

UPDATE ON CANDU FUEL CYCLES

2013 - LAS-ANS SYMPOSIUM

**SITING OF NEW NUCLEAR POWER AND
IRRADIATED FUEL FACILITIES
Argentina - 24-28 June 2013**

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South America



Candu Energy Inc.

- Candu Energy Inc. (Candu Energy) purchased Atomic Energy of Canada Ltd, Reactor Business Division in October 2011.
- Candu Energy is a wholly-owned subsidiary of SNC-Lavalin Inc.
- Candu Energy Inc. is a leading full-service nuclear technology company providing nuclear power reactors and nuclear products and services to customers worldwide.
- Candu Energy 1,400 highly skilled employees design and deliver state-of-the-art CANDU® reactors, carry out life extension projects, offer operations, maintenance and plant life management services for existing nuclear power stations.
- CANDU reactors are installed in Canada, Korea, China, Romania and Argentina.
- Candu 6 is our flagship.

SNC-LAVALIN GROUP

Overview

SNC-Lavalin is one of the leading groups of engineering and construction companies in the world,

- Founded in **1911**
- Labour force of over **24,000 employees**
- Strong financial position with **BBB+ credit rating**
- **Manages 27 billion dollars** of projects per year
- Operating offices in **45 countries worldwide**
- Projects in **100 countries worldwide**

Power Organization

Global Power Organization

Subsidiaries

Divisional Groups

SNC-Lavalin
Nuclear Inc.
(Nuclear)

Candu Energy
Inc.
(Nuclear)

SNC-Lavalin
Constructors
Inc.
(Thermal)

Transmission
& Distribution

Hydro

Energy &
Infrastructure

SNC-LAVALIN POWER EXPERIENCE

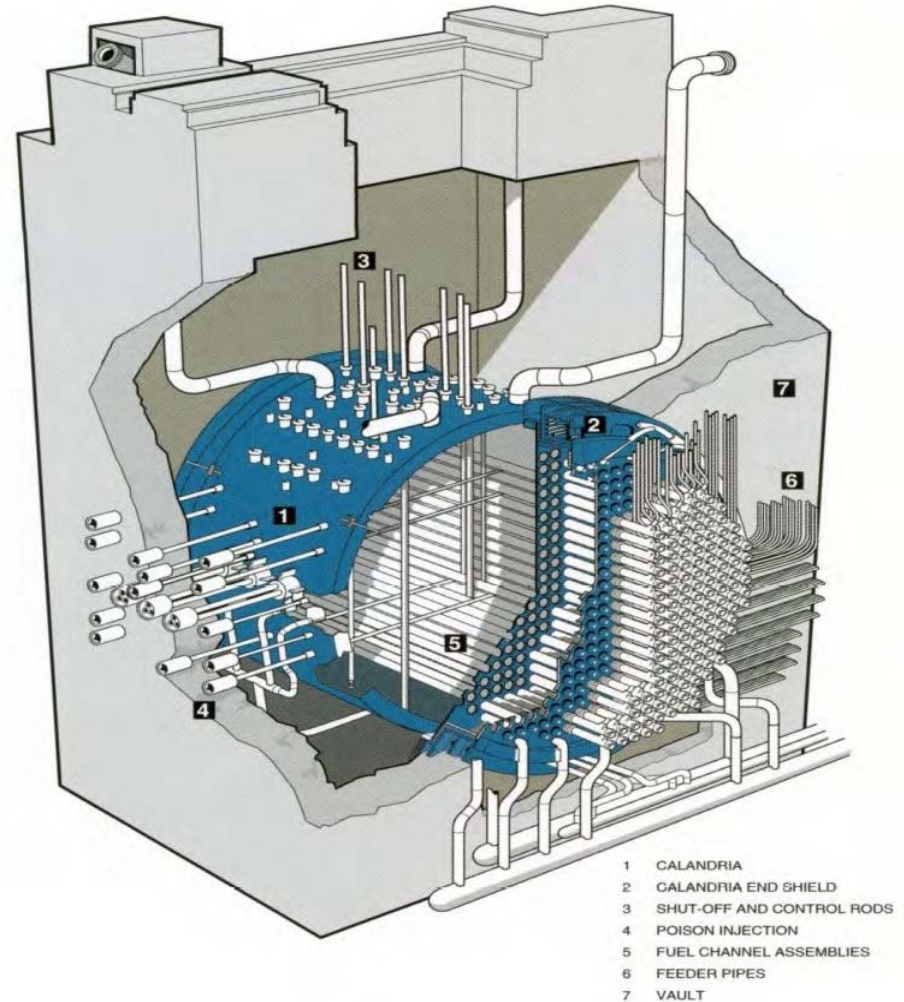
Participated in power projects over 350,000 MW

- Hydro 280,000 MW
- Thermal 48,000 MW
- Nuclear 19,400 MW
- Green 3,500 MW
- T&D 111,000 km

Candu 6

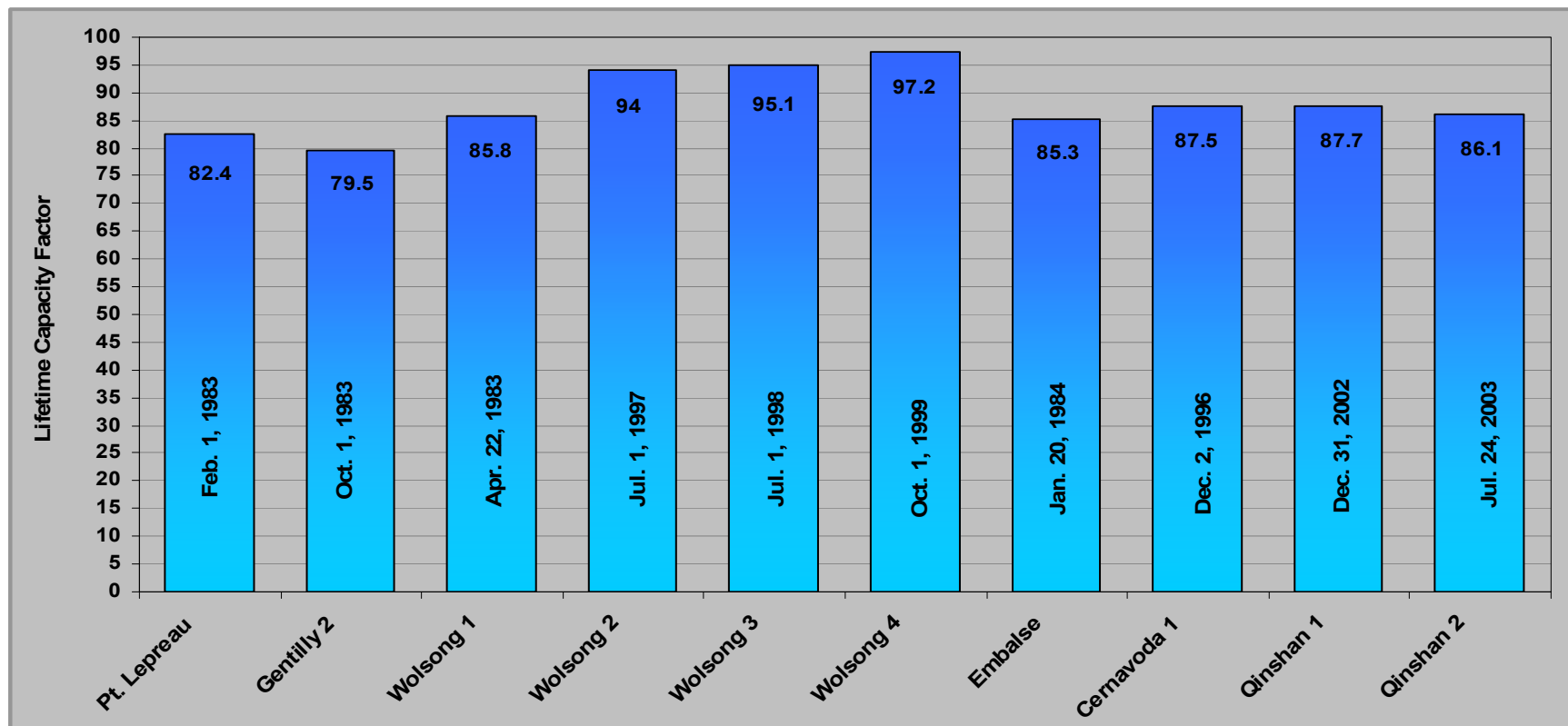
Main characteristic:

- PHWR, 740Mw_e
- Pressure vessel (low T & P)
- Pressure tubes
- PHT and Moderator HW
- Natural uranium
- On power fuelling
- Simple and small fuel bundles
- Reactivity Controls at low T & P



CANDU 6: Excellent Performance

All units installed in 5 countries have excellent performance



WHY ALTERNATIVE FUEL CYCLES?

There is a growing global trend towards extending nuclear fuel resources and reducing spent fuel through the application of fuel cycles.

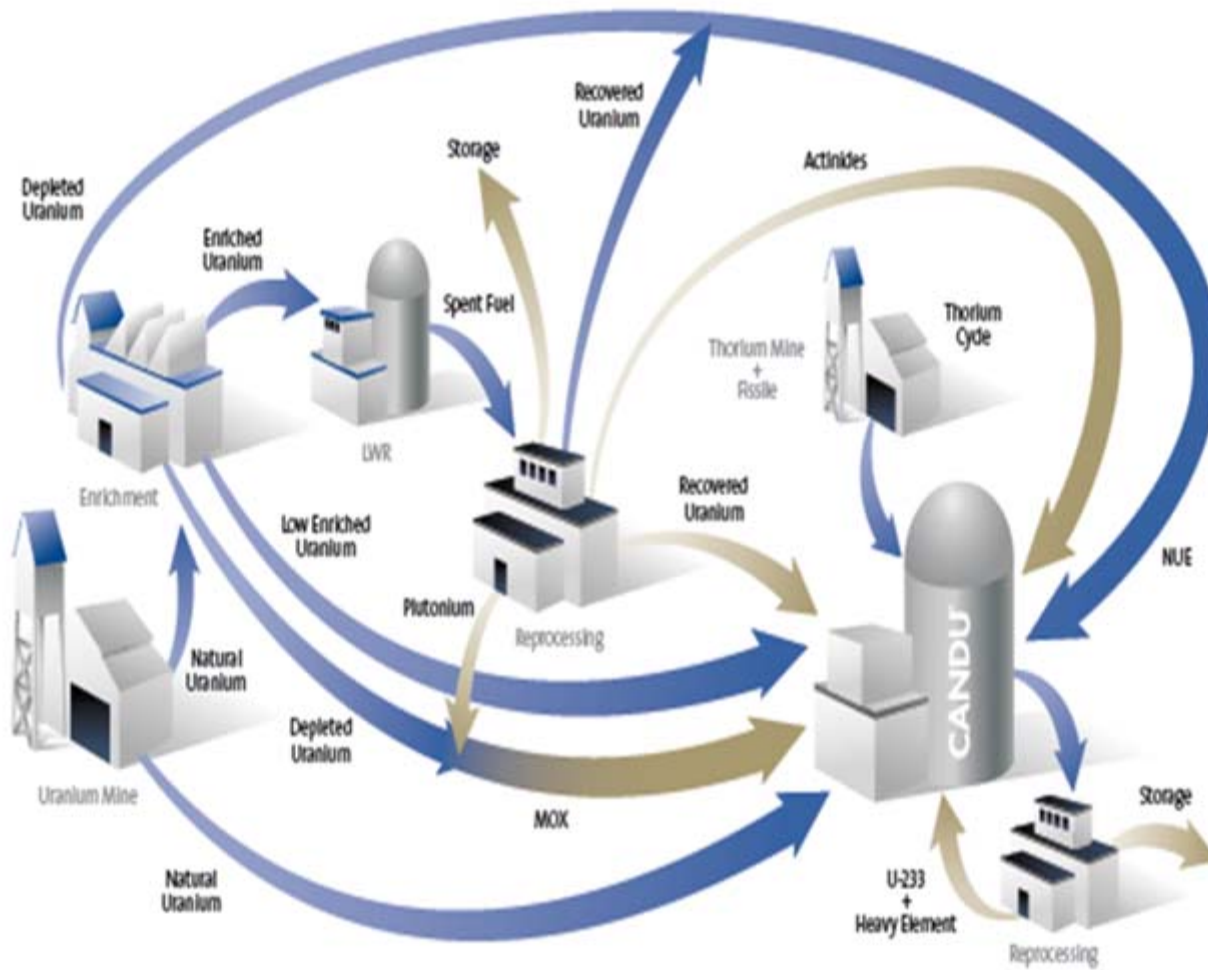
Drivers for fuel-cycle applications include:

- security of fuel supply at a known (steady) price,
- energy independence
- reduction of back-end spent fuel with electricity production.

CANDU reactors exhibit superior fuel cycle flexibility and are expected to play an important role in the future.

CANDU reactors require minimal design changes to use the proposed future fuel cycles.

CANDU Fuel Cycle Flexibility



1. Natural Uranium

2. LWR "Recovered" fuels

-NUE (RU/DU)

-Direct RU

-MOX

-Actinide reduction

3. "Fertile" Fuels

-Th/LEU

-Th/Pu

4. "Close Cycle" fuels

- Th/²³³U/Pu

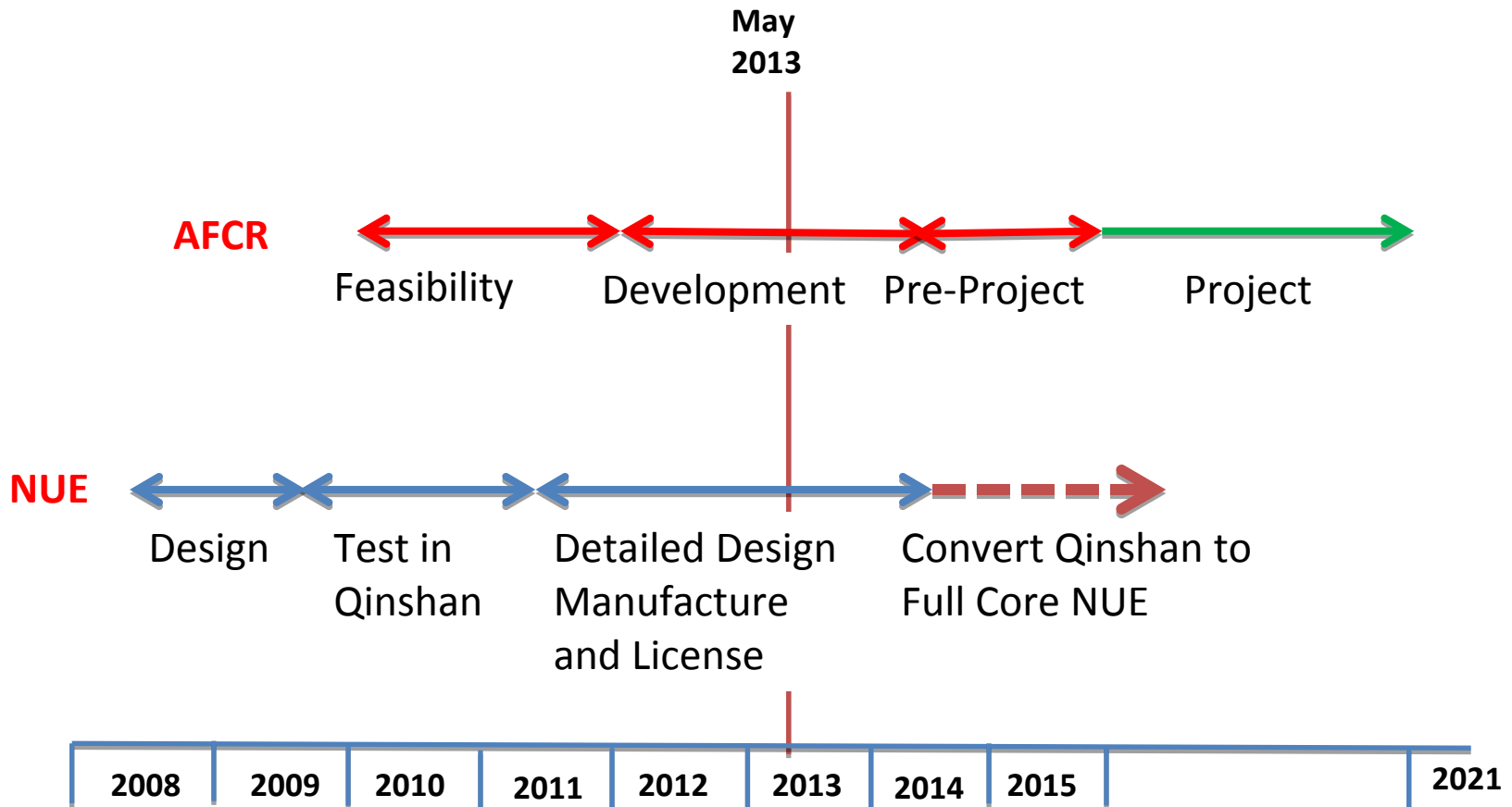
NUE Fuel For Existing Candu Reactors

- NUE fuel is a mixture of RU and DU with equivalency to NU in 37 el. bundle
- NUE fuel can replace NU (and vice versa) in existing Candu reactors
 - Designed to be within the existing licensing, safety and operating envelope
- NUE advantages:
 - Brings RU and DU back into the fuel cycle with favorable economics
 - RU requires no enrichment for use in CANDU
 - Simple mixing process of RU and DU during manufacturing
 - Minimal impact on current CANDU fuel manufacturing plants
- Candu Energy and China initiated joint work on NUE in 2008
 - Irradiation of 24 NUE fuel bundles in Qinshan successfully completed in 2011
 - Parties currently finishing work on the full core NUE conversion of Qinshan units
 - Qinshan units will start full core conversion to NUE first half of 2014
 - NUE fuel will replace NU fuel by on-power fuelling over the next two years

Advanced Fuel Candu Reactor (AFCR)

- Candu Energy and China partners worked jointly and showed that the CANDU6 reactor, with minimal changes, can use Th-LEU fuel with good Uranium Utilization
- Minor reactor design changes were identified and feasibility of changes were verified for use of Th-LEU fuel in CANDU 6
- Independent Chinese expert panels reviewed results and defined the proposed concept to be “practical and feasible”
- All experts unanimously recommended that China shall build two more CANDU6 Reactor units to utilize Thorium
- Currently conceptual design for Advanced Fuel CANDU Reactor (AFCR™) and Th fuel development is in progress.

NUE and AFCR — Progress and Timelines



Conclusion

- CANDU reactors bring the Recycled Uranium back into the fuel cycle in practical manner both for operating and new build reactor
- Based on existing commercial technology, Th-LEU fuel cycle can be rapidly implemented in new build CANDU reactors with minimal changes.
- Such reactors (AFCR) are reviewed to be “practical and feasible” by Canadian & Chinese experts
- First AFCR unit, a Gen III reactor based on proven Qinshan units and the EC6 design, can be delivered in 2021/22

Thank you for your attention!