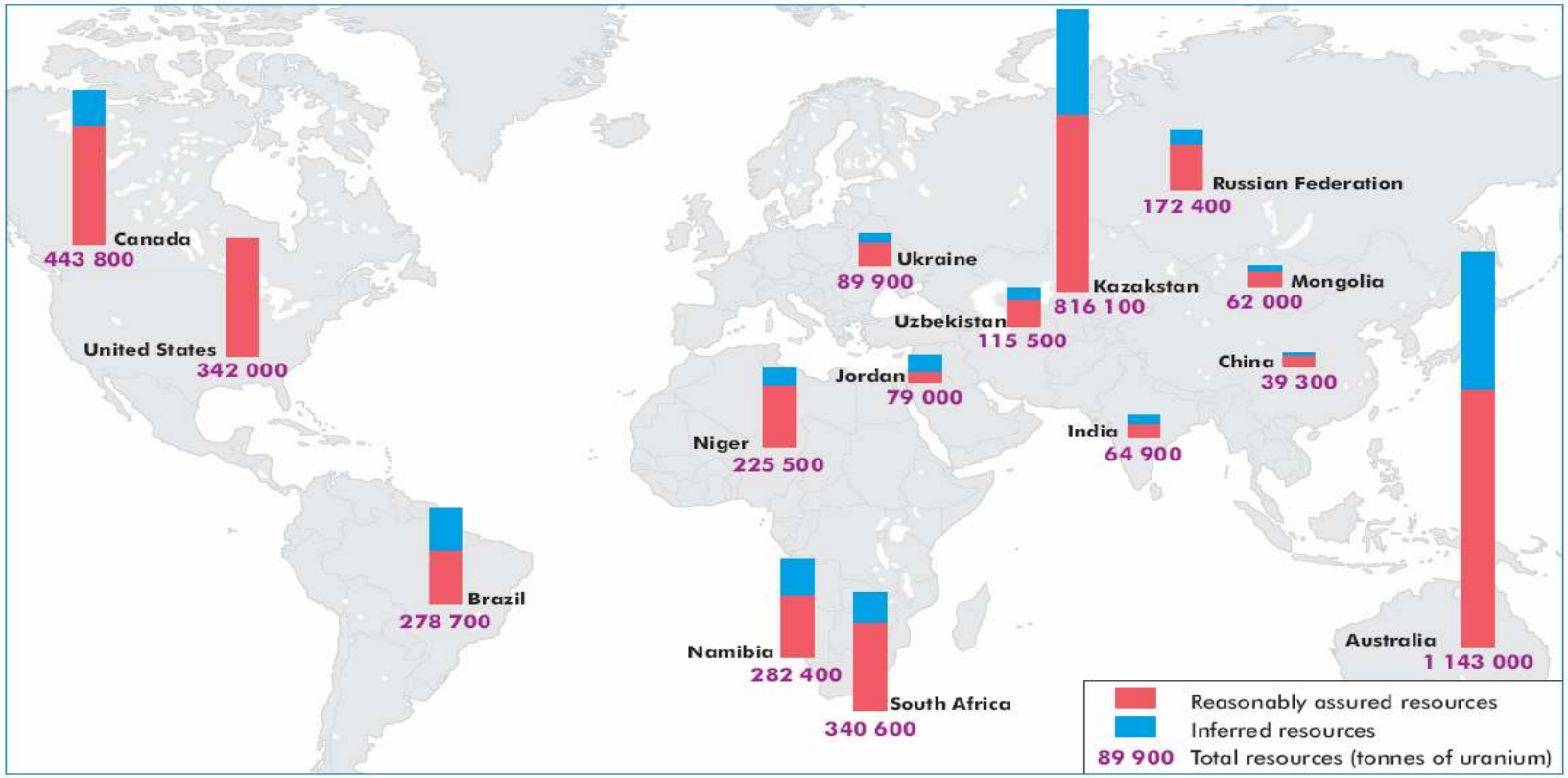
Distribution of Uranium resources



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Low cost (<$80/kg) uranium reserves, thousand tonnes U

Australia	714
Kazakhstan	344
Canada	329
South Africa	206
Russia	172
Brazil	157
Namibia	145
Ukraine	127
USA	99
Others	155
Total	2438 tU

Source: Red Book

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World Uranium production 2008, tU

Canada	9000
Kazakhstan	8521
Australia	8430
Namibia	4366
Russia	3521
Niger	3032
Uzbekistan	2338
USA	1430
Others	3292
Total	43930 tU

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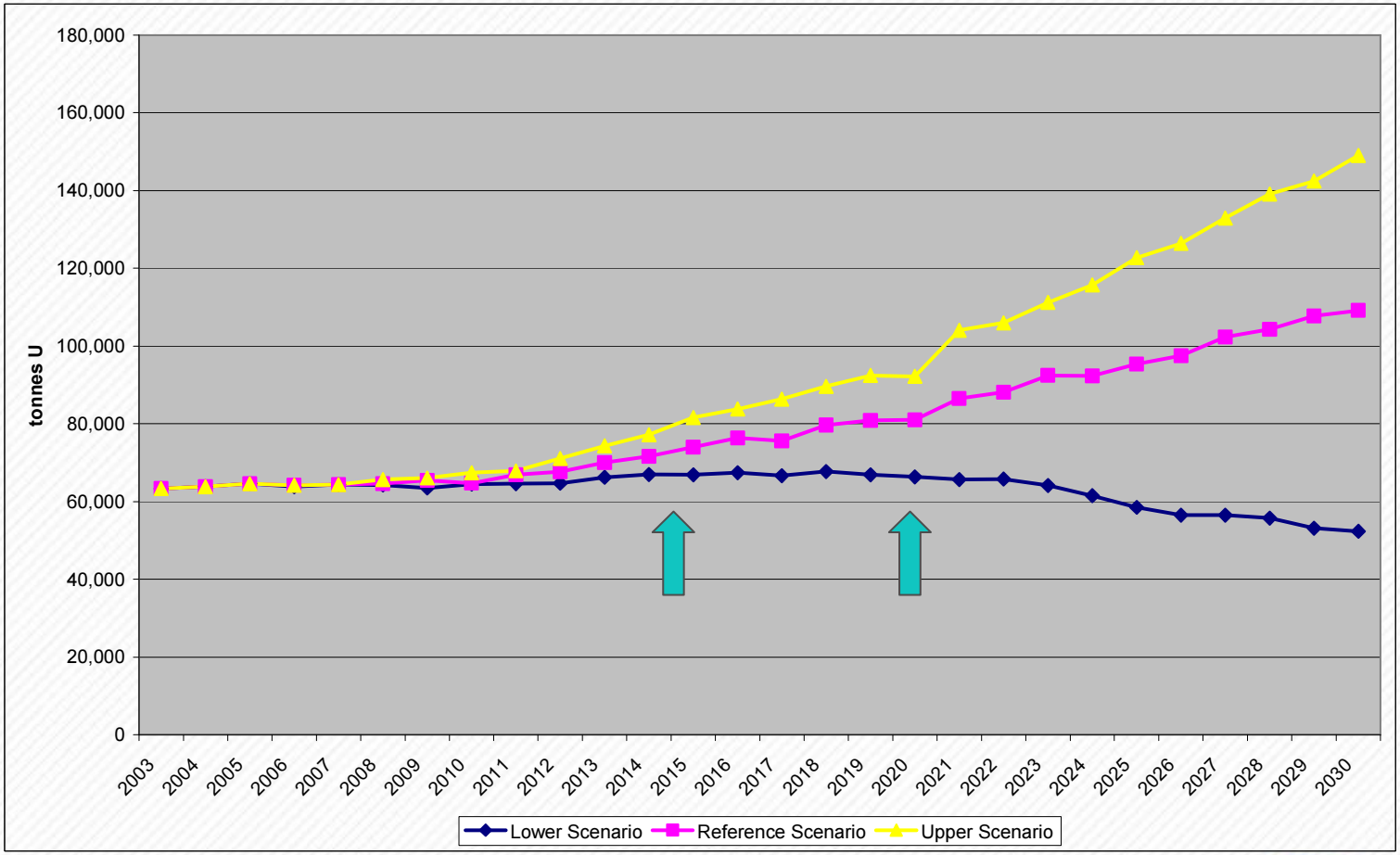
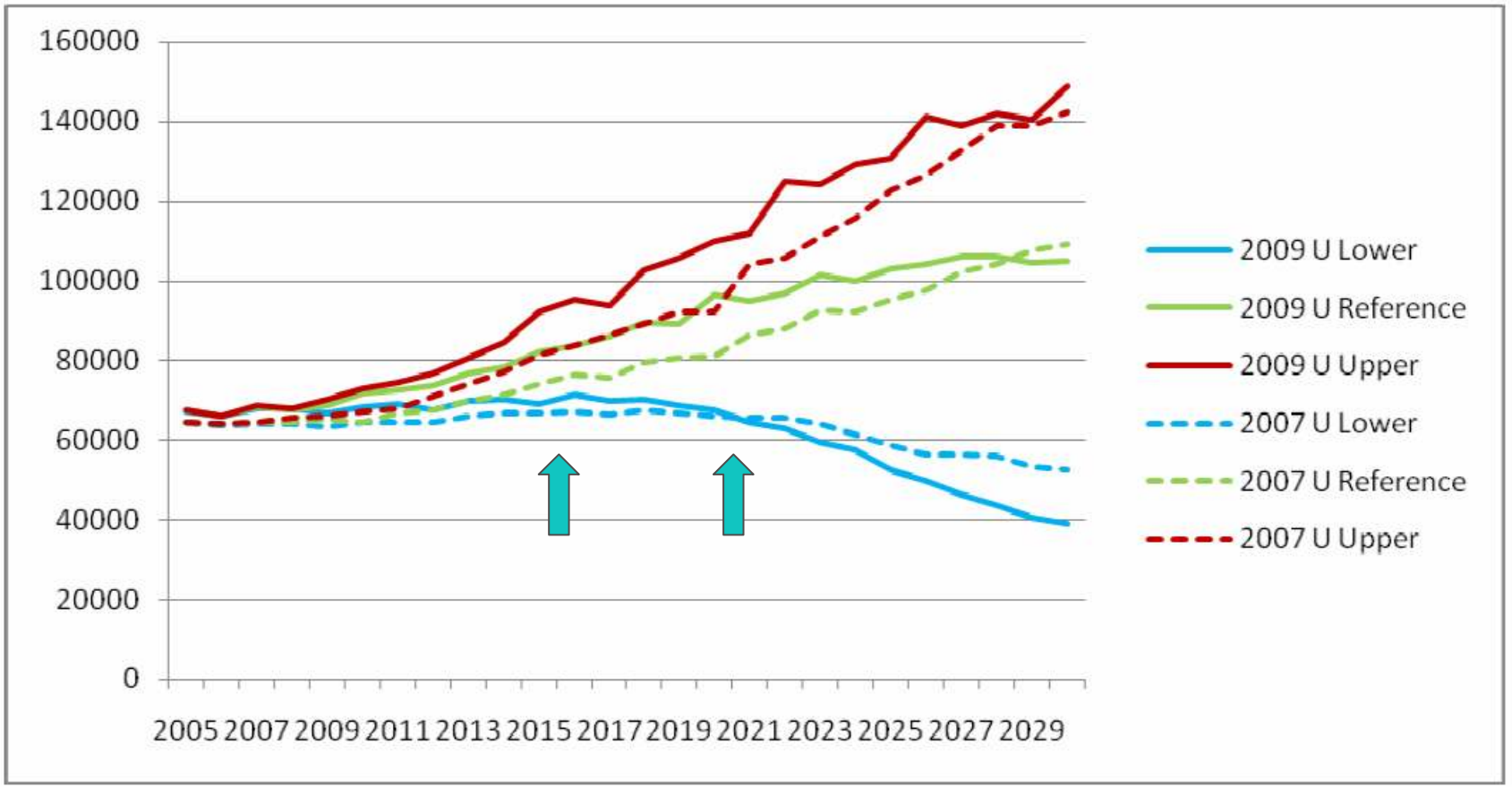
U requirements to 2030, tU
2007 Market Report



Uranium requirements to 2030, tU - 2009 Market Report draft



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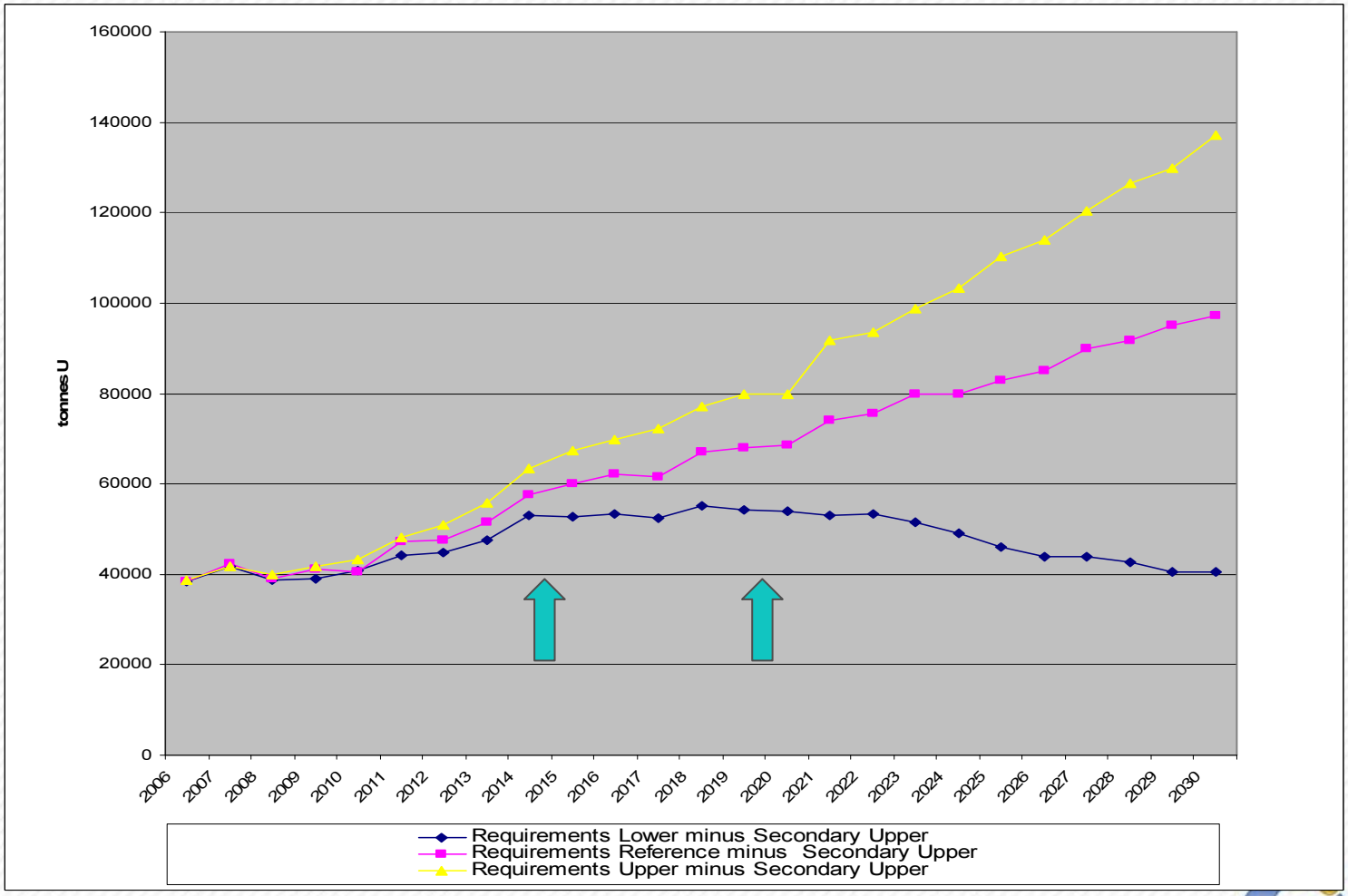
Implied need for primary uranium production - requirements less secondary supplies



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Uranium Mining Outlook

1. U market has sound supply up to 2015-20 but meeting demand becomes likely more challenging thereafter

2. Primary U supply (mining) needs to rise sharply to meet rising market demand
   - Canada and Australia will expand, key increases from Kazakhstan, new producing countries in Africa

3. In-situ leach (ISL) will represent a greater share but conventional mining is to remain dominant

4. Secondary supplies will remain important:
   - Ex-military material, commercial inventories, MOX-RepU

URANIUM CONVERSION: GROWTH

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Conversion - Basics

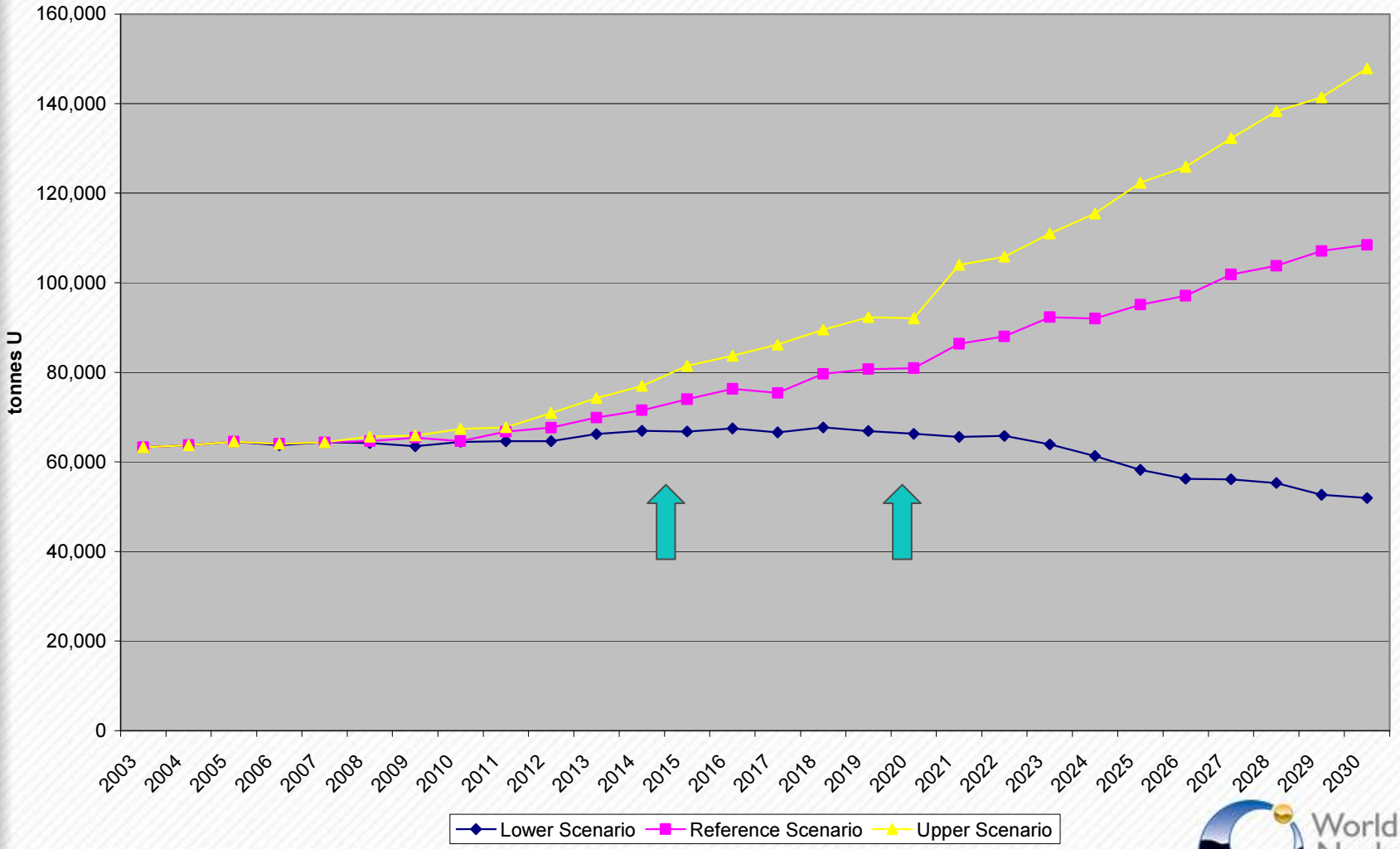
Enrichment for light water reactors (PWR) requires conversion to UF_6 - [Serves 90% of all nuclear reactors]

CANDU reactors require direct conversion to UO_2

5 major UF_6 conversion suppliers - Cameco, Springfields, Comurhex, ConverDyn and Rosatom

UO_2 conversion by Cameco and domestic suppliers in Argentina, China, India and Romania

UF_6 conversion requirements to 2030, tU



Uranium Conversion Outlook

1. UF_6 conversion will expand to cope with rising demand
   - Replacement of present plant in France, and expansion of facilities elsewhere

2. Small-scale UO2 conversion facilities may continue in a few countries but Cameco will remain dominant

3. World UF_6 conversion demand will rise steadily in line with overall U requirements

URANIUM ENRICHMENT: GROWTH

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Enrichment - Basics

U-235 is enriched from 0.71% (natural) to 3-5% (typical):
[Such fuel is needed for 90% of power reactors]

2 main technologies - older gaseous diffusion and more recent centrifuges

Investment in laser enrichment so far remains unrewarded by commercial application

Note: Effort to enrich measured in Separative Work Units (SWUs)

Enrichment - Supply

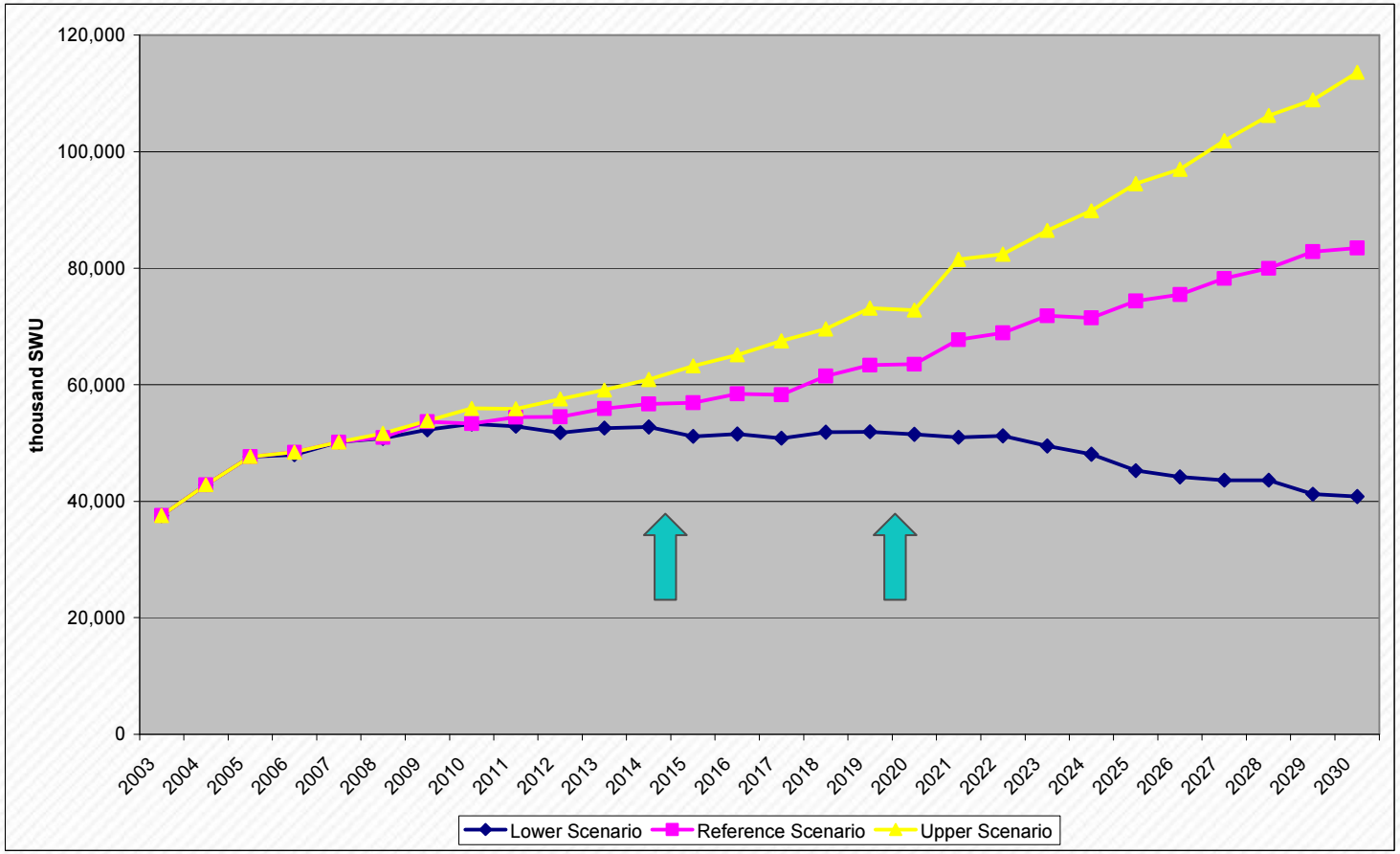
4 large suppliers of primary enrichment services
- USEC (USA), Areva (France), Urenco (Western Europe) and Rosatom (Russia)

USEC and Areva use gas diffusion, Urenco and Rosatom use centrifuges

JNFL (Japan) and CNNC (China) also primary suppliers

Heavy current investment in new centrifuge plants by USEC, Areva and Urenco in USA and by Areva in France

Enrichment requirements to 2030



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Uranium Enrichment Outlook

1. The key change is the gradual replacement of older gas diffusion plants (France, USA) by gas centrifuge plants
2. Elsewhere, Western Europe and Russia will likely expand their centrifuge capacity
3. Investors in the SILEX laser technology will try to commercialise it within the next 5 years

Overall Outlook on NFC Front-End Growth

U Mining

Sound growth until 2015-2020. Becomes challenging thereafter

U Conversion

Sound growth with rising demand

U Enrichment

Sound growth with rising demand. Technology change

Thank you for your attention

Questions?

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